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.:	**444-8530**
SRP Section:	**16 - Technical Specifications**
Application Section:	**16.3.7, 16.3.3.8, 16.3.3.9, 16.3.3.10**
Date of RAI Issue:	**03/16/2016**

Question No. 16-133

The applicant is requested to revise generic TS 3.3.8, "Containment Purge Isolation ActuationSignal (CPIAS)" and Bases as follows (See DCD Figure 7.3-10):

1. Change LCO statement to say, "One CPIAS **instrument division with two area radiation monitor** channels, **one Manual Actuation division, and one Actuation Logic division** shall be OPERABLE." This makes more sense because Fig. 7.3-77 shows Division A and Division B, each with two (gamma) radiation monitors. Also make conforming changes to the Bases for generic TS 3.3.8.

2. Move the Actions table Note to the Applicability, consistent with STS 3.3.8B. Also make conforming changes to the Bases for generic TS 3.3.8.

3. Revise the Applicability Note as indicated: "Only required when the **associated containment purge or exhaust line** penetration **flow path** is not isolated by at least one closed and deactivated automatic valve, closed manual valve, or blind flange." Also make conforming changes to the Bases for generic TS 3.3.8.

4. Revise Condition A as follows: "CPIAS **required** Manual Actuation **division**, **required** Actuation Logic **division**, or **required instrument division with** one or more required ~~channels of~~ **area** radiation monitor~~s~~ **channels** inoperable in MODES 1, 2, 3, and 4." Also make conforming changes to the Bases for generic TS 3.3.8.

5. Revise Required Action A.1 as follows: "Enter applicable Conditions and Required Actions ~~for affected valves~~ of LCO 3.6.3, "Containment Isolation Valves," **for containment purge isolation valves** made inoperable by CPIAS instrumentation. Also make conforming changes to the Bases for generic TS 3.3.8.

6. Revise Condition C as follows: "CPIAS **required** Manual Actuation **division**, **required** Actuation Logic **division**, or **required instrument division with** one or more required

~~channels of~~ **area** radiation monitor~~s~~ **channels** inoperable during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment." Also make conforming changes to the Bases for generic TS 3.3.8.

7. The Surveillance Requirements table for Specification 3.3.8 has sufficient room to begin on the fourth line below the end of the Actions table, instead of on the next page.

8. How does the 7 day Channel Check Frequency of STS 3.3.8B, SR 3.3.8.2 for CPIS particulate and iodine radiation monitor channels apply to the APR1400 containment operating area (gamma) radiation monitor channels? The generic TS SR 3.3.8.2 Channel Check Frequency should also be 12 hours, the same as the generic TS SR 3.3.8.1 Frequency of 12 hours for the containment upper operating area (gamma) radiation monitor channels. Also make conforming changes to the Bases for generic TS 3.3.8.

9. Revise surveillance column Note for SR 3.3.8.3 as indicated: ~~This SR is applicable~~ "**Only required to be met** in MODES 1,~~-~~2, 3, and 4 ~~only~~. Also make conforming changes to the Bases for generic TS 3.3.8.

10. Revise surveillance column Note for SR 3.3.8.4 as indicated: ~~This SR is applicable~~ "**Only required to be met** during CORE ALTERATIONS or during movement of irradiated fuel assemblies within containment." Also make conforming changes to the Bases for generic TS 3.3.8.

11. To be consistent with STS 3.3.8B, SR 3.3.8.3, Channel Functional Test, revise generic TS SR 3.3.8.4 by inserting "each" before "required" because SR 3.3.8.4 should address testing of "each required containment radiation monitor channel" as does SR 3.3.8.3. Also make conforming changes to the Bases for generic TS 3.3.8.

12. To be consistent with STS 3.3.8B, SR 3.3.8.5, Channel Functional Test on "required CPIS Actuation Logic channel," revise surveillance column Note for generic TS SR 3.3.8.5 as indicated: "Surveillance ~~Requirement~~ of Actuation Logic shall include actuation of each initiation circuit and verification of proper operation of each initiation circuit. In addition, the STS SR 3.3.8.5 Note says "Surveillance of Actuation Logic shall include the actuation of each initiation relay and verification of the proper operation of each initiation relay." Explain the difference between "initiation circuit" and "initiation relay."

13. To be consistent with suggested edits to LCO 3.3.8, and Conditions A and C, revise SR 3.3.8.5 as indicated: "Perform CHANNEL FUNCTIONAL TEST on required CPIAS Actuation Logic ~~channel~~ **division**." Also make conforming changes to the Bases for generic TS 3.3.8.

14. To be consistent with suggested edits to LCO 3.3.8, Conditions A and C, and SR 3.8.3.4, revise SR 3.3.8.6 as indicated: "Perform CHANNEL CALIBRATION on **each** required containment radiation monitor channel in accordance with Setpoint Control Program." Also make conforming changes to the Bases for generic TS 3.3.8.

15. To be consistent with suggested edits to SR 3.3.8.6, revise generic TS SR 3.3.8.7 as indicated: “Verify that the response time of **each** required CPIAS ~~channel~~ **division** is within limits.” Also make conforming changes to the Bases for generic TS 3.3.8.

16. To be consistent with suggested edits to LCO 3.3.8, Conditions A and C, and SR 3.3.8.7, revise generic TS SR 3.3.8.8 as indicated: “Perform CHANNEL FUNCTIONAL TEST on required CPIAS Manual Actuation ~~channel~~ **division**.” Also make conforming changes to the Bases for generic TS 3.3.8.

17. Applicant is requested to revise the Bases for Specification 3.3.8 as follows:

    a. B 3.3.8 Background section

        (1) The first paragraph is almost identical to the STS B 3.3.8B paragraph. Such material should be formatted as a Reviewer’s Note because it describes CPIAS as a “plant specific instrumentation channel” and states, “Individual plants shall include the CPIAS Function and LCO requirements that are applicable to them.” In a design certification application’s generic TS, site- or plant-specific information is called combined license information, or a COL Action Item, which is denoted with square brackets enclosing the site-specific information. However, there is no site-specific information in the first paragraph. Staff request the applicant to consider revising the paragraph for clarity and consistency, as follows:

> This LCO encompasses the CPIAS, which is ~~a plant specific~~ **an Engineered Safety Feature (ESF)** instrumentation **and control system** ~~channel~~ that performs a~~n~~ **containment isolation** actuation function required for plant protection **against the uncontrolled release of radioactivity but** is not otherwise included in LCO 3.3.6, “Engineered Safety Features Actuation System (ESFAS) Logic and **M**~~m~~anual **Trip** ~~actuation~~,” or LCO 3.3.7, “Emergency Diesel Generator (EDG) – Loss of Voltage Start (LOVS).” ~~Individual plants shall include the CPIAS Function and LCO requirements that are applicable to them.~~

        (2) The second paragraph should be revised for consistency with the STS B 3.3.8B paragraph:

> The CPIAS provides protection from **the release of radioactivity and** radioactive contamination in the containment in the event a fuel assembly should be severely damaged during handling. It also closes the purge valves during plant operation in response to a reactor coolant system (RCS) leak.

        (3) The fourth paragraph should be revised (per the markup below) for consistency with DCD Figure 7.3-10, and to append an explanation of the differences in the range of radiation intensity between the upper operating area monitors (RE 233A, 234B) and the [lower] operating area monitors (RE-231A, 231B). DCD Table 7.3-5B indicates that the normal operation ranges for these monitors are 14 mSv/hr and 0.5 mSv/hr, respectively, with nominal actuation setpoints of 28

mSv/hr and 2.5 mSv/hr, respectively. This table also indicates that the containment operating area radiation monitors are used for CPIAS actuation during fuel handling operations. DCD Table 12.3-6 states the ranges as "10^{1} ~ 10^{8} mSv/hr" and "10^{-3} ~ 10^{2} mSv/hr," respectively.

> The CPIAS includes two independent, redundant logic **divisions** ~~subsystems~~, including actuation **logic** ~~trains~~. Each ~~train~~ **division** employs two sensors, each one detecting gamma (area).

DCD 12.3.4.1.5.a describes safety-related area monitors, and states:

> "These monitors are accident monitoring instrumentation (AMI), type C, and also listed on Table 7.5-1."
>
> "The containment upper operating area monitors (RE-233A, 234B) consist of physically independent and electrically separated detectors located inside the containment away from the influence of the reactor coolant system to measure high-range gamma radiation. This monitor gives operators a seismically and environmentally qualified indication of containment airborne activity."

(4) The fifth and sixth paragraphs should be revised as indicated for consistency:

If **the signal from** any one of these **four** sensors exceeds the bistable **logic** trip setpoint, ~~the~~ **both** CPIAS ~~train~~ **Division A and Division B** will be actuated (one-out-of-~~two~~ **four** logic).

Each ~~train~~ **CPIAS division** actuates a separate series valve in the containment **low and high volume** purge supply and return lines. Either ~~train~~ **CPIAS division** controls sufficient equipment to perform the isolation function. These valves are also isolated on a Safety Injection Actuation Signal (SIAS) and Containment Isolation Actuation Signal (CIAS).

(5) The seventh, eighth, and ninth paragraphs should be revised as indicated for consistency:

Nominal Trip~~Actuation~~ Setpoints and Allowable Values

~~Actuation~~ **The nominal trip** setpoints **(NTSPs)** used in the bistable~~s~~ **logic** are based on the **accident analyses'** analytical limits (Reference 1). The selection of ~~these actuation setpoints~~ **NTSPs** is such that adequate protection is provided when all sensor and processing time delays are taken into account.

To allow for calibration tolerances, instrumentation uncertainties, and instrument drift, actuation setpoint Allowable Values specified in the setpoint control program (SCP) are conservatively ~~adjusted~~ **calculated** with respect to the analytical limits. The actual ~~nominal actuation setpoint~~ **NTSP** entered into the bistable **logic** is ~~normally still~~ more conservative than ~~that specified by~~ the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.

One example of such a change in measurement error is drift **of the transmitter** during the surveillance interval. If the ~~measured~~ **as-found actuation** ~~setpoint~~ **setting measured by the CHANNEL FUNCTIONAL TEST remains conservative with respect to the As-Found Tolerance (AFT) band around the previous as-left setting between successive CHANNEL CALIBRATIONS and** does not exceed the Allowable Value, the ~~bistable~~ **instrument channel** is considered OPERABLE**, provided the channel is performing normally as expected**.

Setpoints in accordance with the ~~allowable value~~ **Allowable Value** will ensure that safety limits are not violated during anticipated operational occurrences (AOOs) and the consequences of design basis accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the AOO or accident and the equipment functions as designed.

b. B 3.3.8 Applicable Safety Analyses section

Revise the three paragraphs as shown in the following markup for clarity and consistency:

The CPIAS is a backup to the CIAS systems in MODES 1, 2, 3, and 4 and will close the containment **low and high volume** purge **supply and exhaust line isolation** valves in the event of high radiation levels resulting from a primary leak in the containment.

The CPIAS is also required to close the containment purge **line isolation** valves in the event of the fuel handling accident in containment, as described in Reference 1. This accident is a limiting case representing a class of accidents that may involve ~~radiation~~ **radioactivity** release in containment without CIAS actuation. The CPIAS ensures the consequences of a dropped **irradiated fuel** assembly in containment are not as severe as a dropped **irradiated fuel** assembly in the fuel handling area. This ensures that the offsite consequences of ~~radiation~~ **fuel handling** accidents in containment are within 10 CFR 50.34 limits (Reference 2).

The CPIAS satisfies the requirements of ~~LCO Selection~~ Criterion 3 **of 10 CFR 50.36(c)(2)(ii)**.

c. B 3.3.8 LCO section

(1) Revise the first five paragraphs as shown in the following markup for clarity and consistency:

LCO 3.3.8 requires one CPIAS ~~channel~~ **division** to be OPERABLE. The required ~~channel~~ **division** consists of **one instrument division with two** area radiation monitor~~s~~ **channels**, one ~~a~~**A**ctuation **L**ogic **divi~~s~~ion**; and **one** ~~m~~**M**anual ~~a~~**A**ctuation **division**.

The specific Allowable Values for the **actuation (trip)** setpoints of the CPIAS are listed in the ~~SRs~~ **Setpoint Control Program required documentation**.

Operation with a trip setpoint less conservative than the ~~nominal trip setpoint~~**NTSP**, but within its Allowable Value, is acceptable provided that the difference between the ~~nominal actuation~~ **actual trip setting** ~~setpoint~~ and the Allowable Value is equal to or greater than the drift allowance assumed for each actuation in the **calculated NTSP, which is derived from the analytical limit in the** transient and accident analyses.

Each **specified** Allowable Value ~~specified~~ is more conservative than the analytical limit assumed in the transient and accident analysi**e**s in order to account for instrument uncertainties appropriate to the actuation function. **These uncertainties are defined in the NRC approved setpoint methodology specified by the Setpoint Control Program, Specification 5.5.19.**

The ~~bases~~ **Bases** for the LCO on CPIAS are discussed below for each

Function:

a. **Manual Actuation**~~manual actuation~~

The LCO on **the CPIAS Manual Actuation**~~manual actuation~~ **Function division** backs up the ~~automatic actuation~~ **CPIAS Automatic Actuation Function division** and ensures operators have the capability to rapidly initiate the CPIAS Function if any parameter is trending toward its **NTSP**~~setpoint~~. Only one **Manual Actuation**~~manual channel~~ **division** of CPIAS is required in MODES 1, 2, 3, and 4, since the CPIAS is redundant ~~with~~ **to** the CIAS and SIAS **for isolating the purge supply and exhaust line containment penetrations**. Only one **Manual Actuation**~~manual channel~~ **division** of CPIAS is required during CORE ALTERATIONS and movement of irradiated fuel assemblies, since there are additional means of closing the containment purge **isolation** valves in the event of a **Manual Actuation**~~manual channel~~ **division** failure.

b. Containment Area Radiation **Monitors and Bistable Logic**

The LCO on the **CPIAS instrument Function division requires that** each **of the two area** radiation **monitor** channels ~~requires that each channel~~ be OPERABLE for ~~each actuation logic channel~~ **sending a bistable logic trip signal to the Actuation Logic division. The two area radiation monitor channels are not totally redundant to each other, since the indication overlap only ranges from 10 mSv/hour to 100 mSv/hour; however both NTSPs are within this range**.

The **CPIAS NTSP** ~~actuation setpoint~~ is selected to allow detection of small deviations from **the** normal **background radiation level**. The absolute value of the **NTSP** ~~actuation setpoint~~ in MODES 5 and 6

differs from the **NTSP** in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the **lower levels of** radiation ~~level~~ expected in ~~these~~ MODES **5 and 6**. **The containment upper operating area radiation monitor channel supports the CPIAS during MODES 1, 2, 3, and 4, and has a higher NTSP. The containment operating area radiation monitor channel supports the CPIAS during MODES 5 and 6, and has a lower NTSP. In any MODE, just one area radiation monitor channel is relied upon for initiating an automatic containment purge line isolation.**

c. **Actuation Logic** ~~actuation logic~~

One ~~channel of actuation logic~~ **Actuation Logic division** is required, since the **containment purge isolation** valves can be shut independently of the CPIAS signal either manually from the MCR or using either the SIAS or CIAS push button.

d. B 3.3.8 Applicability section

Revise the three paragraphs as shown in the following markup for clarity and consistency:

In MODES 1, 2, 3, and 4, the low volume purge **line isolation valves** ~~values~~ may be open. In ~~the~~ **these** MODES, it is necessary to ensure the valves will shut in the event of a primary **coolant** leak in containment whenever any of the containment purge valves are open.

With the purge **line isolation** valves open during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, there is the possibility of a fuel handling accident requiring CPIAS on high radiation in containment.

The APPLICABILITY is modified by a Note, which states that the CPIAS Specification is only required when ~~the~~ **a purge line containment** penetration is not isolated by at least one closed and deactivated automatic valve, closed manual valve, or blind flange.

e. B 3.3.8 Actions section

(1) First, second, and third paragraphs should be revised as indicated for consistency: A CPIAS ~~channel~~ **division** is inoperable when it does not satisfy the OPERABILITY criteria for the ~~channel's~~ **division's** function. The most common cause of a **process instrument** channel inoperability is outright failure or drift of the ~~bistable or process module~~ **sensor, transmitter, or analog signal processing equipment** sufficient to exceed the tolerance allowed by the ~~plant specific~~ **NRC-approved setpoint methodology specified in the Setpoint Control Program, Specification 5.5.19**~~analysis~~. Typically, the drift is not large and would result in a delay of actuation rather than a total loss of function. This determination is generally made during the

performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it within specification. If the **as-found** actuation ~~setpoint~~ **setting** is not consistent with the Allowable Value, the ~~channel~~ **division** must be declared inoperable immediately, and the appropriate Conditions must be entered.

In the event a ~~channel's~~ **division's** actuation ~~setpoint~~ **setting** is found nonconservative with respect to the Allowable Value, or the sensor, instrument loop, signal processing electronics, or bistable **logic processor** is found inoperable, then all affected Functions provided by that ~~channel~~ **division** are required to be declared inoperable and the LCO Condition entered for the particular protective function affected.

When the number of inoperable channels **or divisions of** ~~in a~~ **an ESF** actuation Function exceeds that specified in any related Condition associated with the same **ESF** actuation Function, then the ~~plant~~ **unit** is outside the safety analysi~~e~~s. Therefore, LCO 3.0~~.~~3 is immediately entered if applicable in the current MODE of operation.

(2) The fourth and sixth paragraphs should be revised as indicated for consistency: A.1

Condition A applies to the failure of the CPIAS **required Manual Actuation division**~~manual actuation~~, **required Actuation Logic division,** ~~actuation logic,~~ and **one or more of the** required **CPIAS instrument division** area radiation monitor~~s~~ **channels in MODES 1, 2, 3, and 4**. The Required Action is to **immediately** enter the applicable Conditions and Required Actions for affected valves of LCO 3.6.3, “Containment Isolation Valves.” The Completion Time accounts for the condition that the capability to isolate containment on valid containment high radiation or manual signals is degraded during power operation**, startup, standby,** or **hot** shutdown MODES.

C.1, C.2.1, C.2.2

Condition C applies to the same conditions as are described in Condition A**,**~~;~~ ~~however, the applicability is~~ **but** during CORE ALTERATIONS or during the movement of irradiated fuel assemblies within containment. Required Action C.1 is to place the containment purge and exhaust isolation valves in the closed position. The Required Action immediately performs the isolation function of the CPIAS. Required Actions C.2.1 and C.2.2 may be performed in lieu of Required Action C.1. Required Action C.2.1 requires the suspension of CORE ALTERATIONS and Required Action C.2.2 requires suspension of movement of irradiated fuel in containment immediately. The Completion Time accounts for the fact that the automatic capability to isolate containment on valid containment high radiation signals is degraded during conditions in which a fuel handling accident is possible and CPIAS provides the only automatic mitigation of radiation release.

f. B 3.3.8 Surveillance Requirements section

(1) The second, third, and fourth sentences of the Bases for SR 3.3.8.2 (Channel Check for Division A containment operating area radiation monitor channel, and Division B containment operating area radiation monitor channel) do not appear to be applicable to the gamma detectors of the containment operating area radiation monitor channels. And so, there appears to be no need for a separate 7 day Channel Check for these channels. That is, SR 3.3.8.1 may be appropriate for these monitors in addition to the containment upper operating area radiation monitor channels, and SR 3.3.8.2 may be removed.

(2) The applicant is requested to revise the Bases for SR 3.3.8.1 (Channel Check for

- Division A containment upper operating area radiation monitor channel,
- Division B containment upper operating area radiation monitor channel,
- Division A containment operating area radiation monitor channel, and
- Division B containment operating area radiation monitor channel).

The Bases should explain that

- Both containment upper operating area radiation monitor channels need to be operable so comparison of their indication can be made; and
- Both containment operating area radiation monitor channels need to be operable so comparison of their indication can be made.

(3) The applicant is requested to clarify the Bases for SR 3.3.8.3 and SR 3.3.8.4 regarding whether each applies to both the required upper operating area radiation monitor channel and the required operating area radiation monitor channel, or to just one of these monitors, respectively.

In addition, the first paragraph, last sentence of the Bases for SR 3.3.8.3 and SR 3.3.8.4 regarding the justification for the 92 day Frequency of the Channel Functional Test for the required area radiation monitor channels, may need revising if each of these SRs applies to just one of these monitors, respectively.

(4) The last sentence of the Bases for SR 3.3.8.3 and the last sentence of the Bases for SR 3.3.8.4, regarding the surveillance column Note, should be revised to be consistent with the requested changes to these Notes in Sub-questions 9 and 10 above.

(5) The Bases for SR 3.3.8.5 needs to be revised to reflect the design of the CPIAS division, as indicated:

<u>SR 3.3.8.5</u>

Proper operation of the individual initiation ~~relays~~ **circuits** is verified by actuating these ~~relays~~ **circuits** during the CHANNEL FUNCTIONAL TEST of the ~~actuation logic~~ **required Actuation Logic division** every

18 months. This will actuate the Function, operating all associated equipment. Proper operation of the equipment actuated by each ~~train~~ **division** is thus verified. The Frequency of 18 months is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of ~~more than one channel~~ **an Actuation Logic division** of a given Function during any ~~18 month~~ **18 month** interval is a rare event. A Note to the SR indicates that this Surveillance includes verification of operation for each initiation ~~relay~~ **circuit**.

(6) The Bases for SR 3.3.8.6 needs to be revised to correct errors and be more consistent with the STS SR 3.3.8.6 Bases, as indicated:

SR 3.3.8.6

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains ~~operational~~ **OPERABLE** between successive surveillances. **The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the NRC-approved setpoint methodology.**

The ~~18 month~~ **18 month** Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage ~~and the potential for an unplanned transient if the Surveillance were performed with the reactor at power~~.

(7) Revise the first sentence of the Bases for SR 3.3.8.7, for consistency, as indicated:

This Surveillance ensures that the ~~train~~ **CPIAS division** actuation response times are less than or equal to the maximum times assumed in the **accident** analyses **(Reference 1)**.

(8) Revise the Bases for SR 3.3.8.8, for consistency, as indicated; revise the second paragraph so it is consistent with the CPIAS Manual Actuation division design; insert a justification for the Frequency:

SR 3.3.8.8

Every 18 months, a CHANNEL FUNCTIONAL TEST is performed on the **required** CPIAS **Manual Actuation division** ~~manual actuation channel~~.

This test verifies that the actuation push buttons are capable of ~~opening contacts in the actuation logic as designed, de-energizing the initiation relays and~~ providing manual actuation of the **containment purge line isolation** Function.

The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

g. B 3.3.8 References section

Replace “DCD Tier 2” with “FSAR” in Reference 1, and append “, Transient and Accident Analyses.”

Response

APR1400 Technical Specifications section 3.3.8 and Bases section 3.3.8 will be revised.

Impact on DCD

Same as changes described in Impact on Technical Specification section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

APR1400 Technical Specifications section 3.3.8 and Bases section 3.3.8 will be revised, as indicated in the attachment associated with this response.

Impact on Technical/Topical/Environmental Reports

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

One CPIAS instrument division with two area radiation monitor channels, one Manual Actuation division, and one Actuation Logic division

3.3 INSTRUMENTATION

3.3.8 Containment Purge Isolation Actuation Signal (CPIAS)

LCO 3.3.8 ~~One CPIAS channel~~ shall be OPERABLE.

associated containment purge or exhaust line penetration flow path

APPLICABILITY: MODES 1, 2, 3, and 4,
During CORE ALTERATIONS,
During movement of irradiated fuel assemblies within containment.

Move the "NOTE" to this position.

ACTIONS

Move

NOTE
Only required when the ~~penetration~~ is not isolated by at least one closed and deactivated automatic valve, closed manual valve, or blind flange.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~CPIAS Manual Actuation, Actuation Logic, or one or more required channels of radiation monitors inoperable in MODES 1, 2, 3, and 4.~~	A.1 ~~Enter applicable Conditions and Required Actions for affected valves of LCO 3.6.3, "Containment Isolation Valves," made inoperable by CPIAS instrumentation.~~	Immediately
B. Required Action and associated Completion Time not met in MODE 1, 2, 3, or 4.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

CPIAS required Manual Actuation division, required Actuation Logic division, or required instrument division with one or more required area radiation monitor channels inoperable in MODES 1, 2, 3, and 4.

Enter applicable Conditions and Required Actions of LCO 3.6.3, "Containment Isolation Valves," for containment purge isolation valves made inoperable by CPIAS instrumentation.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. CPIAS ~~Manual Actuation, Actuation Logic, or one or more required channels of radiation monitors~~ inoperable during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment.	C.1 Place and maintain containment purge and exhaust valves in closed position. OR	Immediately
	C.2.1 Suspend CORE ALTERATIONS. AND	Immediately
	C.2.2 Suspend movement of irradiated fuel assemblies in containment.	Immediately

required Manual Actuation division, required Actuation Logic division, or required instrument division with one or more required area radiation monitor channels

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SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.8.1	Perform CHANNEL CHECK on required containment upper operating area radiation monitor channel and operating area radiation monitor channel.	12 hours
SR 3.3.8.2	~~Perform CHANNEL CHECK on required containment operating area radiation monitor channel.~~ This SR is not applicable	~~7 days~~ N/A
SR 3.3.8.3	Only required to be met NOTE ~~This SR is applicable~~ in MODES 1, 2, 3, and 4 ~~only~~.	
	Perform CHANNEL FUNCTIONAL TEST on ~~each required containment radiation monitor channel~~ each required upper operating area radiation monitor channel and required operating area radiation monitor channel in accordance with Setpoint Control Program.	92 days
SR 3.3.8.4	Only required to be met NOTE ~~This SR is only applicable~~ during CORE ALTERATIONS or during movement of irradiated fuel assemblies within containment.	
	Perform CHANNEL FUNCTIONAL TEST on ~~required containment radiation monitor channel~~ each required upper operating area radiation monitor channel and required operating area radiation monitor channel in accordance with Setpoint Control Program.	92 days
SR 3.3.8.5	NOTE Surveillance ~~Requirement~~ of Actuation Logic shall include actuation of each initiation ~~circuit~~ and verification of proper operation of each initiation ~~circuit~~ relay	
	Perform CHANNEL FUNCTIONAL TEST on required CPIAS Actuation Logic ~~channel~~ division.	18 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.8.6	Perform CHANNEL CALIBRATION on required containment radiation monitor channel in accordance with Setpoint Control Program.	18 months
SR 3.3.8.7	Verify that the response time of required CPIAS ~~channel~~ is within limits.	18 months
SR 3.3.8.8	Perform CHANNEL FUNCTIONAL TEST on required CPIAS Manual Actuation ~~channel~~.	18 months

each

each

division

division

B 3.3 INSTRUMENTATION

B 3.3.8 Containment Purge Isolation Actuation Signal (CPIAS)

BASES

BACKGROUND

~~This LCO encompasses the CPIAS, which is a plant specific instrumentation channel that performs an actuation function required for plant protection but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and manual actuation," or LCO 3.3.7, "Emergency Diesel Generator (EDG) – Loss of Voltage Start (LOVS)." Individual plants shall include the CPIAS Function and LCO requirements that are applicable to them.~~

This LCO encompasses the CPIAS, which is an Engineered Safety Feature (ESF) instrumentation and control system that performs a containment isolation actuation function required for plant protection against the uncontrolled release of radioactivity but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Trip," or LCO 3.3.7, "Emergency Diesel Generator (EDG) - Loss of Voltage Start (LOVS)."

the release of radioactivity and

The CPIAS provides protection from radioactive contamination in the containment in the event a fuel assembly should be severely damaged during handling. It also closes the purge valves during plant operation in response to a reactor coolant system (RCS) leak.

The CPIAS will detect any abnormal amounts of radioactive material in the containment and will initiate purge valve closure to limit the release of radioactivity to the environment. Both the low and high volume purge supply and exhaust valves are closed on a CPIAS when a high radiation level in containment is detected.

divisions

The CPIAS includes two independent, redundant logic ~~subsystems~~, including actuation ~~trains~~. Each ~~train~~ employs two sensors, each one detecting gamma (area).

logic

division

If the signal from any one of these four sensors exceeds the bistable logic trip setpoint, both CPIAS Division A and Division B will be actuated (one-out-of-four logic).

~~If any one of these sensors exceeds the bistable trip setpoint, the CPIAS train will be actuated (one-out-of-two logic).~~

low and high volume

Each ~~train~~ actuates a separate series valve in the containment purge supply and return lines. Either ~~train~~ controls sufficient equipment to perform the isolation function. These valves are also isolated on a Safety Injection Actuation Signal (SIAS) and Containment Isolation Actuation Signal (CIAS).

CPIAS division

Nominal Trip

~~Actuation~~ Setpoints and Allowable Values

The nominal trip setpoints (NTSPs) used in the bistable logic are based on the accident analyses' analytical limits (Reference 1).

~~Actuation setpoints used in the bistables are based on the analytical limits (Reference 1).~~ The selection of ~~these actuation setpoints~~ is such that adequate protection is provided when all sensor and processing time delays are taken into account.

NTSPs

The actual NTSP entered into the bistable logic is more conservative than the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.

BASES

BACKGROUND (continued)

One example of such a change in measurement error is drift of the transmitter during the surveillance interval. If the as-found actuation setting measured by the CHANNEL FUNCTIONAL TEST remains conservative with respect to the As-Found Tolerance (AFT) band around the previous as-left setting between successive CHANNEL CALIBRATIONS and does not exceed the Allowable Value, the instrument channel is considered OPERABLE, provided the channel is performing normally as expected.

calculated

To allow for calibration tolerances, instrumentation uncertainties, and instrument drift, actuation setpoint Allowable Values specified in the setpoint control program (SCP) are conservatively ~~adjusted~~ with respect to the analytical limits. ~~The actual nominal actuation setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.~~

~~One example of such a change in measurement error is drift during the surveillance interval.~~ ~~If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.~~

Allowable Value

Setpoints in accordance with the ~~allowable value~~ will ensure that safety limits are not violated during anticipated operational occurrences (AOOs) and the consequences of design basis accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the AOO or accident and the equipment functions as designed.

low and high volume purge supply and exhaust line isolation

SAFETY ANALYSES

The CPIAS is a backup to the CIAS systems in MODES 1, 2, 3, and 4 and will close the containment ~~purge~~ valves in the event of high radiation levels resulting from a primary leak in the containment.

radioactivity

line isolation

The CPIAS is also required to close the containment purge valves in the event of the fuel handling accident in containment, as described in Reference 1. This accident is a limiting case representing a class of accidents that may involve ~~radiation~~ release in containment without CIAS actuation. The CPIAS ensures the consequences of a dropped fuel assembly in containment are not as severe as a dropped assembly in the fuel handling area. This ensures that the offsite consequences of ~~radiation~~ accidents in containment are within 10 CFR 50.34 limits (Reference 2).

irradiated

fuel handling

irradiated fuel

The CPIAS satisfies the requirements of ~~LCO Selection~~ Criterion 3.

of 10 CFR 50.36(c)(2)(II)

BASES

LCO

LCO 3.3.8 requires one CPIAS division to be OPERABLE. The required division consists of one instrument division with two area radiation monitor channels, one Actuation Logic division; and one Manual Actuation division.

~~LCO 3.3.8 requires one CPIAS channel to be OPERABLE. The required channel consists of area radiation monitors, actuation logic, and manual actuation.~~

actuation (trip)

The specific Allowable Values for the setpoints of the CPIAS are listed in the ~~SRs~~.

Setpoint Control Program required documentation.

NTSP

Operation with a trip setpoint less conservative than the ~~nominal trip setpoint~~, but within its Allowable Value, is acceptable provided that the difference between the ~~nominal actuation setpoint~~ and the Allowable Value is equal to or greater than the drift allowance assumed for each actuation in the transient and accident analyses.

actual trip setting

specified

calculated NTSP, which is derived from the analytical limit in the

These uncertainties are defined in the NRC approved setpoint methodology specified by the Setpoint Control Program, Specification 5.5.19.

Each Allowable Value ~~specified~~ is more conservative than the analytical limit assumed in the transient and accident ~~analysis~~ in order to account for instrument uncertainties appropriate to the actuation function.

analyses

The ~~bases~~ for the LCO on CPIAS are discussed below for each Function:

Bases

a. ~~manual actuation~~

Manual Actuation

Replace with "A" on the next page.

~~The LCO on manual actuation backs up the automatic actuation and ensures operators have the capability to rapidly initiate the CPIAS Function if any parameter is trending toward its setpoint. Only one manual channel of CPIAS is required in MODES 1, 2, 3, and 4, since the CPIAS is redundant with the CIAS and SIAS. Only one manual channel of CPIAS is required during CORE ALTERATIONS and movement of irradiated fuel assemblies, since there are additional means of closing the containment purge valves in the event of a channel failure.~~

Containment Area Radiation Monitors and Bistable Logic

b. ~~Containment Area Radiation~~

Replace with "B" on the next page.

~~The LCO on the radiation channels requires that each channel be OPERABLE for each actuation logic channel.~~

~~The actuation setpoint is selected to allow detection of small deviations from normal. The absolute value of the actuation setpoint in MODES 5 and 6 differs from the setpoint in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the radiation level expected in these MODES.~~

"A"

The LCO on the CPIAS Manual Actuation Function division backs up the CPIAS Automatic Actuation Function division and ensures operators have the capability to rapidly initiate the CPIAS Function if any parameter is trending toward its NTSP Only one Manual Actuation division of CPIAS is required in MODES 1, 2, 3, and 4, since the CPIAS is redundant to the CIAS and SIAS for isolating the purge supply and exhaust line containment penetrations. Only one Manual Actuation division of CPIAS is required during CORE ALTERATIONS and movement of irradiated fuel assemblies, since there are additional means of closing the containment purge isolation valves in the event of a Manual Actuation division failure.

"B"

The LCO on the CPIAS instrument Function division requires that each of the two area radiation monitor channels be OPERABLE for sending a bistable logic trip signal to the Actuation Logic division. The two area radiation monitor channels are not totally redundant to each other, since the indication overlap only ranges from 10 mSv/hour to 100 mSv/hour; however both NTSPs are within this range.

The CPIAS NTSP is selected to allow detection of small deviations from the normal background radiation level. The absolute value of the NTSP in MODES 5 and 6 differs from the NTSP in MODES 1, 2, 3, and 4 so that a fuel handling accident can be detected in the lower levels of radiation expected in MODES 5 and 6. The containment upper operating area radiation monitor channel supports the CPIAS during MODES 1, 2, 3, and 4, and has a higher NTSP. The containment operating area radiation monitor channel supports the CPIAS during MODES 5 and 6, and has a lower NTSP. In any MODE, just one area radiation monitor channel is relied upon for initiating an automatic containment purge line isolation.

BASES

LCO (continued)

c. ~~actuation logic~~

Actuation Logic

Actuation Logic division

One ~~channel of actuation logic~~ is required, since the valves can be shut independently of the CPIAS signal either manually from the MCR or using either the SIAS or CIAS push button.

containment purge isolation

---

these

line isolation valves

APPLICABILITY In MODES 1, 2, 3, and 4, the low volume purge ~~valves~~ may be open. In ~~the~~ MODES, it is necessary to ensure the valves will shut in the event of a primary leak in containment whenever any of the containment purge valves are open.

coolant

line isolation

associated containment purge or exhaust line

With the purge valves open during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, there is the possibility of a fuel handling accident requiring CPIAS on high radiation in containment.

flow path

The APPLICABILITY is modified by a Note, which states that the CPIAS Specification is only required when the penetration is not isolated by at least one closed and deactivated automatic valve, closed manual valve, or blind flange.

---

process instrument

division

division's

sensor, transmitter, or analog signal processing equipment

ACTIONS A CPIAS ~~channel~~ is inoperable when it does not satisfy the OPERABILITY criteria for the ~~channel's~~ function. The most common cause of channel inoperability is outright failure or drift of the ~~bistable or process module~~ sufficient to exceed the tolerance allowed by the ~~plant specific setpoint analysis~~. Typically, the drift is not large and would result in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it within specification. If the actuation ~~setpoint~~ is not consistent with the Allowable Value, the ~~channel~~ must be declared inoperable immediately, and the appropriate Conditions must be entered.

NRC-approved setpoint methodology specified in the Setpoint Control Program, Specification 5.5.19

as-found

division

division's

setting

In the event a ~~channel's~~ actuation ~~setpoint~~ is found nonconservative with respect to the Allowable Value, or the sensor, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that ~~channel~~ are required to be declared inoperable and the LCO Condition entered for the particular protective function affected.

division

logic processor

BASES

ACTIONS (continued)

When the number of inoperable channels ~~in a~~ actuation Function exceeds that specified in any related Condition associated with the same actuation Function, then the ~~plant~~ is outside the safety ~~analysis~~. Therefore, LCO 3.0.3 is immediately entered if applicable in the current MODE of operation.

or divisions of an ESF

unit

analyses

ESF

immediately

A.1

~~Condition A applies to the failure of CPIAS manual actuation, actuation logic, and required area radiation monitors.~~ The Required Action is to enter the applicable Conditions and Required Actions ~~for affected valves~~ of LCO 3.6.3, "Containment Isolation Valves." The Completion Time accounts for the condition that the capability to isolate containment on valid containment high radiation or manual signals is degraded during power operation ~~or~~ shutdown MODES.

Condition A applies to the failure of the CPIAS required Manual Actuation division, required Actuation Logic division, and one or more of the required CPIAS instrument division area radiation monitor channels in MODES 1, 2, 3, and 4.

, startup, standby, or hot

, " for containment purge isolation valves made in operable by CPIAS instrumentation.

B.1 and B.2

Condition B applies when the Required Action and associated Completion Time of Condition A are not met in MODE 1, 2, 3, or 4. If Required Action A cannot be met within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and MODE 5 within 36 hours.

C.1, C.2.1, and C.2.2

, but

Condition C applies to the same conditions as are described in Condition A~~; however, the applicability is~~ during CORE ALTERATIONS or during the movement of irradiated fuel assemblies within containment. Required Action C.1 is to place the containment purge and exhaust isolation valves in the closed position. The Required Action immediately performs the isolation function of the CPIAS. Required Actions C.2.1 and C.2.2 may be performed in lieu of Required Action C.1. Required Action C.2.1 requires the suspension of CORE ALTERATIONS and Required Action C.2.2 requires suspension of movement of irradiated fuel in containment immediately. The Completion Time accounts for the fact that the automatic capability to isolate containment on valid containment high radiation signals is degraded during conditions in which a fuel handling accident is possible and CPIAS provides the only automatic mitigation of radiation release.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.8.1

and operating area radiation monitor channels

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred on the required upper operating area radiation monitor channels used in the CPIAS. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels.

Both containment upper operating area radiation monitor channels and both containment operating area radiation monitor channels need to be OPERABLE so comparison can be made.

It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure. Thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it could be an indication that the transmitter or the signal processing equipment has drifted outside its limit.

The Surveillance Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Since the probability of two random failures in redundant channels in any 12-hour period is low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO required channels.

SR 3.3.8.2

~~SR 3.3.8.2 is the performance of a CHANNEL CHECK on the operating area monitor channels used in the CPIAS. It differs only in the Frequency as weekly. This technique results in an integration of total operating area radiation activity until the assemblies are replaced. The low levels of activity expected make more frequent monitoring unnecessary.~~

SR 3.3.8.2 is the performance of a CHANNEL CHECK on the particulate and iodine channels. SR 3.3.8.2 is not applicable because there is no particulate and iodine channels in CPIAS.

BASES

each required upper operating area radiation monitor channel and required operating area radiation monitor channel

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.8.3

A CHANNEL FUNCTIONAL TEST is performed on the ~~required containment radiation monitoring channel~~ to ensure the entire channel will perform its intended function. The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology. The Frequency of 92 days is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 92-day Frequency is a rare event.

required to be met

A Note to the SR indicates this Surveillance is ~~applicable~~ in MODES 1, 2, 3, and 4 only.

each required upper operating area radiation monitor channel and required operating area radiation monitor channel

SR 3.3.8.4

A CHANNEL FUNCTIONAL TEST is performed on the ~~required containment radiation monitoring channel~~ to ensure the entire channel will perform its intended function. The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology. The Frequency of 92 days is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 92-day interval is a rare event.

required to be met

A Note to the SR indicates that this test is only ~~applicable~~ during CORE ALTERATIONS or during movement of irradiated fuel assemblies within containment.

SR 3.3.8.5

required Actuation Logic division

Proper operation of the individual initiation relays is verified by actuating these relays during the CHANNEL FUNCTIONAL TEST of the ~~actuation logic~~ every 18 months. This will actuate the Function, operating all associated equipment. Proper operation of the equipment actuated by each ~~train~~ is thus verified. The Frequency of 18 months is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of ~~more than one channel~~ of a given Function during any ~~18 month~~ interval is a rare event. A Note to the SR indicates that this Surveillance includes verification of operation for each initiation relay.

division

18 month

an Actuation Logic division

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.8.6

OPERABLE

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains ~~operational~~ between successive surveillances.

The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the NRC-approved setpoint methodology.

The ~~18 month~~ Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage ~~and the potential for an unplanned transient if the Surveillance were performed with the reactor at power~~.

18 month

SR 3.3.8.7

CPIAS division

accident analyses (Reference 1).

This Surveillance ensures that the ~~train~~ actuation response times are less than or equal to the maximum times assumed in the ~~analyses~~. The ~~18 month~~ Frequency is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Testing of the final actuating devices, which make up the bulk of the response time, is included in the Surveillance.

The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

SR 3.3.8.8

required CPIAS Manual Actuation division.

Every 18 months, a CHANNEL FUNCTIONAL TEST is performed on the ~~CPIAS manual actuation channel~~.

containment purge line isolation

This test verifies that the actuation push buttons are capable of ~~opening contacts in the actuation logic as designed, de-energizing the initiation relays and~~ providing manual actuation of the ~~F~~unction.

REFERENCES

1. DCD Tier 2, Chapter 15.
2. 10 CFR 50.34.

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.:	**444-8530**
SRP Section:	**16 - Technical Specifications**
Application Section:	**16.3.7, 16.3.3.8, 16.3.3.9, 16.3.3.10**
Date of RAI Issue:	**03/16/2016**

Question No. 16-134

The applicant is requested to revise generic TS 3.3.9, "Control Room Emergency Ventilation Actuation Signal (CREVAS)," as follows (See DCD Figure 7.3-11):

1. Change LCO statement to say, "One CREVAS **instrument division with one radiation monitor** channel**, one Manual Actuation division, and one Actuation Logic division** shall be OPERABLE." Also make conforming changes to the Bases for generic TS 3.3.9.

2. Revise Condition A as follows: "CREVAS **required** Manual Actuation **division**, **required** Actuation Logic **division**, or **required instrument division with** one ~~or more~~ required ~~channels of~~ radiation monitor~~s~~ **channel** inoperable in MODES 1, 2, 3, and 4." Also make conforming changes to the Bases for generic TS 3.3.9.

3. Revise Required Action A.1 to define acronym 'HVAC" as follows: "Place one control room area **heating, ventilation, and air conditioning (**HVAC**)** system train in emergency operation mode. | 1 hour"

4. Revise Condition C as follows: "CREVAS **required** Manual Actuation **division**, **required** Actuation Logic **division**, or **required instrument division with** one ~~or more~~ required ~~channels of~~ radiation monitor~~s~~ **channel** inoperable during CORE ALTERATIONS or movement of irradiated fuel assemblies." Also make conforming changes to the Bases for generic TS 3.3.9.

5. To be consistent with STS 3.3.9B, SR 3.3.9.3, Channel Functional Test on "required CRIS Actuation Logic channel," revise surveillance column Note for generic TS SR 3.3.9.3 as indicated: "Surveillance ~~Requirement~~ of Actuation Logic shall include verification of proper operation of each initiation circuit. In addition, the STS SR 3.3.9.3 Note says "Surveillance of Actuation Logic shall include the verification of the proper

operation of each initiation relay." Explain the difference between "initiation circuit" and "initiation relay."

6. To be consistent with suggested edits to LCO 3.3.9, and Conditions A and C, revise SR 3.3.9.3 as indicated: "Perform CHANNEL FUNCTIONAL TEST on required CPIAS Actuation Logic ~~channel~~ **division**." Also make conforming changes to the Bases for generic TS 3.3.9.

7. Applicant is requested to revise the Bases for Specification 3.3.9 to be consistent with the requested changes to the Bases for Specification 3.3.8.

Response

APR1400 Technical Specifications, generic TS 3.3.9 and Bases for generic TS 3.3.9 will be revised, as indicated in the attachment associated with this response.

Impact on DCD

Same as changes described in Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

APR1400 Technical Specifications3.3.9 and Bases section 3.3.9 will be revised, as indicated in the attachment associated with this response.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.9 Control Room Emergency Ventilation Actuation Signal (CREVAS)

LCO 3.3.9 ~~One CREVAS channel shall be OPERABLE.~~ One CREVAS instrument division with one radiation monitor channel, one Manual Actuation division, and one Actuation Logic division shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4,
During CORE ALTERATIONS,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~CREVAS Manual Actuation, Actuation Logic, or required channels of radiation monitors inoperable in MODE 1, 2, 3, or 4.~~ CREVAS required Manual Actuation division, required Actuation Logic division, or required instrument division with one required radiation monitor channel inoperable in MODES 1, 2, 3, and 4.	A.1 Place one control room area ~~HVAC~~ heating, ventilation, and air conditioning (HVAC) system train in emergency operation mode.	1 hour
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. ~~CREVAS Manual Actuation, Actuation Logic, or radiation monitors channels inoperable during CORE ALTERATIONS or movement of irradiated fuel assemblies.~~	C.1 Place one control room area HVAC system train in emergency operation mode. OR C.2.1 Suspend movement of irradiated fuel assemblies. AND C.2.2 Suspend positive reactivity additions. AND C.2.3 Suspend CORE ALTERATIONS.	Immediately Immediately Immediately Immediately

CREVAS required Manual Actuation division, required Actuation Logic division, or required instrument division with one required radiation monitor channel inoperable during CORE ALTERATIONS or movement of irradiated fuel assemblies.

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.9.1	Perform CHANNEL CHECK on required CREVAS radiation monitor channel.	12 hours
SR 3.3.9.2	Perform CHANNEL FUNCTIONAL TEST on required CREVAS radiation monitor channel in accordance with Setpoint Control Program.	92 days
SR 3.3.9.3	---------- NOTE ---------- Surveillance ~~Requirement~~ of Actuation Logic shall include verification of proper operation of each initiation ~~circuit~~. relay ----------	
	Perform CHANNEL FUNCTIONAL TEST on required CREVAS Logic ~~channel~~. division	18 months
SR 3.3.9.4	Perform CHANNEL CALIBRATION on required CREVAS radiation monitor channel in accordance with Setpoint Control Program.	18 months
SR 3.3.9.5	Perform CHANNEL FUNCTIONAL TEST on required CREVAS Manual Actuation ~~channel~~. division	18 months
SR 3.3.9.6	Verify that the response time of required CREVAS ~~channel~~ is within limits. division	18 months

B 3.3 INSTRUMENTATION

B 3.3.9 Control Room Emergency Ventilation Actuation Signal (CREVAS)

BASES

BACKGROUND

~~This LCO encompasses CREVAS actuation, which is a plant specific instrumentation channel that performs an actuation Function required for plant protection but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and manual actuation," or LCO 3.3.7, "Emergency Diesel Generator (EDG) – Loss of Voltage Start (LOVS)."~~ This is a BOP ESFAS Function that, because of differences in purpose, design, and operating requirements, is not included in LCO 3.3.6 and LCO 3.3.7. Details of this LCO are for illustration only. ~~Individual plants shall include those Functions and LCO requirements that are applicable to them.~~

This LCO encompasses the CREVAS, which is an Engineered Safety Feature (ESF) instrumentation and control system that performs a emergency ventilation actuation function required for plant protection but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Trip," or LCO 3.3.7, "Emergency Diesel Generator (EDG) - Loss of Voltage Start (LOVS)."

division

divisions

logic

The CREVAS terminates the normal supply of outside air to the MCR and initiates actuation of the control room emergency air cleaning unit to minimize operator radiation exposure. The CREVAS includes two independent, redundant ~~subsystems~~, including actuation ~~trains~~. Each ~~train~~ employs two separate sensors and detects gaseous activity. Since there are separate sensors in each ~~train~~, the ~~trains~~ are redundant. ~~If the bistable monitoring either sensor indicates an unsafe condition, that train will be actuated (one out of two logic).~~ ~~The two trains actuate~~ separate equipment. Actuating ~~either train~~ will perform the intended function. Control room isolation also occurs on a Safety Injection Actuation Signal (SIAS).

CREVAS division

Each CREVAS division actuates

If the signal from any one of these four sensors exceeds the bistable logic trip setpoint, both CREVAS Division A and Division B will be actuated (one-out-of-four logic).

~~Actuation~~ Setpoints and Allowable Values

Nominal Trip

NTSPs

~~Actuation setpoints used in the bistables are based on the analytical limits (Reference 1).~~ The selection of ~~these actuation setpoints~~ is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, and instrument drift, Allowable Values specified in the setpoint control program (SCP) are conservatively ~~adjusted~~ with respect to the analytical limits. ~~The actual nominal actuation setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.~~

The nominal trip setpoints (NTSPs) used in the bistable logic are based on the accident analyses' analytical limits (Reference 1).

calculated

The actual NTSP entered into the bistable logic is more conservative than the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.

BASES

BACKGROUND (continued)

~~One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.~~

Allowable Value

Setpoints in accordance with the ~~allowable value~~ will ensure that the main control room (MCR) dose is not violated during anticipated operational occurrences (AOOs) and the consequences of design basis accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the AOO or accident and the equipment functions as designed.

APPLICABLE SAFETY ANALYSES

The CREVAS, in conjunction with the control room area HVAC System maintains the MCR atmosphere within conditions suitable for prolonged occupancy throughout the duration of any one of the accidents discussed in Reference 1. The radiation exposure of MCR personnel, through the duration of any one of the postulated accidents discussed in "Transient and Accident Analysis," DCD Tier 2, Chapter 15 (Reference 1), does not exceed the limits set by 10 CFR Part 50, Appendix A, GDC 19 (Reference 2).

of 10 CFR 50.36(c)(2)(II)

The CREVAS satisfies the requirements of ~~LCO SELECTION~~ CRITERION 3.

Setpoint Control Program required documentation.

LCO

~~LCO 3.3.9 requires one channel of CREVAS to be OPERABLE. The required channel consists of actuation logic, manual actuation, and gaseous radiation monitors.~~ The specific Allowable Values for the setpoints of the CREVAS are listed in the ~~SRs~~.

actuation (trip)

LCO 3.3.9 requires one CREVAS division to be OPERABLE. The required division consists of one instrument division with one area radiation monitor channels, one Actuation Logic division; and one Manual Actuation division.

NTSP

Operation with an actuation setpoint less conservative than the ~~nominal actuation setpoint~~, but within its allowable value, is acceptable provided that the difference between the ~~nominal actuation setpoint~~ and the allowable value is equal to or greater than the drift allowance assumed for each actuation in the transient and accident analyses.

actual trip setting

calculated NTSP, which is derived from the analytical limit in the

One example of such a change in measurement error is drift of the transmitter during the surveillance interval. If the as-found actuation setting measured by the CHANNEL FUNCTIONAL TEST remains conservative with respect to the As-Found Tolerance (AFT) band around the previous as-left setting between successive CHANNEL CALIBRATIONS and does not exceed the Allowable Value, the instrument channel is considered OPERABLE, provided the channel is performing normally as expected.

BASES

LCO (continued)

specified Allowable Value

Each ~~allowable value specified~~ is more conservative than the analytical limit assumed in the transient and accident analysis in order to account for instrument uncertainties appropriate to the actuation function. A channel is inoperable if its actual actuation setpoint is not within its required Allowable Value.

The ~~bases~~ for the LCO on the CREVAS are discussed below for each Function:

Bases

Manual Actuation

a. ~~manual actuation~~

~~The LCO on manual actuation backs up the automatic actuation and ensures operators have the capability to rapidly initiate the CREVAS Function if any parameter is trending toward its setpoint. One channel must be OPERABLE.~~ This considers that the manual actuation capability is a backup and that other means are available to actuate the redundant ~~train~~ if required, including manual SIAS.

These uncertainties are defined in the NRC approved setpoint methodology specified by the Setpoint Control Program, Specification 5.5.19.

The LCO on the CREVAS Manual Actuation Function division backs up the CREVAS Automatic Actuation Function division and ensures operators have the capability to rapidly initiate the CREVAS Function if any parameter is trending toward its NTSP. One Manual Actuation division of CREVAS must be OPERABLE.

division

b. Gaseous Radiation

division

Both channels of gaseous radiation detection in the required ~~train~~ are required to be OPERABLE to ensure the MCR isolates on high gaseous concentration.

Logic

c. Actuation ~~logic~~

Actuation Logic division

One ~~train of actuation logic~~ must be OPERABLE, since there are alternate means available to actuate the redundant ~~train~~, including SIAS.

division

APPLICABILITY The CREVAS Functions must be OPERABLE in MODES 1, 2, 3, and 4, during CORE ALTERATIONS, and during movement of irradiated fuel assemblies to ensure a habitable environment for the MCR operators.

process instrument

sensor, transmitter, or analog signal processing equipment

division

division

BASES

ACTIONS

A CREVAS ~~channel~~ is inoperable when it does not satisfy the OPERABILITY criteria for the ~~channel~~'s function. The most common cause of channel inoperability is outright failure or drift of the ~~bistable or process module~~ sufficient to exceed the tolerance allowed by ~~the plant specific setpoint analysis~~. Typically, the drift is not large and would result in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it within specification.

NRC-approved setpoint methodology specified in the Setpoint Control Program, Specification 5.5.19

as-found

setting

division

If the actuation ~~setpoint~~ is not within the Allowable Value, the ~~channel~~ is inoperable and the appropriate Conditions must be entered.

A.1, B.1, B.2, C.1, C.2.1, C.2.2, and C.2.3

CREVAS required Manual Actuation division, required Actuation Logic division, or required instrument division with one required radiation monitor channel inoperable in MODES 1, 2, 3, and 4.

Conditions A, B, and C are applicable to manual and automatic actuation of the control room area HVAC system by CREVAS. Condition A applies to the failure of the ~~CREVAS manual actuation, actuation logic, and required gaseous radiation monitor channels in MODE 1, 2, 3, or 4.~~ Entry into this Condition requires action to either restore the failed ~~channel~~(s) or manually perform the CREVAS safety function (Required Action A.1).

division

The Completion Time of 1 hour is sufficient to complete the Required Actions and accounts for the fact that CREVAS supplements MCR isolation by other Functions (e.g., SIAS) in MODES 1, 2, 3, and 4. If the channel cannot be restored to OPERABLE status, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours (Required Action B.1) and to MODE 5 within 36 hours (Required Action B.2). The Completion Times of 6 hours and 36 hours for reaching MODES 3 and 5 from MODE 1 are reasonable, based on operating experience and normal cooldown rates, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant safety systems.

CREVAS required Manual Actuation division, required Actuation Logic division, or required instrument division with one required radiation monitor channel inoperable during CORE ALTERATIONS or movement of irradiated fuel assemblies.

Condition C applies to the failure of ~~CREVAS manual actuation, actuation logic, and required gaseous monitor channels during CORE ALTERATIONS or when moving irradiated assemblies.~~ The Required Actions are immediately taken to place one OPERABLE control room area HVAC system train in the emergency radiation protection mode, or to suspend CORE ALTERATIONS, positive reactivity additions, and movement of irradiated fuel assemblies.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.9.2

A CHANNEL FUNCTIONAL TEST is performed on the required MCR radiation monitoring channel to ensure the entire channel will perform its intended function.

The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology.

The Frequency of 92 days is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 92-day interval is a rare event.

SR 3.3.9.3

required Actuation Logic division

Proper operation of the individual initiation relays is verified by de-energizing these relays during the CHANNEL FUNCTIONAL TEST of the ~~actuation logic~~ every 18 months. This will actuate the Function, operating all associated equipment. Proper operation of the equipment actuated by each ~~train~~ is thus verified.

division

The ~~Frequency~~ of 18 months is based on plant operating experience with regard to channel OPERABILITY, which demonstrates that failure of ~~more than one channel~~ of a given Function in any ~~18 month~~ interval is a rare event.

an Actuation Logic division

18 month

Note indicates this Surveillance includes verification of operation for each initiation relay.

The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the NRC-approved setpoint methodology.

SR 3.3.9.4

OPERABLE

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains ~~operational~~ between successive surveillances.

BASES

SURVEILLANCE REQUIREMENTS (continued)

18 month

The Frequency is based upon the assumption of an ~~18 month~~ calibration interval for the determination of the magnitude of equipment drift in the setpoint ~~analysis~~.

analyses

The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

SR 3.3.9.5

required CREVAS Manual Actuation division.

Every 18 months, a CHANNEL FUNCTIONAL TEST is performed on the ~~manual CREVAS actuation channel.~~

control room emergency ventilation

This test verifies that the actuation push buttons are capable of ~~opening contacts in the actuation logic as designed, de-energizing the initiation relays and~~ providing manual actuation of the function.

SR 3.3.9.6

CREVAS division

accident analyses (Reference 1).

This Surveillance ensures that the ~~train~~ actuation response times are less than the maximum times assumed in the ~~analyses~~. The ~~18 month~~ 18 month Frequency is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Testing of the final actuating devices, which make up the bulk of the response time, is included in the Surveillance testing.

REFERENCES

1. DCD Tier 2, Chapter 15.
2. 10 CFR Part 50, Appendix A, GDC 19.

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.:	**444-8530**
SRP Section:	**16 - Technical Specifications**
Application Section:	**16.3.7, 16.3.3.8, 16.3.3.9, 16.3.3.10**
Date of RAI Issue:	**03/16/2016**

Question No. 16-135

The applicant is requested to revise generic TS 3.3.10, "Fuel Handling Area Emergency Ventilation Actuation Signal (FHEVAS)," as follows (See DCD Figure 7.3-9):

1. Change LCO statement to say, "One FHEVAS **instrument division with one radiation monitor** channel**, one Manual Actuation division, and one Actuation Logic division** shall be OPERABLE." Also make conforming changes to the Bases for generic TS 3.3.10.

2. Revise Condition A as follows: "**Required Manual Actuation division**, **required** Actuation Logic **division**, ~~Manual Actuation,~~ **or required instrument division with required** radiation ~~monitors channels~~ **monitor channel** inoperable." Also make conforming changes to the Bases for generic TS 3.3.10.

3. For consistency with STS 3.3.10B, revise Required Action A.1 to define acronym 'HVAC" as follows: "Place one **OPERABLE** fuel handling area **heating, ventilation, and air conditioning (**HVAC**)** system train in emergency operation mode. | Immediately" Also make conforming changes to the Bases for generic TS 3.3.10.

4. Generic TS SR 3.3.10.1 says, "Perform CHANNEL CHECK on required FHEVAS radiation monitor channel." If only one channel is required, how is this surveillance accomplished?

5. STS 3.3.10B, SR 3.3.10.3 surveillance column Note, says "Testing of Actuation Logic shall include the actuation of each initiation relay and verification of the proper operation of each ignition relay." Generic TS SR 3.3.10.3 surveillance column Note says "Testing of Actuation Logic shall include actuation of each initiation circuit and verification of proper operation of each initiation circuit." Explain difference between "initiation relay" and "initiation circuit." Also, revise generic TS SR 3.3.10.3 as indicated: "Perform

CHANNEL FUNCTIONAL TEST on required FHEVAS **Actuation** Logic ~~channel~~ **division**.

6. Revise generic TS SR 3.3.10.4 as indicated: “Perform CHANNEL FUNCTIONAL TEST on required FHEVAS Manual Actuation ~~channel~~ **division**.

7. Revise generic TS SR 3.3.10.6 as indicated: Verify that the response time of required FHEVAS ~~channel~~ **division** is within limits.

8. Applicant is requested to revise the Bases for Specification 3.3.10 to be consistent with the requested changes to the Bases for Specification 3.3.8.

Response

4. Generic TS SR 3.3.10.1 says, “Perform CHANNEL CHECK on required FHEVAS radiation monitor channel.” If only one channel is required, how is this surveillance accomplished?

A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on the other channel.

When a test is performed, one channel is bypassed at the maintenance test panel and a test signal can be manually inserted into the engineered safety features actuation system (ESFAS) actuation circuit at the radiation monitoring system cabinet. The output exists only when the input is higher than the set point. During the test, the other channel will remain in service to perform the required ESFAS initiation.

The APR1400 Technical Specifications, section 3.3.10 and Bases section 3.3.10 will be revised.

Impact on DCD

Same as changes described in Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

APR1400 Technical Specifications section 3.3.10 and the Bases section 3.3.10 will be revised, as indicated in the attachment associated with this response.

Impact on Technical/Topical/Environmental Reports

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

3.3 INSTRUMENTATION

3.3.10 Fuel Handling Area Emergency Ventilation Actuation Signal (FHEVAS)

LCO 3.3.10 ~~One FHEVAS channel shall be OPERABLE.~~

One FHEVAS instrument division with one radiation monitor channel, one Manual Actuation division, and one Actuation Logic division shall be OPERABLE.

APPLICABILITY: During movement of irradiated fuel in the fuel handling area.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~Actuation Logic, Manual Actuation, radiation monitors channels inoperable.~~	A.1 Place one fuel handling area ~~HVAC~~ system train in emergency operation mode.	Immediately
	OR	
	A.2 Suspend movement of irradiated fuel assemblies in fuel handling area.	Immediately

OPERABLE

heating, ventilation, and air conditioning (HVAC)

Required Manual Actuation division, required Actuation Logic division, or required instrument division with required radiation monitor channel inoperable.

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.3.10.1	Perform CHANNEL CHECK on required FHEVAS radiation monitor channel.	12 hours
SR 3.3.10.2	Perform CHANNEL FUNCTIONAL TEST on required FHEVAS radiation monitor channel in accordance with Setpoint Control Program.	92 days
SR 3.3.10.3	---------- NOTE ---------- Testing of Actuation Logic shall include actuation of each initiation ~~circuit~~ and verification of proper operation of each initiation ~~circuit~~. ---------- Perform CHANNEL FUNCTIONAL TEST on required FHEVAS Logic ~~channel~~.	18 months
SR 3.3.10.4	Perform CHANNEL FUNCTIONAL TEST on required FHEVAS Manual Actuation ~~logic~~.	18 months
SR 3.3.10.5	Perform CHANNEL CALIBRATION on required FHEVAS radiation monitor channel in accordance with Setpoint Control Program.	18 months
SR 3.3.10.6	Verify that the response time of required FHEVAS ~~channel~~ is within limits.	18 months

relay
division
Actuation
division
division

B 3.3 INSTRUMENTATION

B 3.3.10 Fuel Handling Area Emergency Ventilation Actuation Signal (FHEVAS)

BASES

BACKGROUND

~~This LCO encompasses FHEVAS, which is a plant specific instrumentation channel that performs an actuation Function required for plant protection, but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Actuation," or LCO 3.3.7, "Emergency Diesel Generator (EDG) – Loss of Voltage Start (LOVS)."~~ This is a BOP ESFAS Function that, because of differences in purpose, design, and operating requirements, is not included in LCO 3.3.6 and LCO 3.3.7. Details of this LCO are for illustration only. ~~Individual plants shall include those Functions and LCO requirements that are applicable to them.~~

This LCO encompasses the FHEVAS, which is an Engineered Safety Feature (ESF) instrumentation and control system that performs a emergency ventilation actuation function required for plant protection but is not otherwise included in LCO 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Trip," or LCO 3.3.7, "Emergency Diesel Generator (EDG) - Loss of Voltage Start (LOVS)."

the release of radioactivity and

The FHEVAS provides protection from radioactive contamination in the spent fuel pool area in the event that a spent fuel element ruptures during handling.

The FHEVAS will detect radioactivity from fission products in the fuel and will initiate appropriate actions so the release to the environment is limited. More detail is provided in Reference 1.

division

divisions

logic

FHEVAS division

The FHEVAS includes two independent, redundant ~~subsystems~~, including actuation ~~trains~~. Each ~~sensing channel~~ employs one separate sensor. Since there is a separate sensor in each ~~sensing channel~~, the ~~actuation trains~~ are redundant. ~~If the bistable monitoring either sensor indicates an unsafe condition, the redundant actuation trains will be actuated through one-out-of-two logic coincidence logic. The two trains actuate~~ separate equipment.

If the signal from any one of these four sensors exceeds the bistable logic trip setpoint, both FHEVAS Division A and Division B will be actuated (one-out-of-two logic).

Each FHEVAS division actuates

~~Actuation~~ Setpoints and Allowable Values

Nominal Trip

NTSPs

~~Actuation setpoints used in the bistables are based on the analytical limits (Reference 2).~~ The selection of ~~these actuation setpoints~~ is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, and instrument drift, Allowable Values specified in the ~~setpoint control program~~ are conservatively ~~adjusted~~ with respect to the analytical limits. ~~The actual nominal actuation setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.~~

The nominal trip setpoints (NTSPs) used in the bistable logic are based on the accident analyses' analytical limits (Reference 2).

calculated

The actual NTSP entered into the bistable logic is more conservative than the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST.

setpoint control program (SCP)

BASES

BACKGROUND (continued)

One example of such a change in measurement error is drift of the transmitter during the surveillance interval. If the as-found actuation setting measured by the CHANNEL FUNCTIONAL TEST remains conservative with respect to the As-Found Tolerance (AFT) band around the previous as-left setting between successive CHANNEL CALIBRATIONS and does not exceed the Allowable Value, the instrument channel is considered OPERABLE, provided the channel is performing normally as expected.

~~One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.~~

Setpoints in accordance with the Allowable Value will ensure that Safety Limits are not violated during anticipated operational occurrences (AOOs) and the consequences of design basis accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the AOO or accident and the equipment functions as designed.

The FHEVAS is required to isolate the normal fuel handling area HVAC system and automatically initiate the recirculation and filtration systems in the event of the fuel handling accident in the fuel handling area, as described in Reference 2. The FHEVAS helps ensure acceptable consequences for the dropping of a spent fuel bundle breaching up to 60 fuel pins.

The FHEVAS satisfies the requirements of ~~LCO SELECTION~~ CRITERION 3 of 10 CFR 50.36(c)(2)(II)

LCO

LCO 3.3.10 requires one FHEVAS division to be OPERABLE. The required division consists of one instrument division with one radiation monitor channel, one Actuation Logic division; and one Manual Actuation division.

~~LCO 3.3.10 requires one channels of FHEVAS to be OPERABLE. The required channel consists of actuation logic, manual actuation, and area radiation monitors.~~ The specific Allowable Values for the setpoints of the FHEVAS are listed in the SRs.

actuation (trip)

Setpoint Control Program required documentation.

NTSP

Only the Allowable values are specified for each actuation Function in the SRs. Operation with an actuation setpoint less conservative than the ~~nominal actuation setpoint~~, but within its allowable value, is acceptable, provided that the difference between the ~~nominal actuation setpoint~~ and the Allowable Value is equal to or greater than the drift allowance assumed for each actuation in the transient and accident analyses.

actual trip setting

specified Allowable Value

analyses

Each ~~allowable value specified~~ is more conservative than the analytical limit assumed in the transient and accident ~~analysis~~ in order to account for instrument uncertainties appropriate to the actuation Function.

These uncertainties are defined in the NRC approved setpoint methodology specified by the Setpoint Control Program, Specification 5.5.19.

calculated NTSP, which is derived from the analytical limit in the

BASES

LCO (continued)

The Bases for the LCO on the FHEVAS are discussed below for each Function:

a. Manual ~~actuation~~

Actuation

the FHEVAS Manual Actuation Function division

divisions

The LCO on ~~manual actuation~~ ensures that the FHEVAS Function can easily be initiated if any parameter is trending rapidly toward its setpoint. Components can be actuated independently of the FHEVAS. Both available ~~channels~~ are required to ensure a single failure will not disable automatic initiation capability.

b. Area Radiation

The LCO on the two area radiation channels requires that each channel be OPERABLE for the required actuation logic.

c. Actuation ~~logic~~

Logic

divisions

Two ~~channels~~ of actuation logic are required to be OPERABLE to ensure no single random failure can prevent automatic actuation.

APPLICABILITY

The FHEVAS Functions are required to be OPERABLE during movement of irradiated fuel in the fuel handling area. The FHEVAS isolates the fuel handling area in the event of a fuel handling accident.

The FHEVAS must be OPERABLE in during movement of irradiated fuel in the fuel handling area, since the FHEVAS isolates the fuel handling area in the event of a fuel handling accident.

BASES

ACTIONS

An FHEVAS ~~channel~~ is inoperable when it does not satisfy the OPERABILITY criteria for the ~~channel's~~ function. The most common cause of channel inoperability is outright failure or drift of the ~~bistable or process module~~ sufficient to exceed the tolerance allowed by the ~~plant specific setpoint analysis~~. Typically, the drift is not large and would result in a delay of actuation rather than a total loss of function. This determination is generally made during the performance of a CHANNEL FUNCTIONAL TEST when the process instrument is set up for adjustment to bring it within specification. If the actuation ~~setpoint~~ is not consistent with the Allowable Value in LCO 3.3.10, the ~~channel~~ must be declared inoperable immediately and the appropriate Conditions must be entered.

In the event a ~~channel's~~ actuation ~~setpoint~~ is found non-conservative with respect to the Allowable Value, or the sensor, instrument loop, signal processing electronics, or bistable is found inoperable, then all affected Functions provided by that ~~channel~~ are required to be declared inoperable and the LCO Condition entered for the particular protective function affected.

When the number of inoperable channels ~~in an~~ actuation Function exceeds that specified in any related Condition associated with the same actuation Function, then the ~~plant~~ is outside the safety ~~analysis~~. Therefore, LCO 3.0.3 is immediately entered if applicable in the current MODE of operation.

A.1 and A.2

Condition A applies only to those configurations when the fuel handling area HVAC is shared with the ESF equipment room.

Condition A applies to any FHEVAS ~~manual actuation, actuation logic, and radiation monitors~~ inoperable during movement of irradiated fuel in the fuel handling area.

The Required Actions place one OPERABLE fuel handling area HVAC system train in ~~operation~~ or suspend movement of irradiated fuel in the fuel handling area. These Required Actions are required to be completed immediately.

The Completion Time accounts for the higher likelihood of releases in the fuel handling area during fuel handling.

process instrument

division

division's

sensor, transmitter, or analog signal processing equipment

NRC-approved setpoint methodology specified in the Setpoint Control Program, Specification 5.5.19

setting

as-found

division

division's

setting

division

logic processor

or divisions of an ESF

ESF

unit

analyses

Required Manual Actuation division, required Actuation Logic division, or required instrument division with required radiation monitor channel

emergency operation mode

assemblies

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.10.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value.

Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it could be an indication that the transmitter or the signal processing equipment has drifted outside its limit.

The Frequency, about once every shift, is based on operating experience that demonstrates the rarity of channel failure. Since the probability of two random failures in redundant channels in any 12-hour period is low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK checks channel OPERABILITY during normal operational use of the displays associated with the LCO required channels.

SR 3.3.10.2

monitor

A CHANNEL FUNCTIONAL TEST is performed on the required fuel handling area radiation ~~monitoring~~ channel to ensure the entire channel will perform its intended function. The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology.

The Frequency of 92 days is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 92-day Frequency is a rare event.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.10.3

Proper operation of the individual initiation relays is verified by actuating these relays during the CHANNEL FUNCTIONAL TEST of the ~~actuation logic~~ every 18 months. This will actuate the Function, operating all associated equipment. Proper operation of the equipment actuated by each ~~train~~ is thus verified. The Frequency of 18 months is based on plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of ~~more than one channel~~ of a given Function during any ~~18 month~~ Frequency is a rare event.

A Note to the SR indicates that this Surveillance includes verification of operation for each initiation relay.

SR 3.3.10.4

Every 18 months, a CHANNEL FUNCTIONAL TEST is performed on the ~~FHEVAS manual actuation channel~~.

This Surveillance verifies that the actuation push buttons are capable of ~~opening contacts in the actuation logic as designed, de-energizing the initiation relays and~~ providing manual actuation of the Function.

SR 3.3.10.5

CHANNEL CALIBRATION is a complete check of the instrument channel including the sensor. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy.

CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains ~~operational~~ between successive tests. The SCP has controls which require verification that the instrument channel functions as required by verifying the as-left and as-found setting are consistent with those established by the setpoint methodology.

The Frequency is based upon the assumption of an ~~18 month~~ calibration interval for the determination of the magnitude of equipment drift in the setpoint ~~analysis~~.

required Actuation Logic division

division

18 month

an Actuation Logic division

required FHEVAS Manual Actuation division.

fuel handling area emergency ventilation

OPERABLE

NRC-approved

18 month

analyses

The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown these components usually pass the Surveillance when performed at a Frequency of once every 18 months.

BASES

SURVEILLANCE REQUIREMENTS (continued)

accident analyses (Reference 2).

FHEVAS division

18 month

SR 3.3.10.6

This Surveillance ensures that the ~~train~~ actuation response times are less than the maximum times assumed in the ~~analyses~~. The ~~18 month~~ Frequency is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences. Testing of the final actuating devices, which make up the bulk of the response time, is included in the Surveillance.

REFERENCES

1. DCD Tier 2, Chapter 9.
2. DCD Tier 2, Chapter 15.