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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 367 Related to ESBWR Design Certification Application – Technical Specifications – RAI Number 16.2-190**

Enclosures 1 and 2 contain the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1 letter.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 09-597, Letter from U.S. Nuclear Regulatory Commission to Jerald G. Head, *Request for Additional Information Letter No. 367 Related to ESBWR Design Certification Application,* September 11, 2009

Enclosures:

1. MFN 09-665 – Response to Portion of NRC Request for Additional Information Letter No. 367 Related to ESBWR Design Certification Application – Technical Specifications – RAI Number 16.2-190
2. MFN 09-665 – DCD Markups for RAI Number 16.2-190

cc:

AE Cubbage	USNRC (with enclosures)
JG Head	GEH (with enclosures)
DH Hinds	GEH (with enclosures)
JD Friday	GEH (with enclosures)
eDRFSection	108-2238

Enclosure 1

MFN 09-665

Response to Portion of NRC Request for

Additional Information Letter No. 367

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Number 16.2-190

NRC RAI 16.2-190

The standard technical specifications (STS) for boiling water reactors (BWRs) include a specification, STS 3.3.3.1, to govern post-accident monitoring (PAM) instrumentation. The bases for STS 3.3.3.1, which is based on Regulatory Guide 1.97, Revision 3, state:

> PAM instrumentation that meets the definition of Type A in Regulatory Guide 1.97 satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). Category 1, non-Type A, instrumentation is retained in the Technical Specifications because it is intended to assist operators in minimizing the consequences of accidents. Therefore, these Category 1, non-Type A variables are important for reducing public risk.

STS 3.3.3.1 contains a Reviewer's Note for applicants or licensees who propose to incorporate STS 3.3.3.1 into their plant's technical specifications. The Note requires replacing the bracketed list of PAM functions in STS Table 3.3.3.1-1 with a list of all Regulatory Guide 1.97 Type A instruments, and the Category 1, non-Type A instruments specified in the plant's Regulatory Guide 1.97 Safety Evaluation Report.

STS 3.3.3.1 and bases, and the STS Table 3.3.3.1-1 Reviewer's Note are based on the May 9, 1988, T.E. Murley (NRC) to R. F. Janecek (BWR Owners' Group) letter, which presented the NRC staff position regarding which accident monitoring instrumentation must be in technical specifications. This letter is known as the "Split Report."

The staff has reviewed its current position, as stated in the STS Reviewer's Note, regarding which accident monitoring instrumentation should be in technical specifications, in comparison to Regulatory Guide 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2008. It is the NRC staff's position that technical specifications should include (1) all Regulatory Guide 1.97, Revision 4, Type A instruments, and (2) all Regulatory Guide 1.97, Revision 4, Type B and Type C instruments in accordance with the units Regulatory Guide 1.97 Safety Evaluation Report. Therefore, a COL applicant should include a technical specification that meets this staff position if the applicant references Regulatory Guide 1.97, Revision 4.

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

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

- Option 2 involves the use of useable bounding information. Option 2 may be practical if the COL applicant is able to develop a truly bounding list of Type A, Type B and Type C PAM instrumentation functions to be included in the plant-specific technical specifications. (The staff recognizes that the ESBWR likely has no Regulatory Guide 1.97, Revision 4, Type A instruments because of its passive design.) However, if a Regulatory Guide 1.97, Revision 4, analysis considering plant-specific EOPs and AOPs, which are based on the as-built plant, shows that additional PAM instrumentation functions are necessary, then the COL holder would need to request a license amendment to make changes to the plant-specific technical specification PAM instrumentation required functions list. The NRC would need to approve this amendment before the COL holder would be allowed to load fuel.

- Option 3 involves an administrative program to control PAM instrumentation functions. Option 3 would require establishing a plant-specific administrative controls program technical specification that would require using an NRC-approved methodology to determine the required PAM instrumentation functions, and maintaining the list of required PAM instrumentation functions in a specified document with appropriate regulatory controls. Option 3 may be practical because the approved methodology, Regulatory Guide 1.97, Revision 4, is already established, and DCD Section 7.5.1 already commits the COL holder to establish a separate document that lists all types of PAM instrumentation. This approach is advantageous because COL holders would not necessarily need to request a license amendment to make changes to the PAM instrumentation required functions list post COL. However, the program technical specification would need to be developed prior to COL issuance.

As noted above, NRC staff has concluded that accident monitoring instrumentation Type B and Type C, as defined Regulatory Guide 1.97, Revision 4, are similar to the Category 1 type defined in Regulatory Guide 1.97, Revision 3. Since standard technical specifications (STS) for boiling water reactors (BWRs) include a technical specification to govern post-accident monitoring (PAM) instrumentation, the staff requests the applicant to include requirements for PAM instrumentation in the ESBWR generic technical specifications. The staff believes the following is an option for such a set of generic technical specification requirements:

(1) Revise Generic Technical Specification 3.3.3.2, “Post-Accident Monitoring (PAM) Instrumentation,” to include a table that specifies the required PAM functions (Table 3.3.3.2-1). The specified PAM functions should be consistent with BWR/6 Standard Technical Specification Table 3.3.3.1-1.

(2) Change the location of the brackets for Generic Technical Specification 3.3.3.2, which are associated with combined license (COL) Item 3.3.3.2-1 in DCD Table 16.0-1-A, to only include Generic Technical Specification Table 3.3.3.2-1, which contains the list of required PAM functions.

(3) Remove the brackets from Generic Technical Specification 5.6.5, “Post Accident Monitoring Report,” and delete COL Item 5.6.5-1 from DCD Table 16.0-1-A.

(4) Revise the Reviewer’s Note for COL Item 3.3.3.2-1 in DCD Table 16.0-1-A to be consistent with Regulatory Guide 1.97, Revision 4, and the reviewer’s note for STS Table 3.3.3.1-1. Also revise the Reviewer’s Note by adding a second note to explain that in lieu of the table listing the PAM functions in the technical specifications, a COL applicant may adopt Specification 5.5.14 (as noted in item 9 below). Establish new COL Item 5.5.14-1 in DCD Table 16.0-1-A and repeat this second note with it.

(5) Revise Generic Technical Specification Limiting Condition for Operation (LCO) 3.3.3.2 to state:

Two channels of each Type A, B, and C PAM Instrumentation Function associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating," shall be OPERABLE.

(6) Revise Generic Technical Specification 3.3.3.2 Conditions A and B to state:

A. One or more required ~~Type A~~ PAM Functions with one required channel inoperable.

B. One or more required ~~Type A~~ PAM Functions with two required channels inoperable.

(7) Revise Availability Control 3.3.4 to address PAM instrumentation not required by revised Generic Technical Specification 3.3.3.2.

(8) Make suitable conforming changes to the bases for Generic Technical Specification 3.3.3.2, consistent with the bases for STS 3.3.3.1. The LCO section of the bases for Generic Technical Specification 3.3.3.2 should contain bracketed discussions of the specified Type A, Type B, and Type C PAM instrumentation functions. Revise the Background and the Applicable Safety Analysis sections of the bases to also include discussions of Type B and Type C PAM instrumentation functions.

(9) Establish a bracketed new specification in Generic Technical Specification Section 5.5 similar to the following model. This would enable COL applicants to choose Option 3 of DC/COL-ISG-8 to complete the technical specifications for PAM instrumentation without having to obtain an exemption from the generic technical specifications.

The following programs shall be established, implemented, and maintained.

[5.5.14 Post-Accident Monitoring (PAM) Instrumentation Program

This program provides controls to establish accident monitoring instrumentation functions that are required by Specification 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." These instrumentation functions shall be those designated as Type A, B, and C, as defined in Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2006, and shall be listed in the PAM function list document as described in FSAR Section 7.5.1. Changes to the list of Type A, B, and C functions shall be made in accordance with the provisions of 10 CFR 50.59 and RG 1.97, Revision 4.]

(10) Revise the Actions of Generic Technical Specification 3.3.3.2 to be consistent with the BWR/6 STS 3.3.3.1 Actions, which require placing the unit in Mode 3 within 12 hours if two required channels of certain PAM functions are inoperable for more than 7 days.

These recommendations result in a PAM instrumentation generic technical specification that includes two COL items. As discussed in DC/COL-ISG-8, a COL applicant may complete the plant-specific technical specification list of required PAM instrumentation functions either by using the bounding approach, Option 2, or by using the programmatic approach, Option 3, with a plant-specific technical specification administrative program requiring that the list of technical specification required PAM instrumentation functions be determined in accordance with an NRC approved methodology.

In the alternative, instead of each COL applicant having to choose an option to complete the PAM COL item, the technical specification administrative program approach (DC/COL-ISG-8, Option 3) could be implemented in the generic technical specifications. This approach would better promote standardization of PAM requirements in plant-specific technical specifications because the administrative program technical specification would be developed on a generic basis for the design center, instead of for each COL applicant. Also, since PAM requirements would no longer be a COL item, the guidance in DC/COL-ISG-8 would not apply, and COL applicants could incorporate by reference the generic administrative program technical specification for PAM instrumentation into the plant-specific technical specifications. Therefore, GEH is requested to consider the alternative of revising PAM instrumentation requirements in the ESBWR generic technical specifications as follows.

(1) Establish a new specification in Generic Technical Specification Section 5.5 similar to the following model:

The following programs shall be established, implemented, and maintained.

5.5.14 Post-Accident Monitoring (PAM) Instrumentation Program

This program provides controls to establish accident monitoring instrumentation functions that are required by Specification 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." These instrumentation functions shall be those designated as Type A, B, and C, as defined in Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2006, and shall be listed in the PAM function list document as described in FSAR Section 7.5.1. Changes to the list of Type A, B, and C functions shall be made in accordance with the provisions of 10 CFR 50.59 and RG 1.97, Revision 4.

(2) Remove the brackets from Generic Technical Specification 3.3.3.2 and bases, and from Generic Technical Specification 5.6.5.

(3) Revise Generic Technical Specification LCO 3.3.3.2 to state:

Two channels of each Type A, B, and C PAM Instrumentation Function associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating," shall be OPERABLE.

(4) Revise Generic Technical Specification 3.3.3.2 Conditions A and B to state:

A. One or more required ~~Type A~~ PAM Functions with one required channel inoperable.

B. One or more required ~~Type A~~ PAM Functions with two required channels inoperable.

(5) Revise Availability Control 3.3.4 to address PAM instrumentation not required by revised Generic Technical Specification 3.3.3.2.

(6) Remove COL Items 3.3.3.2-1 and 5.6.5-1 from DCD Table 16.0-1-A, including the reviewer's notes.

(7) Make suitable conforming changes to the bases for Generic Technical Specification 3.3.3.2, consistent with the bases for STS 3.3.3.1. The LCO section of the bases for Generic Technical Specification 3.3.3.2 need not discuss the specified Type A, B, and C PAM instrumentation functions. Revise the Background and the Applicable Safety Analysis sections of the bases to also include discussions of Type B and Type C PAM instrumentation functions.

(8) Revise the Actions of Generic Technical Specification 3.3.3.2 to be consistent with the BWR/6 STS 3.3.3.1 Actions, which require placing the unit in Mode 3 within 12

hours if two required channels of certain PAM functions are inoperable for more than 7 days.

GEH Response

Revisions have been made to the ESBWR Technical Specifications and Technical Specifications Bases as recommended in Option 3 of this RAI. However, the following recommendation was not implemented:

Revise Availability Control 3.3.4 to address PAM instrumentation not required by revised Generic Technical Specification 3.3.3.2.

As described in DCD Section 19A.3.1.4, the Post-Accident Monitoring (PAM) variables that meet the criteria for Regulatory Treatment of Non-Safety Systems (RTNSS) are those designated as Type A, B, and C per Regulatory Guide 1.97. Accordingly, ACLCO 3.3.4, "Post-Accident Monitoring (PAM) Instrumentation," addresses those variables designated as Type A, B, and C. Since the scope of Technical Specification 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation," has been broadened to include Type A, B, and C variables, there are no variables remaining which require Availability Controls, and thus ACLCO 3.3.4 has been deleted. Additional changes were made to Chapter 19 to state that operability of the post-accident monitoring instrumentation is addressed in the Technical Specifications.

DCD Impact

DCD Chapters 16, 16B, and 19 will be revised as shown in Enclosure 2.

Enclosure 2

MFN 09-665

DCD Markups for

RAI Number 16.2-190

Table 16.0-1-A (page 2 of 10)
COL - Applicant Open Items

COL Item	Description	Reviewer's Note
3.3.1.1-2	Allowance to exclude certain sensors or other instrumentation components from response time testing	Applicants or Licensees may remove brackets and adopt this provision by application of Specification 5.5.7, "Bases Control Program," after appropriate assessment and incorporation into the plant licensing basis of an NRC approved methodology evaluating sensor and instrumentation loop response time requirements. All implementation requirements of the NRC Safety Evaluation Report for the methodology must be addressed. This allowance is provided as a template for potential future assessments.
3.3.1.2-1	Allowance to exclude certain portions of the actuation circuitry from response time testing	Applicants or Licensees may remove brackets and adopt this provision by application of Specification 5.5.7, "Bases Control Program," after appropriate assessment and incorporation into the plant licensing basis of an NRC approved methodology evaluating sensor and instrumentation loop response time requirements. All implementation requirements of the NRC Safety Evaluation Report for the methodology must be addressed. This allowance is provided as a template for potential future assessments.
3.3.1.4-2	Allowance to exclude certain sensors or other instrumentation components from response time testing	Applicants or Licensees may remove brackets and adopt this provision by application of Specification 5.5.7, "Bases Control Program," after appropriate assessment and incorporation into the plant licensing basis of an NRC approved methodology evaluating sensor and instrumentation loop response time requirements. All implementation requirements of the NRC Safety Evaluation Report for the methodology must be addressed. This allowance is provided as a template for potential future assessments.
3.3.1.5-2	Allowance to exclude certain portions of the actuation circuitry from response time testing	Applicants or Licensees may remove brackets and adopt this provision by application of Specification 5.5.7, "Bases Control Program," after appropriate assessment and incorporation into the plant licensing basis of an NRC approved methodology evaluating sensor and instrumentation loop response time requirements. All implementation requirements of the NRC Safety Evaluation Report for the methodology must be addressed. This allowance is provided as a template for potential future assessments.
~~3.3.3.2-1~~	~~Post-Accident Monitoring (PAM) Instrumentation~~	~~This Specification and the associated Administrative Controls 5.6.5, "Post-Accident Monitoring Report," are not required to be incorporated in the plant-specific COL applicant Technical Specifications. This generic Specification is provided as a template for potential future design changes.~~

Table 16.0-1-A (page 10 of 10)
COL - Applicant Open Items

COL Item	Description	Reviewer's Note
5.6.4-1	Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR) listing of analytical methods used to determine the RCS pressure and temperature limits	Identify the Topical Report(s) by number and title or identify the NRC Safety Evaluation for a plant specific methodology by NRC letter and date. The PTLR will contain the complete identification for each of the TS referenced Topical Reports used to prepare the PTLR (i.e., report number, title, revision, date, and any supplements). The methodology for the calculation of the P/T limits for NRC approval should include the following provisions: 1. The methodology shall describe how the neutron fluence is calculated (reference new Regulatory Guide when issued). 2. The Reactor Vessel Material Surveillance Program shall comply with Appendix H to 10 CFR 50. The reactor vessel material irradiation surveillance specimen removal schedule shall be provided, along with how the specimen examinations shall be used to update the PTLR curves. 3. The adjusted reference temperature for each reactor beltline material shall be calculated, accounting for radiation embitterment, in accordance with Regulatory Guide 1.99, Revision 2. 4. The limiting adjusted reference temperature shall be incorporated into the calculation of the pressure and temperature limit curves in accordance with NUREG-0800 Standard Review Plan 5.3.2, Pressure-Temperature Limits. 5. The minimum temperature requirements of Appendix G to 10 CFR Part 50 shall be incorporated into the pressure and temperature limit curves. In lieu of a PTLR, COL applicants may insert their plant specific P/T curves as figures in TS 3.4.4 and delete TS 5.6.4.
~~5.6.5-1~~	~~Specification 5.6.5, Post-Accident Monitoring Report~~	~~Include Post-Accident Monitoring Report if LCO 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation" is incorporated. This generic Specification is provided as a template for potential future design changes.~~

3.3 INSTRUMENTATION

3.3.3.2 Post-Accident Monitoring (PAM) Instrumentation

LCO 3.3.3.2 Two channels of each Type A, B, and C PAM Instrumentation Function associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating," shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

- NOTE -
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required Type A PAM Functions with one required channel inoperable.	A.1 Restore required channel to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action in accordance with Specification 5.6.5.	Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B~~C. One or more required ~~Type A~~ PAM Functions with two required channels inoperable.	~~B~~C.1 Restore one required channel to OPERABLE status. OR C.2.1 Verify preplanned alternate method of monitoring the affected Function is available. AND C.2.2 Initiate action in accordance with Specification 5.6.5.	7 days 7 days 7 days
~~C~~D. Required Action and associated Completion Time of Condition C not met.	~~C~~D.1 ~~Initiate action in accordance with Specification 5.6.5.~~ Be in MODE 3.	~~Immediately~~12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.3.2.1	Perform CHANNEL CHECK on each required channel.	31 days
SR 3.3.3.2.2	Perform CHANNEL CALIBRATION on each required channel.	24 months

~~]~~

~~[~~

~~COL 16.0-1-A~~
~~3.3.3.2-1~~

B 3.3 INSTRUMENTATION

B 3.3.3.2 Post-Accident Monitoring (PAM) Instrumentation

BASES

BACKGROUND

The purpose of the Post-Accident Monitoring Instrumentation is to display plant variables that provide information required by the control room operators during accident situations. The instruments that monitor these variables are designated as Type A, B, and C in accordance with Regulatory Guide 1.97 (Ref.1).

The OPERABILITY of the accident monitoring instrumentation ensures that there is sufficient information available on selected plant parameters to monitor and assess plant status and behavior following an accident. This capability is consistent with the recommendations of Reference 1. ~~Consistent with the recommendations in Regulatory Guide 1.97 (Ref. 1), instrumentation is designated as Type A if it is needed to provide the primary information required to permit the control room operating staff to:~~

~~• Take specific preplanned manually-controlled actions for which no automatic control is provided and that are required for safety systems to perform their safety-related functions as assumed in the plant accident analysis; and~~

~~• Take the specified, preplanned, manually controlled actions for which no automatic control is provided and that are required to mitigate the consequences of an anticipated operational occurrence (AOO).~~

APPLICABLE SAFETY ANALYSES

The PAM Instrumentation LCO ensures the OPERABILITY of ~~Variables that satisfy the criteria as Type A variables in Regulatory Guide~~ Regulatory Guide 1.97, Type A, variables. Type A variables provide~~1.97 (Ref. 1) meet Criterion 3 of 10 CFR 50.36(c)(2)(ii) and are discussed~~ the primary information required to permit the control room operating staff to:~~in the LCO section of these Bases. Reference 2 summarizes the analysis that determined the variables or instrumentation required to monitor these variables that meet criteria for designation as Type A in accordance with Reference 1.~~

- Take specific planned manually-controlled actions for which no automatic control is provided and that are required for safety systems to perform their safety-related functions as assumed in the plant Accident Analysis Licensing Basis.

BASES

- Take specific planned manually-controlled actions for which no automatic control is provided and that are required to mitigate the consequences of an anticipated operational occurrence.

The PAM Instrumentation LCO ensures the OPERABILITY of Regulatory Guide 1.97, Type B, variables. Type B variables are those variables that provide primary information to the control room operators to assess the plant critical safety functions.

The PAM Instrumentation LCO ensures the OPERABILITY of Regulatory Guide 1.97, Type C, variables. Type C variables are those variables that provide primary information to the control room operators to indicate the potential for breach or the actual breach of the three fission product barriers (fuel cladding, reactor coolant pressure system boundary, and containment pressure boundary).

APPLICABLE SAFETY ANALYSES (continued)

The list of Type A, B, and C PAM variables is developed and maintained in accordance with Specification 5.5.14, “Post-Accident Monitoring (PAM) Instrumentation Program.”

PAM instrumentation that meets the definition of Type A in Regulatory Guide 1.97 satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). PAM instrumentation that meets the definition of Type B or C in Regulatory Guide 1.97 is retained in the Technical Specifications because it is intended to assist operators in minimizing the consequences of accidents. Therefore, these Type B and C variables are important for reducing public risk.

LCO

LCO 3.3.3.2 requires ~~sufficient~~two OPERABLE channels for each Type A, B, and C PAM Instrumentation Function, identified in accordance with Specification 5.5.14~~in Reference 2~~ and associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems – Operating," to ensure no single failure prevents the operators from being presented with the information necessary to determine the status of the unit and to bring the unit to, and maintain it in, a safe condition following that accident. A minimum of two channels allows a CHANNEL CHECK during the post accident phase to confirm the validity of displayed information.

BASES

LCO (continued)

Listed below is a discussion of the specified Type A instrument Functions listed in Reference 2, and applicable to the accompanying LCO.

COL 16.0-1-A 3.3.3.2-1

[Insert discussions of specified Type A instrument Functions.]

APPLICABILITY The PAM Instrumentation LCO is applicable in MODES 1 and 2. These Type A variables are related to the diagnosis and preplanned actions required to mitigate Design Basis Accidents (DBAs). The applicable DBAs are assumed to occur in MODES 1 and 2. In MODES 3, 4, 5, and 6, plant conditions are such that the likelihood of an event that would require PAM instrumentation is extremely low; therefore, PAM instrumentation is not required to be OPERABLE in these MODES.

ACTIONS A Note has been added to the ACTIONS Table. This Note modifies the ACTIONS related to PAM instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for

ACTIONS (continued)

each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable PAM instrumentation channels provide appropriate compensatory measures for separate Functions. As such, the Note allows separate Condition entry for each inoperable Type A PAM Function.

A.1

When one or more required Type A PAM Functions have one required channel that is inoperable, the required inoperable channel must be restored to OPERABLE status within 30 days. The 30-day Completion Time is based on operating experience and takes into account the remaining OPERABLE channel, the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval.

B.1

If a channel has not been restored to OPERABLE status in 30 days, this Required Action specifies initiation of actions in accordance with Specification 5.6.5, "Post-Accident Monitoring Report," which requires a written report to be submitted to the NRC. This report discusses the cause of the inoperability and identifies proposed restorative actions. This Action is appropriate in lieu of a shutdown requirement since alternative Actions are identified before loss of functional capability, and given the likelihood of plant conditions that would require information provided by this instrumentation.

~~B~~C.1, C.2.1, and C.2.2

Condition C applies ~~W~~when one or more required ~~Type A~~ PAM Functions have two required channels inoperable, (i.e., two required channels inoperable in the same Function) ~~one required channel in the Function must be restored to OPERABLE status within 7 days~~. Required Action C.1 directs restoration of one required channel to OPERABLE status. Alternatively, Required Actions C.2.1 and C.2.2 require verification that a preplanned alternate method of monitoring the affected PAM Function is available and initiation of actions in accordance with Specification 5.6.5. Required Actions C.2.1 and C.2.2 are appropriate in instances where alternate means of monitoring have been developed and tested. These alternate means may be permanently or temporarily installed and utilized if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. The report provided to the NRC should discuss the alternate means used, describe

ACTIONS (continued)

the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation.
~~and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM function will be in a degraded condition should an accident occur.~~

~~C~~D.1

BASES

~~This Required Action specifies initiating actions of Specification 5.6.5, "Post Accident Monitoring Report," which ensures appropriate corrective measures are taken when Type A PAM Instrumentation Functions are inoperable for extended time periods. Specification 5.6.5 requires a written report to be submitted to the NRC. This report discusses the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.~~If the Required Actions and associated Completion Times of Condition C cannot be met, the plant must be placed in a MODE where the LCO does not apply. This is done by placing the plant in at least MODE 3 within 12 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant condition from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.3.3.2.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is 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 required 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 isolation, indication, and readability. If a required channel is outside the match criteria, it may be an indication that the sensor or the signal-processing equipment has drifted outside its limit. Performance of the CHANNEL CHECK guarantees that undetected channel failure is limited to 31 days.

The Frequency of 31 days is based upon plant operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one required channel of a given function in any 31 day interval is rare. The CHANNEL CHECK supplements less

SURVEILLANCE REQUIREMENTS (continued)

formal, but more frequent, checks of channels during normal operational use of those displays associated with the required channels of this LCO.

BASES

SR 3.3.3.2.2

A CHANNEL CALIBRATION is performed at every 24 months for each required channel. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to measured parameter with the necessary range and accuracy. The Frequency is based on operating experience and consistency with the typical industry refueling cycles.

REFERENCES

1. Regulatory Guide 1.97, “Instrumentation for Light-Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident,” Revision 4, June 2006.

~~2. Section 7.5.~~

5.5 Programs and Manuals

5.5.13 Ventilation Filter Testing Program (VFTP) (continued)

d. Demonstrate for each of the ESF systems that the pressure drop across the combined HEPA filters, the prefilters, and the carbon adsorbers is less than the value specified below when tested in accordance with Regulatory Guide 1.52, Revision 3 and ASME AG-1-2003 at the system flowrate specified below ± 10%:

ESF Ventilation System	Delta P	Flowrate
CRHAVS EFU	500 Pa (2.0" w.g.)	220 l/s (466 cfm)

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the VFTP test frequencies.

5.5.14 Post-Accident Monitoring (PAM) Instrumentation Program

This program provides controls to establish accident monitoring instrumentation functions that are required by Specification 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." These instrumentation functions shall be those designated as Type A, B, and C, as defined in Regulatory Guide (RG) 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, June 2006, and shall be listed in the PAM function list document as described in Section 7.5.1. Changes to the list of Type A, B, and C functions shall be made in accordance with the provisions of 10 CFR 50.59 and RG 1.97, Revision 4.

5.6 Reporting Requirements

5.6.3 CORE OPERATING LIMITS REPORT (COLR) (continued)

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

[5.6.4 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

COL 16.0-1-A 5.6.4-1

a. RCS pressure and temperature limits for heatup, cooldown, low temperature operation, criticality, and hydrostatic testing as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

LCO 3.4.4, “RCS Pressure and Temperature (P/T) Limits.”

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

[Identify the Topical Report(s) by number and title or identify the NRC Safety Evaluation for a plant specific methodology by NRC letter and date. The PTLR will contain the complete identification for each of the TS referenced Topical Reports used to prepare the PTLR (i.e., report number, title, revision, date, and any supplements).]

c. The PTLR shall be provided to the NRC upon issuance for each reactor vessel fluence period and for any revision or supplement thereto.]

~~[~~5.6.5 Post-Accident Monitoring Report

~~COL 16.0-1-A 5.6.5-1~~

When a Special Report is required by Condition B or C of LCO 3.3.3.2, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.~~]~~

The ancillary diesel generators and associated buses are rated at 480 volts alternating current (VAC). These buses are also capable of being powered by offsite power or the onsite standby diesel generators through the PIP buses (Section 8.3). The ancillary diesels start automatically on a loss of offsite power. If an onsite standby diesel generator fails to start and provide power, the feed from the PIP bus to the ancillary diesel bus will be isolated and the ancillary diesel generator will power the associated ancillary diesel bus.

19A.3.1.3 Control Room Habitability

The control room habitability area must have adequate temperature controls during an accident to support operator actions. In addition, General Design Criterion 19 states that adequate radiation protection shall be provided to permit access to and occupancy of the control room under accident conditions, for the duration of the accident.

The safety-related function of controlling radiation dose is accomplished by the safety-related emergency filter unit (EFU) fans (Subsection 9.4.1), which automatically start and are powered by safety-related Q-DCIS for the first 72 hours following an event. For longer-term operation, Q-DCIS is powered from the ancillary AC buses.

The safety-related cooling function is provided by the passive heat sink characteristics of the outer walls, floor and ceiling of the CRHA. In addition, if active room cooling is not functional, a safety-related trip of selected nonsafety-related displays in the control room is performed to eliminate their continued heat production.

Long-term operational activities in the control room are attributed to post-accident monitoring, which is discussed in Subsection 19A.3.1.4.

19A.3.1.4 Post-Accident Monitoring

Beyond the first 72 hours of an accident, operator actions are necessary to support continued operation of core cooling, containment integrity, and control room habitability functions, as discussed above. During this time, operators use information on the condition of the plant to support the functions needed for accident response. Therefore, post-accident monitoring safety functions include safety-related displays in the control room, emergency lighting, and control room cooling to remove heat generated by personnel and the monitoring equipment.

Safety-related post-accident monitoring is performed by instrumentation that is categorized as Reg Guide 1.97 Type A, B, or C (Sections 3.9, 3.10, 3.11). These are safety-related functions for the first 72 hours, and therefore are in the scope of RTNSS beyond 72 hours for long-term post-accident monitoring. Operability of the post-accident monitoring instrumentation is addressed in Technical Specification LCO 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." Post-accident monitoring is provided by Q-DCIS, (Subsection 7.1.2.8) which is powered by uninterruptible power, including DC batteries that are designed to function for at least 72 hours. Emergency lighting is provided to support post-accident monitoring functions, and it is powered by 72-hour batteries. Passive cooling, provided by the Control Building and Reactor Building structures, maintains the equipment within acceptable temperature limits for at least 72 hours. Post 72 hours the CRHA air handling units and auxiliary cooling units maintain control room temperatures within limits.

- MSIV Closure
- SRV Actuation
- FMCRD Actuation
- ICS Actuation
- SLC Actuation for LOCA
- ADS Inhibit Function

These functions do not have a high risk significance, so their proposed level of regulatory oversight is in the Availability Controls Manual.

19A.8.4.4 Post-Accident Monitoring

Post-accident monitoring is performed by Q-DCIS. Operability of the post-accident monitoring instrumentation is addressed in Technical Specification LCO 3.3.3.2, "Post-Accident Monitoring (PAM) Instrumentation." Support for the safety-related post-accident monitoring instrumentation is necessary for component cooling and lighting. The CRHAVS air handling units and auxiliary heating and cooling units ensure that, after 72 hours, room temperatures for equipment used in post-accident monitoring are within the range for qualified operation. Emergency lighting assists the operators in post-accident monitoring activities. These functions provide long-term support and are RTNSS Criterion B. Because they are not required for the first 72 hours, they do not affect core cooling or containment heat removal in the PRA, and thus have low risk significance. The proposed level of regulatory oversight for emergency lighting is in the Maintenance Rule and the proposed level of oversight for heating/cooling is in the Availability Controls Manual.

19A.8.4.5 Basemat Internal Melt Arrest and Coolability System and GDCS Deluge Lines

The BiMAC device and GDCS deluge valves play an important role in mitigating core melt scenarios. Therefore, they are candidates for RTNSS consideration. The BiMAC device and GDCS valves function during severe accidents, and thus have no effect on the Level 1 PRA. The inclusion of the BiMAC device in the ESBWR design provides an engineered method to assure heat transfer between the debris bed and cooling water. By flooding the lower drywell after the introduction of core material, the potential for energetic fuel-coolant interaction is minimized. Covering core debris with water provides scrubbing of fission products released from the debris and cools the corium, limiting potential core-concrete interaction (CCI). The BiMAC device provides additional assurance of debris bed cooling by providing engineered pathways for water flow through the debris bed. BiMAC failure can occur if no water is supplied. Other failure mechanisms include manufacturing defects, unforeseen phenomenology problems or a broken GDCS line that would divert flow. In these instances, the situation becomes similar to flooding the debris bed without the engineered flow through the corium. Thus, BiMAC failure to function can be conservatively modeled as failure to supply water from the GDCS deluge lines.

Loss of the BiMAC function does not pose a challenge to the LRF goals when other safety-related and RTNSS systems are taken into account. The proposed level of regulatory oversight for the BiMAC function is in the Availability Controls Manual.

Table 19A-2
RTNSS Functions

RTNSS Function	Description	Availability Controls
DPS – ARI Actuation	A - ATWS Rule	ACLCO 3.3.1
DPS – FWRB Actuation	A - ATWS Rule	ACLCO 3.3.3
DPS – ADS Inhibit	A - ATWS Rule	ACLCO 3.3.4~~5~~
FPS Diesel Driven Pump	B - Long Term Core Cooling: RPV At-Power and Spent Fuel Pool; Long Term Containment Integrity	ACLCO 3.7.1
FPS Motor Driven Pump	B - Long Term Core Cooling: RPV At-Power and Spent Fuel Pool; Long Term Containment Integrity	ACLCO 3.7.1
FPS to FAPCS Connection Piping	B - Long Term Core Cooling: RPV At-Power and Spent Fuel Pool; Long Term Containment Integrity	ACLCO 3.7.1
PARs	B - Long Term Containment Integrity	ACLCO 3.6.2
PCCS Vent Fans	B - Long Term Containment Integrity	ACLCO 3.6.3
Emergency Lighting	B - Post-Accident Monitoring	Maintenance Rule
DPS – GDCS Injection	C - Focused PRA (CDF, LRF) High Regulatory Oversight	TS LCO 3.3.8.1
DPS – ADS Actuation	C - Focused PRA (CDF, LRF) High Regulatory Oversight	TS LCO 3.3.8.1
DPS – Open IC/PCCS Pool Cross-Connect Valves	C - Focused PRA (CDF, LRF) High Regulatory Oversight	TS LCO 3.3.8.1
DPS – Isolation RWCU/SDC Valves	C - Focused PRA (CDF, LRF) High Regulatory Oversight	TS LCO 3.3.8.1
DPS – Scram	C - Focused PRA (CDF, LRF)	ACLCO 3.3.4~~5~~
DPS – MSIV Closure	C - Focused PRA (CDF, LRF)	ACLCO 3.3.4~~5~~
DPS – SRV Actuation	C - Focused PRA (CDF, LRF)	ACLCO 3.3.4~~5~~
DPS- FMCRD Actuation	C - Focused PRA (CDF, LRF)	ACLCO 3.3.4~~5~~
DPS – ICS Actuation	C - Focused PRA (CDF, LRF)	ACLCO 3.3.4~~5~~
DPS – SLC Actuation LOCA	C - Focused PRA (CDF, LRF)	ACLCO 3.3.4~~5~~

19ACM AVAILABILITY CONTROLS MANUAL

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ACM 3.3 INSTRUMENTATION

AC 3.3.4 Post-Accident Monitoring (PAM) Instrumentation

ACLCO 3.3.4 Two PAM instrumentation channels for each critical safety function required by DCD Tier 2, Subsection 7.5.1 shall be AVAILABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

- NOTE -
Separate Condition entry is allowed for each critical safety function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more critical safety functions with one required channel unavailable.	A.1 Restore required channel to AVAILABLE status.	30 days
B. One or more critical safety functions with two required channels unavailable.	B.1 Restore one required channel to AVAILABLE status.	7 days
C. Required Action and associated Completion Time not met.	C.1 Enter ACLCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
ACSR 3.3.4.1	Perform CHANNEL CHECK on each required channel.	31 days
ACSR 3.3.4.2	Perform CHANNEL CALIBRATION on each required channel.	24 months

ACM B 3.3 INSTRUMENTATION

AC B 3.3.4 Post-Accident Monitoring (PAM) Instrumentation

BASES

The PAM Variable List is prepared as a separate document utilizing inputs from the design process, licensing design basis, and HFE process, including the development of the Emergency Procedure Guidelines (EPGs) and/or Plant Specific Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs). The PAM variable list document provides summary information for each PAM variable as applicable (Reference DCD Tier 2, Subsection 7.5.1).

For accident monitoring instrumentation associated with critical safety functions and powered from the safety-related sources, the safety-related Distributed Control and Information System (Q-DCIS) provides the required signal path to process this information. This information is then displayed on Q-DCIS divisional safety-related displays. The safety-related information can also be transmitted via isolated safety-related gateways to the nonsafety-related Distributed Control and Information System (N-DCIS) for input to nonsafety-related displays, plant computer functions and the Alarm Management System. Type A, Type B, and Type C variables are powered from safety-related sources.

The PAM instrumentation function is a nonsafety-related function that satisfies the significance criteria for Regulatory Treatment of Non-Safety Systems, and therefore requires regulatory oversight. The short-term availability controls for this function, which are specified as Completion Times, are acceptable to ensure that the availability of this function is consistent with the functional unavailability in the ESBWR PRA. The surveillance requirements also provide an adequate level of support to ensure that component performance is consistent with the functional reliability in the ESBWR PRA.

DPS
AC 3.3.45

ACM 3.3 INSTRUMENTATION

AC 3.3.45 Diverse Protection System (DPS)

ACLCO 3.3.45 The DPS Functions in Table 3.3.45-1 shall be AVAILABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more DPS Functions unavailable.	A.1 Restore DPS Function(s) to AVAILABLE Status.	30 days
B. Required Action and associated Completion Time not met.	B.1 Enter ACLCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
ACSR 3.3.45.1	Perform CHANNEL CHECK.	12 hours
ACSR 3.3.45.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
ACSR 3.3.45.3	Perform CHANNEL CALIBRATION.	24 months
ACSR 3.3.45.4	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

DPS
AC 3.3.45

Table 3.3.45-1 (page 1 of 1)
Diverse Protection System

FUNCTION
1. Reactor Scram
2. Main Steam Isolation Valve Closure
3. Safety Relief Valve Actuation
4. Fine Motor Control Rod Drive Run-in Actuation
5. Isolation Condenser System Actuation
6. Standby Liquid Control System Actuation (for Loss-of-Coolant Accident)
7. Automatic Depressurization System (ADS) Inhibit

ACM B 3.3 INSTRUMENTATION

AC B 3.3.45 Diverse Protection System (DPS)

BASES

DPS provides diverse actuation functions that enhance the plant's ability to mitigate dominant accident sequences involving the common cause failure of actuation logic or controls. The DPS Functions are implemented in a highly reliable triple redundant control system whose sensors, hardware, and software are diverse from their counterparts on any of the safety-related platforms.

The following diverse actuation Functions are provided by DPS:

- A set of protection logics that provide a diverse means to scram the reactor via control rod insertion (reference Subsection 7.8.1.2.1),
- A set of initiation logics that provide a diverse means to initiate certain engineered safety features (ESF) functions (safety relief valves, Isolation Condenser System, and Standby Liquid Control System (reference Subsection 7.8.1.2.2)),
- A set of initiation logics that provide a diverse means to initiate closure of the main steam isolation valves (reference Subsection 7.8.1.2.4), and
- A set of initiation logics that provide a diverse means of control rod insertion by means of Fine Motor Control Rod Drive Run-in (reference Subsection 7.8.1.1.2).

For Anticipated Transient Without Scram (ATWS) mitigation, the DPS initiation of ADS is inhibited automatically. The ADS Inhibit Function required by this availability control is automatically actuated by nonsafety-related logic that is processed by the DPS (reference Subsection 7.8.1.2.3). The ADS Inhibit Function prevents an undesirable DPS initiation of the ADS during ATWS conditions.

The DPS Functions are nonsafety-related functions that satisfy the significance criteria for Regulatory Treatment of Non-Safety Systems, and therefore require regulatory oversight. The short-term availability controls for these Functions, which are specified as Completion Times, are acceptable to ensure that the availability of these Functions is consistent with the functional unavailability in the ESBWR PRA. The surveillance requirements also provide an adequate level of support to ensure that component performance is consistent with the functional reliability in the ESBWR PRA.