FENOC™
FirstEnergy Nuclear Operating Company

5501 North State Route 2
Oak Harbor, Ohio 43449

Brian D. Boles
Vice President,
Nuclear

419-321-7676
Fax: 419-321-7582

January 11, 2017
L-16-308

10 CFR 50.90

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Davis-Besse Nuclear Power Station, Unit No. 1
Docket No. 50-346, License No. NPF-3
Request for an Amendment to Revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation"

In accordance with the provisions of 10 CFR 50.90, FirstEnergy Nuclear Operating Company (FENOC) hereby requests an amendment to the technical specifications (TS) for the Davis-Besse Nuclear Power Station.

The proposed amendment would revise TS 3.3.1 to extend the ultrasonic flow meter allowed outage time to 72 hours under specific conditions, along with other administrative changes.

The FENOC evaluation of the proposed amendment is enclosed. Approval of the proposed amendment is requested by December 1, 2017. The amendment shall be implemented within 60 days of approval.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager - Fleet Licensing, at (330) 315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 11, 2017.

Sincerely,

Brian D. Boles

Brian D. Boles

Enclosure:
Evaluation of the Proposed Amendment

cc: NRC Regional III Administrator
NRC Resident Inspector
NRC Project Manager
Executive Director, Ohio Emergency Management Agency,
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

Subject: License Amendment Request to Revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation"

Attachments:

1. Proposed Technical Specification Changes, Annotated Copy
2. Proposed Technical Specification Changes, Retyped Copy
3. Proposed Technical Specification Bases Changes, Annotated Copy

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Operating License NPF-3 for the Davis-Besse Nuclear Power Station (DBNPS).

The proposed change would revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation" to extend the ultrasonic flow meter (UFM) allowed outage time (AOT) to 72 hours under specific conditions. The existing Limiting Condition for Operation (LCO) 3.3.1 Required Actions (RAs) F.1 and F.2 immediately initiate actions to reduce thermal power when the UFM is not used to perform the calorimetric heat balance calculation required by Surveillance Requirement (SR) 3.3.1.2, and thermal power is greater than 50 percent rated thermal power (RTP). Within 10 hours, RA F.3 requires a corresponding reduction of the high flux – high setpoint to less than or equal to 103.3 percent RTP. The proposed change would retain these required actions but add a new option of delaying the thermal power reduction not to exceed 72 hours since the last calorimetric heat balance calculation based on UFM feedwater (FW) flow measurements. The corresponding reduction of the high flux – high setpoint would be completed within 82 hours of the last calorimetric heat balance calculation based on UFM FW flow measurements. This option would be valid when thermal power is maintained greater than 90 percent RTP and SR 3.3.1.2 is performed using venturi-based FW flow measurements that are normalized to the last UFM-based measurements used in the calorimetric heat balance calculation.

Administrative changes are also proposed. Condition F would be divided into two conditions (F and G) corresponding to the number of reactor coolant pumps (RCPs) operating (four for F, three for G). Condition statements in F and G incorporate the same conditions as the existing condition F, but are supplemented with an additional condition stating the number of RCPs operating. Three notes from the existing RAs F.1, F.2, and F.3 stating the number of RCPs operating for each required action would therefore be eliminated. Conditions F and G would be stated using distinct sub-conditions and logical connectors to be more consistent with TS formatting guidance than the existing Condition F.

2.0 DETAILED DESCRIPTION

DBNPS technical specifications require that the nuclear instrumentation power indication be compared to a calculated calorimetric heat balance power value on a daily basis using FW measurements.

The originally-installed Bailey venturis and resistance temperature detectors (RTDs) continue to measure the FW flow rate and temperature. However, the preferred FW flow measurement system used to obtain input to the calorimetric heat balance calculation at DBNPS is a Caldon LEFM CheckPlus™ ultrasonic, multi-path, transit time flowmeter, hereafter referred to as the UFM. The UFM system includes two

measurement sections, or spool pieces, located upstream of the respective venturi in each of two main feedwater flow headers that supply each steam generator. Each UFM measurement section includes sixteen ultrasonic transducers to measure transit times of ultrasonic pulses through the flowing fluid. The LEFM uses these transit times and time differences between pulses to determine the FW velocity and temperature. Use of the UFM system is described in Section 3.1 of the Nuclear Regulatory Commission (NRC) safety evaluation to Amendment No. 278 (Accession No. ML081410652), which approved a power uprate based on use of the UFM.

Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation," LCO 3.3.1 requires, in part, that "The ultrasonic flow meter (UFM) instrumentation shall be used to perform SR 3.3.1.2 when THERMAL POWER is > 50% RTP." SR 3.3.1.2 requires the result of a calorimetric heat balance calculation to be compared to the power range channel output at a 24-hour frequency. When LCO 3.3.1 is not satisfied (TS 3.3.1 actions table, Condition F), thermal power must be immediately reduced depending on the number of RCPs operating, and the RPS High Flux – High setpoint must be reduced to less than or equal to 103.3 percent RTP (RA F.3) within 10 hours if four RCPs are operating.

The UFM system is not used to perform the heat balance calculation when any ultrasonic transducer is inoperable. In order to avoid a reduction in reactor power, sufficient time is desired for repairs to the UFM system, which may include planning, procuring, and installing replacement components.

NRC Regulatory Issue Summary (RIS) 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications," Attachment 1, Section I, Items G and H request the licensee to describe (G) a proposed AOT for the UFM, along with the technical basis for the time selected and (H) proposed actions to reduce power level if the AOT is exceeded. The NRC staff's safety evaluation of the DBNPS measurement uncertainty recapture power uprate application (Accession No. ML081410652) concluded that the guidance in Items G and H was adequately addressed at that time.

In order to support extending the UFM AOT, a statistical evaluation has been performed on the difference between historical UFM-based FW flow values and venturi-based values. The results demonstrate that venturi-based FW flow values normalized to UFM values obtained up to five days prior can be used as input to the calorimetric heat balance calculation, resulting in the same degree of uncertainty for the calculated power level as if the UFM system were used. This provides a basis to extend the completion time (CT) for RA F.1 ("Immediately") to "72 hours since the last calorimetric heat balance based on UFM readings" when additional conditions are met. Seventy-two hours is an established practice in the nuclear power industry. This also provides the basis for extending the "10 hours" CT for F.3 to "82 hours" – a 72 hour extension if normalized venturi-based FW flow values are used as input to

the calorimetric heat balance calculation in addition to the previously-allowed 10 hours CT required to reset the RPS High Flux – High setpoint.

The proposed amendment would revise TS 3.3.1, Condition F to extend the existing UFM AOT to a maximum of 72 hours after the last calorimetric heat balance calculation (based on UFM measurement) when:

- Four RCPs are operating, and
- Reactor power has been continuously maintained greater than 90 percent RTP, and
- FW flow (used in the calorimetric heat balance calculation) is obtained from venturi-based FW flow measurements that are normalized to flow values used in the last calorimetric heat balance based on UFM measurements.

The restriction for reactor power maintained greater than 90 percent RTP is to avoid the possibility of changes in FW flow or temperature that are postulated to de-foul the venturis and alter their calibration in a non-conservative direction.

Currently, Condition F applies when the UFM system is not used to perform SR 3.3.1.2 and thermal power is greater than 50 percent RTP. Condition F contains three required actions (F.1 AND F.2 AND F.3). Each required action contains a qualifying note stating how many RCPs must be operating for that particular required action to apply. The proposed amendment would divide the existing Condition F into two conditions (F and G). The revised Condition F would apply when four RCPs are operating and reflects the existing required actions F.1 and F.3, plus a proposed alternative required action that permits an extended AOT. Condition G would apply when three RCPs are operating and reflects existing RA F.2. Specific revisions are as follows:

New Condition F:

The new Condition F would reflect the same requirements as the existing Condition F when four RCPs are operating. Existing RAs F.1 and F.3, including the existing CTs will be preserved in the new Condition F as RAs F.1.1 and F.1.2. Since existing notes in the required action column constitute conditions, the notes stating that RAs F.1 and F.3 apply only if four RCPs are operating would be removed from the required action column and incorporated as part of the new condition statement that invokes RAs F.1.1 and F.1.2. The existing Condition F, "UFM instrumentation not used to perform SR 3.3.1.2 when THERMAL POWER is >50% RTP" would be divided into distinct sub-conditions combined by logical connectors and supplemented by a sub-condition making it applicable only when four RCPs are operating. The revised Condition F would state, "UFM instrumentation not used to perform SR 3.3.1.2 AND THERMAL POWER >50% RTP AND four reactor coolant pumps (RCPs)

operating." These aspects of the proposed change are strictly editorial in nature since the original meaning of Condition F, associated required actions, and CTs with four RCPs operating, is entirely preserved.

As an alternative to existing required actions that would require power reduction to commence immediately, a new RA F.2 would be inserted. New RA F.2.2 is the same as RA F.1.1, but the CT is extended to a maximum of 72 hours since the last calorimetric heat balance based on UFM readings. New RA F.2.3 is the same as RA F.1.2, but the CT is extended to a maximum of 82 hours since the last calorimetric heat balance based on UFM readings. When SR 3.3.1.2 is not performed using the UFM, new RA F.2.1 would provide the option of performing SR 3.3.1.2 immediately using normalized venturi-based FW flow measurements, provided that THERMAL POWER has been continuously maintained greater than 90 percent RTP since the last calorimetric heat balance based on UFM readings. New RAs F.2.1, F.2.2, and F.2.3 are connected by ANDs, preventing the extended CTs from being exercised if normalized FW flow measurements are not used immediately to perform SR 3.3.1.2 or thermal power has not been continuously maintained greater than 90 percent RTP since the last calorimetric heat balance based on UFM readings.

New Condition G:

Requirements of existing Condition F when only three RCPs are operating (RA F.2 and associated CT) would be incorporated in a new Condition G, RA G.1 and the associated CT. The note associated with existing RA F.2 ("Only required if three RCPs are operating.") would more appropriately be expressed as part of Condition G rather than as a note in RA G.1. These aspects of the proposed change are strictly editorial in nature since the original meaning of Condition F, associated required actions and CTs with three RCPs operating, is entirely preserved.

Affected pages of the current technical specifications, annotated to show the proposed changes, are provided in Attachment 1. Re-typed technical specification pages with the proposed changes incorporated are provided for information only in Attachment 2. Technical specification bases pages annotated to show proposed changes are provided for information only in Attachment 3.

3.0 TECHNICAL EVALUATION

If differences between venturi-based feedwater flow measurements and UFM-based measurements over the AOT period are sufficiently consistent, then venturi-based measurements normalized to UFM measurements within that period can provide a degree of accuracy comparable to UFM measurements during that period. A

statistical evaluation of plant operating data has been performed that reflects the combined effects of factors (such as gradual fouling or instrument drift) affecting consistency during the data sampling period.

The statistical evaluation involved evaluating corresponding FW flow data at 15-minute intervals from the UFM and venturis over a two-cycle period beginning June 15, 2012 and ending November 15, 2015, utilizing over 108,000 data points. Data points were limited to a reactor thermal power greater than 90 percent. The data exhibits random behavior with a growing bias over time, attributable to venturi fouling.

Expressed in percent of nominal FW flow, the 72-hour change in the upper bounds of the dataset with a 95 percent probability and 95 percent confidence was calculated to be 0.00349 percent. Similarly, the 120-hour change was calculated to be 0.00375 percent. These results demonstrate that when normalized venturi flow measurements are substituted for UFM measurements to perform required calorimetric heat balance calculations during the proposed AOT, operation within the rated thermal power limit will be ensured. Therefore, the proposed 72-hour AOT is appropriate.

Feedwater venturi flow measurements may drift during the AOT period if fouling occurs. Fouling of the venturis would result in a conservative FW flow input to the calorimetric heat balance, thereby causing the reactor to be operated below the power level indicated by plant instrumentation. Sudden de-fouling during the AOT period is unlikely if stable power conditions are maintained. The proposed TS condition requiring that power be continuously maintained greater than 90 percent RTP throughout the AOT period is intended to ensure a stable power condition.

Furthermore, a population of over 94,000 differences between the UFM-based FW temperature measurements and FW RTDs was evaluated over the same time period as the evaluated flow measurements. The average difference between corresponding UFM and RTD temperature measurements was 0.3 degrees Fahrenheit, which is within the uncertainty allowance of UFM temperature measurements. Therefore, the use of measurements from the FW RTDs in lieu of the UFM will not impact the overall uncertainty of calculated reactor power.

With regard to extending the amount of time allowed before reducing the nuclear instrumentation high flux trip setpoint, the 82-hour period is acceptable because the drift allowance (0.225 percent power every 92 days) used in setpoint calculations for the RPS high flux trip indicates that the instruments will remain calibrated for a period of time considerably longer than 82 hours.

4.0 REGULATORY EVALUATION

FirstEnergy Nuclear Operating Company (FENOC) proposes to amend Operating License NPF-3 for the Davis-Besse Nuclear Power Station (DBNPS). The proposed amendment would revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation" to extend the existing feedwater (FW) Caldon LEFM CheckPlus™ ultrasonic flow meter (UFM) allowed outage time (AOT). The proposed amendment would permit the plant to operate at rated thermal power (RTP) for up to 72 hours after the last calorimetric heat balance calculation based on UFM measurements, provided that stable thermal power conditions have been maintained, and FW flow is obtained from venturi-based measurements that have been normalized to UFM measurements. FW resistance temperature detectors (RTDs) would also be used to obtain temperature measurements used in the calculations. The previously-allowed ten hours completion time to reset the RPS High Flux – High trip setpoint is retained, in addition to the 72 hour extension.

A plant-specific statistical evaluation of the difference between historical UFM-based FW flow measurements and venturi-based FW flow measurements has demonstrated that the average difference between a UFM-based measurement and a venturi-based measurement does not vary significantly over short periods of time. Therefore, if current venturi-based FW flow measurements are normalized to UFM measurements that were obtained no greater than 120 hours prior, the same degree of uncertainty in the heat balance calculations would be obtained with the venturis as with the UFM. The proposed amendment restricts application of a 72-hour AOT to conditions when the plant is operated consistently above 90 percent RTP during the 72-hour period to avoid changes in FW flow or temperature that have potential to affect FW venturi measurement. Temperature measurement differences between the UFM and FW RTDs were also evaluated. The evaluation demonstrates that the average difference between corresponding UFM and RTD temperature measurements is within the margin already applied to UFM temperature measurements used for calculating power. The proposed amendment will maintain a consistent degree of uncertainty in heat balance calculations during the proposed 72-hour period, thereby assuring that the plant will not be operated above the RTP limit.

4.1 Significant Hazards Consideration

FENOC has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

The proposed amendment would extend the existing UFM AOT to 72 hours. There are no modifications to the plant being made. As there are no modifications to the plant or a change in plant control systems, extending the UFM outage would not significantly increase accident probability.

Accident consequences are, in part, dependent on the operating power level of the reactor assumed in accident analyses. The UFM is used to obtain information needed to perform a calorimetric heat balance calculation to determine reactor power output and maintain operation within accident analysis limits. The proposed amendment would permit measurements from FW venturis and RTDs to be substituted for UFM measurements while maintaining a stable power level during a 72-hour period. Venturi-based FW flow measurements would be normalized to the last UFM-based measurements used as input to a calorimetric heat balance and would have a nearly identical degree of uncertainty as UFM measurements for the duration of the proposed AOT when stable thermal power conditions are maintained. Therefore, calculated reactor power based on normalized FW flow venturi measurements will continue to be maintained within accident analysis limits, ensuring that accident consequences will not be significantly increased.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The proposed amendment would extend the existing UFM AOT to 72 hours. Modifications to the plant are not being made. FW flow venturi measurements that are normalized to the last UFM-based measurements used as input to a calorimetric heat balance have a nearly identical degree of uncertainty as UFM measurements for the duration of the proposed AOT when stable thermal power conditions are maintained. Calculated reactor power based on normalized FW flow venturi measurements will continue to be maintained within accident analysis limits.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No.

The proposed amendment would permit the plant to operate at rated thermal power for up to 72 hours after the last calorimetric heat balance based on UFM readings before reducing power. A plant-specific statistical evaluation of the difference between historical UFM-based FW flow measurements and venturi-based FW flow measurements has demonstrated that the average difference does not vary significantly over short periods of time. Therefore, if current venturi-based FW flow measurements are normalized to the last UFM-based measurements used as input to a calorimetric heat balance no greater than 72 hours prior, a nearly identical degree of uncertainty would be obtained with the venturis as with the UFM. The proposed amendment restricts application of the 72-hour AOT to conditions when the plant is operated consistently above 90 percent RTP during the 72-hour period to avoid changes in FW flow or temperature that have potential to de-foul venturis and affect measurements.

As the proposed change will result in the same degree of uncertainty in reactor power calculations using alternate measurements as with using the UFM, there is no significant reduction in a margin of safety.

Based on the above, FENOC concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

4.2 Applicable Regulatory Requirements / Criteria

<u>10 CFR Part 50, Appendix K</u>

Appendix K to 10 CFR Part 50 requires loss of coolant accident and emergency core cooling system analyses to assume “that the reactor has been operating continuously at a power level at least 1.02 times the licensed power level” to allow for instrumentation uncertainties. Alternately, Appendix K allows an assumption of lower than the specified 102 percent, but not less than the licensed thermal power level, "provided the proposed alternative value has been demonstrated to account for uncertainties due to power level instrumentation error." This allowance provides licensees an option of justifying a power uprate with reduced margin between the licensed power level and the power level assumed in the analyses by using more accurate instrumentation to calculate the reactor power. Based on the use of a Caldon LEFM CheckPlus™ UFM system for measuring the main FW flow and temperature at DBNPS, the plant is licensed to apply a power measurement uncertainty of 0.37 percent, allowing an increase in the reactor power available for electrical generation by 1.63 percent. The proposed amendment would maintain the same degree of power measurement uncertainty as the UFM during the proposed allowed outage time. Therefore, the loss of coolant accident and emergency core

cooling system analysis assumptions of 10 CFR Part 50, Appendix K remain satisfied.

NRC Regulatory Issue Summary (RIS) 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications"

This RIS provides guidance on the scope and detail of the information that should be provided to the NRC for reviewing measurement uncertainty recapture power uprate applications. The RIS Attachment 1, Section I, Item G requests a proposed allowed outage time for the instrumentation with increased accuracy, along with the technical basis for the time selected. Item H requests proposed actions to reduce power level if the allowed outage time is exceeded, including a discussion of the technical basis for the proposed reduced power level. These items were previously addressed by FENOC and considered by the NRC in granting a power uprate in 2008 (Accession No. ML081410652).

The proposed amendment requests a 72-hour AOT. The basis for the 72-hour AOT is detailed in this application, and as the new actions involve reduction of power to the same level as the current technical specifications, the technical basis for the reduced power level requires no further justification. Therefore, the information provided in this application is consistent with the guidance of RIS 2002-03.

4.3 Precedent

The proposed changes to Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation" to extend the existing feedwater UFM allowed outage time utilizes a basis similar to an aspect of an amendment for Fermi 2 regarding a measurement uncertainty recapture power uprate license amendment. The Fermi 2 amendment utilized a statistical analysis to justify a 72-hour completion time for operation with their Cameron International (formerly Caldon) CheckPlus™ ultrasonic flow measurement instrumentation inoperable (Accession No. ML13364A131).

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within

the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

License Amendment Request to Revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation"

Attachment 1

Proposed Technical Specification Changes, Annotated Copy

The following is a list of the affected pages:

3.3.1-2
3.3.1-3
3.3.1-4

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. As required by Required Action C.1 and referenced in Table 3.3.1-1.	D.1 Be in MODE 3. AND D.2 ----------NOTE---------- Only applicable to Functions 1.a, 3, and 6. ---------- Open all CONTROL ROD drive (CRD) trip breakers.	6 hours 6 hours
E. As required by Required Action C.1 and referenced in Table 3.3.1-1.	E.1 Open all CRD trip breakers.	6 hours
F. UFM instrumentation not used to perform SR 3.3.1.2. ~~when~~ AND THERMAL POWER ~~is~~ > 50% RTP. AND Four reactor coolant pumps (RCPs) operating.	~~F.1 ----------NOTE----------~~ ~~Only required if four reactor coolant pumps (RCPs) are operating.~~ ~~----------~~ F.1.1 Initiate action to reduce THERMAL POWER to ≤ 98.4% RTP. ~~AND~~ ~~F.2 ----------NOTE----------~~ ~~Only required if three RCPs are operating.~~ ~~----------~~ ~~Initiate action to reduce THERMAL POWER to ≤ 73.8% RTP.~~ AND	 Immediately ~~Immediately~~

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued)	~~F.3 ----------NOTE---------- Only required if four RCPs are operating. ----------~~	
	F.1.2 Reset High Flux – High Setpoint Allowable Value to ≤ 103.3% RTP.	10 hours
	OR	
	F.2.1 Perform SR 3.3.1.2 using calorimetric heat balance based on feedwater flow venturi readings normalized to the last UFM readings provided THERMAL POWER has been continuously maintained > 90% RTP since the previous calorimetric heat balance based on UFM readings.	Immediately
	AND	
	F.2.2 Initiate action to reduce THERMAL POWER to < 98.4% RTP.	72 hours since the last calorimetric heat balance based on UFM readings
	AND	
	F.2.3 Reset High Flux – High Setpoint Allowable Value to < 103.3% RTP.	82 hours since the last calorimetric heat balance based on UFM readings
G. UFM instrumentation not used to perform SR 3.3.1.2. AND THERMAL POWER > 50% RTP.	G.1 Initiate action to reduce THERMAL POWER to < 73.8% RTP.	Immediately

AND Three RCPs operating.		

SURVEILLANCE REQUIREMENTS

----------NOTE----------
Refer to Table 3.3.1-1 to determine which SRs apply to each RPS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.2	----------NOTES---------- 1. Adjust power range channel output if the calorimetric heat balance calculation results exceed power range channel output by > 2% RTP. 2. Not required to be performed until 24 hours after THERMAL POWER is ≥ 15% RTP. ---------- Compare result of calorimetric heat balance calculation to power range channel output.	24 hours

License Amendment Request to Revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation"

Attachment 2

Proposed Technical Specification Changes, Retyped Copy

The following is a list of the affected pages:

3.3.1-2
3.3.1-3
3.3.1-4
3.3.1-5

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. As required by Required Action C.1 and referenced in Table 3.3.1-1.	D.1 Be in MODE 3. AND D.2 ----------NOTE---------- Only applicable to Functions 1.a, 3, and 6. ---------- Open all CONTROL ROD drive (CRD) trip breakers.	6 hours 6 hours
E. As required by Required Action C.1 and referenced in Table 3.3.1-1.	E.1 Open all CRD trip breakers.	6 hours
F. UFM instrumentation not used to perform SR 3.3.1.2. AND THERMAL POWER > 50% RTP. AND Four reactor coolant pumps (RCPs) operating.	F.1.1 Initiate action to reduce THERMAL POWER to ≤ 98.4% RTP. AND F.1.2 Reset High Flux – High Setpoint Allowable Value to ≤ 103.3% RTP. OR F.2.1 Perform SR 3.3.1.2 using calorimetric heat balance based on feedwater flow venturi readings normalized to the last UFM readings provided THERMAL POWER has been continuously maintained > 90% RTP since the previous calorimetric heat balance based on UFM readings.	Immediately 10 hours Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued)	AND	
	F.2.2 Initiate action to reduce THERMAL POWER to ≤ 98.4% RTP.	72 hours since the last calorimetric heat balance based on UFM readings
	AND	
	F.2.3 Reset High Flux – High Setpoint Allowable Value to ≤ 103.3% RTP.	82 hours since the last calorimetric heat balance based on UFM readings
G. UFM instrumentation not used to perform SR 3.3.1.2. AND THERMAL POWER > 50% RTP. AND Three RCPs operating.	G.1 Initiate action to reduce THERMAL POWER to ≤ 73.8% RTP.	Immediately

SURVEILLANCE REQUIREMENTS

----------NOTE----------
Refer to Table 3.3.1-1 to determine which SRs apply to each RPS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.2	----------NOTES---------- 1. Adjust power range channel output if the calorimetric heat balance calculation results exceed power range channel output by > 2% RTP. 2. Not required to be performed until 24 hours after THERMAL POWER is ≥ 15% RTP. ---------- Compare result of calorimetric heat balance calculation to power range channel output.	24 hours
SR 3.3.1.3	----------NOTES---------- 1. Neutron detectors are excluded from CHANNEL CALIBRATION. 2. For Function 8, flow rate measurement sensors may be excluded from CHANNEL CALIBRATION. ---------- Perform CHANNEL CALIBRATION.	23 days on a STAGGERED TEST BASIS
SR 3.3.1.4	----------NOTES---------- 1. Adjust the power range channel imbalance output if the absolute value of the offset error is ≥ 2.5%. 2. Not required to be performed until 24 hours after THERMAL POWER is ≥ 50% RTP. ---------- Compare results of out of core measured AXIAL POWER IMBALANCE (API_0) to incore measured AXIAL POWER IMBALANCE (API_1) as follows: $(RTP/TP)(API_0 - API_1)$ = offset error.	31 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.5	Perform CHANNEL FUNCTIONAL TEST.	46 days on a STAGGERED TEST BASIS
SR 3.3.1.6	Perform CHANNEL CALIBRATION.	18 months
SR 3.3.1.7	----------NOTE---------- For Function 8, flow rate measurement sensors are only required to be calibrated. ---------- Perform CHANNEL CALIBRATION.	 24 months
SR 3.3.1.8	----------NOTE---------- Neutron detectors are excluded from RPS RESPONSE TIME testing. ---------- Verify that RPS RESPONSE TIME is within limits.	 24 months on a STAGGERED TEST BASIS

License Amendment Request to Revise Technical Specification 3.3.1, "Reactor Protection System (RPS) Instrumentation"

Attachment 3

Proposed Technical Specification Bases Changes, Annotated Copy

---

The following is a list of the affected pages:

B 3.3.1-11
B 3.3.1-12
B 3.3.1-20
B 3.3.1-21
B 3.3.1-22
B 3.3.1-23

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~In addition, t~~The LCO also requires the ultrasonic flow meter (UFM) instrumentation to be used to perform SR 3.3.1.2 when THERMAL POWER is > 50% RTP. The use of the UFM instrumentation for the secondary side feedwater flow and feedwater temperature inputs into the heat balance calculation provides an uncertainty of 0.37% above 50% RTP. An uncertainty of 2% is assumed when non-UFM instrumentation is used for the secondary-side feedwater flow and feedwater temperature inputs into the heat balance calculation except during the allowed outage time of the UFM. At ≤ 50% RTP, the heat balance is performed using primary side instrumentation. Hence, this part of the LCO is only applicable above 50% RTP.

The UFM includes a flow meter measurement section in each of the two main feedwater flow headers. Each measurement section consists of sixteen ultrasonic transducers. With any transducer inoperable, the UFM instrumentation cannot be used to perform SR 3.3.1.2.

Certain RPS trips function to indirectly protect the SLs by detecting specific conditions that do not immediately challenge SLs but will eventually lead to challenge if no action is taken. These trips function to minimize the unit transients caused by the specific conditions. The Allowable Value for these Functions is selected at the minimum deviation from normal values that will indicate the condition, without risking spurious trips due to normal fluctuations in the measured parameter.

The safety analyses applicable to each RPS Function are discussed next.

1. High Flux

   a. High Flux - High Setpoint

      The High Flux - High Setpoint trip provides protection for the design thermal overpower condition based on the measured out of core fast neutron leakage flux.

      The High Flux - High Setpoint trip initiates a reactor trip when the neutron power reaches a predefined setpoint at the design overpower limit. Because THERMAL POWER lags the neutron power, tripping when the neutron power reaches the design overpower will limit THERMAL POWER to a maximum value of the design overpower. Thus, the High Flux - High Setpoint trip protects against violation of the DNBR and fuel centerline melt SLs.

      The High Flux - High Setpoint trip provides transient protection for rapid positive reactivity excursions during operations. These

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

events include the uncontrolled control rod assembly group withdrawal from a subcritical condition event, uncontrolled rod assembly group withdrawal at power event, the rod ejection accident, and the steam line break accident. By providing a trip during these events, the High Flux - High Setpoint trip protects the unit from excessive power levels and also serves to reduce reactor power to prevent violation of the RCS pressure SL.

Rod withdrawal accident analyses cover a large spectrum of reactivity insertion rates (rod worths), which exhibit slow and rapid rates of power increases. At high reactivity insertion rates, the High Flux - High Setpoint trip provides the primary protection. At low reactivity insertion rates, the high pressure trip provides primary protection.

The specified Allowable Values are selected to provide protection against DNB and fuel centerline melt. Allowable Values are provided for four reactor coolant pump operation and three reactor coolant pump operation. The three reactor coolant pump operation Allowable Value is only applicable when reset in accordance with LCO 3.4.4, "RCS Loops - MODES 1 and 2." In addition, ~~ITS~~ Table 3.3-1 Footnote (e) provides a lower four reactor coolant pump operation Allowable Value that is applicable only when reset in accordance with ACTION F. This is required when the UFM is not used during performance of SR 3.3.1.2. The normal RPS High Flux - High Setpoint Allowable Value is based on the assumption that the required high accuracy secondary heat balance instrumentation (i.e., the UFM) is necessary to provide sufficient margin to the analytical setpoint. When the UFM is not used to perform SR 3.3.1.2, the Allowable Value is reduced to account for the difference in heat balance error between the UFM instrumentation and non-UFM instrumentation. No reduction in the three reactor coolant pump operation Allowable Value is needed since the normal Allowable Value is conservative and bounds operation irrespective of the use of the UFM for heat balance calculation. The Allowable Values do not account for harsh environment induced errors, because the trip will actuate prior to degraded environmental conditions being reached.

b. <u>High Flux - Low Setpoint</u>

While in shutdown bypass, with the Shutdown Bypass High Pressure trip OPERABLE, the High Flux - Low Setpoint trip must be reduced to ≤ 5% RTP. The low power setpoint, in conjunction with the lower Shutdown Bypass High Pressure setpoint, ensure

BASES

ACTIONS (continued)

D.1 and D.2

If the Required Action and associated Completion Time of Condition A or B are not met or if more than two channels are inoperable, and Table 3.3.1-1 directs entry into Condition D, the unit must be brought to a MODE in which the specified RPS trip Functions are not required to be OPERABLE. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and to open all CRD trip breakers without challenging plant systems. As Noted, the CRD trip breakers are only required to be opened for Functions 1.a, 3, and 6.

E.1

If the Required Action and associated Completion Time of Condition A or B are not met or if more than two channels are inoperable, and Table 3.3.1-1 directs entry into Condition E, the unit must be brought to a condition in which the specified RPS trip Functions are not required to be OPERABLE. To achieve this status, all CRD trip breakers must be opened. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to open CRD trip breakers without challenging plant systems.

F.1, F.2, and ~~F.3~~G.1

If the UFM is not available for use, the heat balance can be performed using inputs from less accurate installed instrumentation. However, since these instruments are not as accurate, action must be ~~immediately~~ initiated to reduce THERMAL POWER to ≤ 98.4% RTP with four reactor coolant pumps operating (Required Actions ~~F.1~~F1.1.1 and F.2.2) and ≤ 73.8% RTP with three reactor coolant pumps operating (Required Action ~~F.2~~G.1). Given the larger heat balance uncertainty, these limits preserve the core power used in the accident analysis and the initial conditions for DNB as required by LCO 3.2.1, "Regulating Rod Insertion Limits." Actions to reduce power, once initiated, must continue until power is reduced to within the required limit. The immediate Completion Time for Required Action F.1.1 reflects the importance of reducing power since the heat balance uncertainty when not using the UFM is larger than assumed. The Completion Times for Required Action F.2 are based on statistical evidence that the difference between UFM-based and venturi-based feedwater flow values does not change significantly over short periods of time when power level is stable (maintained greater than 90% RTP). Therefore, the venturi-based heat balance uncertainty will be essentially the same as when UFM-based inputs are used if the venturi-

BASES

ACTIONS (continued)

F.1, F.2, and ~~F.3~~G.1 (continued)

values are normalized to the last UFM values used in the calorimetric heat balance calculation. The difference between UFM feedwater temperature measurements and feedwater resistance temperature detector measurements is within the margin allowance of the UFM temperature uncertainty and will have no effect on the heat balance uncertainty.

In addition, when operating with four reactor coolant pumps, the Reactor Protection System High Flux – High Setpoint Allowable Value must be reset to the value specified in Table 3.3.1-1 Note (e) within ten hours (Required Action ~~F.3~~F.1.2) or within 82 hours since the last calorimetric heat balance based on UFM readings (Required Action F.2.3). This reduction ensures that when the increased uncertainty of the instrumentation is considered, the maximum analytical setpoint value of 110.2% RTP will not be exceeded as required by the safety analyses. Historical comparison of the two feedwater flow measurement systems used for secondary-side heat balance calculations above 50% RTP, UFM-based and feedwater venturi-based, indicates that the two methods do not diverge significantly during power operations over short periods of time. The long-term fouling of the venturis results in a more conservative feedwater flow input to the heat balance calculation. Nuclear Instrumentation (NI) trend analysis indicates that the NI to heat balance comparison will not drift significantly over a three-week period, and surveillance data indicates essentially no drift of the RPS High Flux - High Setpoint trip setpoints. Accordingly, the accuracy and conservatism of the RPS High Flux –High Setpoint trip is acceptable during the completion times of Required Actions F.1.2 or F.2.3~~in the ten hour period provided for Allowable Value reduction after completion of the non-UFM-based heat balance calculation~~.

SURVEILLANCE REQUIREMENTS

The SRs for each RPS Function are identified by the SRs column of Table 3.3.1-1 for that Function. Most Functions are subject to CHANNEL CHECK, CHANNEL FUNCTIONAL TEST, CHANNEL CALIBRATION, and RPS RESPONSE TIME testing.

The SRs are modified by a Note. The Note directs the reader to Table 3.3.1-1 to determine the correct SRs to perform for each RPS Function.

SR 3.3.1.1

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

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1 (continued)

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 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; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the unit staff based on a combination of the channel instrument uncertainties, including isolation, indication, and readability. If a channel is outside the criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit. If the channels are within the criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during times when surveillance is required, the CHANNEL CHECK will only verify that they are off scale in the same direction. Off scale low current loop channels are verified to be reading at the bottom of the range and not failed downscale.

The Frequency, 12 hours, is based on operating experience that demonstrates channel failure is rare. Since the probability of two random failures in redundant channels in any 12 hour period is extremely 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's required channels.

For Functions that trip on a combination of several measurements, such as the Flux - ΔFlux - Flow, the CHANNEL CHECK must be performed on each input.

SR 3.3.1.2

This SR is the performance of a heat balance calibration for the power range channels every 24 hours when reactor power is ≥ 15% RTP. The heat balance calibration consists of a comparison of the results of the calorimetric with the power range channel output. The outputs of the power range channels are normalized to the calorimetric. Note 1 to the SR clarifies that if the calorimetric heat balance calculation results exceed the Nuclear Instrumentation System (NIS) channel output by > 2% RTP, the NIS is not declared inoperable but must be adjusted. If the NIS

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.2 (continued)

channel cannot be properly adjusted, the channel is declared inoperable. Note 2 clarifies that this Surveillance is required only if reactor power is ≥ 15% RTP and that 24 hours is allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels, calorimetric data are inaccurate.

The power range channel's output shall be adjusted consistent with the calorimetric results if the calorimetric heat balance calculation results exceed the power range channel's output by > 2% RTP. The value of 2% is adequate because this value is assumed in the safety analyses of UFSAR, Chapter 15 (Ref. 8). These checks and, if necessary, the adjustment of the power range channels ensure that channel accuracy is maintained within the analyzed error margins. The 24 hour Frequency is adequate, based on unit operating experience, which demonstrates the change in the difference between the power range indication and the calorimetric results rarely exceeds a small fraction of 2% RTP in any 24 hour period. Furthermore, the control room operators monitor redundant indications and alarms to detect deviations in channel outputs.

SR 3.3.1.3

A CHANNEL CALIBRATION is a complete check of the instrument channel, including the sensor. The test verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift to ensure that the instrument channel remains operational between successive tests. CHANNEL CALIBRATION shall find that measurement errors and bistable setpoint errors are within the assumptions of the unit specific setpoint analysis. CHANNEL CALIBRATIONS must be performed consistent with the assumptions of the unit specific setpoint analysis. The Surveillance includes two Notes. The first Note to the Surveillance indicates that neutron detectors are excluded from CHANNEL CALIBRATION. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response. The second Note states that for Function 8, Flux - ΔFlux - Flow, flow rate measurement sensors may be excluded from CHANNEL CALIBRATION for this SR. This is acceptable because these sensors are calibrated in accordance with SR 3.3.1.7 every 24 months.

The Frequency is justified by the assumption of a 92 day calibration interval in the determination of the magnitude of equipment drift in the