Station Support Department
10 CFR 50.90

PECO ENERGY

PECO Energy Company
Nuclear Group Headquarters
965 Chesterbrook Boulevard
Wayne, PA 19087-5691

January 17, 1995

Docket Nos. 50-277
50-278

License Nos. DPR-44
DPR-56

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

SUBJECT: Peach Bottom Atomic Power Station, Units 2 and 3
Facility Operating License Change Request 93-18

Dear Sir:

PECO Energy Company hereby submits License Change Request (LCR) 93-18, in accordance with 10 CFR 50.90, requesting changes to Appendix A of the Peach Bottom Atomic Power Station (PBAPS) Facility Operating Licenses.

The proposed changes are necessary to support PBAPS Modification P00271, which will replace the Source Range and Intermediate Range Monitors with a new Wide Range Neutron Monitoring System (WRNMS).

Attachment 1 to this letter describes the proposed changes, Attachment 2 contains the revised Technical Specifications pages, and Attachment 3 contains NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report For Peach Bottom Atomic Power Station, Units 2 and 3," which was prepared by GE Nuclear Energy.

If you have any questions concerning this submittal, please contact us.

Sincerely,

G. A. Hunger, Jr.

G. A. Hunger, Jr.
Director - Licensing

Enclosures: Affidavit, Attachments

cc: T. T. Martin, Administrator, Region I, USNRC
W. L. Schmidt, Senior Resident Inspector, PBAPS, USNRC
R. R. Janati, Commonwealth of Pennsylvania

A001
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COMMONWEALTH OF PENNSYLVANIA :

: SS.

COUNTY OF CHESTER :

W. H. Smith, III, being first duly sworn, deposes and says:

That he is Vice President of PECO Energy Company; the applicant herein; that he has read the attached License Change Request (LCR 93-18) for changes to the Peach Bottom Facility Operating Licenses DPR-44 and DPR-56, and knows the contents thereof; and that the statements and matters set forth therein are true and correct to the best of his knowledge, information and belief.

William H. Smith III

Vice President

Subscribed and sworn to

before me this 17th day

of January 1995.

[illegible]

Notary Public

[illegible]
Erica A. S[illegible] Public
Tredyffrin Twp., [illegible]
My Commission Expires [illegible] 1995

ATTACHMENT 1

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 AND 3

Docket Nos. 50-277
50-278

License Nos. DPR-44
DPR-56

Facility Operating License Change Request
93-18

"Wide Range Neutron Monitoring Instrumentation"

Supporting Information for Changes

PECO Energy Company (PECO Energy), Licensee under Facility Operating Licenses DPR-44 and DPR-56 for the Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3 respectively, requests that the Technical Specifications (TS) contained in Appendix A to the Operating Licenses be amended.

Attachment 2 contains the proposed handwritten Technical Specifications changes for Unit 2 only. The changes are identical for Unit 3. PECO Energy is providing the proposed changes in the Improved Technical Specifications format as the requested approval date for these changes is beyond the implementation date of our previously submitted Improved Technical Specifications application.

Attachment 3 contains the GE Nuclear Energy Licensing Topical Report, NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report For Peach Bottom Atomic Power Station, Units 2 and 3." This report summarizes the analysis and evaluation performed which justify installing and operating a Nuclear Measurement Analysis and Control (NUMAC) Wide Range Neutron Monitoring System (WRNMS) into PBAPS, Units 2 and 3. The WRNMS replaces the Source Range Monitor and Intermediate Range Monitor. The PBAPS WRNMS is effectively identical to the NRC generically approved system documented in Licensing Topical Report NEDO-31439-A, "The Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System (NUMAC-WRNMS)." The NRC Safety Evaluation Report for NEDO-31439-A, was transmitted to GE Nuclear Energy by letter dated October 3, 1990. The minor plant-specific differences between PBAPS and the generic system are evaluated in this report

PECO Energy is requesting that the NRC approve Licensing Report NEDO-32368 for PBAPS, Units 2 and 3 by April 30, 1995. PECO Energy is seeking NRC approval of this report prior to committing the substantial financial resources necessary to construct and assemble the WRNMS. PECO Energy further proposes that the actual Technical Specifications changes be approved by June 1, 1996, to allow for installation of the modification during the Fall 1996 refueling outage. Implementation of the Technical Specifications changes will then occur upon completion of modification P00271.

Description of Changes

See Table 4-4, page 4-10, of Licensing Report NEDO-32368, (Attachment 3) for a description of the proposed Technical Specifications changes.

Safety Discussion

The safety discussion for the proposed changes is provided in attachment 3.

No Significant Hazards Consideration

Licensee proposes that this application does not involve significant hazards consideration for the following reasons:

i) The proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

The use of the WRNMS as discussed herein will not increase the probability or consequences of an accident previously evaluated.

The probability (frequency of occurrence) of design basis accidents (DBAs) occurring is not affected by the WRNMS. The only plant safety analysis affected by WRNMS is the Rod Withdrawal Error (RWE) at low power, and a reanalysis assuming use of WRNMS shows that the criteria of 170 cal/gm for fuel enthalpy increase under RWE is satisfied; thus, RWE is not a limiting event. Scram setpoints (equipment settings that initiate automatic plant shutdowns) will be established such that there is no increase in scram frequency due to the WRNMS. No new challenges to safety-related equipment will result from WRNMS.

ii) The proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.

As summarized below, this change will not create the possibility of a new or different kind of accident from any accident previously evaluated.

The components of the WRNMS will be supplied to equivalent or better design and qualification criteria than is currently required for the plant. Equipment that could be affected by WRNMS has been evaluated. No new operating mode, safety-related equipment lineup, accident scenario, system interaction, or equipment failure mode was identified. Therefore, the WRNMS will not adversely affect plant equipment.

iii) The proposed changes do not involve a significant reduction in a margin of safety.

All the SRM/IRM functions required in the Technical Specifications are replaced with equivalent (more reliable) WRNMS functions. The accuracy and response times of the WRNMS are superior to those of the SRM/IRM subsystems. Implementation of the WRNMS does not affect any fuel or safety limit. The applicable Bases of the Technical Specifications have been rewritten, and the new Bases maintain the equivalent margin of safety as was provided by the SRM/IRM Bases.

The WRNMS (a) does not decrease a channel trip occurrence beyond its acceptable limit, (b) does not increase a channel response time beyond its acceptable limit, (c) increases indicated accuracies, and (d) does not cause any plant parameter for any analyzed event to fall outside of its acceptable limit(s).

The surveillance test frequency change of 7 to 31 days is based on the WRNMS having (1) fixed in-core detectors, (2) greater reliability than the SRMs and IRMs, and (3) self test features. The 13 second allowable value for the WRNM Period-Short surveillance, and the surveillance test frequency change of 184 days to 24 months is based on trip setpoint calculations using GE's standard (NRC approved) setpoint methodology.

The WRNMS will not involve a reduction in a margin of safety, as loads on plant equipment will not increase, and reactions to or results of transients and postulated accidents will not increase from those presently approved by the NRC.

Environmental Impact Assessment

An environmental impact assessment is not required for the changes proposed by this application because the changes conform to the criteria for "actions eligible for categorical exclusion" as specified in 10 CFR 50.22(c)(9).

The proposed change supports Modification P00271 which will replace the existing SRMs/IRMs with a new WRNMS. This Application involves no significant change in the types or significant increase in the amounts of any effluent that may be released offsite. As a result of the proposed changes, there will be no significant increase in individual or cumulative occupational radiation exposure, and no changes to power levels.

Conclusion

The Plant Operations Review Committee and the Nuclear Review Board have reviewed these proposed changes and have concluded that they do not involve an unreviewed safety question and that they are not a threat to the health and safety of the public.

ATTACHMENT 2

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 AND 3

Docket Nos. 50-277
50-278

License Nos. DPR-44
DPR-56

Facility Operating License Change Request
93-18

"Wide Range Neutron Monitoring Instrumentation"

List of Revised Pages

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3.3-4	B 3.3-32	3.3-4	B 3.3-32
3.3-5	B 3.3-33	3.3-5	B 3.3-33
3.3-7	B 3.3-34	3.3-7	B 3.3-34
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1.1 Definitions (continued)

CHANNEL FUNCTIONAL TEST

A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY, including required alarm, interlock, display, and trip functions, and channel failure trips. The CHANNEL FUNCTIONAL TEST may be performed by means of any series of sequential, overlapping, or total channel steps so that the entire channel is tested.

CORE ALTERATION

CORE ALTERATION shall be the movement of any fuel, sources, or reactivity control components within the reactor vessel with the vessel head removed and fuel in the vessel. The following exceptions are not considered to be CORE ALTERATIONS:

a. Movement of ~~source~~ wide range neutron monitors, local power range monitors, ~~intermediate range monitors,~~ traversing incore probes, or special movable detectors (including undervessel replacement); and

b. Control rod movement, provided there are no fuel assemblies in the associated core cell.

Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.

CORE OPERATING LIMITS REPORT (COLR)

The COLR is the unit specific document that provides cycle specific parameter limits for the current reload cycle. These cycle specific limits shall be determined for each reload cycle in accordance with Specification 5.6.5. Plant operation within these limits is addressed in individual Specifications.

DOSE EQUIVALENT I-131

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites."

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.3	------------------NOTE------------------ Not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. -- Perform CHANNEL FUNCTIONAL TEST.	7 days
SR 3.3.1.1.4	Perform CHANNEL FUNCTIONAL TEST.	7 days
SR 3.3.1.1.5	~~Verify the source range monitor (SRM) and intermediate range monitor (IRM) channels overlap.~~ Perform CHANNEL FUNCTIONAL TEST ----- NOTE ----- Not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2 -----------	~~Prior to withdrawing SRMs from the fully inserted position~~ 31 days
SR 3.3.1.1.6	~~-----------------NOTE-----------------~~ ~~Only required to be met during entry into MODE 2 from MODE 1.~~ ~~--~~ ~~Verify the IRM and APRM channels overlap.~~ Perform CHANNEL FUNCTIONAL TEST	~~7 days~~ 31 days
SR 3.3.1.1.7	Adjust the channel to conform to a calibrated flow signal.	31 days
SR 3.3.1.1.8	Calibrate the local power range monitors.	1000 MWD/T average core exposure

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.1.9	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.1.1.10	------------------NOTE------------------ Radiation detectors are excluded. -- Perform CHANNEL CALIBRATION.	92 days
SR 3.3.1.1.1~~1~~2	------------------NOTES------------------ 1. Neutron detectors are excluded. 2. Not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. -- Perform CHANNEL CALIBRATION	~~184 days~~ 24 months
SR 3.3.1.1.1~~2~~1	------------------NOTES------------------ 1. Neutron detectors are excluded. 2. For Function 2.a, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. -- Perform CHANNEL CALIBRATION.	18 months
SR 3.3.1.1.13	Verify Turbine Stop Valve — Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure — Low Functions are not bypassed when THERMAL POWER is ≥ 30% RTP.	24 months

(continued)

Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. ~~Intermediate~~ Wide Range Neutron Monitors					
a. ~~Neutron Flux - High~~ Period - Short	2	3	G	SR 3.3.1.1.1 ~~SR 3.3.1.1.3~~ SR 3.3.1.1.5 ~~SR 3.3.1.1.6~~ SR 3.3.1.1.~~11~~12 SR 3.3.1.1.17	~~≤ 120/125 divisions of full scale~~ ≥ 13 seconds
	5[(a)]	3	H	SR 3.3.1.1.1 SR 3.3.1.1.~~4~~6 SR 3.3.1.1.~~11~~12 SR 3.3.1.1.17	~~≤ 120/125 divisions of full scale~~ ≥ 13 seconds
b. Inop	2	3	G	SR 3.3.1.1.~~3~~5 SR 3.3.1.1.17	NA
	5[(a)]	3	H	SR 3.3.1.1.~~4~~6 SR 3.3.1.1.17	NA
2. Average Power Range Monitors					
a. Startup High Flux Scram	2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.3 ~~SR 3.3.1.1.6~~ SR 3.3.1.1.8 SR 3.3.1.1.~~12~~11 SR 3.3.1.1.17	≤ 15.0% RTP
b. Flow Biased High Scram	1	2	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.7 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.~~12~~11 SR 3.3.1.1.17	≤ 0.66 W + 63.9% RTP[(b)]
c. Scram Clamp	1	2	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.~~12~~11 SR 3.3.1.1.17	≤ 118.0% RTP
d. Downscale	1	2	F	SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.17	≥ 2.5% RTP
e. Inop	1,2	2	G	SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.17	NA

(continued)

(a) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(b) 0.66 W + 63.9% - 0.66 ΔW RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

3.3 INSTRUMENTATION

3.3.1.2 Wide Range Neutron Monitor (WRNM) ~~Source Range Monitor (SRM)~~ Instrumentation

LCO 3.3.1.2 The WRNM ~~SRM~~ instrumentation in Table 3.3.1.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1.2-1.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required WRNMs ~~SRMs~~ inoperable in MODE 2. ~~with intermediate range monitors (IRMs) on Range 2 or below.~~	A.1 Restore required WRNMs ~~SRMs~~ to OPERABLE status.	4 hours
B. Three required WRNMs ~~SRMs~~ inoperable in MODE 2. ~~with IRMs on Range 2 or below.~~	B.1 Suspend control rod withdrawal.	Immediately
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3.	12 hour.

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. One or more required WRNMs ~~SRMs~~ inoperable in MODE 3 or 4.	D.1	Fully insert all insertable control rods.	1 hour
	<u>AND</u>		
	D.2	Place reactor mode switch in the shutdown position.	1 hour
E. One or more required WRNMs ~~SRMs~~ inoperable in MODE 5.	E.1	Suspend CORE ALTERATIONS except for control rod insertion.	Immediately
	<u>AND</u>		
	E.2	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

-----------------------------------NOTE-----------------------------------
Refer to Table 3.3.1.2-1 to determine which SRs apply for each applicable MODE or other specified conditions.

SURVEILLANCE		FREQUENCY
SR 3.3.1.2.1	Perform CHANNEL CHECK.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.2.2	------------------NOTES------------------ 1. Only required to be met during CORE ALTERATIONS. 2. One ~~SRM~~ WRNM may be used to satisfy more than one of the following. --- Verify an OPERABLE ~~SRM~~ WRNM detector is located in: a. The fueled region; b. The core quadrant where CORE ALTERATIONS are being performed, when the associated ~~SRM~~ WRNM is included in the fueled region; and c. A core quadrant adjacent to where CORE ALTERATIONS are being performed, when the associated ~~SRM~~ WRNM is included in the fueled region.	12 hours
SR 3.3.1.2.3	Perform CHANNEL CHECK.	24 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.2.4	-------------------NOTES------------------- 1. Not required to be met with less than or equal to four fuel assemblies adjacent to the ~~SRM~~ WRNM and no other fuel assemblies in the associated core quadrant. 2. Not required to be met during spiral unloading. --- Verify count rate is: a. ≥ 3.0 cps; or b. Within the limits of Figure 3.3.1.2-1.	12 hours during CORE ALTERATIONS AND 24 hours
~~SR 3.3.1.2.5~~	~~Perform CHANNEL FUNCTIONAL TEST and determination of signal to noise ratio.~~	~~7 days~~
SR 3.3.1.2.~~6~~5	-------------------NOTE------------------- Not required to be performed until 12 hours after ~~IRMs on Range 2 or below.~~ WRNMs indicate 125E-5% power or below. --- Perform CHANNEL FUNCTIONAL TEST and determination of signal to noise ratio.	31 days
SR 3.3.1.2.~~7~~6	-------------------NOTES------------------- 1. Neutron detectors are excluded. 2. Not required to be performed until 12 hours after ~~IRMs on Range 2 or below.~~ WRNMs indicate 125E-5% power or below. --- Perform CHANNEL CALIBRATION.	~~184 days~~ 24 months

Table 3.3.1.2-1 (page 1 of 1)
~~Source~~ Wide Range Neutron Monitor Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS
1. ~~Source~~ Wide Range Neutron Monitor	2(a)	3(d)	SR 3.3.1.2.1 SR 3.3.1.2.4 SR 3.3.1.2.~~6~~ 5 SR 3.3.1.2.~~7~~ 6
	3,4	2	SR 3.3.1.2.3 SR 3.3.1.2.4 SR 3.3.1.2.~~6~~ 5 SR 3.3.1.2.~~7~~ 6
	5	2(b)(c)	SR 3.3.1.2.1 SR 3.3.1.2.2 SR 3.3.1.2.4 SR 3.3.1.2.5 SR 3.3.1.2.~~7~~ 6

(a) With WRNMs reading ≤ 25E-5% power ~~IRMs on Range 2~~ or below.

(b) Only one WRNM ~~SRM~~ channel is required to be OPERABLE during spiral offload or reload when the fueled region includes only that WRNM ~~SRM~~ detector.

(c) Special movable detectors may be used in place of WRNMs ~~SRMs~~ if connected to normal WRNM ~~SRM~~ circuits.

(d) Channels must be in 3 of 4 core quadrants

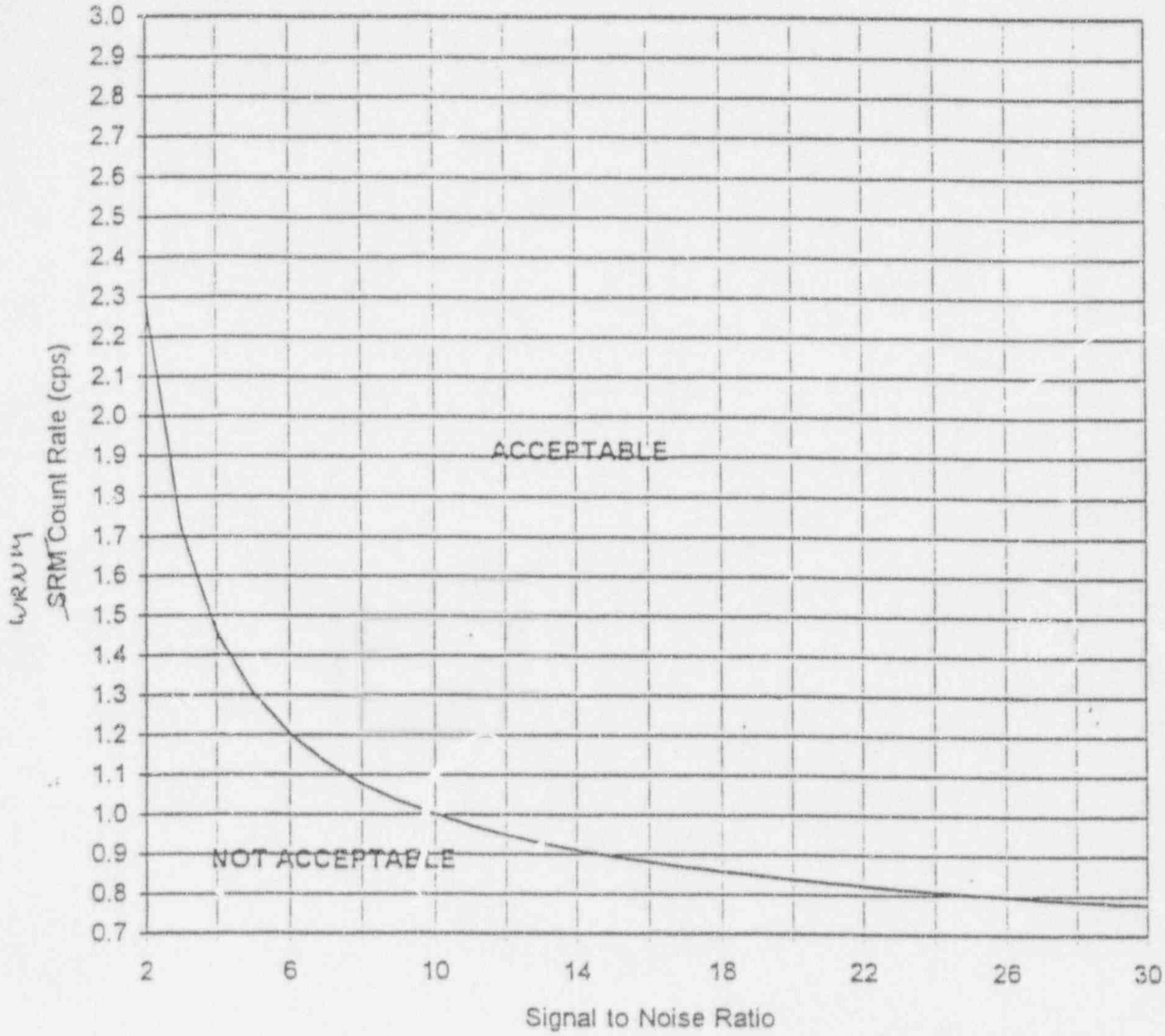

Figure 3.3.1.2-1 (page 1 of 1)
Minimum ~~SRM~~ WRNM Count Rate Versus Signal to Noise Ratio

3.6 CONTAINMENT SYSTEMS

3.6.2.1 Suppression Pool Average Temperature

LCO 3.6.2.1 Suppression pool average temperature shall be:

a. ≤ 95°F when any OPERABLE ~~intermediate~~ wide range neutron monitor ~~(IRM)~~ (WRNM) channel is ~~on Range 7,~~ at 1.00E0% power or above and no testing that adds heat to the suppression pool is being performed;

b. ≤ 105°F when any OPERABLE ~~IRM~~ WRNM channel is ~~on Range 7~~ at 1.00E0% power or above and testing that adds heat to the suppression pool is being performed; and

c. ≤ 110°F when all OPERABLE ~~IRM~~ WRNM channels are below ~~Range 7~~ 1.00E0% power.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Suppression pool average temperature > 95°F but ≤ 110°F. AND Any OPERABLE ~~IRM~~ WRNM ~~channel on Range 7~~ at 1.00E0% power or above. AND Not performing testing that adds heat to the suppression pool.	A.1 Verify suppression pool average temperature ≤ 110°F. AND A.2 Restore suppression pool average temperature to ≤ 95°F.	Once per hour 24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time of Condition A not met.	B.1 Reduce THERMAL POWER until all OPERABLE WANM ~~IRM~~ channels are below ~~Range 7.~~ 1.00E0% power	12 hours
C. Suppression pool average temperature > 105°F. AND Any OPERABLE WANM ~~IRM~~ at 1.00E0% power ~~channel on Range 7~~ or above. AND Performing testing that adds heat to the suppression pool.	C.1 Suspend all testing that adds heat to the suppression pool.	Immediately
D. Suppression pool average temperature > 110°F but ≤ 120°F.	D.1 Place the reactor mode switch in the shutdown position. AND D.2 Verify suppression pool average temperature ≤ 120°F. AND D.3 Be in MODE 4	Immediately Once per 30 minutes 36 hours

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(continued)

BASES

LCO (continued)

multiplying the smaller of the $MAPFAC_p$ and $MAPFAC_f$ factors times the exposure dependent APLHGR limits. With only one recirculation loop in operation, in conformance with the requirements of LCO 3.4.1, "Recirculation Loops Operating," the limit is determined by multiplying the exposure dependent APLHGR limit by the smaller of either $MAPFAC_p$ or $MAPFAC_f$.

APPLICABILITY

The APLHGR limits are primarily derived from fuel design evaluations and LOCA and transient analyses that are assumed to occur at high power levels. Design calculations (Ref. 6) and operating experience have shown that as power is reduced, the margin to the required APLHGR limits increases. This trend continues down to the power range of 5% to 15% RTP when entry into MODE 2 occurs. When in MODE 2, the wide range neutron monitor period-short ~~intermediate range monitor~~ scram function provides prompt scram initiation during any significant transient, thereby effectively removing any APLHGR limit compliance concern in MODE 2. Therefore, at THERMAL POWER levels ≤ 25% RTP, the reactor is operating with substantial margin to the APLHGR limits; thus, this LCO is not required.

ACTIONS

A.1

If any APLHGR exceeds the required limits, an assumption regarding an initial condition of the DBA and transient analyses may not be met. Therefore, prompt action should be taken to restore the APLHGR(s) to within the required limits such that the plant operates within analyzed conditions and within design limits of the fuel rods. The 2 hour Completion Time is sufficient to restore the APLHGR(s) to within its limits and is acceptable based on the low probability of a transient or DBA occurring simultaneously with the APLHGR out of specification.

B.1

If the APLHGR cannot be restored to within its required limits within the associated Completion Time, the plant must be brought to a MODE or other specified condition in which the LCO does not apply. To achieve this status, THERMAL POWER must be reduced to < 25% RTP within 4 hours. The

(continued)

BASES

APPLICABILITY (continued)

flow conditions. These studies encompass the range of key actual plant parameter values important to typically limiting transients. The results of these studies demonstrate that a margin is expected between performance and the MCPR requirements, and that margins increase as power is reduced to 25% RTP. This trend is expected to continue to the 5% to 15% power range when entry into MODE 2 occurs. When in MODE 2, the ~~intermediate range monitor~~ wide range neutron monitor period-short function provides rapid scram initiation for any significant power increase transient, which effectively eliminates any MCPR compliance concern. Therefore, at THERMAL POWER levels < 25% RTP, the reactor is operating with substantial margin to the MCPR limits and this LCO is not required.

ACTIONS

A.1

If any MCPR is outside the required limits, an assumption regarding an initial condition of the design basis transient analyses may not be met. Therefore, prompt action should be taken to restore the MCPR(s) to within the required limits such that the plant remains operating within analyzed conditions. The 2 hour Completion Time is normally sufficient to restore the MCPR(s) to within its limits and is acceptable based on the low probability of a transient or DBA occurring simultaneously with the MCPR out of specification.

B.1

If the MCPR cannot be restored to within its required limits within the associated Completion Time, the plant must be brought to a MODE or other specified condition in which the LCO does not apply. To achieve this status, THERMAL POWER must be reduced to < 25% RTP within 4 hours. The allowed Completion Time is reasonable, based on operating experience, to reduce THERMAL POWER to < 25% RTP in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.2.2.1

The MCPR is required to be initially calculated within 12 hours after THERMAL POWER is ≥ 25% RTP and then every 24 hours thereafter. It is compared to the specified limits

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

~~Intermediate~~ Wide Range Neutron Monitor ~~(IRM)~~ WRNM

1.a. ~~Intermediate~~ Wide Range Neutron Monitor ~~Neutron Flux - High~~ Period - Short

Insert A → ~~The IRMs monitor neutron flux levels from the upper range of the source range monitor (SRM) to the lower range of the average power range monitors (APRMs). The IRMs are capable of generating trip signals that can be used to prevent fuel damage resulting from abnormal operating transients in the intermediate power range.~~ In ~~this power~~ the startup range, the most significant source of reactivity change is due to control rod withdrawal. The ~~IRM~~ WRNM provides diverse protection from the rod worth minimizer (RWM), which monitors and controls the movement of control rods at low power. The RWM prevents the withdrawal of an out of sequence control rod during startup that could result in an unacceptable neutron flux excursion (Ref. 2). The ~~IRM~~ WRNM provides mitigation of the neutron flux excursion. To demonstrate the capability of the ~~IRM~~ WRNM System to mitigate control rod withdrawal events, an ~~generic~~ analyses ~~have~~ has been performed (Ref. 3) to evaluate the consequences of control rod withdrawal events during startup that are mitigated only by the ~~IRM~~ WRNM period-short function. The withdrawal of a control rod out of sequence, during startup, analysis ~~(Ref. 2 and~~ Ref. 3) assumes that one ~~IRM~~ WRNM channel in each trip system is bypassed, demonstrates that the ~~IRMs~~ WRNMs provide protection against local control rod withdrawal errors and results in peak fuel enthalpy below the 170 cal/gm fuel failure threshold criterion.

The ~~IRMs~~ WRNMs are also capable of limiting other reactivity excursions during startup, such as cold water injection events, ~~Specifically, the IRMs are credited as an alternate function in the feedwater controller failure - maximum demand event.~~ although no credit is specifically assumed.

(continued)

A

The WRNMs provide signals to facilitate reactor scram in the event that core reactivity increase (shortening period) exceeds a predetermined reference rate. To determine the reactor period, the neutron flux signal is filtered. The period of this filtered neutron flux signal is used to generate trip signals when the respective trip setpoints are exceeded. The time to trip for a particular reactor period is dependent on the filter time constant, actual period of the signal and the trip setpoints. This period based signal is available over the entire operating range from initial control rod withdrawal to full power operation.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.a. ~~Intermediate~~ Wide Range Neutron Monitor ~~Neutron Flux—High~~ Period-Short (continued)

The ~~IRM~~ WRNM System is divided into two groups of ~~IRM~~ WRNM channels, with four ~~IRM~~ channels inputting to each trip system. The analysis of Reference~~s 2 and~~ 3 assumes that one channel in each trip system is bypassed. Therefore, six channels with three channels in each trip system are required for ~~IRM~~ WRNM OPERABILITY to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. ~~This trip is active in each of the 10 ranges of the IRM, which must be selected by the operator to maintain the neutron flux within the monitored level of an IRM range.~~

The analysis of Reference 3 has adequate conservatism to permit an ~~IRM~~ Allowable Value of ~~120 divisions of a 125 division scale.~~ 13 seconds.

The ~~Intermediate Range Monitor Neutron Flux—High~~ WRNM Period-Short Function must be OPERABLE during MODE 2 when control rods may be withdrawn and the potential for criticality exists. In MODE 5, when a cell with fuel has its control rod withdrawn, the ~~IRMs~~ WRNMs provide monitoring for and protection against unexpected reactivity excursions. In MODE 1, the APRM System and the RWM provide protection against control rod withdrawal error events and the ~~IRMs~~ WRNMs are not required. The ~~IRMs~~ WRNMs are automatically bypassed when the mode switch is in the Run position.

1.b. ~~Intermediate~~ Wide Range Neutron Monitor—Inop

This trip signal provides assurance that a minimum number of ~~IRMs~~ WRNMs are OPERABLE. Anytime ~~an IRM~~ a WRNM mode switch is moved to any position other than "Operate," ~~the detector voltage drops below a preset level, or when a module is not plugged in~~ a loss of power occurs, or the self-test system detects a failure which would result in the loss of a safety-related function, an inoperative trip signal will be received by the RPS unless the ~~IRM~~ WRNM is bypassed. Since only one ~~IRM~~ WRNM in each trip system may be bypassed, only one ~~IRM~~ WRNM in each RPS trip system may be inoperable without resulting in an RPS trip signal.

This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY

1.b. Intermediate Range Monitor—Inop (continued)

Six channels of the Intermediate Range Monitor—Inop Function, with three channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. Since this Function is not assumed in the safety analysis, there is no Allowable Value for this Function.

This Function is required to be OPERABLE when the Intermediate Range Monitor Neutron Flux—High Function is required.

Average Power Range Monitor

2.a. Average Power Range Monitor Startup High Flux Scram

The APRM channels receive input signals from the local power range monitors (LPRMs) within the reactor core which provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from approximately 1% RTP to approximately 125% RTP. For operation at low power (i.e., MODE 2), the Average Power Range Monitor Startup High Flux Scram Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the Average Power Range Monitor Startup High Flux Scram Function will provide a secondary scram to the Intermediate Range Monitor Neutron Flux—High Function because of the relative setpoints. With the IRMs at Range 9 or 10, it is possible that the Average Power Range Monitor Startup High Flux Scram Function will provide the primary trip signal for a core wide increase in power.

No specific safety analyses take direct credit for the Average Power Range Monitor Startup High Flux Scram Function. However, this Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed 25% RTP (SL 2.1.1.1)

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.b. Average Power Range Monitor Flow Biased High Scram (continued)

The Average Power Range Monitor Flow Biased High Scram Function is required to be OPERABLE in MODE 1 when there is the possibility of generating excessive THERMAL POWER and potentially exceeding the SL applicable to high pressure and core flow conditions (MCPR SL). During MODES 2 and 5, other ~~IRM~~ WRNM and APRM Functions provide protection for fuel cladding integrity.

2.c. Average Power Range Monitor Scram Clamp

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The Average Power Range Monitor Scram Clamp Function is capable of generating a trip signal to prevent fuel damage or excessive RCS pressure. For the overpressurization protection analysis of Reference 4, the Average Power Range Monitor Scram Clamp Function is assumed to terminate the main steam isolation valve (MSIV) closure event and, along with the safety/relief valves (S/RVs), limit the peak reactor pressure vessel (RPV) pressure to less than the ASME Code limits. The control rod drop accident (CRDA) analysis (Ref. 5) takes credit for the Average Power Range Monitor Scram Clamp Function to terminate the CRDA.

The APRM System is divided into two groups of channels with three APRM channels inputting to each trip system. The system is designed to allow one channel in each trip system to be bypassed. Any one APRM channel in a trip system can cause the associated trip system to trip. Four channels of Average Power Range Monitor Scram Clamp with two channels in each trip system arranged in a one-out-of-two logic are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least 14 LPRM inputs are required for each APRM channel, with at least two LPRM inputs from each of the four axial levels at which the LPRMs are located.

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.c. Average Power Range Monitor Scram Clamp (continued)

The Allowable Value is based on the Analytical Limit assumed in the CRDA and the loss of feedwater heater event analyses.

The Average Power Range Monitor Scram Clamp Function is required to be OPERABLE in MODE 1 where the potential consequences of the analyzed transients could result in the SLs (e.g., MCPR and RCS pressure) being exceeded. Although the Average Power Range Monitor Scram Clamp Function is assumed in the CRDA analysis, which is applicable in MODE 2, the Average Power Range Monitor Startup High Flux Scram Function conservatively bounds the assumed trip and, together with the assumed WRNM ~~IRM~~ trips, provides adequate protection. Therefore, the Average Power Range Monitor Scram Clamp Function is not required in MODE 2.

2.d. Average Power Range Monitor—Downscale

This signal ensures that there is adequate Neutron Monitoring System protection if the reactor mode switch is placed in the run position prior to the APRMs coming on scale. With the reactor mode switch in run, an APRM downscale signal coincident with an associated Wide ~~Intermediate~~ Range Neutron Monitor Period-Short ~~Neutron Flux—High~~ or Inop signal generates a trip signal. This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

The APRM System is divided into two groups of channels with three inputs into each trip system. The system is designed to allow one channel in each trip system to be bypassed. (However, the potential exists to bypass a second APRM using WANM ~~an IRM~~ bypass switch.) Four channels of Average Power Range Monitor—Downscale with two channels in each trip system arranged in a one-out-of- two logic are required to be OPERABLE to ensure that no single failure will preclude a scram from this Function on a valid signal. The Wide ~~Intermediate~~ Range Neutron Monitor Period-Short ~~Neutron Flux—High~~ and Inop Functions are also part of the OPERABILITY of the Average Power Range Monitor—Downscale Function. If either of these WANM ~~IRM~~ Functions cannot send a signal to the Average Power Range Monitor—Downscale Function either automatically when

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.d. Average Power Range Monitor—Downscale (continued)

the trip conditions exist or manually when the ~~IRM~~ WRNM is inoperable (e.g., when ~~IRM~~ WRNM is taken out of operate), the associated Average Power Range Monitor—Downscale channel is considered inoperable.

The Allowable Value is based upon ensuring that the APRMs are on scale when transfers are made between APRMs and ~~IRMs~~ WRNMs

This Function is required to be OPERABLE in MODE 1 since this is when the APRMs are the primary indicators of reactor power. This Function is automatically bypassed when the mode switch is not in the Run position.

2.e. Average Power Range Monitor—Inop

This signal provides assurance that a minimum number of APRMs are OPERABLE. Anytime an APRM mode switch is moved to any position other than "Operate," an APRM module is unplugged, the electronic operating voltage is low, or the APRM has too few LPRM inputs (< 14), an inoperative trip signal will be received by the RPS, unless the APRM is bypassed. Since only one APRM in each trip system may be bypassed, only one APRM in each trip system may be inoperable without resulting in an RPS trip signal. This Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

Four channels of Average Power Range Monitor—Inop with two channels in each trip system are required to be OPERABLE to ensure that no single failure will preclude a scram from this Function on a valid signal.

There is no Allowable Value for this Function.

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

(continued)

BASES

ACTIONS

C.1 (continued)

on a valid signal. For the typical WRNM Function with one-out-of-two taken twice logic and the ~~IRM~~ and APRM Functions, this would require both trip systems to have one channel OPERABLE or in trip (or the associated trip system in trip). For Function 5 (Main Steam Isolation Valve—Closure), this would require both trip systems to have each channel associated with the MSIVs in three main steam lines (not necessarily the same main steam lines for both trip systems) OPERABLE or in trip (or the associated trip system in trip). For Function 8 (Turbine Stop Valve—Closure), this would require both trip systems to have three channels, each OPERABLE or in trip (or the associated trip system in trip). For Functions 12 (Reactor Mode Switch—Shutdown Position) and 13 (Manual Scram), this would require both trip systems to have one channel, each OPERABLE or in trip (or the associated trip system in trip).

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

D.1

Required Action D.1 directs entry into the appropriate Condition referenced in Table 3.3.1.1-1. The applicable condition specified in the Table is Function and MODE or other specified condition dependent and may change as the Required Action of a previous Condition is completed. Each time an inoperable channel has not met any Required Action of Condition A, B, or C and the associated Completion Time has expired, Condition D will be entered for that channel and provides for transfer to the appropriate subsequent Condition.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.2 (continued)

A restriction to satisfying this SR when < 25% RTP is provided that requires the SR to be met only at ≥ 25% RTP because it is difficult to accurately maintain APRM indication of core THERMAL POWER consistent with a heat balance when < 25% RTP. At low power levels, a high degree of accuracy is unnecessary because of the large, inherent margin to thermal limits (MCPR and APLHGR). At ≥ 25% RTP, the Surveillance is required to have been satisfactorily performed within the last 7 days, in accordance with SR 3.0.2. A Note is provided which allows an increase in THERMAL POWER above 25% if the 7 day Frequency is not met per SR 3.0.2. In this event, the SR must be performed within 12 hours after reaching or exceeding 25% RTP. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

SR 3.3.1.1.3

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. Any setpoint adjustment shall be made consistent with the assumptions of the current plant specific setpoint methodology.

As noted, SR 3.3.1.1.3 is not required to be performed when entering MODE 2 from MODE 1, since testing of the MODE 2 required ~~IRM and~~ APRM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads, or movable links. This allows entry into MODE 2 if the 7 day Frequency is not met per SR 3.0.2. In this event, the SR must be performed within 12 hours after entering MODE 2 from MODE 1. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

A Frequency of 7 days provides an acceptable level of system average unavailability over the Frequency interval and is based on reliability analysis (Ref. 9).

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.4

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. A Frequency of 7 days provides an acceptable level of system average availability over the Frequency and is based on the reliability analysis of References 9 and 10. (The RPS Channel Test Switch Function's CHANNEL FUNCTIONAL TEST Frequency was credited in the analysis to extend many automatic scram Functions' Frequencies.)

SR 3.3.1.1.5 and SR 3.3.1.1.6

Insert B →

These Surveillances are established to ensure that no gaps in neutron flux indication exist from subcritical to power operation for monitoring core reactivity status.

The overlap between SRMs and IRMs is required to be demonstrated to ensure that reactor power will not be increased into a neutron flux region without adequate indication. This is required prior to withdrawing SRMs from the fully inserted position since indication is being transitioned from the SRMs to the IRMs.

The overlap between IRMs and APRMs is of concern when reducing power into the IRM range. On power increases, the system design will prevent further increases (by initiating a rod block) if adequate overlap is not maintained. Overlap between IRMs and APRMs exists when sufficient IRMs and APRMs concurrently have onscale readings such that the transition between MODE 1 and MODE 2 can be made without either APRM downscale rod block or IRM upscale rod block. Overlap between SRMs and IRMs similarly exists when, prior to withdrawing the SRMs from the fully inserted position, IRMs are above mid-scale on range 1 before SRMs have reached the upscale rod block.

As noted, SR 3.3.1.1.6 is only required to be met during entry into MODE 2 from MODE 1. That is, after the overlap requirement has been met and indication has transitioned to the IRMs, maintaining overlap is not required (APRMs may be reading downscale once in MODE 2).

(continued)

Insert B

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. Any setpoint adjustment shall be made consistent with the assumptions of the current plant specific setpoint methodology.

As noted, SR 3.3.1.1.5 is not required to be performed when entering MODE 2 from MODE 1, since testing of the MODE 2 required WRNM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads, or movable links. This allows entry into MODE 2 if the 31 day Frequency is not met per SR 3.0.2. In this event, the SR must be performed within 12 hours after entering MODE 2 from MODE 1. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

A Frequency of 31 days provides an acceptable level of system average unavailability over the Frequency interval and is based on fixed incore detectors, overall reliability, and self-monitoring features.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.5 and SR 3.3.1.1.6 (continued)

If overlap for a group of channels is not demonstrated (e.g., IRM/APRM overlap), the reason for the failure of the surveillance should be determined and the appropriate channel(s) declared inoperable. Only those appropriate channels that are required in the current MODE or condition should be declared inoperable.

A Frequency of 7 days is reasonable based on engineering judgment and the reliability of the IRMs and APRMs.

SR 3.3.1.1.7

The Average Power Range Monitor Flow Biased High Scram Function uses the recirculation loop drive flows to vary the trip setpoint. This SR ensures that the total loop drive flow signals from the flow units used to vary the setpoint is appropriately compared to an injection test flow signal to verify the flow signal trip setpoint and, therefore, the APRM Function accurately reflects the required setpoint as a function of flow. If the flow unit signal is not within the appropriate limit, the affected APRMs that receive an input from the inoperable flow unit must be declared inoperable.

The Frequency of 31 days is based on engineering judgement, operating experience, and the reliability of this instrumentation.

SR 3.3.1.1.8

LPRM gain settings are determined from the local flux profiles measured by the Traversing Incore Probe (TIP) System. This establishes the relative local flux profile for appropriate representative input to the APRM System. The 1000 MWD/T Frequency is based on operating experience with LPRM sensitivity changes.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.9 and SR 3.3.1.1.14

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference 9.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.1.10, SR 3.3.1.1.11, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This 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 drifts between successive calibrations, consistent with the current plant specific setpoint methodology. SR 3.3.1.1.16, however, is only a calibration of the radiation detectors using a standard radiation source.

As noted for SR 3.3.1.1.11 and SR 3.3.1.1.12, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 7 day calorimetric calibration (SR 3.3.1.1.2) and the 1000 MWD/T LPRM calibration against the TIPs (SR 3.3.1.1.8). A second note is provided for SRs 3.3.1.1.11 and 3.3.1.1.12 that allows the APRM and ~~IRM~~ WRNM SRs to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM and ~~IRM~~ WRNM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads or movable links. This Note allows entry into MODE 2 from MODE 1, if the ~~184 day~~ 18 or ~~18~~ 24 month Frequency is not met

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.10, SR 3.3.1.1.11, SR 3.3.1.1.12, SR 3.3.1.1.15, and SR 3.3.1.1.16 (continued)

per SR 3.0.2. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR. As noted for SR 3.3.1.1.10, radiation detectors are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. The radiation detectors are calibrated in accordance with SR 3.3.1.1.16 on a 24 month Frequency.

The 92 day Frequency of SR 3.3.1.1.10 is conservative with respect to the magnitude of equipment drift assumed in the setpoint analysis. The Frequencies of SR 3.3.1.1.11 and SR 3.3.1.1.12 are based upon the assumption of an ~~184 day~~ 18 month or a~~n~~ ~~18~~ 24 month calibration interval, respectively, in the determination of the magnitude of equipment drift in the setpoint analysis. The Frequencies of SR 3.3.1.1.15 and SR 3.3.1.1.16 are based upon the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the applicable setpoint analysis.

SR 3.3.1.1.13

This SR ensures that scrams initiated from the Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP. This involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodologies are incorporated into the Allowable Value (≤ 29.4% RTP which is equivalent to ≤ 138.4 psig as measured from turbine first stage pressure) and the actual setpoint. Because main turbine bypass flow can affect this setpoint nonconservatively (THERMAL POWER is derived from turbine first stage pressure), the main turbine bypass valves must remain closed during the calibration at THERMAL POWER ≥ 30% RTP to ensure that the calibration is valid.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1.13 (continued)

If any bypass channel's setpoint is nonconservative (i.e., the Functions are bypassed at ≥ 30% RTP, either due to open main turbine bypass valve(s) or other reasons), then the affected Turbine Stop Valve—Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure—Low Functions are considered inoperable. Alternatively, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the channel is considered OPERABLE.

The Frequency of 24 months is based on engineering judgment and reliability of the components.

SR 3.3.1.1.17

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods (LCO 3.1.3), and SDV vent and drain valves (LCO 3.1.8), overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components will pass the Surveillance when performed at the 24 month Frequency.

REFERENCES

1. UFSAR, Section 7.2.

2. UFSAR, Section Chapter 14.

3. ~~NEDO-23842, "Continuous Control Rod Withdrawal in the Startup Range," April 18, 1978.~~ NEDO-32368, "Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System Licensing Report For Peach Bottom Atomic Power Station, Units 2 & 3, November 1994

4. NEDC-32183P, "Power Rerate Safety Analysis Report for Peach Bottom 2 & 3," dated May 1993.

5. UFSAR, Section 14.6.2.

(continued)

B 3.3 INSTRUMENTATION

B 3.3.1.2 ~~Source Range Monitor (SRM)~~ Wide Range Neutron Monitor (WRNM) Instrumentation

BASES

BACKGROUND

The ~~SRMs provide~~ WRNMs are capable of providing the operator with information relative to the neutron flux level at very low flux levels in the core. As such, the ~~SRM~~ WRNM indication is used by the operator to monitor the approach to criticality and determine when criticality is achieved. ~~The SRMs are maintained fully inserted until the count rate is greater than a minimum allowed count rate (a control rod block is set at this condition). After SRM to intermediate range monitor (IRM) overlap is demonstrated (as required by SR 3.3.1.1.6), the SRMs are normally fully withdrawn from the core.~~

The ~~SRM~~ WRNM subsystem of the Neutron Monitoring System (NMS) consists of ~~four~~ eight channels. Each of the ~~SRM~~ WRNM channels can be bypassed, but only one per RPS trip system at any given time, by the operation of a bypass switch. Each channel includes one detector that is ~~can be physically~~ permanently positioned in the core. Each detector assembly consists of a miniature fission chamber with associated cabling, signal conditioning equipment, and electronics associated with the various ~~SRM~~ WRNM functions. The signal conditioning equipment converts the current pulses from the fission chamber to analog DC currents that correspond to the count rate. Each channel also includes indication, alarm, and control rod blocks. However, this LCO specifies OPERABILITY requirements only for the monitoring and indication functions of the ~~SRMs~~. WRNMs.

During refueling, shutdown, and low power operations, the primary indication of neutron flux levels is provided by the ~~SRMs~~ WRNMs or special movable detectors connected to the normal ~~SRM~~ WRNM circuits. The ~~SRMs~~ WRNMs provide monitoring of reactivity changes during fuel or control rod movement and give the control room operator early indication of unexpected subcritical multiplication that could be indicative of an approach to criticality.

APPLICABLE SAFETY ANALYSES

Prevention and mitigation of prompt reactivity excursions during refueling and low power operation is provided by LCO 3.9.1, "Refueling Equipment Interlocks"; LCO 3.1.1, "SHUTDOWN MARGIN (SDM)"; LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation"; ~~IRM Neutron Flux—High~~ WRNM Period-Short and

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

Average Power Range Monitor (APRM) Startup High Flux Scram Functions; and LCO 3.3.2.1, "Control Rod Block Instrumentation."

The SRMs have no safety function and are not assumed to function during any UFSAR design basis accident or transient analysis. However, the SRMs provide the only on-scale monitoring of neutron flux levels during startup and refueling. Therefore, they are being retained in Technical Specifications.

LCO

During startup in MODE 2, three of the ~~four~~ SRM channels are required to be OPERABLE to monitor the reactor flux level prior to and during control rod withdrawal, subcritical multiplication and reactor criticality, ~~and neutron flux level and reactor period until the flux level is sufficient to maintain the IRMs on Range 3 or above. All but one of the channels are required~~ in order to provide a representation of the overall core response during those periods when reactivity changes are occurring throughout the core.

In MODES 3 and 4, with the reactor shut down, two SRM channels provide redundant monitoring of flux levels in the core.

In MODE 5, during a spiral offload or reload, an SRM outside the fueled region will no longer be required to be OPERABLE, since it is not capable of monitoring neutron flux in the fueled region of the core. Thus, CORE ALTERATIONS are allowed in a quadrant with no OPERABLE SRM in an adjacent quadrant provided the Table 3.3.1.2-1, footnote (b), requirement that the bundles being spiral reloaded or spiral offloaded are all in a single fueled region containing at least one OPERABLE SRM is met. Spiral reloading and offloading encompass reloading or offloading a cell on the edge of a continuous fueled region (the cell can be reloaded or offloaded in any sequence).

In nonspiral routine operations, two SRMs are required to be OPERABLE to provide redundant monitoring of reactivity changes occurring in the reactor core. Because of the local nature of reactivity changes during refueling, adequate coverage is provided by requiring one SRM to be OPERABLE in the quadrant of the reactor core where CORE ALTERATIONS are

(continued)

BASES

LCO (continued)

being performed, and the other [WRNM] ~~SRM~~ to be OPERABLE in an adjacent quadrant containing fuel. These requirements ensure that the reactivity of the core will be continuously monitored during CORE ALTERATIONS.

Special movable detectors, according to footnote (c) of Table 3.3.1.2-1, may be used in place of the normal ~~SRM~~ [WRNM] nuclear detectors. These special detectors must be connected to the normal [WRNM] ~~SRM~~ circuits in the NMS, such that the applicable neutron flux indication can be generated. These special detectors provide more flexibility in monitoring reactivity changes during fuel loading, since they can be positioned anywhere within the core during refueling. They must still meet the location requirements of SR 3.3.1.2.2 and all other required SRs for ~~SRMs.~~ [WRNMs.]

[Insert "C" →]

For an SRM channel to be considered OPERABLE, it must be providing neutron flux monitoring indication.

APPLICABILITY

The [WRNMs] ~~SRMs~~ are required to be OPERABLE in MODES 2, 3, 4, and 5 prior to the ~~IRMs being on scale on Range 3~~ [WRNMs reading 125E-5% power] to provide for neutron monitoring. In MODE 1, the APRMs provide adequate monitoring of reactivity changes in the core; therefore, the [WRNMs] ~~SRMs~~ are not required. In MODE 2, with ~~IRMs on Range 3 or above, the IRMs~~ [WRNMs reading greater than 125E-5% power the WRNM Period-Short function] provides adequate monitoring and the ~~SRMs are~~ [WRNMs monitoring indication is] not required.

ACTIONS

A.1 and B.1

In MODE 2, ~~with the IRMs on Range 2 or below, SRMs~~ [the WRNM channels] provide the means of monitoring core reactivity and criticality. With any number of the required [WRNMs] ~~SRMs~~ inoperable, the ability to monitor neutron flux is degraded. Therefore, a limited time is allowed to restore the inoperable channels to OPERABLE status.

Provided at least one [WRNM] ~~SRM~~ remains OPERABLE, Required Action A.1 allows 4 hours to restore the required [WRNMs] ~~SRMs~~ to OPERABLE status. This time is reasonable because there is adequate capability remaining to monitor the core, there is limited risk of an event during this time, and there is sufficient time to take corrective actions to restore the required [WRNMs] ~~SRMs~~ to OPERABLE status. During this time, control rod withdrawal and power increase is not precluded by this

(continued)

["C" The Table 3.3.1.2-1, footnote (d), requirement provides for conservative spatial core coverage.]

BASES

ACTIONS

A.1 and B.1 (continued)

Required Action. Having the ability to monitor the core with at least one WRNM, proceeding to WRNM indication greater than 125E-5% power ~~SRM, proceeding to IRM Range 3 or greater (with overlap required by SR 3.3.1.1.6)~~, and thereby exiting the Applicability of this LCO, is acceptable for ensuring adequate core monitoring and allowing continued operation.

With three required WRNMs ~~SRMs~~ inoperable, Required Action B.1 allows no positive changes in reactivity (control rod withdrawal must be immediately suspended) due to inability to monitor the changes. Required Action A.1 still applies and allows 4 hours to restore monitoring capability prior to requiring control rod insertion. This allowance is based on the limited risk of an event during this time, provided that no control rod withdrawals are allowed, and the desire to concentrate efforts on repair, rather than to immediately shut down, with no ~~SRMs~~ WRNMs OPERABLE.

C.1

In MODE 2, if the required number of ~~SRMS~~ WRNMs is not restored to OPERABLE status within the allowed Completion Time, the reactor shall be placed in MODE 3. With all control rods fully inserted, the core is in its least reactive state with the most margin to criticality. The allowed Completion Time of 12 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

D.1 and D.2

With one or more required ~~SRMs~~ WRNMs inoperable in MODE 3 or 4, the neutron flux monitoring capability is degraded or nonexistent. The requirement to fully insert all insertable control rods ensures that the reactor will be at its minimum reactivity level while no neutron monitoring capability is available. Placing the reactor mode switch in the shutdown position prevents subsequent control rod withdrawal by maintaining a control rod block. The allowed Completion Time of 1 hour is sufficient to accomplish the Required Action, and takes into account the low probability of an event requiring the ~~SRM~~ WRNM occurring during this interval.

(continued)

BASES

ACTIONS (continued)

E.1 and E.2

With one or more required ~~SRM~~ WRNMs inoperable in MODE 5, the ability to detect local reactivity changes in the core during refueling is degraded. CORE ALTERATIONS must be immediately suspended and action must be immediately initiated to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Suspending CORE ALTERATIONS prevents the two most probable causes of reactivity changes, fuel loading and control rod withdrawal, from occurring. Inserting all insertable control rods ensures that the reactor will be at its minimum reactivity given that fuel is present in the core. Suspension of CORE ALTERATIONS shall not preclude completion of the movement of a component to a safe, conservative position.

Action (once required to be initiated) to insert control rods must continue until all insertable rods in core cells containing one or more fuel assemblies are inserted.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each ~~SRM~~ WRNM Applicable MODE or other specified conditions are found in the SRs column of Table 3.3.1.2-1.

SR 3.3.1.2.1 and SR 3.3.1.2.3

Performance of the CHANNEL CHECK ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on another channel. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2.1 and SR 3.3.1.2.3 (continued)

The Frequency of once every 12 hours for SR 3.3.1.2.1 is based on operating experience that demonstrates channel failure is rare. While in MODES 3 and 4, reactivity changes are not expected; therefore, the 12 hour Frequency is relaxed to 24 hours for SR 3.3.1.2.3. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.1.2.2

To provide adequate coverage of potential reactivity changes in the core, one ~~SRM~~ WRNM is required to be OPERABLE in the quadrant where CORE ALTERATIONS are being performed, and the other OPERABLE ~~SRM~~ WRNM must be in an adjacent quadrant containing fuel. Note 1 states that the SR is required to be met only during CORE ALTERATIONS. It is not required to be met at other times in MODE 5 since core reactivity changes are not occurring. This Surveillance consists of a review of plant logs to ensure that ~~SRMs~~ WRNMs required to be OPERABLE for given CORE ALTERATIONS are, in fact, OPERABLE. In the event that only one ~~SRM~~ WRNM is required to be OPERABLE, per Table 3.3.1.2-1, footnote (b), only the a. portion of this SR is required. Note 2 clarifies that more than one of the three requirements can be met by the same OPERABLE ~~SRM~~ WRNM. The 12 hour Frequency is based upon operating experience and supplements operational controls over refueling activities that include steps to ensure that the ~~SRMs~~ WRNMs required by the LCO are in the proper quadrant.

SR 3.3.1.2.4

This Surveillance consists of a verification of the ~~SRM~~ WRNM instrument readout to ensure that the ~~SRM~~ WRNM reading is greater than a specified minimum count rate, which ensures that the detectors are indicating count rates indicative of neutron flux levels within the core. The signal-to-noise ratio shown in Figure 3.3.1.2-1 is the ~~SRM~~ WRNM count rate at which there is a 95% probability that the ~~SRM~~ WRNM signal indicates the presence of neutrons and only a 5% probability that the ~~SRM~~ WRNM

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2.4 (continued)

signal is the result of noise (Ref. 1). With few fuel assemblies loaded, the WRNMs ~~SRMs~~ will not have a high enough count rate to satisfy the SR. Therefore, allowances are made for loading sufficient "source" material, in the form of irradiated fuel assemblies, to establish the minimum count rate.

To accomplish this, the SR is modified by Note 1 that states that the count rate is not required to be met on a WRNM ~~an SRM~~ that has less than or equal to four fuel assemblies adjacent to the WRNM ~~SRM~~ and no other fuel assemblies are in the associated core quadrant. With four or less fuel assemblies loaded around each WRNM ~~SRM~~ and no other fuel assemblies in the associated core quadrant, even with a control rod withdrawn, the configuration will not be critical. In addition, Note 2 states that this requirement does not have to be met during spiral unloading. If the core is being unloaded in this manner, the various core configurations encountered will not be critical.

The Frequency is based upon channel redundancy and other information available in the control room, and ensures that the required channels are frequently monitored while core reactivity changes are occurring. When no reactivity changes are in progress, the Frequency is relaxed from 12 hours to 24 hours.

SR 3.3.1.2.5 ~~and SR 3.3.1.2.6~~

Performance of a CHANNEL FUNCTIONAL TEST demonstrates the associated channel will function properly. SR 3.3.1.2.5 is required in MODES 2, 3, 4 and 5 ~~MODE 5~~ and the 31 ~~7~~ day Frequency ensures that the channels are OPERABLE while core reactivity changes could be in progress. This Frequency is reasonable, based on fixed incore detectors, overall reliability, self-monitoring features, operating experience and on other Surveillances (such as a CHANNEL CHECK), that ensure proper functioning between CHANNEL FUNCTIONAL TESTS.

~~SR 3.3.1.2.6 is required in MODE 2 with IRMs on Range 2 or below, and in MODES 3 and 4. Since core reactivity changes do not normally take place in MODES 3 and 4 and core reactivity changes are due only to control rod movement in~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2.5 ~~and SR 3.3.1.2.6~~ (continued)

~~MODE 2, the Frequency has been extended from 7 days to 31 days. The 31 day Frequency is based on operating experience and on other Surveillances (such as CHANNEL CHECK) that ensure proper functioning between CHANNEL FUNCTIONAL TESTS.~~

Verification of the signal to noise ratio also ensures that the detectors are correctly monitoring the neutron flux. ~~inserted to an acceptable operating level. In a fully withdrawn condition, the detectors are sufficiently removed from the fueled region of the core to essentially eliminate neutrons from reaching the detector. Any count rate obtained while the detectors are fully withdrawn is assumed to be "noise" only.~~

The Note to the Surveillance allows the Surveillance to be delayed until entry into the specified condition of the Applicability (THERMAL POWER decreased to ~~IRM Range 2 or~~ WRNM power reading of 125E-5% or below). The SR must be performed within 12 hours after ~~IRMs~~ WRNMs are ~~on Range 2~~ reading 125E-5% power or below. The allowance to enter the Applicability with the 31 day Frequency not met is reasonable, based on the limited time of 12 hours allowed after entering the Applicability. ~~and the inability to perform the Surveillance while at higher power levels.~~ Although the Surveillance could be performed while ~~on IRM Range 3,~~ at higher power the plant would not be expected to maintain steady state operation at this power level. In this event, the 12 hour Frequency is reasonable, based on the ~~SRMs~~ WRNMs being otherwise verified to be OPERABLE (i.e., satisfactorily performing the CHANNEL CHECK) and the time required to perform the Surveillances.

SR 3.3.1.2.~~7~~6

Performance of a CHANNEL CALIBRATION at a Frequency of 24 months ~~184 days~~ verifies the performance of the ~~SRM~~ WRNM detectors and associated circuitry. The Frequency considers the plant conditions required to perform the test, the ease of performing the test, and the likelihood of a change in the system or component status. Note 1 excludes the neutron detectors from the CHANNEL CALIBRATION because they cannot readily be adjusted. The detectors are fission chambers that are designed to have a relatively constant sensitivity over the range and with an accuracy specified for a fixed useful life.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2.~~7~~6 (continued)

Note 2 to the Surveillance allows the Surveillance to be delayed until entry into the specified condition of the Applicability. The SR must be performed in MODE 2 within 12 hours of entering MODE 2 with WRNMs reading ≤ 125E-5% power or below ~~IRMs on Range 2 or below~~. The allowance to enter the Applicability with the ~~184 day~~ 24 month Frequency not met is reasonable, based on the limited time of 12 hours allowed after entering the Applicability. ~~and the inability to perform the Surveillance while at higher power levels.~~ Although the Surveillance could be performed while at higher power, ~~on IRM Range 3,~~ the plant would not be expected to maintain steady state operation at this power level. In this event, the 12 hour Frequency is reasonable, based on the WRNMs ~~SRMs~~ being otherwise verified to be OPERABLE (i.e., satisfactorily performing the CHANNEL CHECK) and the time required to perform the Surveillance.

REFERENCES

1. NRC Safety Evaluation Report for Amendment Numbers 147 and 149 to Facility Operating License Numbers DPR-44 and DPR-56, Peach Bottom Atomic Power Station, Unit Nos. 2 and 3, August 28, 1989.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Reference 1 and Reference 2 analyses. Reactor shutdown at a pool temperature of 110°F and vessel depressurization at a pool temperature of 120°F are assumed for the Reference 2 analyses. The limit of 105°F, at which testing is terminated, is not used in the safety analyses because DBAs are assumed to not initiate during unit testing.

Suppression pool average temperature satisfies Criteria 2 and 3 of the NRC Policy Statement.

LCO

A limitation on the suppression pool average temperature is required to provide assurance that the containment conditions assumed for the safety analyses are met. This limitation subsequently ensures that peak primary containment pressures and temperatures do not exceed maximum allowable values during a postulated DBA or any transient resulting in heating of the suppression pool. The LCO requirements are:

a. Average temperature ≤ 95°F when any OPERABLE wide range neutron monitor (WRNM) ~~intermediate range monitor (IRM)~~ channel is ~~on Range 7~~ at 1.00E0% power or above and no testing that adds heat to the suppression pool is being performed. This requirement ensures that licensing bases initial conditions are met.

b. Average temperature ≤ 105°F when any OPERABLE ~~IRM~~ WRNM channel is ~~on Range 7~~ at 1.00E0% power or above and testing that adds heat to the suppression pool is being performed. This required value ensures that the unit has testing flexibility, and was selected to provide margin below the 110°F limit at which reactor shutdown is required. When testing ends, temperature must be restored to ≤ 95°F within 24 hours according to Required Action A.2. Therefore, the time period that the temperature is > 95°F is short enough not to cause a significant increase in unit risk.

c. Average temperature ≤ 110°F when all OPERABLE ~~IRM~~ WRNM channels are below ~~Range 7~~ 1.00E0% power. This requirement ensures that the unit will be shut down at > 110°F. The pool is designed to absorb decay heat and sensible heat but could be heated beyond design limits by the steam generated if the reactor is not shut down.

(continued)

BASES

LCO (continued)

Note that WRNM indication at 1.00E0% power ~~on IRM Range 7~~ is a convenient measure of when the reactor is producing power essentially equivalent to 1% RTP. At this power level, heat input is approximately equal to normal system heat losses.

APPLICABILITY

In MODES 1, 2, and 3, a DBA could cause significant heatup of the suppression pool. In MODES 4 and 5, the probability and consequences of these events are reduced due to the pressure and temperature limitations in these MODES. Therefore, maintaining suppression pool average temperature within limits is not required in MODE 4 or 5.

ACTIONS

A.1 and A.2

With the suppression pool average temperature above the specified limit when not performing testing that adds heat to the suppression pool and when above the specified power indication, the initial conditions exceed the conditions assumed for the Reference 1, 2, and 3 analyses. However, primary containment cooling capability still exists, and the primary containment pressure suppression function will occur at temperatures well above those assumed for safety analyses. Therefore, continued operation is allowed for a limited time. The 24 hour Completion Time is adequate to allow the suppression pool average temperature to be restored below the limit. Additionally, when suppression pool temperature is > 95°F, increased monitoring of the suppression pool temperature is required to ensure that it remains ≤ 110°F. The once per hour Completion Time is adequate based on past experience, which has shown that pool temperature increases relatively slowly except when testing that adds heat to the suppression pool is being performed. Furthermore, the once per hour Completion Time is considered adequate in view of other indications in the control room, including alarms, to alert the operator to an abnormal suppression pool average temperature condition.

B.1

If the suppression pool average temperature cannot be restored to within limits within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the power must be reduced to below ~~Range 7~~ 1.00E0% power for all OPERABLE ~~IRMs~~ WRNMs within

(continued)

BASES

ACTIONS

B.1 (continued)

12 hours. The 12 hour Completion Time is reasonable, based on operating experience, to reduce power from full power conditions in an orderly manner and without challenging plant systems.

C.1

Suppression pool average temperature is allowed to be > 95°F when any OPERABLE ~~IRM channel is on Range 7~~ WRNM channel is at 1.00E0% power or above, and when testing that adds heat to the suppression pool is being performed. However, if temperature is > 105°F, all testing must be immediately suspended to preserve the heat absorption capability of the suppression pool. With the testing suspended, Condition A is entered and the Required Actions and associated Completion Times are applicable.

D.1, D.2, and D.3

Suppression pool average temperature > 110°F requires that the reactor be shut down immediately. This is accomplished by placing the reactor mode switch in the shutdown position. Further cooldown to MODE 4 is required at normal cooldown rates (provided pool temperature remains ≤ 120°F). Additionally, when suppression pool temperature is > 110°F, increased monitoring of pool temperature is required to ensure that it remains ≤ 120°F. The once per 30 minute Completion Time is adequate, based on operating experience. Given the high suppression pool average temperature in this Condition, the monitoring Frequency is increased to twice that of Condition A. Furthermore, the 30 minute Completion Time is considered adequate in view of other indications available in the control room, including alarms, to alert the operator to an abnormal suppression pool average temperature condition.

E.1 and E.2

If suppression pool average temperature cannot be maintained at ≤ 120°F, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the reactor pressure must be reduced to < 200 psig within 12 hours, and the plant must be brought to at least MODE 4 within

(continued)

B 3.9 REFUELING OPERATIONS

B 3.9.3 Control Rod Position

BASES

BACKGROUND

Control rods provide the capability to maintain the reactor subcritical under all conditions and to limit the potential amount and rate of reactivity increase caused by a malfunction in the Reactor Manual Control System. During refueling, movement of control rods is limited by the refueling interlocks (LCO 3.9.1 and LCO 3.9.2) or the control rod block with the reactor mode switch in the shutdown position (LCO 3.3.2.1).

UFSAR design criteria require that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The control rods serve as the system capable of maintaining the reactor subcritical in cold conditions.

The refueling interlocks allow a single control rod to be withdrawn at any time unless fuel is being loaded into the core. To preclude loading fuel assemblies into the core with a control rod withdrawn, all control rods must be fully inserted. This prevents the reactor from achieving criticality during refueling operations.

APPLICABLE SAFETY ANALYSES

Prevention and mitigation of prompt reactivity excursions during refueling are provided by the refueling interlocks (LCO 3.9.1 and LCO 3.9.2), the SDM (LCO 3.1.1), the wide range neutron monitor period-short ~~intermediate range monitor neutron flux~~ scram (LCO 3.3.1.1), and the control rod block instrumentation (LCO 3.3.2.1).

The safety analysis for the control rod withdrawal error during refueling in the UFSAR (Ref. 2) assumes the functioning of the refueling interlocks and adequate SDM. The analysis for the fuel assembly insertion error (Ref. 3) assumes all control rods are fully inserted. Thus, prior to fuel reload, all control rods must be fully inserted to minimize the probability of an inadvertent criticality.

Control rod position satisfies Criterion 3 of the NRC Policy Statement.

(continued)

B 3.9 REFUELING OPERATIONS

B 3.9.4 Control Rod Position Indication

BASES

BACKGROUND

The full-in position indication for each control rod provides necessary information to the refueling interlocks to prevent inadvertent criticalities during refueling operations. During refueling, the refueling interlocks (LCO 3.9.1 and LCO 3.9.2) use the full-in position indication to limit the operation of the refueling equipment and the movement of the control rods. The absence of the full-in position indication signal for any control rod removes the all-rods-in permissive for the refueling equipment interlocks and prevents fuel loading. Also, this condition causes the refuel position one-rod-out interlock to not allow the withdrawal of any other control rod.

UFSAR design criteria require that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The control rods serve as the system capable of maintaining the reactor subcritical in cold conditions.

APPLICABLE SAFETY ANALYSES

Prevention and mitigation of prompt reactivity excursions during refueling are provided by the refueling interlocks (LCO 3.9.1 and LCO 3.9.2), the SDM (LCO 3.1.1), the wide range neutron monitor period-short ~~intermediate range monitor neutron flux~~ scram (LCO 3.3.1.1), and the control rod block instrumentation (LCO 3.3.2.1).

The safety analysis for the control rod withdrawal error during refueling (Ref. 2) assumes the functioning of the refueling interlocks and adequate SDM. The analysis for the fuel assembly insertion error (Ref. 3) assumes all control rods are fully inserted. The full-in position indication is required to be OPERABLE so that the refueling interlocks can ensure that fuel cannot be loaded with any control rod withdrawn and that no more than one control rod can be withdrawn at a time.

Control rod position indication satisfies Criterion 3 of the NRC Policy Statement.

(continued)

B 3.9 REFUELING OPERATIONS

B 3.9.5 Control Rod OPERABILITY—Refueling

BASES

BACKGROUND

Control rods are components of the Control Rod Drive (CRD) System, the primary reactivity control system for the reactor. In conjunction with the Reactor Protection System, the CRD System provides the means for the reliable control of reactivity changes during refueling operation. In addition, the control rods provide the capability to maintain the reactor subcritical under all conditions and to limit the potential amount and rate of reactivity increase caused by a malfunction in the CRD System.

UFSAR design criteria require that one of the two required independent reactivity control systems be capable of holding the reactor core subcritical under cold conditions (Ref. 1). The CRD System is the system capable of maintaining the reactor subcritical in cold conditions.

APPLICABLE SAFETY ANALYSES

Prevention and mitigation of prompt reactivity excursions during refueling are provided by refueling interlocks (LCO 3.9.1 and LCO 3.9.2), the SDM (LCO 3.1.1), the *wide range neutron monitor period-short* ~~intermediate range monitor neutron flux~~ scram (LCO 3.3.1.1), and the control rod block instrumentation (LCO 3.3.2.1).

The safety analyses for the control rod withdrawal error during refueling (Ref. 2) and the fuel assembly insertion error (Ref. 3) evaluate the consequences of control rod withdrawal during refueling and also fuel assembly insertion with a control rod withdrawn. A prompt reactivity excursion during refueling could potentially result in fuel failure with subsequent release of radioactive material to the environment. Control rod scram provides protection should a prompt reactivity excursion occur.

Control rod OPERABILITY during refueling satisfies Criterion 3 of the NRC Policy Statement.

LCO

Each withdrawn control rod must be OPERABLE. The withdrawn control rod is considered OPERABLE if the scram accumulator pressure is ≥ 955 psig and the control rod is capable of

(continued)

B 3.10 SPECIAL OPERATIONS

B 3.10.2 Reactor Mode Switch Interlock Testing

BASES

BACKGROUND

The purpose of this Special Operations LCO is to permit operation of the reactor mode switch from one position to another to confirm certain aspects of associated interlocks during periodic tests and calibrations in MODES 3, 4, and 5.

The reactor mode switch is a conveniently located, multiposition, keylock switch provided to select the necessary scram functions for various plant conditions (Ref. 1). The reactor mode switch selects the appropriate trip relays for scram functions and provides appropriate bypasses. The mode switch positions and related scram interlock functions are summarized as follows:

a. Shutdown—Initiates a reactor scram; bypasses main steam line isolation and main condenser low vacuum scrams;

b. Refuel—Selects Neutron Monitoring System (NMS) scram function for low neutron flux level operation (~~but~~ wide range neutron monitors and ~~does not disable the~~ average power range monitor setdown scram); bypasses main steam line isolation and main condenser low vacuum scrams;

c. Startup/Hot Standby—Selects NMS scram function for low neutron flux level operation (~~intermediate range~~ wide range neutron monitors and average power range monitors); bypasses main steam line isolation and main condenser low vacuum scrams; and

d. Run—Selects NMS scram function for power range operation.

The reactor mode switch also provides interlocks for such functions as control rod blocks, scram discharge volume trip bypass, refueling interlocks, and main steam isolation valve isolations.

APPLICABLE SAFETY ANALYSES

The acceptance criterion for reactor mode switch interlock testing is to prevent fuel failure by precluding reactivity excursions or core criticality. The interlock functions of

(continued)

B 3.10 SPECIAL OPERATIONS

B 3.10.8 SHUTDOWN MARGIN (SDM) Test—Refueling

BASES

BACKGROUND

The purpose of this MODE 5 Special Operations LCO is to permit SDM testing to be performed for those plant configurations in which the reactor pressure vessel (RPV) head is either not in place or the head bolts are not fully tensioned.

LCO 3.1.1, "SHUTDOWN MARGIN (SDM)," requires that adequate SDM be demonstrated following fuel movements or control rod replacement within the RPV. The demonstration must be performed prior to or within 4 hours after criticality is reached. This SDM test may be performed prior to or during the first startup following the refueling. Performing the SDM test prior to startup requires the test to be performed while in MODE 5, with the vessel head bolts less than fully tensioned (and possibly with the vessel head removed). While in MODE 5, the reactor mode switch is required to be in the shutdown or refuel position, where the applicable control rod blocks ensure that the reactor will not become critical. The SDM test requires the reactor mode switch to be in the startup/hot standby position, since more than one control rod will be withdrawn for the purpose of demonstrating adequate SDM. This Special Operations LCO provides the appropriate additional controls to allow withdrawing more than one control rod from a core cell containing one or more fuel assemblies when the reactor vessel head bolts are less than fully tensioned.

APPLICABLE SAFETY ANALYSES

Prevention and mitigation of unacceptable reactivity excursions during control rod withdrawal, with the reactor mode switch in the startup/hot standby position while in MODE 5, is provided by the ~~intermediate range monitor (IRM)~~ wide range neutron monitor (WRNM) period-short ~~neutron flux~~ scram (LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation"), and control rod block instrumentation (LCO 3.3.2.1, "Control Rod Block Instrumentation"). The limiting reactivity excursion during startup conditions while in MODE 5 is the control rod drop accident (CRDA).

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

CRDA analyses assume that the reactor operator follows prescribed withdrawal sequences. For SDM tests performed within these defined sequences, the analyses of References 1 and 2 are applicable. However, for some sequences developed for the SDM testing, the control rod patterns assumed in the safety analyses of References 1 and 2 may not be met. Therefore, special CRDA analyses, performed in accordance with an NRC approved methodology, are required to demonstrate the SDM test sequence will not result in unacceptable consequences should a CRDA occur during the testing. For the purpose of this test, the protection provided by the normally required MODE 5 applicable LCOs, in addition to the requirements of this LCO, will maintain normal test operations as well as postulated accidents within the bounds of the appropriate safety analyses (Refs. 1 and 2). In addition to the added requirements for the RWM, APRM, and control rod coupling, the notch out mode is specified for out of sequence withdrawals. Requiring the notch out mode limits withdrawal steps to a single notch, which limits inserted reactivity, and allows adequate monitoring of changes in neutron flux, which may occur during the test.

As described in LCO 3.0.7, compliance with Special Operations LCOs is optional, and therefore, no criteria of the NRC Policy Statement apply. Special Operations LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria satisfied for the other LCOs is provided in their respective Bases.

LCO

As described in LCO 3.0.7, compliance with this Special Operations LCO is optional. SDM tests may be performed while in MODE 2, in accordance with Table 1.1-1, without meeting this Special Operations LCO or its ACTIONS. For SDM tests performed while in MODE 5, additional requirements must be met to ensure that adequate protection against potential reactivity excursions is available. To provide additional scram protection beyond the normally required IRMs, the APRMs are also required to be OPERABLE (LCO 3.3.1.1, Functions 2a and 2e) as though the reactor were in MODE 2. Because multiple control rods will be withdrawn and the reactor will potentially become critical, the approved control rod withdrawal sequence must be enforced by the RWM (LCO 3.3.2.1, Function 2, MODE 2), or must be verified by a

(continued)

ATTACHMENT 3

PEACH BOTTOM ATOMIC POWER STATION
UNITS 2 AND 3

Docket Nos. 50-277
50-278

License Nos. DPR-44
DPR-56

Facility Operating License Change Request
93-18

"Wide Range Neutron Monitoring Instrumentation"

NEDO-32368

Nuclear Measurement Analysis and Control
Wide Range Neutron Monitoring System Licensing Report
For Peach Bottom Atomic Power Station, Units 2 and 3

GE Nuclear Energy

175 Curtner Avenue
San Jose, CA 95125

NEDO-32368
DRF C51-00129/1
Class I
November 1994

Nuclear Measurement Analysis and Control
Wide Range Neutron Monitoring System
Licensing Report
For Peach Bottom Atomic Power Station, Units 2 & 3

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IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

Please Read Carefully

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EXECUTIVE SUMMARY

This report summarizes the analyses and evaluation performed that justify installing and operating a Nuclear Measurement Analysis and Control (NUMAC) Wide Range Neutron Monitoring System (WRNMS) into Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3. The WRNMS replaces the Source Range Monitor and Intermediate Range Monitor. The PBAPS WRNMS is effectively identical to the NRC generically approved system documented in licensing topical report (LTR) NEDO-31439-A (Reference 1).

The minor plant-specific differences between the PBAPS and the generic system are evaluated in this report.

This evaluation for the WRNMS has reviewed the predominant plant licensing challenges, and demonstrates that implementing the WRNMS at PBAPS can be accomplished without a significant increase in the probability or consequences of an accident previously evaluated, without creating the possibility of a new or different kind of accident from any accident previously evaluated, and without exceeding any presently existing regulatory limits applicable to the plant, which might cause a reduction in a margin of safety. This modification involves no significant hazards consideration.

1. GENERAL INTRODUCTION AND SUMMARY

The Wide Range Neutron Monitoring System (WRNMS) combines the long life capabilities of the regenerative in-core fission detector with the reliable characteristics of the Nuclear Measurement Analysis and Control (NUMAC) nuclear instrumentation to provide a major improvement in wide range neutron monitoring. The system uses fixed location in-core breeder detectors, locally mounted preamplifiers, and control room mounted signal conditioning electronics to continuously monitor neutron fluxes over the range of startup through full power, and provide an operator interface. It replaces the heretofore used Source Range and Intermediate Range Monitor (SRM/IRM) startup and intermediate range neutron sensors, the detector retraction mechanisms and controls, and the accompanying monitoring electronics (see Appendix A of Reference 1).

1.1 Summary

The WRNMS monitors approximately 11 decades of neutron flux over the startup, intermediate, and power ranges. It operates in the counting and Mean Square Voltage (MSV) modes using a in-core ion chamber having a fissionable and regenerative emitter to cover all of the ranges, and a microprocessor-based NUMAC-WRNMS control room monitor to calculate reactor parameters. The NUMAC-WRNMS is capable of performing the following functions:

(1) Using the measurements from a breeder type neutron sensitive ion chamber to calculate reactor power and period over 11 decades.

(2) Providing continuous monitoring of neutron flux from 10^{-9}% to full power.

(3) Providing power and period output data to remote meters and recorders, in analog form and over digital data link.

(4) Providing alarm, trip and control rod block signals.

(5) Semi-automatic self-calibration of control room monitor, including the preamplifier.

(6) Providing security against tampering (by password and keylock control).

(7) Reducing human error through the use of a digital display, and a simple front panel design incorporating human factor guidelines.

(8) Reducing possibility of inoperable or inadvertent trip outputs by improved calibration and testing techniques.

(9) Supply both analog and digital outputs for remote meters and recorders.

(10) Providing operator interfaces and remote readouts.

Section 2 of this report contains a summary description of the PBAPS NUMAC-WRNMS, Section 3 discusses the design considerations and performance standards, and Section 4 discusses the safety concerns for the system.

1.2 Conclusion

The PBAPS NUMAC-WRNMS meets all of the applicable regulatory requirements, and offers improved reliability and performance over prior wide range monitoring instrumentation. The WRNMS provides (Class 1E qualified) neutron monitoring backup for post-accident applications. Digital circuitry and microprocessor capabilities, together with the self-test system, improve the overall accuracy and availability of the control room instrumentation, which enhances nuclear power plant availability and safety.

2. SYSTEM DESCRIPTION

The Wide Range Neutron Monitoring System (WRNMS) uses a fixed in-core regenerative fission chamber with associated NUMAC electronics to provide neutron monitoring over the entire range of normal BWR operation and post-accident neutron monitoring from 10^{-9}% to 100% (11 decades) of full power.

2.1 Introduction

Currently, PBAPS uses four source range monitors (SRMs) and eight intermediate range monitors (IRMs) to provide approximately 10 decades of startup range coverage. The detectors have to be inserted during shutdown and withdrawn after startup to preserve their limited life using non-Class 1E retract mechanisms. In addition, range switches are used for the linear IRM output to switch between decades during power ascension (see Appendices A.1 and A.3 of Reference 1). The present SRM/IRM system will be replaced with 8 NUMAC-WRNMS channels (2 trip systems with 4 channels/system), using fixed location in-core regenerative breeder detectors. The number and locations of the WRNM sensors have been analytically and experimentally determined to provide sufficient flux level information under the most limiting bypass and sensor failure conditions. Each quadrant of the reactor has provision for three sensor locations (previously the SRM and IRM locations). Any two locations out of the three in each of the quadrants for a total of eight sensors (refer to Figure 2-1) provide sufficient coverage. The vertical portion will be the same as the IRMs in their fully inserted condition. The four SRM sensors would be eliminated from the system. Use of regenerative sensors permits permanent in-core locations corresponding to present "full in" detector positions.

The WRNMS indication ranges versus what are normally termed as source and intermediate ranges are shown in Table 2-1.

The current SRMs are required to have 3 operable channels, and the current IRMs are required to have 3 operable channels per trip system. To provide adequate coverage, equivalent to the SRMs, the WRNMS in Range 0 needs to have 3 operable channels with each channel located in a separate quadrant of the core. To provide adequate coverage, equivalent to the IRMs, the WRNMS in Ranges 1-5 needs to have 3 operable channels per trip system. However, as the WRNMS operates continuously over both source and intermediate ranges (providing monitoring and trip functions), WRNMS source range monitoring will usually have at least 6 operable

channels. Therefore, the WRNMS sensor arrangement provides equal or better coverage than the current SRMs and IRMs.

A single NUMAC-WRNMS channel consists of a fixed in-core (no retract mechanism required) regenerative sensor, dry tube, environmentally qualified cable, preamplifier, NUMAC control room monitor electronics which utilize counting, mean square voltage and constant current techniques to process the signal and provide controls and readouts for the operator. Protective trip functions are provided based on stable reactor period, which eliminates the need for range switches. By using a regenerative uranium mixture of U-234 and U-235, the wide range sensor can remain in-core and provide a useful life of approximately 7 full power years. Since the sensor is fixed in-core, the detector drive equipment is eliminated. Bottom entry type sensor assemblies will be used for ease of detector replacement.

A graphic representation of the neutron flux monitoring function is shown in Figure 2-2 of Reference 1. There is a near one-to-one relationship between true and indicated neutron flux from startup to full power. Figure 2-2 shows a block diagram of a single channel NUMAC-WRNMS.

The sensor is housed in a dry tube in the vessel and connected by coaxial cable to a preamplifier which is located outside the primary containment. The preamplifier provides a signal output to the control room monitor which processes the flux signals.

Wide range neutron monitoring by the NUMAC-WRNMS consists of a combination of a source range and an intermediate range. The source range uses a count rate function that covers the same low neutron flux range and supplies the low count rate block as the present SRM subsystem (see Table 4-1). Since the signal is continuous between the SRM and IRM functions, the trips associated with SRM upscale and IRM downscale are not needed, and thus, are eliminated. All range switch based trips are eliminated, and instead, a period based trip is introduced over the entire range. The intermediate range uses a Mean Square Voltage (MSV) technique that is consistent with the present IRM subsystem in providing the middle range of neutron flux monitoring. Outputs from the source range and intermediate range functions of the WRNMS interface with control room and remote equipment. The combined count rate/MSV wide range function covers the source and intermediate neutron flux range of 1.0×10^3 nv to 7.5×10^{13} nv (Above 1.5×10^{13} nv, constant dc current mode operation is employed instead of the constant voltage method). In the constant dc current mode the flux calculated by the MSV method at constant voltage is compensated for high voltage reduction caused by the current limit.) and provides continuous logarithmic and digital signal outputs with no discontinuity

between the two functions over the complete range. Trips are combined in the new WRNMS Trip Auxiliary Units to interface with the Reactor Protection System (RPS) and the Reactor Manual Control System (RMCS).

As shown in Reference 1, the WRNMS originally provided upscale (high) neutron flux rod block and scram functions. A generic Rod Withdrawal Error (RWE) analysis justified these functions. However, a PBAPS specific RWE (see Section 4) demonstates that the short period rod block and scram functions provide adequate protection against flux excursions. Plus, the APRM Setdown scram (in non-Run mode) at PBAPS provides additional backup protection against flux excursions. Therefore, the upscale neutron flux rod block and scram functions are not required, and thus are not included in the PBAPS WRNMS.

2.2 Hardware Configuration

The components for the NUMAC-WRNMS include the sensor/integral cable assembly, dry tube, preamplifier and control room monitor with operator interface(s). Figure 2-3 of Reference 1 shows the mechanical configuration for the system. The general details of the system are described in Section 2.2 of Reference 1. Specific design differences between the generic design in Reference 1 and the PBAPS design are provided below.

2.2.1 Generic vs. PBAPS Design Differences

Appendix C of Reference 1 describes the configuration variation of the WRNMS. The eight channel replacement of the SRM and IRM subsystems is applicable to the WRNMS at PBAPS. The range switches are eliminated, as linear power indication is performed via auto-ranging. Stable period trip is used instead of manual range switch related trips.

2.3 System Operation

Operation of the WRNMS at PBAPS will be consistent with the description provided in Section 2.4 of Reference 1.

2.3.1 System Outputs

The system outputs are listed in Table 2-2.

Table 2-1

WRNMS Indication Ranges

Range	WRNMS Range	WRNMS Indication Range
Source	0	0.1 - 1E6 counts per second
Intermediate	1	0 - 125E-5 % power
	2	0 - 125E-4 % power
	3	0 - 125E-3 % power
	4	0 - 125E-2 % power
	5	0 - 125E-1 % power
Power	6	0 - 125E0 % power

Table 2-2

WRNMS Outputs

Description	Signal Level	Range	Type
Percent Power (Recorder)	0 - 1 Volt	10^{-9} to 100%	Analog log-scale
Percent Power (Recorder)	0 - 1 Volt	0 - 12.5%	Analog auto-ranged linear scale
Percent Power (Computer)	0 - 160 mv	0 to 12.5%	Analog Auto-ranged linear scale
Reactor Period (Recorder)	0 - 1 Volt	-100 to inf to +3 secs.	Analog non-linear
Reactor Period (Meter)	0 - 1 ma	-100 to inf to +3 secs.	Analog non-linear
Reactor Period (Computer)	0 - 160 mv	-100 to inf to +3 secs.	Analog non-linear
Log Count Rate HI Trip	Variable	Set point	Trip Logic
Log Count Rate HI HI Trip	Variable	Set point	Trip Logic
HI Reactor Period Trip	Variable	Set point	Trip Logic
HI HI Reactor Period Trip	Variable	Set point	Trip Logic
Downscale Power Trip	Variable	Set point	Trip Logic
INOP Alarm (non-fatal) Trip			Trip Logic
INOP Trip (fatal) Trip			Trip Logic
Percent Power and Period	Digital	Serial	RS 232
Range Indication	BCD	0 - 10	Discrete
Percent of Full Power	Internal	10^{-9} to 100%	Graphic Bar
Percent to Full Power	Internal	10^{-10} to 150%	Alphanumeric Display
Period	Internal	-100 to inf to +3 secs	Graphic Bar
Period	Internal	-100 to inf to +3 secs.	Alphanumeric Display
Log Count Rate	Internal	0.1 to 10^{7} cps	Alphanumeric Display
Setpoints	Internal	As set	Alphanumeric Display
Polarizing Voltage	Internal	0 to 400V	Alphanumeric Display

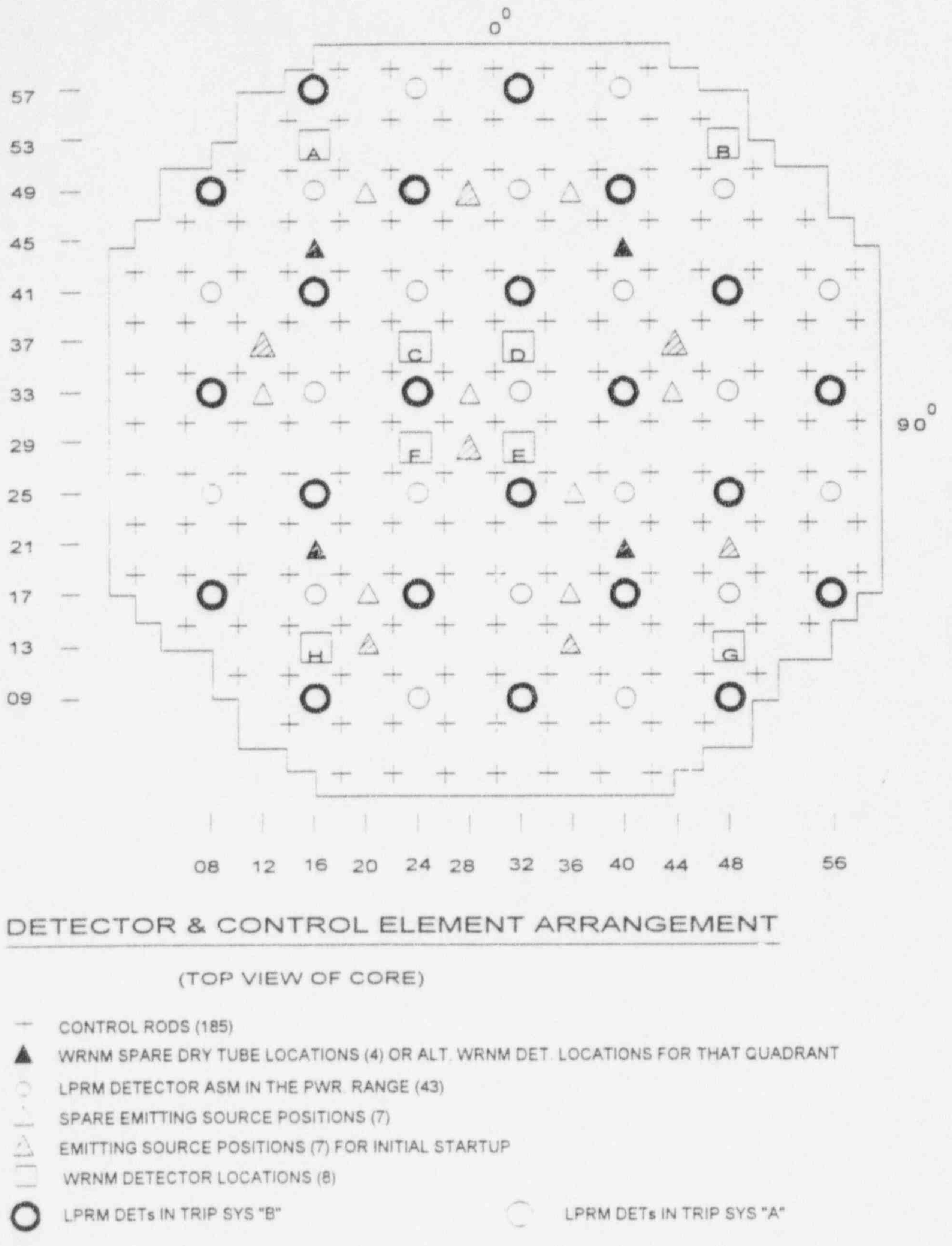
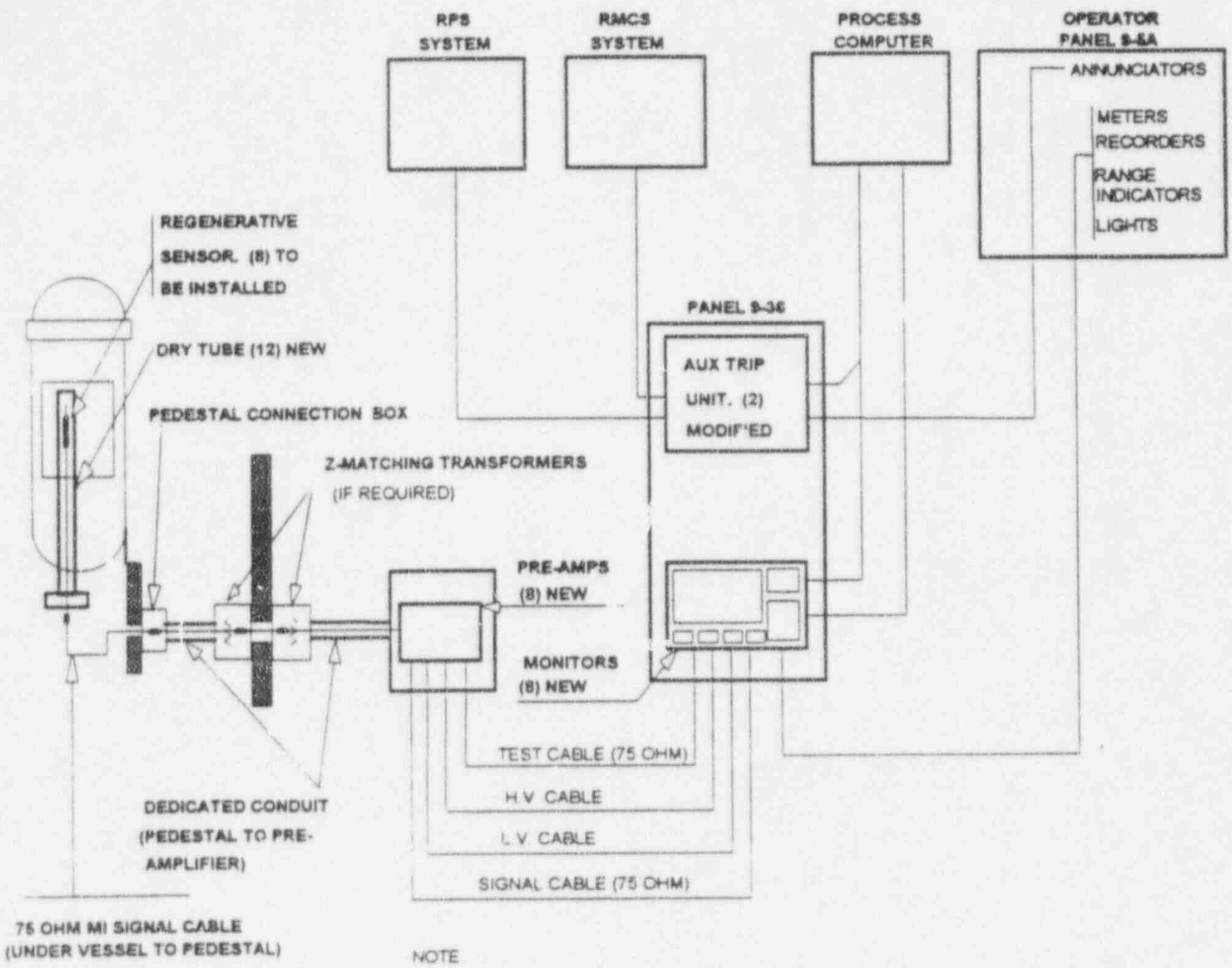


Figure 2-1. Core Location of Neutron Monitoring System Detectors



NOTE

1) TEST/H.V./L.V./SIGNAL CABLES BETWEEN CONTROL ROOM AND PREAMPLIFIER MAY BE REUSED FROM SRM/IRM SYSTEMS.

2) SIGNAL CABLE (75 OHM) TO BE INSTALLED NEW FROM UNDER VESSEL TO PREAMPLIFIER.

Figure 2-2. Configuration of the WRNMS (One Channel)

3. DESIGN CONSIDERATIONS

The PBAPS WRNMS design criteria, requirements and qualification are consistent with those described in Section 3 of Reference 1. The one exception is that at PBAPS the WRNMS is not required to meet Regulatory Guide 1.97, since this requirement is met by other equipment. However, the PBAPS WRNMS does provide an alternate (redundant) method to perform the Regulatory Guide 1.97 neutron monitoring function.

3.1 Safety Classification

The WRNMS is designed to perform the same functions as the SRM/IRM subsystems, while eliminating the insert-retract hardware and drive control electronics. No SRM function is safety-related. However, the IRM high neutron flux scram is a safety-related function. Therefore, the WRNMS (in part) is safety-related, and is qualified as a Class 1E system. To ensure maximum system availability, a Self-Test System (located in the control room monitor) periodically tests the system electronics, and if a failure of a safety-related function is detected (fatal inop.), the system trip.

3.2 Instrument Power

The WRNMS is designed to operate off of existing plant power supplies used for the SRM/IRM ±24 Vdc power. This power is backed up by standby power sources.

3.2.1 WRNMS Control Room Chassis Power

Two types of internal power supplies are provided within the NUMAC WRNMS control room monitor; (1) a pair of low voltage power supplies for preamplifier and chassis modules; and (2) a detector high voltage power supply. Power to operate the control room chassis is as follows:

Voltage	±19.5 to ±29
Current	1 Amp

3.3 Qualification

The qualification of the WRNMS has been reviewed against the environmental and seismic qualification requirements for PBAPS, and the qualification of the WRNMS bounds the PBAPS requirements. WRNMS qualification is described below.

3.3.1 General Requirements

The WRNMS has been qualified to the applicable requirements of:

- NRC Regulatory Guide 1.89 (IEEE 323-1974)
- NRC Regulatory Guide 1.100 (IEEE 344-1975)
- NRC Regulatory Guide 1.97

The qualification was established using qualification methods set forth in General Electric Environmental Qualification Program, Document NEDE 24326-1-P (Reference 2). The generic WRNMS qualification program is provided in Section 4 of Reference 1.

Control Room equipment

NUMAC equipment is qualified to the environment shown below:

a. Temperature: 5 to 50°C
b. Humidity: 10 to 90% RH
c. Atmospheric Pressure: Standard Atmospheric Pressure, +/- 1.0 Inch of Water
d. Radiation: 0.0005 Rad/Hr, 1000 Rad (TID)
e. Seismic: Response spectra at instrument location, both horizontal and vertical, 3% damping

	Fault (SSE)	Upset (OBE)
1 Hz	0.1 g	0.1 g
4 Hz	10.8 g	7.2 g
19 Hz	10.8 g	7.2 g
30 Hz	6.0 g	4.0 g
100 Hz	6.0.g	4.0 g

This envelops the Peach Bottom specific requirements as follows:

Temperature	114°F max
Humidity	27 to 50 % RH
Pressure	None
Radiation	None
Seismic	1.92 g, 0.5% damping max

Preamplifier

Detector Preamplifier is located in the reactor building in harsher environment and will be qualified by type testing to perform its safety-related functions in the environment shown below:

Temperature	Normal 65 to 103°F, Transient temperature 149°F steady state, 207°F peak for 10 minutes)
Humidity	Normal 20 to 90 % RH, Transient 100%
Pressure	-0.25 IN WG, Transient 14.7/16.7 psia
Radiation	6.49 E4 Rad TID

Dry Tube, Integral cable and Incore detector

These items is are located in the reactor vessel in harsher environment and the type test qualification envelops the Peach Bottom environment shown below:

Temperature:	Normal 50 to 545°F, Transient temperature 575°F steady state
Pressure	0 - 1050 psig, Transient 1250 psig
Neutron Flux	1.8 E14 nv, Transient 3.4 E14 nv max
Gamma Flux	1.68 E8 R/hr max

Under Vessel cables and Connectors

The under vessel cables and connectors are located in the containment in harsh environment. The standard type tested qualification will envelop the Peach Bottom environment shown below:

Temperature:	Normal 65 to 150°F, Transient temperature 340°F for a short period
Humidity	Normal 20 to 90 % RH, Transient 100%

Pressure	-0.5 - 2.0 psig, Transient 58.8 psig
Radiation	4.69 E7 Rad TID

Individual component qualification outlines follow.

3.3.2 Sensor, Cable, and Connector Qualification

Qualification to meet the requirements of NUREG 0588 and IEEE 323-1974 was done by a combination of type testing and analysis.

a. Type Testing

1) Sensor Seismic

2) Environmental Testing of Connector
Thermal Age
Radiation Age
Seismic
Post-LOCA Environmental (100 days)

b. Analysis

1) Sensor and Integral Cable

2) Materials

3) Construction

4) Similarity to Other Sensors

3.3.3 NUMAC Electronics Dynamic Qualification

Operational Test Under Dynamic Conditions

a. Type Testing

1) Fixture

The interface fixture was subject to a sine sweep survey along each of the three orthogonal axes to the following levels:

1-100 Hz 0.2 Peak
Sweep Rate One Octave/Minute

The fixture was found to be free of resonance at any given frequency of 100 Hz or below. A resonance is defined as an amplification of response acceleration over input acceleration by a factor of four.

2) Fixture/Hardware

The hardware under test, mounted rigidly to its interface fixture, was subject to a sine sweep survey along each of its three orthogonal axes to the levels above. Identify and record product resonances exceeding an amplification factor of four to one.

b. Seismic Exposure (Upset Condition)

Five random vibration bi-axial seismic events at the upset levels were performed. The test was performed twice, one in each horizontal axis, with the interface fixture rotated 90 degrees in the horizontal plane between tests.

c. Seismic Exposure (Faulted Condition)

Perform one random vibration bi-axial seismic event at the faulted levels in accordance with the requirements of IEEE 344-1975, Section 2.2.3.b, except that the test duration is twenty seconds minimum. The test is performed twice, once in each horizontal axis, with the interface fixture rotated 90 degrees in the horizontal plane between tests.

3.3.4 Cable Qualification

Cable provided as part of this project for use inside the primary containment or reactor building has been conditioned and tested to demonstrate that it will function during a Loss of Coolant

Accident (LOCA) postulated to occur at any time during 40 years of operation under conditions as prescribed by IEEE-383-1974. The cables were subjected to the LOCA profile of IEEE-323-1974 Appendix A for combined PWR/BWR while energized with rated voltage.

The cable has also been tested in accordance with IEEE-383-1974, Section 2.5.6. Samples were subjected to and passed the vertical flame test as described in Part 6 of ICEA S-19-81.

3.4 Compliance With IEEE 279

IEEE 279-1968 is the licensing basis for PBAPS. However, for conservatism the following assessment is based on the 1971 version of IEEE 279.

The WRNMS replaces the IRM subsystem. All functions performed by the IRM subsystem are performed by the WRNMS.

1. The WRNMS meets the same IEEE-279 bypass and inoperable status indication requirements as the IRM subsystem.

2. The WRNMS meets Paragraph 4.1 by providing automatic initiation of scram and rod block trips.

3. The neutron monitoring system WRNM trips comply with the (Paragraph 4.2) single failure criterion through the use of physical panel barriers and electrical isolation provisions to provide independence among the four redundant WRNM channels in each trip system.

4. The qualification and design of the WRNMS trip meet the quality and reliability requirements of Paragraph 4.3.

5. Consistent with Paragraph 4.4, all required equipment is either type tested or analyzed, in conjunction with field experience of the components, to demonstrate that the equipment will meet performance requirements. "In-situ" operational testing of the sensor channels and protection system will be performed during preoperational testing.

6. The components are qualified to operate (as needed) under abnormal conditions of environment, energy supply and accidents, and thus, maintain channel integrity and meet the requirements of Paragraph 4.5.

7. Paragraph 4.6 requires redundant and physically separated RPS trip channels. The eight WRNM channels are electrically isolated and physically separated from one another so as to comply with this requirement, except immediately under the reactor vessel where complete physical separation is not practical.

8. The channels for the WRNMS-RPS trip variables are electrically isolated from plant control systems in compliance with Paragraph 4.7. Within the WRNM modules, (i.e., prior to their output trip unit driving the RPS), analog outputs are derived for use with control room meters, recorders and the process computer. Electrical isolation has been incorporated into the design at this interface to prevent any single failure from influencing the protective output from the trip unit. The trip unit outputs are physically separated and electrically isolated from other plant equipment in their routing to the RPS panels.

9. The WRNMS directly measures neutron flux to determine and protect against (short period RPS trip) a reactor over-power condition in compliance with Paragraph 4.8.

10. The WRNMS is not required to supply a RPS trip when the reactor is in the "run" mode. Therefore, the requirements of Paragraph 4.9 are not applicable. However, the WRNMS would normally be in operation, and would respond to local neutron flux and provide the operator with indication.

11. The WRNMS-RPS trip has provisions for sensor test and calibration during reactor operation in compliance with Paragraph 4.10.

12. With respect to Paragraph 4.11, there are sufficient WRNM channels to permit any one channel in a given trip system to be manually bypassed and still ensure that the remaining operable channels comply with the IEEE 279 single failure design requirements. One WRNM manual bypass switch is provided for each RPS trip system. The characteristics of the switch permit only one of the four WRNM channels of the trip system to be bypassed at any time. With any channel bypassed in a given trip system, three channels remain operable to satisfy the protection system requirements.

13. With respect to Paragraph 4.12, an operating bypass is provided for the WRNM system trip, when the reactor is in the "run" mode.

14. With respect to Paragraph 4.13, when any WRNM instrument channel output to the RPS is bypassed, it is indicated by a light in the main control room.

15. With respect to Paragraph 4.14, manual bypassing of any WRNM channel is accomplished with control room selector switches.

16. With respect to Paragraph 4.15, the analytical limits for the WRNMS setpoint are provided in Table 4-1.

17. With respect to Paragraph 4.16, the WRNMS output is connected to the RPS trip relays which drive the scram actuators.

18. Paragraph 4.17 is not directly applicable to the WRNMS.

19. With respect to Paragraph 4.18, access to setpoint adjustments, calibration controls and test points for the WRNMS-RPS variables is under administrative control.

20. With respect to Paragraph 4.19, when any one of the redundant sensors exceeds its setpoint value for a WRNMS-RPS trip variable, a control room annunciator is initiated to identify the particular variable.

21. The WRNMS-RPS system trip data presented to the operator complies with Paragraph 4.20.

22. With respect to Paragraph 4.21, during reactor operation the control room operator will be able to determine failed WRNMS sensors, but subsequent repair can only be accomplished during reactor shutdown.

3.5 System Application Considerations

Appendix G of Reference 1 lists a number of (SRM/IRM and Regulatory Guide 1.97 related) plant-specific system application considerations to be confirmed. Some of the considerations are applicable for using the WRNMS to meet Regulatory Guide 1.97. As the WRNMS is not required to meet Regulatory Guide 1.97 at PBAPS, these considerations need not be addressed. Each of the SRM/IRM considerations is addressed below.

1. The Rod Withdrawal Error event was reanalyzed (see Section 4.1), and specific period based trip setpoints are based on the analytical limit shown in Table 4-1.

2. The PBAPS specific location of detectors and cables are based on Reference 1, and summary descriptions are provided in Section 2.

3., 4., 6., & 7. Not applicable to PBAPS.

5. The WRNMS system meets the existing IRM subsystem separation requirements. The separation between safety-related and nonsafety-related circuits is via coil to contact separation in relays. The WRNMS is not designed or required to meet Regulatory Guide 1.75.

8. The plant specific Technical Specification changes are provided in NUREG-1433 format and content, which are different from the original BWR/5 type standard Technical Specification changes provided in Reference 1. However, the technical content of the PBAPS Technical Specification changes meet the intent of the proposed Technical Specification changes from Reference 1.

9. Plant procedures including emergency procedures will be modified, as needed, during the implementation of the WRNMS.

4. SAFETY CONCERNS

Of all of the plant safety analyses only a rod withdrawal error (RWE) event at low power is potentially affected by the implementation of a WRNMS at PBAPS No other safety analysis takes credit for a source or intermediate range neutron scram function. For example, in the feedwater controller failure (FWCF) event (re-analyzed as part of the Peach Bottom Power Rerate program) the scram function assumed in the analysis resulted from a high water level trip, and no credit was taken for possible trips from the neutron monitoring system. In the original design the IRM scram function would mitigate a RWE. Table 4-1 shows that the WRNMS will continue to perform required scram functions and all other (as needed) SRM and IRM type functions. A plant-specific low power RWE event was analyzed and is summarized below.

As the plant-specific RWE analysis only takes credit for the short period trips, no PBAPS safety analysis takes credit for the WRNMS upscale level functions, and these functions are not needed to meet any design or regulatory criterion. Therefore, the WRNMS upscale level functions are not included in the PBAPS design (see Table 4-1).

4.1 RWE At Low Power (During Reactor Startup)

4.1.1 Identification of Causes and Frequency Classification

It is postulated that during a reactor startup, a single control rod is inadvertently withdrawn continuously due to a procedural error by the operator and operator failure to acknowledge continuous alarm annunciations prior to safety system actuation. The probability of initial causes or errors of this event alone is considered low enough to be categorized as an infrequent incident. The probability of further development of this event is low, because it is contingent upon the failure of the Rod Worth Minimizer (RWM) system, together with a high worth out-of-sequence rod selection contrary to procedures.

The WRNMS has period-based functions that will stop a continuous rod withdrawal by initiating a rod block if the flux excursion, caused by rod withdrawal, generates a period shorter than 20 seconds. The period-based functions also initiate a scram trip if the flux excursion generates a period shorter than 10 seconds. Any single WRNMS rod block trip initiates a rod block. One out of two taken twice logic is used to initiate a scram. A detailed description of the period-based trip function is presented in Reference 1.

For this transient to happen, a large reactivity addition must be introduced. The reactor must be critical, with control rod density greater than 50%. The causes of the event are summarized in Table 4-2. The probability for this event to occur is considered low enough to warrant its being categorized as an infrequent incident.

4.1.2 Sequence of Events and Systems Operation

4.1.2.1 Sequence of Events

Control rod withdrawal errors are not considered credible in the startup and low power ranges. The RWM system prevents the operator from selecting and withdrawing an out-of-sequence control rod. However, the sequence of events of a postulated continuous control rod withdrawal error during reactor startup is shown in Table 4-3.

4.1.2.2 Identification of Operator Actions

No operator actions are required to preclude or terminate this event, since the plant design, as discussed above prevents the event's occurrence, and WRNMS period-based trip functions will initiate and terminate this event.

4.1.2.3 Effect of Single Failures and Operator Errors

Any additional single failure or operator error will not prevent the event mitigation functions (e.g., rod blocks and scrams) from automatically occurring prior to any design or safety limit being exceeded.

4.1.3 Core and System Performance

4.1.3.1 Analysis Method and Assumptions

The analysis uses the reactivity insertion analysis code described in Reference 3. It is a two-dimensional adiabatic code assuming no heat transfer to the coolant. The analysis consists of four steps. In Step 1, with the error rod being continuously withdrawn from full-in, the model is used to calculate the average power and period change as a function of time with a continuous reactivity insertion simulating the RWE. In Step 2, the power versus time data are used as input to a calculation of the WRNMS rod block and scram trip times. Both the rod block trip and scram trip times are then determined. In Step 3, the reactivity insertion input to the adiabatic

model is adjusted such that after the period reaches the rod block setpoint (20 sec), there is no further reactivity insertion. The RWE transient is then recalculated by the model with the adjusted reactivity input. The reactor scram time is also adjusted based on the time determined in Step 2. The calculated fuel enthalpy does not consider local peaking effect. In Step 4, the peak fuel enthalpy that includes the local peaking effect is calculated.

Other assumptions used in the analysis are:

(1) The standard BWR data of the adiabatic model is used.

(2) The scram reactivity shape is derived from the design core, assuming no failing rods and same scram speed for all rods.

(3) Six delayed neutron groups are assumed.

4.1.3.2 Analysis Conditions and Results

(1) Analysis Conditions

(a) The reactor is assumed to be in the critical condition before the control rod withdrawal, with an initial power of 0.1% rated, and a core average temperature of 286°F.

(b) The worth of the withdrawn rod is 2.5%Δk from full-in to full-out.

(c) The control rod withdrawal speed is 3.11 in/s, the nominal withdrawal speed.

(2) Analysis Result

With this 2.5%Δk reactivity insertion, the flux excursion generates a period of approximately 0.5 second. The rod block trip is initiated at 7 seconds after the start of the transient. The scram is initiated at about 8 seconds. The event is terminated by the scram. The peak fuel enthalpy reached is approximately 19.9 cal/g, which is 2.9 cal/g higher than the initial fuel enthalpy.

4.1.3.3 Evaluation Based On Criteria

Due to the effective protection function of the period-based trip function, the fuel enthalpy increase is small. The criterion of 170 cal/gm for fuel enthalpy increase under RWE event is satisfied. It is concluded that a RWE at low power is not a limiting event, and thus, need not be reanalyzed for future fuel reloads.

4.1.4 Barrier Performance

An evaluation of the barrier performance is not made for this event, because there is no fuel damage in this event and only with mild change in gross core characteristics.

4.1.5 Radiological Consequences

An evaluation of the radiological consequences is not required for this event, because no radioactive material is released from the fuel.

4.2 Failure Evaluation

The following failure evaluation examines (1) potential single failures and determine their effects on plant safety, and (2) design and process control features to prevent software common cause failures.

4.2.1 Single Failures

The WRNMS meets all the redundancy requirements, and can accommodate potential single failures as the SRM and IRM subsystems that the WRNMS is replacing. Therefore, compliance to single failure criteria at PBAPS does not change with the implementation of the WRNMS, and plant safety will not be adversely affected.

4.2.2 Software Common Cause Failures

The design and process control features that prevent software common cause failures are described in Section E.2 of Reference 1.

Potential errors caused by human-machine interface (HMI) are prevented by the design features described in Section 3 of Reference 1. The system performs reactor trip functions only during

startup operation. When the reactor is in the Run mode, the trips are bypassed. There are several channels which are compared against each other for consistency of data. The system itself protects against a RWE, by providing rod blocks. This function backs up the (nonsafety-related) RWM system.

4.2.3 EMI and RFI Concerns

Numerous tests, in accordance with electro-magnetic interference (EMI) and radio frequency interference (RFI) related industry standards, have been performed to demonstrate protection against EMI/RFI related disturbances. Complete immunity to EMI/RFI is dependent upon the equipment installation methods (conduits and grounding, etc.). The NUMAC-WRNMS has been installed in a number of plants. No adverse affect due to EMI events has been encountered.

An EMI/RFI mapping data were collected for the Peach Bottom site in compliance with MIL-Std 461D and NUREG/CR-5941. A comparison was made between the EMI susceptibility characteristics of the NUMAC WRNMS and the EMI emission environment of the plant, as reported in the site survey data.

Conducted Susceptibility

When the conducted susceptibility and worst case emission spectra for the plant are compared, the susceptibility spectra envelope the emission spectra with a margin of at least 18 dB. Therefore, the WRNMS will not be affected by conducted noise present at the Peach Bottom site.

Radiated Susceptibility (Magnetic Fields)

When the radiated magnetic field susceptibility and worst case emission spectra for the plant are compared, the susceptibility spectra envelope the emission spectra with a margin of at least 52 dB. Therefore, the WRNMS will not be affected by radiated magnetic fields present at the Peach Bottom site.

Radiated Susceptibility (Electric Fields)

When the radiated electric field susceptibility and worst case emission spectra for the plant are compared with the WRNM's susceptibility of at least 10 V/m over the entire frequency range, then a margin of 12 dB exists at the emission peak located at 450 MHz, and a

margin of at least 52 dB elsewhere. Therefore, the WRNMS will not be affected by radiated electric fields present at the Peach Bottom site.

In addition, the system employs fail safe logic for RPS trips. The EMI/RFI disturbances generally cause signal spikes (transients), which in turn would produce a reactor period trip, causing a reactor scram. Thus, the EMI related disturbances do not prevent the system from performing its safety-related function.

4.3 Changes To Technical Specifications

The changes to the Technical Specifications (TS) are provided in the NUREG-1433 format. The TS changes are applicable to both Units 2 and 3. Except for the plant-specific licensing basis differences, the proposed PBAPS TS are technically the same as those provided in Appendix F of Reference 1. Per the criteria for what items should be incorporated into NUREG-1433 based TS, Table 4-4 presents the proposed TS changes needed to implement the WRNMS at PBAPS.

4.4 Conclusion

The WRNMS performs all the necessary functions of the original SRMs and IRMs, and the RWE at low power remains non-limiting. Therefore, the WRNMS will continue to ensure that PBAPS remains within its licensed safety basis.

Table 4-1

Comparison of Outputs Between SRM/IRM and WRNMS

(The following table shows the outputs provided by the original SRM and IRM systems compared to those provided by the WRNMS.)

SRM/IRM Outputs (nominal values)		WRNMS Outputs (analytical limits)
SRM	IRM	
Downscale : Alarm (3 cps) : Rod Block	Downscale : Rod Block (2.5/125 of scale) *	Downscale : Alarm and Rod Block (1 cps)
INOP : Rod Block	INOP : Scram and Rod Block	INOP #1 : Scram and Rod Block (fatal)
		INOP #2 : Alarm (Non fatal)
Retract Permissive (100 cps) : Rod Block *		Not needed
High Level (10[5] cps) : Rod Block *		Flux High Level ($5x10^5$ cps) : Rod Block for Fuel Loading
	High Level (108/125 of scale) : Rod Block	Not needed for Startup (Replaced by period trip)
High High Level (5×10^5 cps) : Red Light		Flux High High ($1x10^6$ cps) : Scram for Fuel Loading
	High High Level (120/125 of scale) : Scram	Not needed for Startup (Replaced by period trip)
Period High (10 sec) : Alarm *	Selected Range Low : Rod Block *	Period Based Trip High (20 sec) : Alarm and Rod Block **
	Selected Range High : Scram *	Period Based Trip High High (10 sec) : Scram **

* These outputs eliminated
** RC Time Constant = 40

Table 4-2

Causes of Control Rod Withdrawal Error

Operator Selects Out-of-sequence Control Rod and Initiates Rod Withdrawal

↓

RWM Rod Block Fails

↓

Operator Procedural Errors --
Alarms Are Ignored and
Control Rod Is Continuously Withdrawn

Table 4-3

Sequence of Events

Time (sec)	Events
---	The reactor is critical and operating in the startup range.
>0	The operator selects and withdraws an out-of-sequence control rod at the maximum normal drive speed of 3.11 in/sec.
	The RWM fail to block the selection (selection error) and continuous withdrawal (withdraw error) of the out-of-sequence rod.
	Neutron flux increases rapidly (due to the continuous reactivity addition) with a very short period.
7	The WRNMS Period-Based Rod Block Trip initiates rod block due to short period (less than the 20 seconds).
8	The WRNMS Period-Based Scram Trip initiates reactor scram due to short period (less than the 10 seconds).
9	Reactor is scrammed and event is terminated.

Table 4-4

Proposed Technical Specification Changes
(Based on NUREG-1433)

Page	Section	General Description of Change
1.1-2	1.1	Change "source range monitor" to "range neutron monitors," and delete "intermediate range monitors."
3.3-4	SR 3.3.1.1.5 & SR 3.3.1.1.6	Change text and test frequency to 31 days to reflect WRNMS, overall reliability from fixed incore detectors, high reliability components, and self-monitoring (self test feature) feature.
3.3-5	SR 3.3.1.1.11 & 12	Reverse the order of these SRs to be consistent with improved Tech Specs format. Change channel calibration to reflect the 24 months frequency applicable to the WRNM.
3.3-7	Table 3.3.1.1-1	Change Function 1 reference from IRM to WRNM.
	Item 1.a.	Change to period-short trip, delete SR's that are no longer applicable due to the implementation of the WRNM, re-number SR's as applicable to the implementation of the WRNM, and supply allowable values.
	Item 1.b.	Re-number SR's as applicable to the implementation of the WRNM.
	2.a., 2.b. & 2.c.	Delete SR that is no longer applicable due to the implementation of the WRNM, and re-number SR's as applicable to the implementation of the WRNM
3.3-10 & 11	Spec. 3.3.1.2	Change title and text from SRM to WRNM, including LCO.
		Modify ACTIONS A, A.1, B, D & E to reflect WRNM instead of IRM and SRM.
3.3-12	SR 3.3.1.2.2	Change title and text from SRM to WRNM.
3.3-13	SR 3.3.1.2.4	Change title and text from SRM to WRNM.
	SR 3.3.1.2.5	Delete this SR, as it is no longer relevant. Re-number following SRs accordingly here and on page 3.3-14.
	(now) SR 3.3.1.2.5	Change note to indicate the WRNMS value.
	(now) SR 3.3.1.2.6	Change note to indicate the WRNMS value.
		Change SR frequency to reflect WRNMS.

Table 4-4 (continued)

Page	Section	General Description of Change
3.3-14	Table 3.3.1.2-1	Modify the titles, function and notes applicable to the WRNM instead of the SRM instrumentation.
3.3-15	Figure 3.3.1.2-1	Change SRM to WRNM.
3.6-23	Spec. 3.6.2.1	Change all 4 (3 in LCO and 1 in ACTION A.) indicated values to reflect WRNM.
3.6-24	CONDITIONS, ACTIONS	Change indicated values in B.1 and C. to reflect WRNM.
B3.2-3	B3.2.1 APPLICABILITY	Change intermediate range monitor to WRNM.
B3.2-8	P 3.2.2 APPLICABILITY	Change reference from IRM to wide range neutron monitor period-short function.
B3.3-5 & 6	B 3.3.1.1 Neutron Period-Short	In Item 1.a, change the titles, and add new text to reflect design change from IRM to the WRNMS, describe the new period measurement and trip functions, and replace Ref. 2 and 3 with just Ref. 3. Replace paragraph addressing "limiting other reactivity excursions" with the equivalent paragraph based on NUREG-1433, and changing IRM to WRNM.
B3.3-6 & 7	B 3.3.1.1 WRNM-Inop.	Item 1.b. change title and description to reflect design change from IRM to the WRNMS.
B3.3-7	B 3.3.1.1 APRM Flux-High	Item 2.a. description changed to reflect design change from IRM to the WRNMS.
B3.3-10 & 11	B 3.3.1.1	Change IRM to WRNM in Items 2.b and 2.c.
B3.3-11 & 12	B 3.3.1.1 APRM Downscale	Description change in Item 2.d. to reflect design change from IRM to the WRNMS.
B3.3-26	B 3.3.1.1 ACTION C.1	Change IRM to WRNM.
B3.3-29	B 3.3.1.1 SR 3.3.1.1.3	Delete reference to IRM functions.
B3.3-30 & 31	B 3.3.1.1 SR 3.3.1.1.5 & SR 3.3.1.1.6	Replace descriptive text to reflect WRNM. Add SRs basis for WRNM functional tests.

Table 4-4 (continued)

Page	Section	General Description of Change
B3.3-32 & 33	B 3.3.1 1 SR 3.3.1.1.11 &12	Change IRM to WRNM. Modify text to reflect WRNMs 24 month SR frequency, based on setpoint analysis.
B3.3-34	B 3.3.1 1 REFERENCES	Replace Reference 3 with the licensing report on the WRNMS.
B3.3-36	B 3.3.1.2 BACKGROUND	Titles and description change to reflect design change from SRM to the WRNM.
B3.3-36 & 37	B 3.3.1.2 APPLICABLE SAFETY ANALYSIS	Description change to reflect design change from SRM/IRM to the WRNMS.
B3.3-37 & 38	B3.3.1.2 LCO	Description change to reflect design change from SRM/IRM to the WRNMS, and change text to address location requirements for detectors.
B3.3-38, 39 & 40	B 3.3.1.2 APPLICABILITY, ACTIONS A.1, B.1, C.1, D.1, D.2, E.1 & E.2	Description change to reflect design change from SRM/IRM to the WRNMS, and update associated ACTIONS.
B3.3-40, 41, 42, 43 & 44	B3.3.1.2 SURVEILLANCE REQUIREMENTS	Description change to reflect design change from SRM to the WRNMS, provide the WRNM indicated value for the bottom of intermediate range, delete reference to SR 3.3.1.2.6 and re-number following SR's accordingly, and revise channel calibration frequency to 24 months based on WRNMS setpoint analysis.
B3.6-49, 50 & 51	B3.6.2.1	Modify LCO and ACTIONS B.1 and C.1 to reflect the applicable power range that is indicated by the WRNMS.
B3.9-8	B 3.9.3 APPLICABLE SAFETY ANALYSES	Description change to reflect design change from IRM to the WRNMS.
B3.9-10	B 3.9.4 APPLICABLE SAFETY ANALYSES	Description change to reflect design change from IRM to the WRNMS.
B3.9-14	B 3.9.5 APPLICABLE SAFETY ANALYSES	Description change to reflect design change from IRM to the WRNMS.

Table 4-4 (continued)

Page	Section	General Description of Change
B3.10-5	B 3.10.2 BACKGROUND	In items b. and c. change text to reflect the WRNMS design, and clarify APRM and WRNMS functions.
B3.10-31 & 32	B 3.10.8 APPLICABLE SAFETY ANALYSES & LCO	Description change to reflect design change from IRM to the WRNMS.

5. REFERENCES

1. GE Nuclear Energy, Licensing Topic Report, "The Nuclear Measurement Analysis and Control Wide Range Neutron Monitoring System (NUMAC-WRNMS)," NEDO-31439-A, Class I (non-proprietary), October 1990.

2. General Electric Co., "General Electric Environmental Qualification Program," NEDE-24362-1-P, Revision 1, Class III (proprietary), January 1983.

3. C. J. Paone and J. A. Woolley, "Rod Drop Accident Analysis for Large Boiling Water Reactors," GE Licensing Topical Report, NEDO-10527, and Supplements 1 and 2, March 1972, July 1972 and January 1973.