December 7, 2001

MEMORANDUM TO: Ledyard B. Marsh, Acting Deputy Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Victor M. McCree, Acting Director /RA/
Division of Reactor Projects

SUBJECT: TASK INTERFACE AGREEMENT (TIA 2001-16) NRC POLICY QUESTIONS ON LICENSEE USE OF RISK TECHNIQUES TO JUSTIFY OPERATION IN UNANALYZED CONDITIONS

The resident inspectors at the Browns Ferry Nuclear Plant (BFN) identified an equipment configuration issue involving the use of probabilistic tools to justify operation in an unanalyzed condition. Between 1998 and 2000, the licensee developed two justifications for operating in this condition. In 1998, the licensee developed a probability-of-occurrence-based maximum time interval that a Unit could be operated in the unanalyzed condition (Evaluation 1, below). In 2000, the licensee used the frequency of the condition to characterize it as an accident as opposed to a transient (Evaluation 2, below). The purpose of this TIA is to request that NRR review and provide a policy position regarding the generic licensee-use of these two evaluation concepts, using the specifics of the BFN example to illustrate the concepts.

SITE-SPECIFIC TECHNICAL ISSUE:

The specific technical issue at BFN relates to operating pre-BWR/6 plants with one of two electro-hydraulic control (EHC) pressure regulators in a failed condition. The pressure regulators are an integral part of the pressure control subsystem described in Section 7.11.3.3 of the BFN Updated Final Safety Analysis Report. Normally, the BFN plants operate with one EHC pressure regulator in service, and a second pressure regulator available as a backup. If one EHC pressure regulator fails downscale, the backup EHC pressure regulator will automatically engage to preclude a significant plant transient. General Electric (GE) Service Information Letter (SIL) 614, Revision 1, (Attachment 1) discusses the potential safety consequences of a downscale failure of the operating EHC pressure regulator (without backup) during power operation below 90%. The SIL states, "Since this partial-power event may not be specifically analyzed, operation without a backup EHC pressure regulator at less than typically 90% power and under minimum allowable fuel thermal margin conditions, may fall outside the licensing basis." SIL 614 was originally issued in late-1997, with Revision 1 issued in March 1999, superseding the original SIL.

The licensee decided that instead of contracting an analysis from the vendor to show that the condition was bounded, an upgrade of the EHC system was a more prudent use of resources. An EHC system digital upgrade was designed to eliminate the single failure vulnerability of the electronic pressure control portion of the EHC system. The EHC upgrade was completed on Unit 2 in April 2001 and is planned for implementation on Unit 3 in Spring 2002. The following evaluations were developed by BFN to justify operating in the unanalyzed condition prior to installation of the modification. It is important to note that neither of the two evaluations used the proposed modification to justify continued operation.

LICENSEE EVALUATION 1: PROBABILITY-OF-OCCURRENCE APPROACH

The licensee initially evaluated the SIL using Problem Evaluation Report BFPER971794 and determined through a PSA analysis in 1998 (Attachment 2) that BFN could operate for 89.7 days per year at power levels <90% with one EHC pressure regulator out-of- service, without a significant increase in risk. The calculation conclusion recommended using a 30-day maximum operating time. The calculation used the guidance of the Nuclear Energy Institute PSA Applications Guide to evaluate an acceptable duration of the condition based on the criteria for permanent plant changes in the Guide. In August 1999, using the results of this calculation, a BFN Engineering recommendation (Attachment 3, PER BFPER971794 Corrective Action Memo) was made to change the appropriate operations procedure to reflect the 30-day maximum operating time in the unanalyzed condition. In November 1999, the licensee changed the power maneuvering procedure using a 10CFR50.59 screening review (Attachment 4) to limit the operation in this unanalyzed condition to 30 days. [In September, 2001, the NRC inspectors noted that the attached revision to the power maneuvering procedure and its associated 10CRF50.59 screening review, both have words that indicate GE recommended the 30-day maximum time frame. This was an erroneous assumption made by the procedure writer, presumably based on an inaccurate interpretation of the internal BFN recommendation from Attachment 3. The licensee initiated a corrective action document to determine the apparent cause and correct the procedure.]

LICENSEE EVALUATION 2: TRANSIENT-TO-ACCIDENT APPROACH

In the Fall 2000, the licensee reevaluated the condition through PER 00-12276-000. The licensee determined, as stated in an Evaluation of Continued Plant Operation from this PER (Attachment 5), that, "...the probability of occurrence of this transient can be reduced to below the threshold for considering an event as an AOT [abnormal operating transient]." The licensee concluded that since the BFN licensing basis did not include a category equivalent to infrequent faults, it was conservative to limit the probability of occurrence to that of an accident, during which more extensive fuel damage is allowed. The licensee further calculated that 22 days at <90% with one EHC pressure regulator failed was a conservative operational limitation. The licensee revised the operating procedure (Attachment 6) to reflect the 22-day limitation for Unit 3 and removed the procedural requirement for Unit 2 (EHC was upgraded).

Initially, Region II approached the BFN technical issue earlier in 2001 as a potential 10 CFR 50.59 violation, resulting in several discussions conducted between 10 CFR 50.59 specialists in

Region II and NRR. Based on these discussions, a decision was reached that, because the EHC upgrade of Unit 3 will take place in the near future, this operating condition change was not a 10 CFR 50.59 violation, but was permissible using the guidance in Generic Letter 91-18. In light of this decision, Region II currently does not have a specific enforcement case to be resolved by this TIA, but does believe that policy issues exist.

REGION II QUESTIONS:

EVALUATION 1: Using the specific information in Evaluation 1, what is the NRC position on the generic licensee-use of a probability-of-occurrence type of approach as the basis for allowing operation in an unanalyzed condition, without prior NRC review and approval?

EVALUATION 2: Using the specific information in Evaluation 2, what is the NRC position on the generic licensee-use of a probability-of-occurrence type of approach as the basis for reducing the frequency of an event described in the FSAR and thereby, characterizing the condition as an accident as opposed to a transient, without prior NRC review and approval?

The contents of this TIA were discussed and mutually agreed upon by P. Fredrickson of my staff and R. Correia of NRR in October 2001. If you have any questions contact Paul Fredrickson at (404)-562-4530.

Attachments:
1. GE SIL 614, Revision 1
2. PSA Evaluation of the Effects of Operating With a Backup Pressure Regulator Out of Service, approved 8/7/98
3. PER BFPER971794 memo, dated 8/27/99
4. Revision 10 to Procedure 3-GOI-100-12
5. PER 00-12276-000 Evaluation
6. Revision 13 to Procedure 3-GOI-100-12

cc:
A. Blough, RI
P. Fredrickson, RII
G. Grant, RIII
K. Brockman, RIV
H. Berkow, NRR
A. Hansen, NRR
R. Correia, NRR
P. Taylor, DRP
J. Barnes, DRP

See attached Comment Sheet

PUBLIC DOCUMENT (circle one): YES NO

OFFICE	DRP/RII	DRS/RII	DRP/RII	DRS/RII	DRP/RII		
SIGNATURE	WSmith	KVanDoorn	PFredrickson	CCasto	LWert		
NAME							
DATE	12/ /2001	12/ /2001	12/ /2001	12/ /2001	12/ /2001	12/ /2001	12/ /2001
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICIAL RECORD COPY DOCUMENT NAME: G:\TIA\TIA - Using Risk For Unanalyzed Cond - Based on BF.wpd

L. Marsh

cc : A. Blough, RI
P. Fredrickson, RII
G. Grant, RIII
K. Brockman, RIV
H. Berkow, NRR
A. Hansen, NRR
R. Correia, NRR
P. Taylor, DRP
J. Barnes, DRP

PUBLIC DOCUMENT (circle one): YES NO

OFFICE	DRP/RII	DRS/RII	DRP/RII	DRS/RII	DRP/RII		
SIGNATURE	WSmith	KVanDoorn	PFredrickson	CCasto	LWert		
NAME	*	B.K.V.					
DATE	11/14/2001	11/19/2001	11/13/2001	11/19/2001	11/19/2001	11/ /2001	11/ /2001
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

OFFICIAL RECORD COPY DOCUMENT NAME: I:\RPB6\TIA\TIA - Using Risk For Unanalyzed Cond - Based on BF.wpd

* Per Tele

* Per Dixon

Backup pressure regulator

SIL No. 614
Revision 1

March 15, 1999

Comments from owners of GE BWRs have indicated confusion regarding the recommended action in SIL No. 614, issued November 5, 1997. GE Nuclear Energy is therefore issuing this Revision 1 to SIL No. 614 to clarify the recommended action and to make other minor changes. This Revision 1 to SIL No. 614 supersedes and voids SIL No. 614.

Two operating GE BWRs located in the United States recently experienced turbine pressure regulator problems that required them to transfer reactor pressure control to the backup pressure regulator. In each case, the operating pressure regulator was exhibiting erratic behavior, which was observed during normal plant monitoring; no plant scrams occurred.

The purpose of this SIL is to alert owners of GE BWRs that operating without a backup pressure regulator may represent an unanalyzed condition, and to reemphasize correct setting of the back–up pressure regulator. This SIL is applicable to all GE BWRs, including those with turbine–generator sets manufactured by others.

Discussion

During normal plant operation, at least two pressure regulators are in service. The purpose of the backup pressure regulator is to take over reactor pressure control if the controlling pressure regulator fails downscale (turbine control valves closing). When the backup pressure regulator takes over pressure control, it is expected that the disturbance will be small enough that a reactor scram will be avoided (this feature is demonstrated during initial plant startup testing).

For pre–BWR/6 plants, one pressure regulator is set to be controlling, and the backup pressure regulator is set about 3–5 psi higher than the controlling pressure regulator (see Section 1 of Appendix 1 to SIL 589 Revision 1). Should the controlling pressure regulator experience a downscale failure during plant operation, its output signal will begin to close the Turbine Control Valves (TCVs), and reactor pressure will increase. When the output of the backup pressure regulator exceeds the output of the controlling regulator, the backup regulator takes over control of the TCVs and restores normal pressure control. The reactor system will settle out with the only change being a 3–5 psi increase in the turbine inlet pressure.

In BWR/6 and ABWR designs, the backup regulator function is performed by redundant or triplicated controls with no pressure setpoint difference.

Should a pre–ABWR plant operate without a backup regulator, a downscale failure of the operating pressure regulator would cause closure of the TCVs (at their normal servo rate), without sending a signal to initiate Bypass Valve (BPV) opening or any anticipatory signal to scram the reactor. A reactor scram would occur either on high reactor pressure or high neutron flux, depending on the speed of the failure and the reactor power at the time of the failure. For the case where the failure completely closes the TCVs, reactor pressure would be maintained by the main steam Safety Relief Valves unless the operator takes manual control of the BPVs.

Scram avoidance is not assured for pre–BWR/6 plants when operating with the backup pressure regulator set more than 3–5 psi above the controlling pressure regulator. In this case, however, the backup pressure regulator would

Attachment 1

be available to control pressure even if a plant scram did occur.

For BWR/6 plants, transfer to the backup pressure regulator functions on the regulator output signal, and is preset to limit the downscale failure disturbance without introducing a final pressure setpoint difference. The ABWR triplicated control design completely avoids any transient disturbance for a single regulator failure.

For ABWR plants, the triplicated pressure regulator design also avoids a reactor scram for failures in the opening direction. For all other BWRs, failures that inadvertently open the TCVs and BPVs can scram and isolate the plant; these failures are analyzed in the plant Final Safety Analysis Report.

Potential safety consequences

Full power operation

A downscale pressure regulator failure (without backup) from full power has been shown to be bounded by the other transient events analyzed for establishing the full power fuel operating limits. The rate of steam flow shutoff is slower than in transients caused by a main turbine or generator trip, and the subsequent scram from high neutron flux is early enough that the fuel response is bounded by the response for the more limiting events. Therefore, a downscale pressure regulator failure at full power (typically >90% power) does not represent a safety concern even if it has not been previously analyzed for the plant. Should a plant discover a backup regulator problem while operating in this high power range, it is expected that continued operation near full power (typically >90% power) is justifiable until the next planned power reduction.

BWR/6 plants are regularly analyzed at full power for a pressure regulator failure (without backup), even though the random failure of the redundant pressure regulators is considered to be very infrequent.

Note: For plants with the triplicated control design (e.g., ABWR), this event is excluded from the list of events classified as Anticipated Operational Occurrences.

Partial power operation

If a downscale failure of the operating pressure regulator (without backup) occurs from partial power conditions, the available fuel thermal margin may be less than previously analyzed. The thermal margin available depends on several factors, including the rate of closure of the TCVs and specific plant protection setpoints. If the failure occurs with normal fuel operating conditions, adequate margin is expected for all plants. Since this partial–power event may not be specifically analyzed, operation without a backup pressure regulator, at less than typically 90% power and under minimum allowable fuel thermal margin conditions, may fall outside the licensing basis. Therefore, the length of time the reactor is operated at below 90% power (e.g., for turbine valve testing) without a backup pressure regulator should be limited unless analyses have been performed to support such operation. If such analyses have not been performed, extended operation in this condition should be avoided.

Overpressure

The Main Steam Line Isolation Valve closure analysis performed for all plants bounds this potential isolation event and continues to demonstrate ASME Code compliance for reactor vessel overpressure protection.

Recommended action

GE Nuclear Energy recommends that, prior to operating for an extended period of time with a pressure regulator out of service, owners of GE BWRs perform the following:

1. Review plant transient licensing analyses to evaluate if operation with a pressure regulator out of service (without backup) is

an analyzed condition. If such analysis does not exist:

a) prepare a Justification of Continued Operation (JCO) to maintain plant power near full power (typically ≥90% of rated) until the next planned power reduction that will permit repair of the problem; and

b) determine if adequate margin exists for operation at partial power to accommodate a pressure regulator failure downscale without backup.

As noted above, the latter concern is not applicable to plants with the triplicated pressure regulator design (e.g., ABWRs).

2. Advise plant operators that:

a) there is reduced ability to avoid a reactor scram if a failure occurs in the remaining, controlling pressure regulator; and

b) controlling reactor pressure by manual opening of the BPVs is desirable to minimize suppression pool heatup if a complete downscale failure of the operating pressure regulator occurs.

GE Nuclear Energy would appreciate any information regarding the cause of, or plant response to pressure regulator failures.

To receive additional information on this subject or for assistance in implementing a recommendation, please contact your local GE Nuclear Energy Service Representative.

This SIL pertains only to GE BWRs. The conditions under which GE Nuclear Energy issues SILs are stated in SIL No. 001 Revision 4, the provisions of which are incorporated into this SIL by reference.

Product reference

A61/A62 — Plant requirements
C85 — Steam bypass and pressure regulation system

Technical source

J. L. Casillas
E. C. Eckert

Issued by

Bernadette Onda Bohn, Program Manager
Service Information Communications
GE Nuclear Energy
175 Curtner Avenue
M/C 187
San Jose, CA 95125

QA Record

ORIGINAL

TVAN CALCULATION COVERSHEET

Title PSA EVALUATION OF THE EFFECTS OF OPERATING WITH A BACKUP PRESSURE REGULATOR OUT OF SERVICE		Page 1 of 16	Plant BFN Unit 2,3
Preparing Organization NE - MECHANICAL/NUCLEAR	Key Nouns (For RIMS) PROBABALISTIC, PROBABILITY, PRA		
Branch/Project Identifiers ND-N0999-980015	Each time these calculations are issued, preparer must ensure that the original (R0) RIMS accession number is filled in.		
~~Applicable Design Document(s)~~ N/A	Rev	(for RIMS use)	RIMS Accession Number
	R	V0	R14 980807 103
	R		
SAR affected: ☐Yes ☒No Section(s): N/A — UNID System(s) 001, 047, 999	R		
	R		

	Revision 0	R	R	R		Yes	No
Design Change Document No. (or indicate Not Applicable)					Quality Related?	☐	☒
Prepared	JDM J.D. McCamy				Safety related?	☐	☒
Checked	M.A. Walker				These calculations contain unverified assumption(s) that must be verified later?	☐	☒
Reviewed	M.A. Walker				These calculations contain special requirements and/or limiting conditions?	☐	☒
Approved	[signature]				These calculations contain a design output attachment?	☐	☒
Date	8/7/98				Calculation Revision: Entire Calculation ☒ Selected pages ☐ Not Applicable ☐		

Statement of Problem:

GE SIL # 614 identified a problem in which operation without a backup pressure regulator at conditions other than full power (typically ≥ 90% RTP) could constitute an unanalyzed condition.

Abstract
This calculation will develop a system fault tree model representing the conditions and equipment failures necessary for operating in an unanalyzed condition, as identified in GE SIL # 614. The fault tree model will then be quantified (using RISKMAN) for two conditions:

1. Normal operation (two pressure regulators in service).
2. Operation with one pressure regulator out of service.

This information is then used to develop time constraints for operation with one pressure regulator out of service which maintains a less than risk-significant level of risk as operation with both pressure regulators in service.

Total Pages R0 16

☐ Microfilm and return calculation to Calculation Library. Address:
☐ Microfilm and return calculation to:
☐ Microfilm and destroy.

Attachment 2

TVAN CALCULATION RECORD OF REVISION

Title PSA EVALUATION OF THE EFFECTS OF OPERATING WITH A BACKUP PRESSURE REGULATOR OUT OF SERVICE

Revision No.	DESCRIPTION OF REVISION	Date Approved
0	Initial Issue	8/7/98

TVAN CALCULATION DESIGN VERIFICATION (INDEPENDENT REVIEW) FORM

Page 1 of 1

TVAN CALCULATION DESIGN VERIFICATION (INDEPENDENT REVIEW) FORM

Calculation No.	Revision
NDN0999980015	0

Method of design verification (independent review) used:

1. Design Review ☒
2. Alternate Calculation ☐
3. Qualification Test ☐

Comments:

This calculation is in compliance with NEDP-2. The inputs and conclusions are reasonable and technically accurate

Design Verifier	Date
[signature]	8/3/98

TVAN CALCULATION CLASSIFICATION FORM

Page 1 of 2

TVAN CALCULATION CLASSIFICATION FORM

CALCULATION INFORMATION:

Plant BFN Unit 2, 3 Identifier NDN0999980015 Rev. 0

Issue Date 8/7/98

Title PSA EVALUATION OF THE EFFECTS OF OPERATING WITH A BACKUP PRESSURE REGULATOR OUT OF SERVICE

System(s), Component, Feature or Subject of Calculation

SYSTEM/DESCRIPTION (AS NEEDED)

- ☐ Safety system — System No.
- ☐ Safety-related feature
- ☐ Nonsafety system — System No.
- ☐ Nonsafety-related feature
- ☐ Quality-related system
- ☐ Quality-related feature
- ☐ Non Quality related system
- ☐ Non Quality related feature
- ☐ Plant environment (EQ, etc.)
- ☐ Appendix R
- ☐ Civil structures
- ☐ Instrumentation (PAM, etc.)
- ☐ Licensing
- ☒ Other — PSA EVALUATION

Calculation Category

Final Classification:

☐ Essential ☐ File Only ☐ Cancel ☐ Engineering Output
☒ Desirable ☐ Superseded ☐ Obsolete ☐

Preparer	J. D. MCCAMY JDM	Date	8/7/98
Checker	M. A. WALLER MAW	Date	8/7/98
Verifier	Kevin Gray KGray	Date	8/7/98

TVAN CALCULATION CLASSIFICATION FORM
Page 2 of 2

TVAN CALCULATION CLASSIFICATION FORM

Identifier: NDN0999980015

Preliminary Classification

☐ Essential	☐ File Only	☐ Cancel	☐ Engineering Output
☒ Desirable	☐ Superseded	☐ Obsolete	☐

CALCULATION CLASSIFICATION JUSTIFICATION:

Preparer

This calculation determines the risk significance of operating for a limited period of time with the backup pressure regularor out of service. It provides information to be used in the evaluation of GE SIL614.

Checker ☒ Agree with classification ☐ Disagree - comments required

Verifier ☒ Agree with classification ☐ Disagree - comments required

TVAN CALCULATION TABLE OF CONTENTS

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PURPOSE

The purpose of this calculation is to determine the length of time operation with one pressure regulator out of service will result in an equivalent level of risk as continuous operation with both pressure regulators in service. GE SIL # 614 identified a problem in which operation without a backup pressure regulator at conditions other than full power (typically ≥ 90% RTP) could constitute an unanalyzed condition, if the in service pressure regulator failed down scale. This condition would result in the turbine control valves closing. This is not a problem at full power conditions since it has been shown that a down scale pressure regulator failure is bounded by other transient events analyzed for establishing fuel operating limits.

At less than full power conditions, a down scale failure of the operating pressure regulator (without backup) may result in the available fuel thermal margin less than previously analyzed. With both pressure regulators available, the backup pressure regulator would limit the transient. Since the control circuitry contains other common components in addition to two pressure regulators, there exists the potential for other single failures (other than a pressure regulator failure with one pressure regulator out of service) that could also result in the turbine control valves closing on a total loss of signal. Since BFN was designed and licensed with two pressure regulators (one controlling and one backup), if the length of time at power operation with one pressure regulator out of service (at less than full power conditions) is limited, the risk increase due to the condition identified in SIL # 614 can be limited to an acceptable level.

REFERENCES

1. RISKMAN Release 8.01.
2. NEI PSA Applications Guide, EPRI Topical Report TR-105396, Final Issue.
3. "Control Line Up Diagram," Browns Ferry Nuclear Plant Drawing 0-236R509-1 (Revision 3), 0-236R509-2 (Revision 2), 236R509-3 (Revision 2), 236R509-4 (Revision 2), 236R509-5 (Revision 2), 236R509-6 (Revision 0) and 236R509-7 (Revision 2).
4. Browns Ferry Nuclear Plant Final Safety Analysis Report, Sections 7.11 and 14.5, Amendment 16.
5. ND-N0999-970003, "PSA Evaluation of Maintenance Rule (10CFR50.65) Performance Criteria", R14 970404 102
6. "Browns Ferry Nuclear Plant Unit 2 Probabilistic Safety Assessment with Unit 3 Operating," Revision 1, R92 960514 001.
7. "Browns Ferry Nuclear Plant Unit 3 Probabilistic Safety Assessment with Unit 2 Operating," Revision 0, R92 960719 002.
8. "Browns Ferry Unit 2 Individual Plant Examination, Section 3.1.1, "Initiating Events," Revision 1.
9. "Browns Ferry Nuclear Plant Unit 2 Probabilistic Risk Assessment," Main Steam System Notebook, Revision 1.
10. "Backup Pressure Regulator," General Electric Service Information Letter 614, November 5, 1997.

FSAR Sections 7.11 and 14.5 have been reviewed and this calculation is in compliance.

DESIGN INPUT DATA

None

ASSUMPTIONS

1. SIL #014 specifies that this condition only exists when reactor power is less than 90% and only one pressure regulator is in service (i.e. one is out of service). For initiating event quantification, it is conservatively assumed that the plant is at less than 90% reactor power for 100% of the time.

2. It is assumed that the change in core damage frequency due to the unavailability associated with maintenance of either pressure regulator will increase the likelihood of plant trip. This form of plant trip is currently evaluated in the PSA (i.e. turbine trip without bypass – TTWB) with an initiating event frequency of 0.234.

3. Due to the number of single order failures for the pressure regulation function, common cause will not materially affect the results of this evaluation is not separately evaluated.

REQUIREMENTS/LIMITING CONDITIONS

This calculation imposes no requirements on the time a pressure regulator may be out of service. It only determines the time that a pressure regulator may be out of service without a significant increase in plant risk.

COMPUTATIONS AND ANALYSIS

1. The pressure regulation system was modeled with fault tree graphics using the RISKMAN 8.01 System Analysis module for failure modes which could cause the turbine control valves to close and potentially result in an unanalyzed condition. The graphical representation of the model is included in the Supporting Graphics section of this calculation.

2. Based on the model developed above, the generic RISKMAN distributions most closely representing the required failure rates were identified. These failure rates were then assigned to the basic events of the system fault tree model as follows:

BASIC EVENT	GENERIC FAILURE DISTRIBUTION	DESCRIPTION	MEAN VALUE (PER HOUR)
RELAY1B12FDO	ZTRL1R	Relay failure during operation	4.20E-7
RELAYFDO	ZTRL1R	Relay failure during operation	4.20E-7
A33BRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
A63BRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
A48BRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
A58BRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
RESCOMPABRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
RESCOMPBBRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
PRESSAMPABRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
PRESSAMPBBRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
PRESSDEMODABRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
PRESSDEMODBBRDFDO	ZTSMDR	Signal modifier failure during operation	2.94E-6
PRESSXMTRAFDO	ZTTRPR	Pressure transmitter failure during operation	7.60E-6
PRESSXMTRBFDO	ZTTRPR	Pressure transmitter failure during operation	7.60E-6
PWRSUP1FDO	ZTPS1R	Power supply failure during operation	1.71E-5
PWRSUP2FDO	ZTPS1R	Power supply failure during operation	1.71E-5

3. Based on discussions with the system 047 (EHC Control) System Engineer, the above failure rates were updated with the following plant specific data using the RISKMAN 8.01 Data Module. This was based on U2/3 operation since recovery of 8.85 years and failures as identified below:

DISTRIBUTION	NUMBER OF COMPONENTS	FAILURES	HOURS IN OPERATION
ZTRL1R	2	0	155,052
ZTSMDR	10	0	775,260
ZTTRPR	2	1	155,052
ZTPS1R	2	1	155,052

Bayesian update of the generic distributions shown above resulted in the following plant specific distributions:

DISTRIBUTION	MEAN VALUE (PER HOUR)
ZTRL1R	3.81E-7
ZTSMDR	1.36E-6
ZTTRPR	6.43E-6
ZTPS1R	8.12E-6

4. The system fault tree was then quantified as resulting in an initiating event under two conditions.

CONDITION 1 - Normal alignment with both "A" and "B" Pressure Regulators in operation. This gives a failure probability of 6.787E-2 per year or approximately once every 15 years. This represents (0.06787 / 0.234 =) 29% of total initiating event frequency for the turbine trip without bypass initiating event (TTWB) frequency. This condition was evaluated within the Riskman model as initiating event PREG.

CONDITION 2 - Operation with one Pressure Regulator out of service. This gives a failure probability of 1.590E-1 per year or approximately once every 6 years. Operation in this alignment for the entire year would represent an increase of (0.159 - 0.068 =) 0.091 in TTWB initiating event frequency (i.e. TTWB frequency would increase by 38%, from 0.234 to 0.325). This condition was evaluated within the Riskman model as initiating event PREG1

These conditions compare with a TTWB core damage frequency of 2.31E-7 for the Unit 2 risk model and 4.11E-7 for the Unit 3 risk model.

5. The PSA Applications Guide, Reference 2, provides guidance on determining whether proposed permanent plant changes should be considered as risk significant or non-risk significant. The threshold below which no further evaluation is required is based on the baseline CDF and has previously been determined for BFN U2 and U3 in Reference 5. These values are calculated using the appropriate equation from Reference 2.

THRESHOLD VALUES FOR NON-RISK SIGNIFICANT CHANGES

	UNIT 2	UNIT 3
Baseline CDF	5.39E-6	9.19E-6
Non-Risk Significant Increase in Baseline CDF (%)	Less than 43%	Less than 33%
Non-Risk Significant Increase in CDF	Less than 2.32E-6	Less than 3.03E-6
Non-Risk Significant CDF	Less than 7.71E-6	Less than 1.22E-5

If plant operation with one pressure regulator out of service is limited to a period in which the probability of the initiating event frequency is increased by less than 33% (based on the above table, the Unit 3 percentage increase is most restrictive and is applied to both Units 2 and 3) over the baseline case (both pressure regulators in service) initiating event frequency, then the change can be considered non-risk significant.

Therefore, the number of days per year BFN could operate with one pressure regulator out of service with no risk-significant increase in risk is:

1.33*(Condition 1) = ((365 - OOS)/365)*(Condition 1) + (OOS/365)*(Condition 2)

NOTE: since Condition 1 and 2 are yearly frequencies, they are divided by 365 to obtain output in units of number of days

or

1.33*6.787E-2 = ((365-OOS)/365)* 6.787E-2 + (OOS/365)*1.590E-1

solving for OOS gives

OOS = 89.7 days

Where OOS = # of days per year in operation in Condition 2

6. The condition with one pressure regulator out of service would only affect the PSA model by increasing the frequency of initiating event TTWB or increasing the unreliability of top event BVR. Therefore, a comparison check of potential risk significance is provided below:

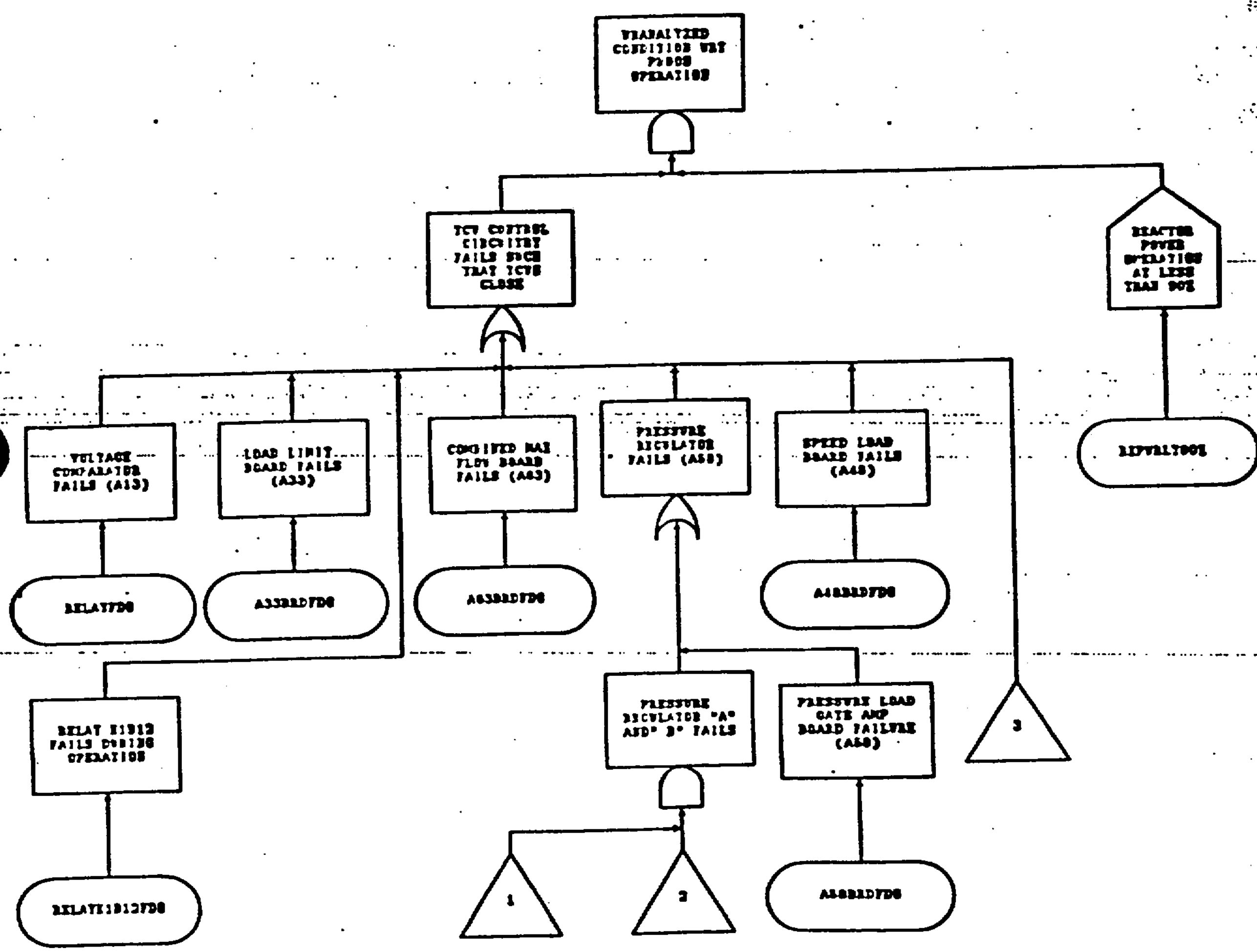
For TTWB, as described in Section 4, above, operation with one pressure regulator out of service will increase the frequency of TTWB from 0.234 events per year to 0.325 per year.

Turbine bypass valve operation following plant trip (i..e. top event BVR) is dominated by valve failure, such that the analyzed mode of failure contributes (0.068 / 365 =) 1.86E-4, or 1% of 0.01377 total BVR failure for the PREG case and (0.159 / 365 =) 4.36E-4, or 3% for the PREG1 case. Due to these extremely low failure rate for the pressure regulation function following plant trip due to other causes, they are not separately evaluated.

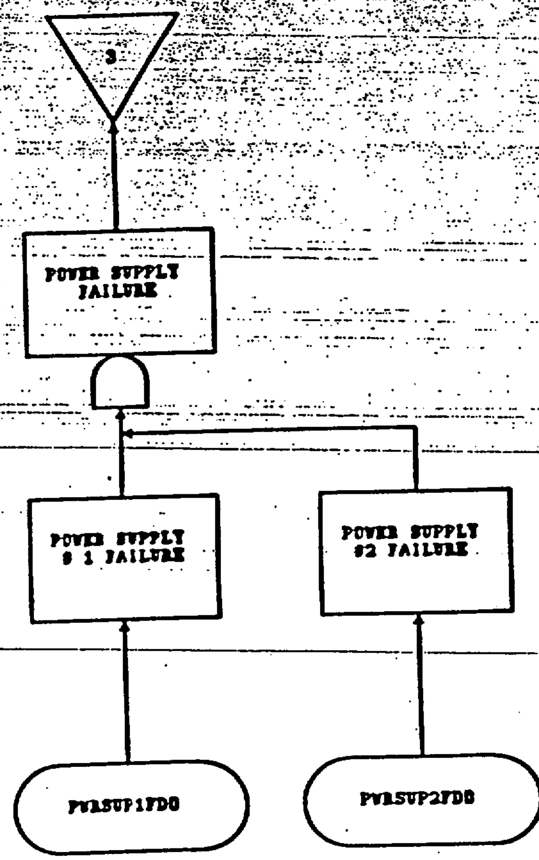
The significance of these potential changes was evaluated by setting split fraction BVR1 to 1.420E-2 in a new master frequency file and requantifying the scenario database with a TTWB initiating event frequency of 0.325. This evaluation resulted in a core damage increase of 9.01E-8 (1.7%) for Unit 2 and 1.64E-7 (1.8%) for Unit 3. As shown in the table above, neither of these changes is risk-significant.

SUPPORTING GRAPHICS

Fault Tree - Page 1 of 4



Fault Tree (Page 4 of 4)



TVA

Calculation No. ND-N0999-980015	Rev: R0	Plant: BFN	Page: 16 of 16
Subject: PSA EVALUATION OF THE EFFECTS OF OPERATING WITH A BACKUP PRESSURE REGULATOR OUT OF SERVICE		Prepared:	Date:
		Checked:	Date:

SUMMARY OF RESULTS

As demonstrated in the Computations and Analysis section, BFN could operate for 89.7 days with one pressure regulator out of service, without a risk-significant increase in risk. This restriction only applies when the reactor is not at full power (e.g. less than 90%). There are additional conservatism's in this calculation which provide additional assurance that BFN will not operate in an unanalyzed condition as specified below:

1. BFN typically operates at less than full power only during startup, while performing specific pre-planned maintenance activities, and during coast down. This typically represents less than 10% of power operation.

2. Generic component failure rate data was used (updated with plant specific data). Only certain specific failures could cause the turbine control valves to close, although the generic data included all failure types. This causes the component failure rate data used in the system model to be high.

3. The system model developed includes faults which would close the turbine control valves. Some of these failures would not prevent the turbine bypass valves from operating. If the turbine bypass valves operated normally, the effects of turbine control valve closure should be minimized.

4. This evaluation is conservative in that it assumes a much higher conditional core damage likelihood due to pressure regulator failure than simply modeling this failure as turbine bypass failure at top event BVR or as a turbine trip without bypass initiating event.

In order to provide additional conservatism with minimal impact on plant operation, an allowed outage time of 30 days for operation with one pressure regulator out of service (if reactor power less than 90%) is chosen. With reactor power greater than 90%, as discussed in Reference 6, there are no safety concerns and no limits are required.

CONCLUSIONS

BFN could operate for 89.7 days per year with one pressure regulator out of service, without a significant increase in risk. Therefore, limiting operation to 30 days per year or less (if reactor power less than 90%) is not risk significant.

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT

GENERAL OPERATING INSTRUCTION

3-GOI-100-12

POWER MANEUVERING

REVISION 10

PREPARED BY: REGGIE KEMP PHONE: 2431

RESPONSIBLE ORGANIZATION: OPERATIONS

APPROVED BY: DAVID OLIVE DATE: 11/10/99

EFFECTIVE DATE: 12/02/99

LEVEL OF USE: REFERENCE USE

VALIDATION DATE: 12/16/96

QUALITY-RELATED

Attachment 4

REVISION LOG

Procedure Number: 3-GOI-100-12 Revision Number: 10

Pages Affected: 7,11

Description of Change: IC 013 BFPER 97-001794-000

Page 7 Added P&L 3.12 page 11 added step 5.9 which state:

Duty Tech Support Engineer should be notified when operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% MWth. GE has recommended if reactor power is less than 90% MWth the main generator should not be operated on the "Backup Pressure Regulator" for more than 30 days. BFPER 97-001794-000

3.0 PRECAUTIONS AND LIMITATIONS (Continued)

3.10 DOWNPOWERING OF NUCLEAR UNITS UNDER LOW SYSTEM LOAD CONDITIONS:

Due to having five nuclear units in an operating status, the frequency of downpowering units under low system load conditions is expected to rise. The following communications process will be used to coordinate downpowering a unit at BFN under low load conditions:

- The Electrical System Operator (ESO) will anticipate the potential need to downpower nuclear units as far in advance as reasonable, normally one to two days. The ESO will inform the Operations Duty Specialist (ODS) of this potential need.
- The ODS will notify the Browns Ferry Shift Manager that a potential need to downpower exists.
- The Shift Manager will notify the Operations Superintendent who will notify the Operations Manager and Duty Plant Manager.
- BFN will initiate a telecon with other operating nuclear units and senior nuclear corporate management (normally, Senior Vice President, Nuclear Operations, or, President, TVA Nuclear and Chief Nuclear Officer) to formulate a contingency plan. The plan will address which units are to be downpowered based on existing plant conditions, the reduction capability of each unit, time to reach reduced power as well as return to full power, and the preferred order for downpowering.
- The contingency plan will be communicated to the appropriate site management and Shift Manager for the impacted units as well as the transmission/power supply organization.
- The ESO will notify the designated Shift Managers approximately two to four hours before the need to actually downpower. The Shift Manager will notify the Operations Superintendent of any actual downpower.
- Any change to unit status that would impact the agreed upon contingency plan will cause the telecon to be reconvened with all affected parties and a revised contingency plan developed. This will be initiated by the site management who identifies the need to revise the plan.

3.11 Whenever Forebay Temperature is >92.5°F, as indicated on 2-TS-27-144, Unit 3 power must be derated to within the limits shown in Illustration 3, per Tech Specs 3.7.1.2.

3.12 Duty Tech Support Engineer should be notified when operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% MWth. GE has recommended if reactor power is less than 90% MWth the main generator should not be operated on the "Backup Pressure Regulator" for more than 30 days. BFPER 97-001794-000

5.0 INSTRUCTION STEPS (Continued) INITIALS / DATE / TIME

5.8 While reducing reactor power, **MONITOR** the following:

5.8.1 Core thermal limits using Illustration 1 and 3-SR-3.4.1.2. ________/________/________

5.8.2 Power reduction on Nuclear Instrumentation. (R) ________/________/________

****

CAUTION

When operating with less than the full complement of condensate pumps, condensate booster pumps, and/or reactor feedpumps, careful monitoring of motor amp limitations, feedpump speed limitations, and reactor vessel makeup capacity should be performed.

****

NOTES:

A condensate pump, condensate booster pump, and/or a reactor feedpump may be removed from service at less than 85% power to support maintenance activities as directed by the Shift Manager/Unit Supervisor.

5.9 NOTIFY Duty Tech Support Engineer if operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% MWth. Otherwise N/A ________/________/________

5.10 **WHEN** reactor is less than 85% reactor power, **THEN** **PERFORM** the following:

5.10.1 **SHUT DOWN** one of three Reactor Feedpumps as directed by the Shift Manager/Unit Supervisor. **REFER TO** 3-OI-3. (N/A if not performed.) ________/________/________

5.10.2 **REMOVE** Condensate Demineralizers as desired. **REFER TO** 3-OI-2A. (N/A if not performed.) ________/________/________

SAFETY ASSESSMENT/SCREENING REVIEW/SAFETY EVALUATION COVERSHEET

Document No: 3-GOI-100-12 Tracking No. 013 Rev. 010

Screening Review Only ☒
Safety Assessment/Screening Review ☐
Safety Assessment/Screening Review/Safety Evaluation ☐
Procedure Exemption ☐
Procedure Change Evaluation ☐

Plant BFNP
Affected Unit(s) 3
Preparing Group Operations Support

Preparer REGGIE KEMP
Reviewer Michael K Teggins

Activity	Number (Include Revision No.)	
☐ Design Change	DCN No.	
☐ Engineering Document Change	EDC No.	
☐ Temporary Alteration	TACF No.	
☐ Special Test/Experiment	Special Test No.	
☐ Temporary Shielding Request	TSRF No.	
☒ Procedure Change	Procedure No. and	3-GOI-100-12 Rev 10
☐ New Procedure	PCF No. (if applicable)	
	Procedure No.	
☐ Maintenance	WR/WO No.	
☐ Other (Identify)		

Comments:
Page 7 Added P&L 3.12 page 11 added step 5.9 which state:

Duty Tech Support Engineer should be notified when operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% mwth. GE has recommended if reactor power is less than 90% mwth the main generator should not be operated on the "Backup Pressure Regulator" for more than 30 days. BFPER 97-001794-000

Revision: (Provide a brief summary of the reason for the revision to the SR, SA, or SE)
nb

Distribution:
cc: EDM
Preparer - Return original to originating document

SCREENING REVIEW FORM

Document No: 3-GOI-100-12 Tracking No. 013 Rev. 010

A. **Potential Technical Specification (T/S) Impact (List TS sections reviewed)**

Yes ☐ No ☒ Is a change to the T/S required for conducting or implementing the change (design or procedure), test, or experiment?

Justification:

Section 3.4.1, Recirculation Loops Operating.

Section 3.4.9, RCS Pressure and Temperature (P/T) Limits.

Section 3.4.2, Jet Pumps.

Section 5.4, Procedures/ Section 5.5, Programs and Manuals.

A review of BFN Technical Specifications was completed for this change. A change to BFN Technical Specifications is <u>NOT</u> required for conducting or implementing this procedure change because neither descriptions, directions, nor setpoints of this procedure conflict with those of BFN Technical Specifications sections referenced.

Page 7 Added P&L 3.12 page 11 added step 5.9 which state:

Duty Tech Support Engineer should be notified when operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% mwth. GE has recommended if reactor power is less than 90% mwth the main generator should not be operated on the "Backup Pressure Regulator" for more than 30 days. BFPER 97-001794-000

This change is a result of BFPER 97-001794-000 corrective action and GE letter to R.J. Moll dated August 27, 1999 RIMS # R92 990827 947. This change is safe from a nuclear standpoint.

If the answer is "Yes," a T/S change is required prior to implementation or the activity needs to be revised or canceled.

B. **Potential Safety Analysis Impact (List FSAR sections reviewed)**

Yes ☐ No ☒ Is this a special test, or experiment not described in the SAR?

Section 4.3, Reactor Recirculation System.

Section 7.9, Recirculation Flow Control System.

SCREENING REVIEW FORM

Document No: 3-GOI-100-12 Tracking No. 013 Rev. 010

Section 14.5, Analysis of Abnormal Operational Transients.

Section 13.6, Normal Operations.

Does the proposed activity affect (directly or indirectly) any information presented in the SAR or deviate from the description given in the SAR?

Yes ☐ No ☒ By changing: The system design or functional requirements; the technical content of text, tables, graphs, or figures? (For radwaste changes see Note in Appendix B for guidance.) If the answer is "Yes," process an FSAR change.

Justification: A review of BFN Final Safety Analysis Report was completed for this proposed procedure change. The change does NOT conflict with text, tables, graphs, or figures in BFN FSAR sections referenced. Furthermore, this change does not affect or impact a radwaste process, system, or discharge flowpath. Page 7 Added P&L 3.12 page 11 added step 5.9 which state:

Duty Tech Support Engineer should be notified when operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% mwth. GE has recommended if reactor power is less than 90% mwth the main generator should not be operated on the "Backup Pressure Regulator" for more than 30 days. BFPER 97-001794-000

This change is a result of BFPER 97-001794-000 corrective action and GE letter to R.J. Moll dated August 27, 1999 RIMS # R92 990827 947. This change is safe from a nuclear standpoint.

Does the proposed change involve new procedures or instructions or revisions thereof that:

Yes ☐ No ☒ N/A ☐ Differ with system operation characteristics from that described in the SAR?

Yes ☐ No ☒ N/A ☐ Conflict with or affect a process or procedure outlined, summarized, or described in the SAR?

Justification: A review of BFN Final Safety Analysis Report was completed for this proposed procedure change. The change does NOT require system operation that significantly differs with system operation characteristics, design, or functional requirements as described in BFN FSAR sections referenced. The change does NOT conflict with or affect a process or procedure outlined, summarized, or described in BFN FSAR sections referenced. Page 7 Added P&L 3.12 page 11 added

Document No: 3-GOI-100-12 Tracking No. 013 Rev. 010

step 5.9 which state:

Duty Tech Support Engineer should be notified when operating the main turbine generator on the "Backup Pressure Regulator" at less than 90% mwth. GE has recommended if reactor power is less than 90% mwth the main generator should not be operated on the "Backup Pressure Regulator" for more than 30 days. BFPER 97-001794-000

This change is a result of BFPER 97-001794-000 corrective action and GE letter to R.J. Moll dated August 27, 1999 RIMS # R92 990827 947. This change is safe from a nuclear standpoint.

If the questions are answered "No" or "N/A," the activity may be implemented without a safety evaluation. If any question is answered "Yes," an SE is required.

C. Review and Approvals

Preparer:	REGGIE KEMP *Name*	*Signature*	11/18/1999 *Date*
Reviewer:	Michael K Teggins *Name*	*Signature*	11/18/99 *Date*
Other: Reviewers (as appropriate)	*Name/Organization*	*Signature*	*Date*

PER 00-12276
EVALUATION OF CONTINUED PLANT OPERATION

PROBLEM DESCRIPTION

FSAR section 14.5.2.8 describes an abnormal operating transient (AOT) wherein pressure regulator failure results in turbine steam flow shutoff and a nuclear system pressure increase as being bounded by a generator trip. GE SIL 614 revealed that the transient may not be bounded if initiated at less than full power (<90%). Although BFN is operated most often at >90% power where other analyses bound the transient, it is necessary to be able to decrease power for short periods of time and enter operating regions where the impact of the transient (assuming it occurs) has not been evaluated. The purpose of this evaluation is to establish compensatory measures until corrective action is completed.

ANALYSIS

For the purposes of interim evaluation, the pressure regulator failure closed transient will be divided into two separate events and evaluated separately. One will be assumed to initiate at >90% power and the other will be assumed to initiate at <90% power.

POWER >90%

In this transient it is assumed that initial power level is >90% and all valves fail closed due to an unspecified failure. Reactor pressure increases and a SCRAM occurs due to high neutron flux. Per SIL 614, the results would be bounded by other analyses. Therefore BFN is analyzed for this transient and it is not of concern

POWER <90%

In this transient it is assumed that initial power level is <90% and all valves fail closed due to an unspecified failure. Reactor pressure increases and a SCRAM occurs due to high neutron flux or high reactor pressure. Per GE SIL 614 the results may not be bounded by other analyses. The worst case consequences of this event would be a small amount of fuel cladding damage many times less severe than that expected in a design basis accident such as LOCA. By limiting the time each unit is operated at <90% power, the probability of occurrence of this transient can be reduced to below the threshold for considering an event as an AOT. Guidance for this threshold is contained in ANSI N-18.2 where this transient (having the potential to result in fuel damage) would be a Category III (INFREQUENT FAULTS) having an expected frequency of 10E-2 < F< 10E-1 per year. Events with a probability beyond 10E-2 are considered accidents to which more extensive fuel damage is allowed.

The BFN licensing basis does not include a category equivalent to INFREQUENT FAULTS and therefore it is conservative to limit the probability of occurrence to that of an accident (<10E-2/yr). Calculation ND-N0999-980015 R0 models the EHC system and determines the probability of occurrence of pressure regulator failure. These are 6.787E-2/yr (for both regulators in service) and 1.59E-1/yr (for one regulator out of service). By setting the limit for probability of occurrence to <1E-2, then satisfying the following equation:

1.59E-1 X [days <90% with 1 regulator out] + 6.79E-2 X [days <90% with both regulators] <365E-2

yields a probability of occurrence commensurate with an accident for the event that may have consequences much less severe than an accident. This yields approximately 53 days at <90% with 2 regulators or 22 days at < 90% with one regulator.

Limiting operation to within the above equation is a conservative compensatory measure to satisfy the intent of the FSAR.

Prepared - [signature] 12-1-00
Checked [signature] 12/1/2000

Attachment 5

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT

GENERAL OPERATING INSTRUCTION

3-GOI-100-12

POWER MANEUVERING

REVISION 13

PREPARED BY: Gerald F. Moody PHONE: 7921

RESPONSIBLE ORGANIZATION: OPERATIONS

APPROVED BY: DAVID M. OLIVE DATE: 03/27/2001

EFFECTIVE DATE: 03/27/2001

LEVEL OF USE: REFERENCE USE

QUALITY-RELATED

Attachment 6

REVISION LOG

Procedure Number: 3-GOI-100-12

Revision Number: 13

Pages Affected: 7, 12

Description of Change: IC 016

Page 7, Precaution and Limitation 3.12; Clarified the P/L to specify the Turbine being less than 90% with only one pressure regulator in service should not remain in this condition for more than 22 days instead of 30 as previously specified. Additionally, the requirement to notify the system engineer when operating in this condition was deleted and instead inserted the requirement to initiate a narrative log entry for this condition.

Page 12, Revised Step 5.9 to correspond with changes made to Precaution 3.12 as stated above.

SCREENING REVIEW/50.59 EVALUATION COVERSHEET

Page 1 of 6

Document No. & Rev: 3-GOI-100-12 Rev 13 TN 16 SR Rev: 000

50.59 Eval Rev.

Screening Review Only ☒ Screening Review/50.59 Evaluation ☐

Procedure Change Evaluation ☐

Screening Review/Procedure Change Evaluation ☐ **(Check only one box)**

Plant BFN

Affected Unit(s) 3

Preparing Group Operations Support

Activity		Number (Include Revision No.)
☐ Design Change	DCN No.	
☐ Engineering Document Change	EDC No.	
☐ Temporary Alteration	TACF No.	
☐ Special Test/Experiment	Special Test No.	
☐ Temporary Shielding Request	TSRF No.	
☒ Procedure Change	Procedure No.	3-GOI-100-12 Rev 13 Tracking #16
☐ New Procedure	PCF No. (if applicable) Procedure No.	
☐ Maintenance	WR/WO No.	
☐ Other (Identify)		

Comment:

Distribution:

cc: EDM

Preparer - Return original to originating document

Reviews and Approvals

	Name	Signature	Date
Preparer:	Gerald F. Moody		03/26/2001
Reviewer:	REGGIE KEMP		03/26/2001
Reviewer: (PORC)			
Other Reviewers: (as appropriate)			

SCREENING REVIEW FORM
Page 1 of 4

I. For a Screening Review provide a brief description of the change or test. If an 50.59 Evaluation is required provide a detailed description of the change, test, or experiment; including design basis accidents involved, and credible failure modes of the activity.

This change was made to delete the requirement to notify the system engineer when operating with one pressure regulator out of service. Instead the procedure requires a narrative log entry be made to document this condition. Additionally, the procedural requirement to operate in this condition for no more than 30 days was changed to specify that operation in this manner should not exceed 22 days.

II. Revision: (Provide a brief summary of the reason for the revision to the SR, or 50.59 Evaluation)

SCREENING REVIEW FORM

III. **50.59 Screening Questions** (Check correct response) (See Section 4.2 of NEI 96-07 for additional guidance):

1. Does the proposed activity involve a change to an SSC that adversely affects an UFSAR described *design function*? (See Section 4.2.1.1 of NEI 96-07)

   Yes ☐ No ☒

   Justification: A review of BFN Final Safety Analysis Report was completed for this proposed procedure change. The change does NOT require system operation that differs with system operation characteristics, design, or functional requirements as described in BFN FSAR sections referenced. Therefore, the change involved in this procedure revision does not involve a change to a System, Structure, or Component (SSC) nor any adverse affects on the UFSAR Described Designed Function.

   This change is intended to require the operation of the turbine generator at less than 90% power with one pressure regulator out of service for a period of no more than 22 days. The previous requirement was 30 days. Additionally, the change requires the initiation of a narrative log entry to document this condition if it exists instead of the previous requirement to notify the system engineer. These changes make no change to any SSC nor do they affect any design function.

2. Does the proposed activity involve a change to a procedure that adversely affects how UFSAR described SSC design functions are performed or controlled? (See Section 4.2.1.2 of NEI 96-07)

   Yes ☐ No ☒

   Justification: This procedure change does not revise, or alter the intent of, any procedures described in the UFSAR. The information provided is in accordance with the current UFSAR description for the SSC design functions and capabilities. The change does NOT conflict with or affect a process or procedure outlined, summarized, or described in BFN FSAR sections referenced. Therefore, the change involved in this procedure revision does not adversely affect how any SSC Functions nor any functional capabilities for any SSCs are performed or controlled.

   This change is intended to require the operation of the turbine generator at less than 90% power with one pressure regulator out of service for a period of no more than 22 days. The previous requirement was 30 days. Additionally, the change requires the initiation of a narrative log entry to document this condition if it exists instead of the previous requirement to notify the system engineer. These changes make no change to any procedure requirement involving an SSC nor do they affect the way any design function is performed or controlled.

3. Does the proposed activity involve revising or replacing an UFSAR described evaluation methodology that is used in establishing the *design bases* or used in the *safety analyses*? (See Section 4.2.1.3 of NEI 96-07)

Yes ☐ No ☒

Justification: This procedure revision does not involve changes to any methodologies used to verify or establish any design basis functions or capabilities. This change does not involve changes to any accident analysis or system response to any design basis event. Therefore, this change does not revise or replace any methodologies described in the UFSAR nor does it make any changes to the established design basis or safety analysis fort the plant.

This change is intended to require the operation of the turbine generator at less than 90% power with one pressure regulator out of service for a period of no more than 22 days. The previous requirement was 30 days. Additionally, the change requires the initiation of a narrative log entry to document this condition if it exists instead of the previous requirement to notify the system engineer. These changes make no change to any evaluation methodology used in establishing the design bases nor does it change any evaluation methodology used in establishing the safety analyses.

SCREENING REVIEW FORM
Page 3 of 4

III. **50.59 Screening Questions** (Check correct response) (See Section 4.2 of NEI 96-07 for additional guidance):

4. Does the proposed activity involve a *test or experiment not described in the UFSAR*, where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the UFSAR? (See Section 4.2.2 of NEI 96-07)

   Yes ☐ No ☒

   Justification: This procedure revision does not involve a test or experiment not described in the UFSAR. The revision does not involve nay SSC being utilized or controlled or controlled outside of the referenced bounds of it's design function. Changes to this instruction do not imply or require that any SSC will be operated in any manner that is not consistent with plant Safety analysis or descriptions in the UFSAR.

   This change is intended to require the operation of the turbine generator at less than 90% power with one pressure regulator out of service for a period of no more than 22 days. The previous requirement was 30 days. Additionally, the change requires the initiation of a narrative log entry to document this condition if it exists instead of the previous requirement to notify the system engineer. This change has no affect on any test or experiment.

5. Does the proposed activity require a change to the Technical Specifications?

   Yes ☐ No ☒

   Justification: A change to BFN Technical Specifications is NOT required for conducting or implementing this procedure change because neither descriptions, directions, nor setpoints of this procedure conflict with those of BFN Technical Specifications sections referenced. This procedure revision does not involve changes to any SSC functional or capability requirements as required by Technical Specifications. All systems evaluated in the procedure revision utilized the current system requirements. A review of BFN Technical Specifications was completed for this change. Therefore, this change does not require a change to Technical Specifications.

   This change is intended to require the operation of the turbine generator at less than 90% power with one pressure regulator out of service for a period of no more than 22 days. The previous requirement was 30 days. Additionally, the change requires the initiation of a narrative log entry to document this condition if it exists instead of the previous requirement to notify the system engineer. These changes have no effect on any Technical Specification requirements..

SCREENING REVIEW FORM
Page 4 of 4

IV. If all questions are answered NO, **then** implement the activity per the applicable plant procedure for the type of activity without obtaining a License Amendment.
If screen question 5 is answered YES, **then** request and receive a License Amendment prior to implementation of the activity.
If screen question 5 is answered NO and question 1, 2, 3 or 4 is answered YES, **then** a 50.59 Evaluation shall be performed.
If only screen question 3 is answered YES, **then** only question 8 in the 50.59 Evaluation is required to be answered.
If screen question 3 is answered NO, **then** question 8 in the 50.59 Evaluation may be left unanswered.

<u>NOTE</u> If an FSAR change is involved process that change per NADP-7, FSAR Management.

V. List the documents (UFSAR, Technical Specifications, and other documents) reviewed where relevant information was found, including section numbers:

<u>UFSAR:</u>

Chapter 7.0, Control And Instrumentation.
Chapter 10.0, Auxiliary Systems.
Section 11.5, Turbine Bypass system.
Chapter 13.0, Conduct of Operations.
Section 13.6, Normal Operations
Section 14.5. Analyses of Abnormal Operational Transients-Uprated

<u>Technical Requirements Manual:</u>

Section 3.1, Reactivity Control.
Section 3.3.1, Reactor Protection System (RPS) Instrumentation.
Section 3.4.1, Coolant Chemistry.
Section 3.3.5, Surveillance Instrumentation

<u>TECHNICAL SPECIFICATIONS:</u>

Section 5.4, Procedures.
Section 5.5, Programs and Manuals.
Section 3.1, Reactivity Control Systems.
Section 3.2.1, Average Planar Linear Heat Generation Rate (APLHGR).
Section 3.2.2, Minimum Critical Power Ratio (MCPR).
Section 3.2.3, Linear Heat Generation Rate (LHGR).
Section 3.2.4, Average Power Range Monitor (APRM) Gain and Setpoints.
Section 3.3.1.1, Reactor Protection System (RPS) Instrumentation.
Section 3.3.2.1, Control Rod Block Instrumentation.
Section 3.7.5, Main Turbine Bypass System.

August 27, 1999

R.J. Moll, PEC 1A-BFN

BROWNS FERRY NUCLEAR PLANT (BFN) - PROBLEM EVALUATION REPORT (PER)
BFPER971794 - BACKUP PRESSURE REGULATOR

Reference: General Electric (GE) Services Information Letter (SIL) 614, R1

BFPER971794 is a "C" level PER which states the following:

> Based on initial engineering review, GE SIL 614 (Backup Pressure Regulator), should be formally evaluated for applicability to BFN.

SIL 614 states, in part, the following in its discussion about partial power operation (< 90%) with one pressure regulator out of service:

> If a downscale failure of the operating pressure regulator (without backup) occurs from partial power conditions, the available fuel thermal margin may be less than previously analyzed. The thermal margin available depends on several factors, including the rate of closure of the TCVs and specific plant protection setpoints. If the failure occurs with normal fuel operating conditions, adequate margin is expected for all plants. But since this partial-power event may not be specifically analyzed, operation without a backup pressure regulator, at less than full power, and under minimum allowable fuel thermal margin conditions, may fall outside the licensing basis. Therefore, the length of time the reactor is operated without a backup pressure regulator should be limited unless analyses have been performed to support such operation. If such analyses have not been performed, extended operation in this condition should be avoided.

This memorandum documents two corrective actions for BFPER971794 that Site Engineering had to complete:

Action item 01 was to perform a Probabilistic Safety Assessment (PSA) analysis to determine the probabilities of the conditions described in SIL 614 occurring at BFN. This item has been completed and formalized in calculation ND-N0999-980015 (RIMS R14 980807 103). This calculation concluded that BFN could operate for 89.7 days per year with one pressure regulator out of service, without a significant increase in risk. Therefore, limiting operation to 30 continuous days per year or less (if reactor power is less than 90%) is not risk significant.

Action item 02 was to determine what actions BFN needs to take, if any, based on the above PSA analysis. The following actions are proposed:

Prioritize the Electric Hydraulic Control (EHC) digital upgrade which will, presently include the installation of a third pressure regulator as part of the design. Most digital logic circuits incorporate at least three trains so that the microprocessor can poll them. Therefore, with

Attachment 3

three pressure regulators this condition would not need to be analyzed. Note that this upgrade is in the BFN 5 Year plan. The latest estimate for GE to perform an analysis is $200,000, which would be more prudently spent toward the EHC digital upgrade modification.

Operations should revise or issue the appropriate procedure to add the following caution statement: "Upon the loss of a reactor pressure regulator concurrent with Reactor power levels at less than 90%, NOTIFY the responsible System Engineer for evaluation and tracking purposes. This mode of operation should be limited to 30 continuous days of operation per calendar year."

J. D. Shaw
Design Manager
PEC 1B-BFN

KTG:FAL:EAS
cc: K. T. Gray, PEC 1B-BFN
G. V. Little, POB 2E-BFN
T. A. Keys, BR 3F-C
J. L. Lewis, PEC 1D-BFN
R. E. Wiggall, PEC 2A-BFN
RIMS, WT 3B-K