UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 222 TO FACILITY OPERATING LICENSE NO. DPR-33

AMENDMENT NO. 237 TO FACILITY OPERATING LICENSE NO. DPR-52

AMENDMENT NO. 196 TO FACILITY OPERATING LICENSE NO. DPR-68

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3

DOCKET NOS. 50-259, 50-260, AND 50-296

1.0 INTRODUCTION

By letter dated March 30, 1994, the Tennessee Valley Authority (the licensee) requested amendments to the Technical Specifications (TS) for the Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3. This request had the following major components:

- Replace the BFN Unit 3 reactor protection system (RPS) and emergency core cooling system (ECCS) mechanical and differential pressure switches with an analog transmitter/trip system (ATTS).
- Change the BFN Units 1 and 3 reactor vessel water level safety limit and Level 1 low reactor water level setpoint.
- Change the BFN Units 1, 2, and 3 suppression chamber-reactor building vacuum breaker calibration frequency.
- Change BFN Unit 1, 2, and 3 calibration frequencies and functional test descriptions, bases, and add instrument identifiers.

The licensee also proposes some editorial changes to the specifications.

The NRC staff requested additional information from the licensee on September 21, 1994 and January 19, 1995. The Licensee responsed to these requests on November 18, 1994 and March 9, 1995, respectively. The staff's proposed finding of no significant hazards considerations was not affected by the additional information provided by the licensee. The lead staff reviewer for this evaluation also reviewed licensee records during a site visit from November 28 through December 2, 1994.

ENCLOSURE

2.0 EVALUATION

The staff evaluation for each of the components described above is given below.

2.1 BFN UNIT 3 ANALOG TRANSMITTER TRIP SYSTEM

TVA proposes to replace the Unit 3 RPS and ECCS mechanical and differential pressure switches with the ATTS. The ATTS modification includes the replacement of power supplies and associated electrical cabling, breakers and fuses. As a result, instrument identifiers, functional test description, group designator, minimum test frequency notes, minimum calibration frequencies and indicator range are being changed in the TS tables to reflect the new equipment. With the exception of some calibration frequency changes, Unit 3 changes make the TS consistent with changes previously approved for Unit 2.

The ATTS was proposed by General Electric Company (GE) in 1978 to replace the original mechanical and differential pressure switches which were not as reliable. The principal objective of the ATTS was to improve sensor intelligence and reliability while enhancing testing capability.

GE submitted the ATTS Topical Report, NEDO-21617-A, for review by the NRC and reference in license applications. The topical report was reviewed by the NRC staff and found acceptable, as documented in a letter dated June 27, 1978.

The ATTS provides the following system improvements:

- Continuous monitoring of parameters.
- Reduced functional tests and calibration frequency for the primary sensors.
- Decreased duration and complexity of required testing and calibration of inputs for safety related parameters.
- Reduced testing and maintenance related scrams.
- Reduced number of reportable events related to setpoint drift.
- Diversity associated with the Anticipated Transient Without Scram (ATWS) mitigation system required by 10 CFR 50.62.

The trip unit (with analog transmitters) and trip relays provide the input intelligence to the system logic for the RPS, ECCS, and the nuclear steam safety supply systems (NSSSS).

2.1.1 Information to Support ATTS Installation

In the staff's evaluation of NEDO-21617-A, the staff requested that each individual referencing application furnish the following information:

Specific Instrument Loops

Variable name, part number of device being deleted, system involved, divisional separation assignment, model number and vendor of the transmitters or RTDs.

Trip Unit Cabinet

Cabinet layout showing location areas of power supplies, trip relays, and trip units, divisional separation assignment, and layout of each card file in the trip unit cabinet showing the trip variable for each card file slot.

Environmental and Seismic Qualification

Demonstration of qualification of the ATTS system to the normal operating and post-accident environment temperature and humidity. Also, a comparison of the floor seismic spectra of the cabinet mounting location for the specific plant to the seismic test envelope in NEDO-21617-A for the ATTS cabinet. If the trip unit cabinets are not located in the preferred location as specified in NEDO-21617-A, provide justification for the alternate selected location.

Interconnection Diagram

An interconnection diagram which shows the interconnection between the existing logic cabinets.

During the staff review of the BFN Unit 2 ATTS, the licensee provided the above information in their letters dated May 8, 1985 and November 20, 1985. For the BFN Unit 3 ATTS, the above information and information regarding the use of Agastat relays in the ATTS was submitted by the licensee on March 30, 1994. The licensee's discussion of each of the criteria requested by NEDO-21617-A is summarized below.

2.1.1.2 Specific Instrument Loops

The licensee's March 30, 1994 letter indicated the variables and devices proposed for replacement by the ATTS. In a request for additional information (RAI) dated September 21, 1994, the staff noted that transmitter PDT-1-25D for Main Steam Line High Flow was assigned to RPS Division IB, which appeared to be in error. In its RAI response of November 18, 1994, the licensee agreed that the divisional assignment for this transmitter was in error, and it was changed to Division IIB.

The staff also noted in the September 21, 1994 RAI that the maximum qualified temperature for a number of Rosemount transmitters for BFN, Unit 2 was 350°F

and identical transmitters for Unit 3 are listed as having a maximum qualified temperature of 415°F. The licensee was asked to clarify the difference in qualification temperature. The licensee clarified that the maximum qualified temperature of 350°F, specified for Rosemount 1153 transmitters was the intended qualification value specified in the Rosemount Test Report. However, during testing, the 350°F limit was exceeded with no damage to the transmitters. Therefore, a new qualification temperature of 415°F was specified for the BFN Unit 3 Rosemount transmitters, reflecting the actual as-qualified temperature. The staff finds the qualification temperature acceptable.

2.1.1.2 Trip Unit Cabinet

The licensee described a Trip Cabinet Assembly, discussing cabinet layout, location areas of power supplies, trip relays, and trip units. A Trip Cabinet Assembly showed divisional separation assignment, layout of each card file in the trip unit cabinet, and the trip variable for each card file slot. The staff finds the information supplied on the Trip Unit Cabinet acceptable.

2.1.1.3 Environmental and Seismic Qualification

The licensee provided an Environmental Interface Temperature and Humidity Table which identified the transmitters, maximum normal temperature and humidity, maximum post-accident temperature and humidity, and the maximum qualified temperature and humidity.

The following instruments were identified by the licensee as not being within the scope of the 10 CFR 50.49 environmental qualification program:

- Main steam low pressure - input to primary containment isolation system (PCIS), PT-1-72, 76, 82, and 86.

- Turbine first stage pressure permissive - input to RPS/RPT, PT-1-81A, 81B, 91A, and 91B.

- Reactor high pressure - input to RPS, PT 3-22AA, 22BB, 22C, AND 22D.

- Reactor high pressure - input to ATWS (ARI/RPT), PT-3-204A, 204B, 204C, and 204D.

In the staff RAI of September 21, 1994, the licensee was requested to justify why these instruments were outside the scope of 10 CFR 50.49. On November 18, 1994, the licensee responded that only PT 3-22A, 22B, 22C and 22D have a safety-related function, and that none of the above instruments provide a safety-related function in a post-accident harsh environment as specified in the requirements of 10 CFR 50.49. The staff finds this justification consistent with 10 CFR 50.49 and, therefore, acceptable.

The licensee supplied a seismic response spectra of the ATTS cabinet mounting location and a comparison to the seismic test envelope that the cabinet was tested to as documented in NEDO-21617-A. This comparison indicated that the

mounting location seismic response spectra was within the cabinet seismic test envelop. The staff finds this acceptable.

The BFN Unit 3 ATTS cabinets are located in the auxiliary room and control room which is the preferred location recommended by NEDO-21617-A. The ATTS instrumentation for BFN Unit 3 will be installed the same way as for Unit 2 with the following exception. The transmitters for the Reactor High Water Level instrument channels (LT-3-208 A, B, C, and D and LIS-3-208 A, B, C, and D) that are identified in the TS are being replaced with qualified Rosemount 1153 transmitters instead of Gould transmitters. Gould transmitters were installed in Unit 2 because Rosemount transmitters were not available at the time of the Unit 2 modification. TVA committed in their March 5, 1993, response to NRC Bulletin 90-01, Supplement 1 "Loss of Fill-Oil in Transmitters Manufactured by Rosemount" to replace or refurbish the Rosemount Model 1153 Series B and D and Model 1154 transmitters in safety related or ATWS applications prior to restart of BFN Unit 3. The staff finds that the Rosemount instruments are capable of fulfilling the design requirements for this installation. Therefore, this exception and commitment are acceptable.

2.1.1.4 Interconnection Diagram

The BFN plant-specific interconnection diagram is represented by NEDO-21617-A, Figure 5-5. This Topical Report was reviewed by the NRC staff and found acceptable. The BFN installation is within the scope of the staff review of NEDO-21617-A, and is also acceptable.

2.1.1.5 Revised Indication Range

The reactor coolant system (RCS) pressure indicator range is changed from 0-to-1500 psig to 0-to-1200 psig due to use of a new indicator. This newly-installed equipment includes the full range of pressure for which operator actions would be required during accident conditions. RCS pressure is recorded over a range of 0-to-1500 psig. Although Regulatory Guide 1.97 "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Environs Conditions During and Following an Accident" recommends Category 1 RCS pressure instrumentation with a range of 0-to-1500 psig, the RCS indicator range of 0-to-1200 psig was accepted for the BFN reactors by the staff in the letter dated May 10, 1991. The revised TS accurately reflects the installation of new equipment, and is consistent with staff expectations, and is, therefore, acceptable.

2.1.2 ATTS Agastat Relays

The Agastat trip unit output relay is used to provide an output from the ATTS to the existing protection system. This relay has a specified qualified life for both the energized and non-energized states. On September 21, 1994, the licensee was requested to identify this qualified life and identify a maintenance program which would assure replacement of the relay prior to the end of its qualified life for both Unit 2 and Unit 3.

On November 18, 1994, the licensee responded to the staff's request for additional information as follows:

1. Agastat Model ETR and EGP relays have been qualified for 20 years of service in their expected service environment.

2. Functional testing either monthly or quarterly ensures a high degree of reliability.

3. Administrative controls ensure failures are identified and evaluated for adverse trends.

4. TVA will either replace the Agastat relays in the ATTS after 20 years of service or document the acceptability of a longer service life.

Further staff investigation into Agastat relay reliabilty identified industry experience which may not be consistent with TVA's position. Therefore, on January 19, 1995, the staff requested additional information to complete its evaluation of TVA's amendment request.

The licensee response to this request of March 9, 1995 is summarized as follows:

- The ATTS output relays are in a mild environment; therefore, determination of a qualified lifetime is not required.

- The current quality assurance requirements are sufficient to ensure adequate performance of this equipment.

- TVA has not identified any instances of Agastat relay failures in the ATTS during its review of BFN equipment failure data.

- Incipient age related failures of Agastat relays would be detected by the current trending program prior to the occurrence of concurrent failures that could defeat redundancy.

The staff concludes that current TS functional testing being performed monthly along with the current trending program will permit TVA to detect Agastat relay failures, properly evaluate these failures and take appropriate corrective action. Therefore, the staff's concerns in this regard are resolved.

2.2 REACTOR VESSEL WATER LEVEL

2.2.1 Safety Limit (SL)

For BFN Units 1 and 3, SL for reactor vessel level is being changed from 378 inches above vessel zero (IAVZ) to 372.5 IAVZ. The licensee states that the revised SL corresponds to the level which is used in design analyses. This level has been established by General Electric to provide a point which can be monitored and provides adequate margin to assure sufficient cooling. The revised limit makes the BFN Units 1 and 3 SL consistent with the BFN Unit 2

SL. The staff finds that these criteria are appropriate. Therefore, the revised safety limit is acceptable.

2.2.2 Limiting Safety System Setting (LSSS)

The original LSSS for reactor vessel low water level in TS Table 3.2.A and Table 3.2.B was equal to the SL of 378 IAVZ. NRC regulations (10 CFR 50.36) state:

> Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded.

This requirement cannot be achieved if the LSSS is equal to the SL. In this case, the LSSS must be set to actuate at a higher reactor water level than the SL to compensate for instrument and loop inaccuracies, and response time of instrumentation and components that actuate to mitigate an event.

For BFN Units 1 and 3, the reactor vessel low water level 1 LSSS is changed from 378 IAVZ to 398 IAVZ. Instruments with this LSSS initiate the following systems:

- Containment spray system (CSS) (TS Table 3.2.B).
- Low pressure coolant injection system (LPCI) (TS Table 3.2.B).
- Main steam isolation system (MSIS) (TS Table 3.2.A).
  main steam isolation valves (MSIV)
  main steam line drain valves
  reactor water sample valves
- Permissive inputs to the automatic depressurization system (ADS) (TS Table 3.2.B).

The reactor vessel low water level 1 LSSS trip setting was chosen to be high enough to prevent spurious actuation but low enough to initiate post-accident cooling while providing margin to the SL.

The methodology used by the licensee to determine the LSSS is in accordance with the Instrument Society of America Standard ISA-S67.04 - 1982 "Setpoints for Nuclear Safety Related Instrumentation Used in Nuclear Power Plants." This methodology is consistent with the guidance of Regulatory Guide 1.105. Therefore, the proposed LSSS is acceptable.

2.3 PRESSURE SUPPRESSION-REACTOR BUILDING VACUUM BREAKERS

For BFN Units 1, 2, and 3, the differential pressure instrumentation (which actuates the pressure suppression-reactor building vacuum breakers) calibration frequency is being revised to reflect current Units 2 and 3 calculations. The calibration frequency of the transmitters, as shown on Table 4.7.A, has been changed from every 3 months to 18 months. A Unit 1

specific calculation will be performed to confirm the calibration frequency prior to Unit 1 restart. The pressure differential setpoint which actuates the vacuum breakers has been changed from 1.1 psid to 0.5 psid as shown on Table 3.7.A. The calibration frequency scaling and setpoint calculations which reflect the above changes are in accordance with the guidance contained in Regulatory Guide 1.105, and are, therefore, acceptable.

2.4 INSTRUMENT IDENTIFIERS

The licensee proposes to revise the TS to add instrument identifiers for the Unit 2 equipment previously installed and Unit 3 equipment installed as part of the ATTS modification. These identifiers provide additional detail which enhances the usability of the TS, and are acceptable.

2.5 TEST DESCRIPTIONS AND CALIBRATION FREQUENCIES

The licensee proposes to revise the instrument calibration frequencies and functional test descriptions for the BFN Unit 2 Reactor High Water Level, reactor core isolation cooling (RCIC) and high pressure coolant injection (HPCI) turbine steam line high flow, and drywell pressure instruments. The licensee states that it has performed scaling and setpoint calculations consistent with the guidance of Regulatory Guide 1.105.

The staff's acceptance of the reduced functional test frequencies and calibration frequencies of instruments and components associated with the ATTS is based upon recommendation by General Electric Company (GE) in their Topical Report NEDO-21617-A and the NRC acceptance of this report. These changes are consistent with GE's Technical Specification Improvement Analysis for Boiling Water Reactor Protection System, NEDC-30851P-A, that was reviewed and approved by the NRC generic safety evaluation report dated July 15, 1987 and the NRC Standard Technical Specifications for BWRs. The NRC has approved operating license amendments, regarding the Analog Transmitter Trip System, for BWRs as follows:

- Vermont Yankee Nuclear Power Station, November 3, 1980.
- Pilgrim Nuclear Power Station, August 6, 1986.
- Browns Ferry Unit 2, August 19, 1986.
- Brunswick Steam Electric Plant Units 1 and 2, March 16, 1989.

The staff finds that the licensee's proposed TS are consistent with regulatory guidance and overall industry practice, and are acceptable.

2.6 SUMMARY OF TS CHANGES

ATTS Implementing Technical Specifications

The following TS tables are to be revised to incorporate equipment installed as part of the BFN Unit 3 ATTS modifications, and to provide appropriate test requirements for those components:

Table 3.1.A, Reactor Protection System (Scram) Instrumentation Requirements,

Table 4.1.A, Reactor Protection System (Scram) Instrumentation Functional Tests Minimum Functional Test Frequencies for Safety Instrumentation and Control Circuits,

Table 4.1.B, Reactor Protection System (Scram) Instrumentation Calibration Minimum Calibration Frequencies for Reactor Protection Instrument Channels,

Table 3.2.A, Primary Containment and Reactor Building Isolation Instrumentation,

Table 3.2.B, Instrumentation that Initiates or Controls the Core and Containment Cooling Systems,

Table 3.2.F, Surveillance Instruction,

Table 3.2.L, Anticipated Transient Without Scram (ATWS) - Recirculation Pump Test (RPT) Surveillance Instrumentation,

Table 4.2.A, Surveillance Requirements for Primary Containment and Reactor Building Isolation Instrumentation,

Table 4.2.B, Surveillance Requirements for Instrumentation that Initiate or Control the CSCS,

Table 4.2.F, Minimum Test and Calibration Frequency for Surveillance Instrumentation.

The licensee has also proposed changes to calibration frequency and functional test requirements for BFN Unit 2. The staff has reviewed the proposed changes, and finds they are consistent with the evaluation provided in sections 2.1, 2.4, and 2.5 above. Therefore, these proposed changes are acceptable.

BFN Units 1 and 3: Reactor Vessel Water Level Safety Limit and Limiting Safety System Setting

The staff has reviewed the proposed changes to Tables 3.2.A and 3.2.B, and finds they are consistent with the evaluation provided in section 2.2 above. Therefore, these proposed changes are acceptable.

BFN Units 1, 2, and 3: Suppression Chamber-Reactor Building Vacuum Breakers Calibration Frequency

The staff has reviewed the proposed changes to TS 3.7.A.3.a, 3.7.A.3.b, 4.7.A.3.a, and new tables 3.7.A and 4.7.A, and finds they are consistent with the evaluation provided in section 2.3 above. Therefore, these proposed changes are acceptable.

BFN Units 1, 2, and 3: Editorial Changes

The licensee has proposed editorial changes to revise capitalization of terms used in the TS affected by the items discussed above. The staff has reviewed these editorial changes, and finds that the changes are consistent with routine practice, where terms defined by Section 1.0 of the TS are capitalized for ease of identification. Therefore, the proposed editorial changes are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Alabama State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes the surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (59 FR 49435). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

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

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