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JUL 31 1990

U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - ENVIRONMENTAL QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT - PROPOSED FINAL SAFETY ANALYSIS REPORT (FSAR) SECTION 3.11

This letter provides proposed updates to FSAR Section 3.11 concerning the equipment qualification programs at WBN.

By letter dated June 26, 1990, TVA submitted Amendment 63 to the WBN FSAR. As stated in that letter, Chapter 3 was not addressed because a Civil Program Review Team is reviewing the civil programs at WBN. However, FSAR Section 3.11 is not affected by those pending reviews. The enclosure provides an advance copy of the proposed updates to that section in order that the current information concerning the mechanical and electrical equipment qualification programs at WBN is available for your review. These proposed revisions will be submitted in a subsequent FSAR amendment.

If there are any questions concerning this matter, please contact R. J. Stevens at (615) 365-8650.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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Enclosure
cc: See page 2

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ENCLOSURE

PROPOSED FINAL SAFETY ANALYSIS
REPORT (FSAR) SECTION 3.11 REVISIONS

3.11 ENVIRONMENTAL DESIGN OF MECHANICAL AND ELECTRICAL EQUIPMENT

The method of assuring that mechanical and electrical components of safety-related equipment are qualified for their potential normal operational and worst-case accident environments is described in this section.

Two programs are in place to environmentally qualify safety-related electrical equipment (including cable) and active safety-related mechanical equipment to function or not fail for event mitigation.

These are:
1. Safety-related electrical equipment within the scope of 10CFR50.49.
2. Active, safety-related mechanical equipment located in a harsh environment.

10 CFR 50.49 equipment excludes that equipment located in mild or essentially mild environments. A mild environment is defined as a room or building zone where (1) the temperature, pressure, or relative humidity resulting from the direct effects of a design basis event (DBE) (e.g., temperature rise due to steam release) are no more severe than those which would occur during an abnormal plant operational condition, (2) the temperature does not exceed 130°F due to the indirect effects of a DBE (e.g., increased heat loads from electrical equipment), (3) the event radiation dose is less than or equal to 1 x 10^4 rads, and (4) the total event plus the 40 year TID (total integrated dose) is less than or equal to 5 x 10^4 rad, Reference [2].

The Mechanical Equipment Qualification (MEQ) program assures that active, safety-related mechanical equipment located in harsh environments will adequately perform the required design safety functions under all normal, abnormal, accident and post-accident environmental conditions in accordance with 10 CFR Part 50, Appendix A, General Design Criterion 4 (GDC-4).

3.11.1 Equipment Identification and Environmental Conditions

3.11.1.1 Identification of Safety Systems and Justification

All systems whose functioning is required to mitigate a loss-of-coolant accident (LOCA) or high-energy line break (HELB) for Watts Bar Nuclear Plant harsh environment areas are listed in Table 3.11-1. These systems were determined by identifying all the systems upon which the safety analyses in the Final Safety Analysis Report and other referenced documents are dependent. Further, any systems which are necessary to support systems so identified were included in this table.

3.11.1.2 Identification of Equipment in Harsh Environments

The identification of the harsh environment is provided in Section 3.11.2. With the harsh environments defined, a survey of the safety-related electrical and active safety-related mechanical equipment in the affected areas was conducted. This survey was conducted using electrical instrument tabulations, mechanical piping drawings, mechanical heating and ventilation drawings, instrumentation and control drawings, electrical equipment drawings, and

conduit and grounding drawings to identify the required components. The electrical components are identified in the Category and Operating Times Calculations. These calculations establish the 10 CFR 50.49 operating category and times for these components. 10 CFR 50.49 Category A or B electrical components located in a harsh environment are qualified in environmental qualification packages, which are referred to as the Environmental Qualification (EQ) Binders. These are a comprehensive set of documentation packages that demonstrate compliance with 10 CFR 50.49. In some instances Category A or B equipment may be contained in "Essentially Mild" (EM) calculations. EM calculations evaluate the 1E equipment located in plant harsh environments for the specific DBE(s). This evaluation concludes that for the specific DBE(s) for which the equipment must function, the environmental conditions (including normal plus accident dose) do not impose a significant environmental stress on the device.

Mechanical components are identified in the Mechanical Equipment List. This list identifies the active safety-related equipment which is required to perform a mechanical motion during the course of accomplishing a system safety function. This calculation identifies all mechanical equipment in the portions of safety system flow paths which are required to mitigate 10 CFR 50.49 accidents. This equipment includes, but is not limited to valves, pumps, dampers, and fans.

Verification of qualification levels for equipment with the scope of 10 CFR 50.49 has been accomplished by a field walkdown of the installed components to provide traceability between the qualification documents and the "in situ" equipment. This field verification walkdown is documented in the EQ binders.

The active safety-related mechanical equipment located within harsh environmental areas in the plant were identified by use of design data and confirmed by field verification walkdowns. This information is documented in the MEQ binders.

3.11.2 Environmental Conditions

3.11.2.1 Harsh Environment

Environmental conditions have been established for all harsh environment areas which contain safety-related electrical and active mechanical equipment exposed to a harsh environment resulting from a design basis event. Temperature, relative humidity, pressure, radiation dose, area type, chemical spray, and flooding were the parameters considered. (Only temperature and radiation were considered for mechanical equipment. The other parameters have no significant detrimental effect on mechanical equipment). All values were based upon the following operational conditions:

1. Normal conditions resulting from routine plant operation or shutdown during a design basis day (maximum and minimum) and an average day.

2. Abnormal conditions resulting from worst case combinations of extreme outside temperatures and relative humidities, abnormally high or low internal space heat loads, and degraded environmental control system operation.

3. Loss of Coolant Accident (LOCA) or High Energy Line Break (HELB) conditions resulting from small, intermediate, or large main steam line breaks inside containment.

4. High Energy Line Break conditions outside primary containment resulting from ruptures and critical cracks in various high energy lines throughout the auxiliary building and steam valve vaults.

5. Tornado Depressurization conditions resulting from a design basis tornado.

6. Inadvertent Containment Spray Initiation conditions resulting from accidental operation of the containment spray system.

7. Fuel Handling Accident

The service conditions, resulting from the operational conditions listed above, are presented in a set of environmental drawings (47E235 Series). Temperature, pressure, and relative humidity vs. time curves are also provided on the drawings to clearly define the effects of various worse case HELB combinations on the area. These drawings include the environmental conditions for mild as well as harsh environmental areas.

For the purpose of 10 CFR 50.49, only design basis events 3, 4, and 7 above are considered design basis accidents. Tornados, Floods, or other natural phenomenon, including seismic, are expressly excluded from the scope of 10 CFR 50.49. Refer to Section 3.10 for Seismic Qualification.

3.11.2.2 Mild Environment

Mild environment qualification is applied to Class 1E electrical equipment only and is required by 10 CFR 50 Appendix A, Criterion 4. Watts Bar satisfies the intent of NRC Generic Letter 82-09 by utilization of a preventive maintenance, surveillance, and testing program, as discussed in that generic letter.

For Class 1E equipment located in a mild environment and procured or installed before April 20, 1982 (date of issuance of NRC Generic letter 82-09), WBN demonstrates qualification by site preventative maintenance, testing, and surveillance programs.

For Class 1E equipment located in a mild environment and procured after April 20, 1982, WBN demonstrates qualification by the design or purchase specifications which identify environmental conditions and any other applicable design requirements as appropriate. These design activities are augmented by the site preventative maintenance, testing, and surveillance programs.

3.11.3 Electrical Equipment Within the Scope of 10 CFR 50.49

The process assuring that electrical equipment/cable is capable of performing its safety function is described in this section. A description of TVA's environmental qualification program is presented in Reference [1]. This reference provides documentation on the program and initial EQ binder preparation to denote that the components are qualified. TVA has implemented a program to ensure that all components will be fully qualified in accordance with 10 CFR 50.49 at fuel load. The EQ binders are maintained as controlled documents.

Safety-related electrical devices located in a harsh environment and required to function or not fail for mitigation of a specific DBA are identified on the Watts Bar Nuclear Plant 10 CFR 50.49 List (1E Electrical Equipment Requiring Qualification Under 10 CFR 50.49). The methodology for establishing the 10 CFR 50.49 List for Watts Bar Unit 1 is located in Section III.2 of Reference [1]. The operating category, operating time, and safety function for the 10 CFR 50.49 devices are established by the Category and Operating Time Calculations. All devices on the 10 CFR 50.49 List are analyzed for qualification to the requirements defined by 10 CFR 50.49 and documented in the EQ binders.

3.11.4 Qualification Tests and Analyses

Qualification tests and analyses for safety-related electrical equipment were conducted in accordance with the requirements of 10 CFR 50.49 and the guidelines of NUREG-0588 reference [3]. See Table 3.11-3 for compliance with NRC criteria and standards.

3.11.5 Qualification Test Results

See Section 3.11.4.

3.11.6 Loss of Ventilation

All plant locations containing safety-related equipment that need a controlled environment to perform required accident mitigation operations are served by fully redundant environmental control facilities. Such redundancy assures that no loss of safety-related equipment will occur from a single failure of equipment provided for controlling the local environment for this equipment. All data describing controlled local environmental conditions during accidents is valid for situations in which a single loss of ventilation has occurred.

3.11.7 Estimated Chemical and Radiation Environment

3.11.7.1 Chemical Spray

The worst case environment (normal or post-accident) chemical composition of the containment spray was based on the following solutions and assumptions noted below:

1. Ice Condenser: Quantity of ice - 2.0 X 10^6 lbm boron concentration - 1800 ppm B added as $Na_2B_4O_7$ (sodium tetraborate)

2. Boron Injection Tank: Volume - 900 gallon boron concentration - 2,100 ppm B in the form of H_3BO_3 (ortho-boric acid)

3. Cold Leg Injection Accumulators: 4 tanks, Volume per tank - 1080 ft^3; boron concentration-2,100 ppm B in the form of H_3BO_3

4. Refueling Water Storage Tank: Volume - 380,000 (maximum) gal; boron concentration - 2,100 ppm B in the form of H_3BO_3. The tech spec volume is 370,000 to 375,000 gallons.

5. Reactor Coolant System: Volume - 12,040 ft^3, boron concentration - 2,000 ppm B in the form of (H_3BO_3)

6. Miscellaneous Injection Piping: Volume - 1850 $ft.^3$; boron concentration - 2,100 ppm B in the form of H_3BO_3.

The following assumptions were used in this analysis:

3.11.7.2.2 Radiation - General Spaces

The normal operating radiation environment in the auxiliary building is shown on the environmental drawings (47E235 Series). The radiation exposure in the general spaces of the auxiliary building after a design basis LOCA is due to (1) containment sump fluid being circulated in the RHR, CS, and SI systems, (2) airborne activity in the auxiliary building, and (3) shine from activity in the containment. The source terms used for this accident are those suggested by the NRC for use in response to NUREG-0588 and correspond to TID-14844 releases. Flow diagrams and equipment layouts were reviewed to determine the flow paths which would be used after an accident and to determine the volume and physical locations of contaminated fluids in the auxiliary building. The layout of the shield walls and equipment within the rooms were conservatively modeled. Source terms were calculated at various times after an accident. Dose rates were then calculated at several positions in the auxiliary building with respect to the contained sources and at various times after an accident. The locations where dose rates were calculated were chosen to conservatively calculate the dose rates in corridors, outside equipment cubicles, in adjacent rooms, and within the equipment cubicles. These dose rates were then integrated to determine equipment exposure for a one-year period after the accident. Airborne activity in the auxiliary building is due to gaseous leakage from the containment which is processed and exhausted through HEPA and charcoal filters in the auxiliary building gas treatment system. The dose rates through the reactor shield building from activity released into the containment atmosphere were also calculated.

The calculation of radiation conditions outside containment in Auxiliary Building general spaces complies with Paragraph 1.4 of NUREG-0588.

3.11.7.2.3 Radiation-Individually Cooled Rooms

The basis for the radiation exposure in individually cooled rooms in the auxiliary building is the same as described above for general spaces at the auxiliary building. The dose rate in a room is due almost entirely to the activity being circulated through equipment in that room.

The calculation of radiation conditions outside containment in auxiliary building individually cooled rooms complies with Paragraph 1.4 of NUREG-0588.

References

1. September 30, 1986, Letter from R. Gridley to B. Youngblood, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants - Summary Status Report - Watts Bar Nuclear Plant - Unit 1".

2. Watts Bar Design Criteria, WB-DC-40-54, "Environmental Qualification to 10 CFR 50.49," Revision 2.

3. NUREG 0588, Interim Staff Report on Environmental Qualification of Safety-Related Electrical Equipment, Revision 1, July 1, 1981.

Figures 3.11-1 through 3.11-46 deleted by Amendment 63.

TABLE 3.11-1

SYSTEMS (OR PORTIONS OF SYSTEMS) REQUIRED TO MITIGATE LOSS-OF-COOLANT ACCIDENTS AND/OR HIGH ENERGY LINE BREAKS

Standby AC Power System (Includes Diesel Generators)
120V Vital AC System
Vital 125V DC Control Power System
Diesel Generator Fuel Oil System
Diesel Air Starting System
Emergency Lighting System
Auxiliary Control Air System
Nuclear Instrumentation System
Reactor Protection System
Hydrogen Recombination System
Containment Isolation Systems
Ice Condenser System
Containment Spray System
Residual Heat Removal System
Safety Injection System
Reactor Coolant System
Auxiliary Feedwater System
Containment Air Return Fan System
Essential Raw Cooling Water System
Component Cooling System
Main Steam System
Radiation Monitoring System
Chemical and Volume Control System
Emergency Gas Treatment Air Cleanup System
Auxiliary Building Gas Treatment System
Control Room Area Ventilation System
Engineered Safety Feature Ventilation System
Auxiliary Building Ventilation Subsystems:
- Shutdown Board Room Air Conditioning System
- Auxiliary Board Rooms Air Conditioning System
- Turbine-Driven Auxiliary Feedwater Pump Ventilation
- Shutdown Transformer Room Ventilation System

Essential Raw Cooling Water Intake Pumping Station Heating
Spent Fuel Pool Cooling System
Main Feedwater System
Steam Generator Blowdown System
Hydrogen Ignition System
Auxiliary Boiler System
Feedwater Control System
Sampling System
Containment Lower Compartment Cooling Systems: Fan only (HELB only)

TABLE 3.11-1

SYSTEMS (OR PORTIONS OF SYSTEMS) REQUIRED TO MITIGATE LOSS-OF-COOLANT ACCIDENTS AND/OR HIGH ENERGY LINE BREAKS

Standby AC Power System (Includes Diesel Generators)
120V Vital AC System
Vital 125V DC Control Power System
Diesel Generator Fuel Oil System
Diesel Air Starting System
Emergency Lighting System
Auxiliary Control Air System
Nuclear Instrumentation System
Reactor Protection System
Hydrogen Recombination System
Containment Isolation Systems
Ice Condenser System
Containment Spray System
Residual Heat Removal System
Safety Injection System
Reactor Coolant System
Auxiliary Feedwater System
Containment Air Return Fan System
Essential Raw Cooling Water System
Component Cooling System
Main Steam System
Radiation Monitoring System
Chemical and Volume Control System
Emergency Gas Treatment Air Cleanup System
Auxiliary Building Gas Treatment System
Control Room Area Ventilation System
Engineered Safety Feature Ventilation System
Auxiliary Building Ventilation Subsystems:
- Shutdown Board Room Air Conditioning System
- Auxiliary Board Rooms Air Conditioning System
- Turbine-Driven Auxiliary Feedwater Pump Ventilation
- Shutdown Transformer Room Ventilation System

Essential Raw Cooling Water Intake Pumping Station Heating
Spent Fuel Pool Cooling System
Main Feedwater System
Steam Generator Blowdown System
Hydrogen Ignition System
Auxiliary Boiler System
Feedwater Control System
Sampling System
Containment Lower Compartment Cooling Systems: Fan only (HELB only)

TABLE 3.11-3

COMPLIANCE WITH NRC CRITERIA AND STANDARDS

General Design Criteria 1	See Chapter 17
General Design Criteria 4	See Sections 3.5, 3.6
General Design Criteria 23	See Sections 7.1, 7.3
General Design Criteria 50	See Section 6.2
10 CFR 50, Appendix B, Criterion III	See Chapter 17
Regulatory Guide 1.30	Current activities generally conform to the requirements of N45.2.4.
Regulatory Guide 1.40	See Table 7.1-1
Regulatory Guide 1.63	See Paragraph 8.3
Regulatory Guide 1.73	See Table 7.1-1
Regulatory Guide 1.89	All 10 CFR 50.49 Equipment was qualified to IEEE 323-1971, or IEEE 323-1974
10 CFR 50.49/NUREG-0588	See References 1 and 3

TABLE 3.11-3

COMPLIANCE WITH NRC CRITERIA AND STANDARDS

General Design Criteria 1	See Chapter 17
General Design Criteria 4	See Sections 3.5, 3.6
General Design Criteria 23	See Sections 7.1, 7.3
General Design Criteria 50	See Section 6.2
10 CFR 50, Appendix B, Criterion III	See Chapter 17
Regulatory Guide 1.30	Current activities generally conform to the requirements of N45.2.4.
Regulatory Guide 1.40	See Table 7.1-1
Regulatory Guide 1.63	See Paragraph 8.3
Regulatory Guide 1.73	See Table 7.1-1
Regulatory Guide 1.89	All 10 CFR 50.49 Equipment was qualified to IEEE 323-1971, or IEEE 323-1974
10 CFR 50.49/NUREG-0588	See References 1 and 3