Public Service

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March 28, 1985
Fort St. Vrain
Unit No. 1
P-85112

Regional Administrator
Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

RECEIVED
APR - 2 1985

Attn: Mr. E. H. Johnson

Docket No. 50-267

SUBJECT: 10CFR50.49, Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

REFERENCES: 1) NRC Letter dated 01/28/85, Johnson to Lee (G-85041)

2) PSC Letter dated 02/04/85, Lee to Johnson (P-85033)

Dear Mr. Johnson:

As requested in your letter, Reference 1, we are providing additional information concerning our environmental qualification program.

The attached report answers each of the staff's concerns and includes a schedule for completion of outstanding items.

We trust this information will satisfy any remaining concerns the staff may have. Should any questions arise, please contact Mr. M. H. Holmes at (303) 571-8409.

Very truly yours,

for D. W. Warembourg, Manager
Nuclear Engineering Division

DWW/SM:pa

Attachment w/enclosures

A048 1/1
RETURN ORIGINAL TO RIV

85-132

Reviewed: Concern No.'s 1,6,8 — A. H. Wong

Concern No.'s 2,4,5,7b,7c,7d — J. C. Selan

Concern No.'s 3,7a,9 — N. L. Howard

Attachment to P-85112

Responses to NRC concerns
raised in letter dated January 28, 1985,
Johnson to Lee, (G-85041)

This report summarizes PSC's responses to each of the NRC's concerns raised in a letter dated January 28, 1985, Johnson to Lee (G-85041)

This report follows the general format of first stating the NRC concern followed by PSC's response.

Included with each response is a schedule for completion of any outstanding item.

NRC Concern No. 1

Submit a description of the sequence of events affecting or involving operator action that take place during a turbine building hot reheat pipe rupture. This description should include the operator actions necessary, the equipment that operates as a result of the operator actions, the elapsed time before the required actions are complete, the information available to the operators to inform them of the need to take the actions, and the sequence of events if the operators fail to take the required action.

PSC Response to Concern No. 1

The sequence of the events following all major steam leaks in both the reactor and turbine buildings are shown in the report entitled "Four Minute Isolation of Postulated Steam Line Breaks at the Fort St. Vrain Nuclear Generating Station," included as Enclosure A. The report describes ten (10) design basis pipe breaks along with automatic and manual actions required to isolate these breaks. Elapsed time has been assigned to various functions based on engineering analysis and detailed interviews with site operations training instructors. The report verifies that a Hot Reheat line break in the turbine building can be isolated in 4 minutes or less.

This report results in a very conservative time for isolation of a Turbine Building Hot Reheat line break. This is based on the assumption that, following a turbine trip due to Loss of Condenser Vacuum, the reactor is not scrammed until the low hot reheat pressure setpoint is achieved. In reality, Emergency Procedure F-2 instructs the operator to scram the reactor if he cannot restore condenser vacuum. Thus, the steam leak will be isolated in significantly less time than 4 minutes. If the operator does not scram the reactor manually, it will scram automatically on Low Hot Reheat Pressure. This will alert the operator to take appropriate action as described in Enclosure A. Therefore, the 4 minute isolation shown in the report is to be considered as the worst case.

NRC Concern No. 2

The best information currently available for LWRs indicates that an acceptable time for operator action commences at 10 minutes after an event initiation, with an additional minute for each discrete operator action. Since FSV is an HTGR, different action times may be appropriate for evaluation of events analyzed as a basis for licensing. Submit a detailed justification that provides assurance that the operators will, for all likely operating contingencies, take the required actions within 4 minutes. To aid the staff in making a determination of the relative consequences of delayed operator action, provide the temperature curves developed assuming that the operators commence isolation at 10 minutes.

PSC Response to Concern No. 2

To verify correct operator action within 4 minutes, PSC performed a detailed task analysis for design basis steamline and feedwater line breaks. This analysis was performed with the assistance of a human factors consultant and a control room operator in our control room mock up. This task analysis verified correct operator action within 4 minutes. The results of this analysis, from a human factors standpoint, are detailed in a letter dated March 28, 1985, Maddox to Niehoff included as Enclosure B.

In order to provide additional assurance of correct operator action, we will revise the appropriate Emergency Procedures to provide a clearer course of action for the operator. This revision will be complete by August 30, 1985.

Based on verbal information received in the February, 1984 meeting between NRC and PSC, PSC began investigating the consequences of utilizing a 10 minute isolation response curve versus the 4 minute curves.

The time versus temperature curves assuming a 10 minute isolation for a reactor building cold reheat line break and a turbine building hot reheat line break are shown in GA Technologies letter dated August 9, 1984. Kowal to Brey (GP-2325). This letter is included as Enclosure C.

It can be readily seen that the temperature for a 10 minute isolation continues to increase beyond that seen with a 4 minute isolation. Application of the 10 minute curve would invalidate the existing environmental qualification for all safe shutdown equipment currently in use.

NRC Concern No. 3

Even though access to any location in the plant is possible before and "shortly" following an accident, the staff's position is that the aging requirements of the DOR Guidelines do apply to FSV. If electrical equipment, safety-related or nonsafety-related, is relied upon to remain functional during and following design basis events, then that equipment must be qualified for the environmental conditions at that location. Any age related degradation which would prevent the equipment from operating as required must be identified and the equipment replaced or repaired as necessary. For the reasons stated above, submit a summary of the FSV maintenance/surveillance program. Include a description of the methods used to maintain the qualification of safety-related equipment, including use of manufacturer's recommended preventive maintenance requirements and use of aging considerations.

PSC Response to Concern No. 3

PSC has concluded in previous submittals that we have an adequate basis for our approach to the 10 CFR 50.49 aging requirements. We still regard our basis as sound.

To resolve the aging concern, PSC will establish an aging qualification program.

PSC has contracted with Wyle Laboratories to evaluate the effects of aging on PSC's environmental qualification program. This program will be utilized to establish a maintenance/surveillance program for safe shutdown electrical equipment located in harsh environments.

The program will consist of several phases. Each phase is identified below, with the expected completion date.

A. Establish data files on safe shutdown electrical equipment located in harsh environments. This phase will be completed by July 26, 1985.

B. Identify equipment that is subject to aging using either test data or Arrhenius models. This will be complete by no later than November 30, 1985.

C. Determine replacement intervals for age sensitive materials as required. Any component determined to have exceeded its qualified life will be replaced as soon as purchasing, plant operations, and plant maintenance schedules will allow.

D. Incorporate aging qualification information into our documentation system. A design document update package for this phase will be complete by March 28, 1986.

E. Incorporate component replacement intervals into our maintenance program. This will be complete no later than March 28, 1986.

F. Establish interim controls to ensure age sensitive components are adequately controlled until the formal documentation is issued.

NRC Concern No. 4

Confirm that an operability time has been established for each item of safety-related electrical equipment that is in a harsh environment and is required to operate or not fail following an accident. The accidents analyzed should include all accidents which will cause a significant adverse environment to electrical equipment.

PSC Response to Concern No. 4

Operability times have not been established for specific items of safety related electrical equipment. Operability times will be established in conjunction with our aging qualification program. This will be complete by November 30, 1985.

NRC Concern No. 5

The previous FSV justification for not using replacement parts qualified to 10 CFR 50.49 is inadequate. Regulatory Guide 1.89, Rev. 1, June 1984, paragraph C6, lists those reasons that the staff regards as adequate.

PSC Response to Concern No. 5

PSC considers the following as applicable reasons for not qualifying replacement parts to 10 CFR 50.49.

A. The item of equipment to be replaced is a component of equipment that is routinely replaced as part of normal equipment maintenance, e.g. gaskets, o-rings, coils; these may be replaced with identical components.

B. The item to be replaced is a component that is part of an item of equipment qualified as an assembly; these may be replaced with identical components.

C. Identical equipment to be used as a replacement was on hand as part of the utilities stock prior to February 22, 1983.

D. The requirements of 10 CFR 50.49 are not all applicable to the FSV EQ program.

NRC Concern No. 6

Submit all applicable justifications for continued operation (JCOs) that are currently being relied upon and confirm the following for each JCO associated with equipment that is assumed to fail:

> No significant degradation of any safety function or misleading information to the operator as a result of failure of equipment under the accident environment resulting from a design basis event will occur.

PSC Response to Concern No. 6

In our letter dated March 25, 1985, Lee to Johnson (P-85103) we certified that we are in full compliance with 10 CFR 50.49 as it applies to the FSV HTGR.

Although there are certain technical issues as addressed herein that require resolution, there are no items that require JCO's within the provisions of 10 CFR 50.49.

NRC Concern No. 7a

The licensee should confirm that, in performing its review of the methodology to identify equipment within the scope of 10 CFR 50.49 (b)(2), that:

A list was generated of safety-related electrical equipment as defined in paragraph (b)(1) of 10 CFR 50.49 required to remain functional during or following design basis accidents. These accidents are the only design-basis accidents which result in significantly adverse environments to electrical equipment which is required for safe shutdown or accident mitigation. The list was based on reviews of the Final Safety Analysis Report (FSAR), Technical Specifications, Emergency Operating Procedures, Piping and Instrumentation Diagrams (P&IDs), and electrical distribution diagrams.

PSC Response to Concern No. 7a

As detailed in our response to NRC Concern No. 8, only two accidents result in harsh environments. These accidents are High Energy Line Breaks (HELB) and Rapid Depressurization of the PCRV (DBA#2). Since HELBs cause a more severe environment than DBA#2, safe shutdown equipment qualified for a HELB is also qualified for DBA#2; therefore, safe shutdown equipment has been qualified to withstand HELBs.

Our safety related components list (SR-6-2) identifies our safe shutdown equipment, both electrical and mechanical. This list was based on the FSAR, Design Basis Events, Process and Instrumentation diagrams, and electrical schematic diagrams. We recently completed an audit which verified that equipment required to mitigate HELBs is classified as safe shutdown equipment and included in SR-6-2.

NRC Concern No. 7b

The licensee should confirm that, in performing its review of the methodology to identify equipment within the scope of 10 CFR 50.49 (b)(2), that:

The elementary wiring diagrams of the safety-related electrical equipment identified in Step a. were reviewed to identify any auxiliary devices electrically connected directly into the control or power circuitry of the safety-related equipment (e.g., automatic trips) whose failure due to postulated environmental conditions could prevent required operation of the safety-related equipment;

PSC Response to Concern No. 7b

We recently completed an extensive program to highlight specific safe shutdown control and instrumentation wiring for equipment in harsh environments. All components whose failure could prevent operation of safety functions were classified as safety related, as defined in our FSAR.

A similar program to highlight specific safe shutdown power wiring for equipment in harsh environments is underway. The program on power wiring will be completed by November 30, 1985.

NRC Concern No. 7c

The licensee should confirm that, in performing its review of the methodology to identify equipment within the scope of 10 CFR 50.49 (b)(2), that:

The operation of the safety-related systems and equipment were reviewed to identify any directly mechanically connected auxiliary systems with electrical components which are necessary for the required operation of the safety-related equipment (e.g., cooling water for lubricating systems). This involved the review of P&IDs, component technical manuals, and/or systems descriptions in the FSAR.

PSC Response to Concern No. 7c

As stated in our response to Concern No. 7a above, our SR-6-2 listing also includes mechanical systems and equipment. Mechanical systems and equipment originally reviewed and established as required for safe shutdown cooling were incorporated into this listing. Electrical equipment required for the proper operation of safe shutdown mechanical systems and equipment has been qualified in accordance with our EQ program.

NRC Concern No. 7d

The licensee should confirm that, in performing its review of the methodology to identify equipment within the scope of 10 CFR 50.49 (b)(2), that:

Nonsafety-related electrical circuits indirectly associated with the electrical equipment identified in Step a. by common power supply or physical proximity were considered by a review of the electrical design including the use of applicable industry standards (e.g., IEEE, NEMA, ANSI, UL, and NEC) and the use of properly coordinated protective relays, circuit breakers, and fuses for electrical fault protection.

PSC Response to Concern No. 7d

PSC's recently completed program which highlighted safe shutdown circuitry, confirmed that all electrical equipment within the fuse boundary of safe shutdown equipment were designated as safety related as defined in our FSAR.

Protective coordination studies exist for breakers and protective relays in our 480 V switchgear, both safety related and non-safety related.

However, we do not have complete protective coordination studies for our Motor Control Center (MCC) breakers, our molded case breakers, and our fuses. Operating experience has confirmed the proper sequencing of these devices. A selective sampling of these devices will be reviewed to confirm proper sequencing. This will be done by July 26, 1985.

NRC Concern No. 8

Provide confirmation that all design basis events which could potentially result in a harsh environment, including flooding, were addressed in identifying safety-related electrical equipment within the scope of 10 CFR 50.49 (b)(1).

PSC Response to Concern No. 8

There are two Design Basis Events (DBE) which would result in harsh environments at Fort St. Vrain.

High Energy Line Breaks (HELBs) are the basis for environmental qualification at FSV.

A Rapid Depressurization of the PCRV (identified as DBA #2 in FSAR Sections 14.11 and 1.4.5.4) is the result of a sudden failure of both the primary and secondary closure of a PCRV penetration. Although the temperature of the primary coolant is much greater than that of cold reheat steam, the heat transfer coefficient of helium is much lower than that of steam. Furthermore, the DBA #2 accident is short term (typically less than 2 minutes). Therefore, the overall effects on instrument skin temperature due to a DBA #2 would be less than the effects of a cold reheat line break.

The FSAR has also considered various flooding incidents.

Water is not used as the primary coolant nor is it used for emergency core spray; in addition the volume of the Reactor Building keyway is large enough to accommodate large quantities of water. Therefore, submergence or flooding in the Reactor Building is not a concern.

FSAR section 10.2.8 has analyzed a large leak of the condensate storage tanks (largest source of water located in the Turbine Building) and has determined this will not jeopardize safe shutdown of the reactor.

FSAR section 2.5.3 considers the case of the 500-year flood. It is concluded that this flood will reach a high level of 4736 feet. The floor level of the bottom floor of the Reactor Building is 4740 feet, with grade level at 4790 feet.

Therefore, flooding does not cause harsh environments at FSV.

NRC Concern No. 9

Confirm that the electrical equipment within the scope of 10 CFR 50.49(b)(3) is all RG 1.97 Category 1 and 2 equipment or that justification for continued operation has been provided for any such equipment not included in the EQ program.

PSC Response to Concern No. 9

In our letter dated February 28, 1985, Warembourg to Johnson (P-85065) we provided a list of our RG 1.97 equipment.

In our letter dated March 25, 1985, Lee to Johnson, (P-85103) we confirmed that our RG 1.97 equipment is qualified in accordance with our EQ program.

A design document update package to verify the qualification of this equipment will be in our system by September 30, 1985.

Summary of Completion Schedule for Outstanding Items

Outstanding Item	Completion Date
Review Proper Coordination of Selected MCC Breakers, Molded Case Breakers, and Fuses	July 26, 1985
Establishment of Aging Data Files	July 26, 1985
Revision of Emergency Procedures	August 30, 1985
Incorporation of RG 1.97 Equipment Qualification into our Document System	September 30, 1985
Identification of Equipment Subject to Aging	November 30, 1985
Establishment of Operability Times	November 30, 1985
Review and Highlight Safe Shutdown Power Wiring	November 30, 1985
Incorporation of Aging Information into our Document System	March 28, 1986
Incorporation of Component Replacement Intervals into our Maintenance Program	March 28, 1986

ENCLOSURE A

Public Service
Public Service Company of Colorado

Interoffice Memo

NDG-84-0631

Date September 12,1984

To J. Reesy, Nuclear Design Manager — NED - Diamond Hill (Department or Division)

From S. Marquez, K. Dvorak - Engineers — NED - Diamond Hill (Department or Division)

Attn.

Subj. Validation of Four Minute Isolation of Steam Line Ruptures

Attached is a report which validates the four minute steam line rupture curves used for environmental qualification. All major steam line breaks were studied and all were determined terminated in less than four minutes. No installation of new equipment or new computer runs are required.

Sam Marquez 9/12/84
S. Marquez

Ken Dvorak 9/12/84
K. Dvorak

Approvals:

Greg Bates
G. S. Bates

F. W. Tilson
F. W. Tilson

SM/KD/dh

Attachment

FORM (A) 850-22-0058