Omaha Public Power District
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402/536-4000

July 3, 1984
LIC-84-207

Mr. Harold R. Denton, Director
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Denton:

Environmental Qualification
of Safety-Related Electrical Equipment
at Fort Calhoun Station - Request for Extension

The Omaha Public Power District, in April, 1984, (Letter W. C. Jones to H. R. Denton, dated 4/3/84) requested an exemption from the schedule requirements of 10 CFR 50.49. This extension was requested to allow adequate time to complete qualification testing of the electrical penetration subassemblies. By letter dated May 18, 1984, the District was granted an extension until September 30, 1984, for the qualification of these penetration assemblies.

During the week of June 18, 1984, the District received preliminary test results from the test laboratory which had been conducting environmental qualification testing on the electrical penetration assemblies. The preliminary results were confirmed and to eliminate uncertainty regarding the reportability of these findings, the District classified the incident as a "significant event" pursuant to 10 CFR 50.72 and made the appropriate 4-hour verbal notification. This notification was accomplished on June 22, 1984.

As a follow-up to that notification, on Monday, June 25, 1984, the District held a phone conversation with Mr. James R. Miller (Chief, ONRR) and Mr. E. G. Tourigny (NRC Project Manager for Fort Calhoun) of your office to inform the NRC of the problem with the environmental qualification of this electrical equipment and the District's plans for resolution.

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The test results indicated that the failure occurred during the MSLB/LOCA profile test which includes the stress parameters of steam, pressure, and chemical spray. The District inspected the penetration assembly and determined that the teflon insulation on the lead wires had become brittle and had cracked. Based upon this, the penetrations were unable to fulfill their electrical function. The failure appears to be due to an interaction between the steam/spray environment and the radiation-weakened lead wire insulation.

The District has concluded that the damage can only occur to the lead wire insulation after accumulation of high radiation doses and in the presence of a pressure/steam environment. We also believe that the only DBA for which these conditions will be present is a Large Break LOCA accompanied by high radiation resulting from fuel damage. Because the failure mechanism is dependent upon the accumulation of a significant radiation dose, the insulation breakdown is not expected to occur at the onset of a design basis accident. However, some modification is necessary to ensure that the reactor could be maintained in a safe condition following such an event. Accordingly, a two phase approach to resolution of the problem is being pursued.

Phase I consists of modifying those penetrations which are required to ensure the ability to achieve long term core cooling or to provide post-accident monitoring capability. These modifications are described in Attachment A. These modifications either are completed or will be completed prior to achieving Mode 2 as defined in the Fort Calhoun Technical Specifications. The remaining assemblies either do not accomplish a post-LBLOCA mitigation function, complete their accident function prior to the accumulation of a large radiation dose, or can be controlled administratively, as described in Attachment A. The qualification of the remaining components will be completed in Phase II.

The completion of Phase II will require an extended outage. The District's next refueling outage is scheduled for the fall of 1985. Therefore, pursuant to 10 CFR 50.49(h), the District respectfully requests an additional extension until November 30, 1985. Attachment B contains the District's revised justification for continued operation until completion of qualification of electrical equipment at Fort Calhoun Station can be accomplished.

Sincerely,

R. L. Andrews
Division Manager
Nuclear Production

RLA/DJM/rh-B

Attachments

cc: LeBoeuf, Lamb, Leiby & MacRae
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Mr. E. G. Tourigny, NRC Project Manager

Mr. L. A. Yandell, Senior Resident Inspector

Attachment A

Technical Discussion
of
Environmental Qualification Testing of
Electrical Penetrations

The Fort Calhoun Station containment electrical penetration system provides a dual function of passing electric power into containment and instrument signals out of containment via insulated conductors, and at the same time sealing the conductors to provide containment integrity (refer to USAR Section 5.9.3 for a description of the penetrations). This function is accomplished by the use of subassemblies which are inserted in a penetration canister. Each subassembly is made up of a stainless steel tube (sheath) through which a lead wire, or wires (depending on the type) are run and sealed at both ends. The penetration system subassembly types are multiconductor low voltage (600 V), single conductor low voltage, medium voltage (4160V), coaxial, triaxial, and thermocouple lead wires. The subassemblies under discussion are the multiconductor low voltage (120V and 480V single and three phase power, A.C. control, D.C. control, and instrumentation) and/or thermocouple configurations. These particular multiconductor penetrations use FEP teflon as the lead wire insulation, and TFE teflon as the seal material in the subassembly.

Because the DOR Guidelines for electrical equipment qualification require the sequential testing of equipment containing materials which are susceptible to radiation damage, the District is conducting an environmental qualification test of the low voltage multiconductor penetration subassembly. The sequential test procedure uses IEEE 317-1976 and IEEE 323-1974 as a guide. Plant specific parameters are used to envelope the sequentially applied environmental stress parameters (aging, short circuit and short time overload, seismic, radiation, and MSLB/LOCA, short circuit).

The District was notified by the test laboratory that after irradiation was performed and during the initial MSLB/LOCA profile test (steam, pressure, chemical spray) an insulation breakdown had occurred. After an inspection by the District and after an evaluation of the information resulting from that inspection, it was determined that the teflon lead wire insulation had become brittle and cracked. It is the District's judgement, based on test evidence, that the penetrations failed to perform their electrical function. The failure appears to be an interaction of the steam/spray environment and the radiation weakened lead wire insulation. The penetration had in fact passed functional tests following radiation exposure, using the outboard (auxiliary building side) seal as the pressure boundary. It is the District's conclusion that damage to the lead wire insulation occurs only after accumulation of a high radiation dose and a pressure/steam environment. It is also the District's judgement that this environment is present only during LBLOCA in which fuel damage occurs releasing fission products. It should be noted that even in the case of a LBLOCA, all equipment is expected to complete its immediate accident function (e.g., reactor trip, safeguards initiation, etc.).

The District is taking a two phase approach to achieve qualification. Phase I, as discussed in the following paragraphs, modifies selected electrical penetrations needed to accomplish long term core cooling or accomplish post-accident monitoring after a Large Break LOCA (LBLOCA). Additionally, administrative control will be established for dealing with the assemblies not required

after a LBLOCA. These controls will be established prior to achieving Mode 2 as defined in the Fort Calhoun Station Technical Specifications. Phase II will address and resolve the Electrical Equipment Qualification-related circuits not modified in Phase I by the requested extension date of November 30, 1985.

Phase I

The District will have upgraded all subassemblies associated with equipment which must be energized to accomplish long term core cooling or accomplish post-accident monitoring prior to Mode 2. The balance of equipment which is Electrical Equipment Qualification (EEQ) related either does not accomplish a mitigation function in a LBLOCA (e.g., the Auxiliary Feedwater System), completes its function before failure (e.g., reactor trip) or can be dealt with administratively. The modifications to the subassemblies are designed to ensure electrical integrity and in doing so also ensure containment integrity. The modifications used a combination of qualified heat shrink tubing to sleeve the lead wires and qualified room temperature vulcanizing (RTV) silicone rubber to seal the heat shrink covered lead wire interface at the subassembly seal by sealing the area between the heat shrink and the stainless steel sheath. Both materials were designed for the purpose which the modifications require. The Raychem heat shrink tubing is qualified for a LOCA in Wyle Laboratories report number 58442-1, including electrical properties. The Dow Corning RTV is qualified by a combination of testing and District analysis. The RTV seals and provides additional electrical insulation at the interface as discussed in Dow Corning Bulletin 61-016a. The RTV has been checked to insure bonding on the Raychem heat shrink tubing and stainless steel subassembly sheath. The teflon has been completely surrounded by the RTV or Raychem. The District has also shortened the teflon insulated lead wires.

Administrative controls will be established prior to Mode 2 to provide direction to operating personnel in the event it becomes necessary to assure proper positioning of pilot-solenoid air-operated valves following a LBLOCA. An analysis of the failiure mechanism indicates the possibility for three instances where this administrative control would be required. The first possibility is that of shorting the solenoid lead wire with the position indication lead wire, causing the valve to change position. Secondly, shorting may cause the loss of position indication. Thirdly, shorting may cause the operator to receive misleading indication (e.g., the valve is indicated to be both open and closed at the same time). The administrative controls are procedural in nature and direct the operator to fail the instrument air supply to containment in the event undesired valve repositioning occurs, or misleading information is indicated. This allows the operator to achieve the desired valve position, regardless of indication.

Phase II

The District will complete the environmental qualification of the remaining penetration assemblies by the requested extension date of November 30, 1985.

Attachment B

Justification for Continued Operation

10 CFR 50.49(i) provides guidance concerning those items which should be considered in development of a justification for continued operation until that time when equipment qualification can be established. The justification should include consideration of the following items:

(1) Accomplishing the safety function by some designated alternative if the principal equipment has not been demonstrated to be fully qualified:

District's Position:

Those assemblies which must function following a DBA of the type expected to induce the failure (i.e., Large Break LOCA) have been modified to alleviate this concern. Administrative controls will be established prior to achieving Mode 2 for a limited number of situations where the failure of electrical equipment has the potential for providing the operator with misleading information. It is expected that solenoid-operated valves will fail in their accident positions. For any indication to the contrary, the operators are instructed to fail the instrument air to containment, thus ensuring the valve is positioned in its desired position. The remaining EEQ-related assemblies will be qualified by the end of the next scheduled refueling outage.

(2) The validity of partial test data in support of the original qualification:

District's Position:

Preliminary test data indicates that the failure was induced by stresses which would only be present as a result of a Large Break LOCA (i.e., high radiation levels combined with a steam environment). Equipment required to mitigate a LBLOCA has been modified. The remaining equipment can be justified for continued operation based upon the fact the failure mechanism is due to DBA conditions for which that equipment is not required. Further, the Phase I modification utilizes qualified components and methods previously found acceptable.

(3) Limited use of administrative controls over equipment that has not been demonstrated to be fully qualified:

District's Position:

Administrative controls will be established prior to achieving Mode 2 for a limited number of situations where the failure of electrical equipment has the potential for providing the operator with misleading information. It is expected that solenoid-operated valves will fail in their accident positions. For any indication to the contrary, the operators are instructed to fail the instrument air to containment, thus ensuring the valve is positioned in its position.

Additionally, any electrical shorting between the solenoid-operated valve and its position indication is not expected to cause valve repositioning. Circuit design is such that shorting would result in either loss of position indication or indication that the valve was simultaneously opened

and closed. In either of these instances, procedures call for the operator to fail instrument air to containment, thus ensuring that no valve repositioning takes place.

(4) Completion of the safety function prior to exposure to the accident environment resulting from a design basis event and ensuring that the subsequent failure of the equipment does not degrade any safety function or mislead the operator:

District's Position:

Certain of the subassemblies could not be classified as completing their design function prior to exposure to the failure-inducing LBLOCA environment. These subassemblies have been modified as a part of Phase I. The remaining assemblies (those assemblies who will complete their accident function prior to exposure to the failure-inducing environment or those whose accident function is not required after a LBLOCA - the only DBA expected to induce failure) can be justified for continued operation until qualification.

(5) 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:

District's Position:

Phase I modified all subassemblies whose failure (post-LOCA) would adversely affect a post-LBLOCA safety function. The remaining assemblies are justified for continued operation until qualified.

Additionally, administrative controls will be established prior to achieving Mode 2 to ensure that the operator is not misled by confusing information resulting from the failure of any of these subassemblies. (See (3) above)

Based upon these five items, continued operation of the Fort Calhoun Station until the requested extension date of November 30, 1985, is justified.