



ARKANSAS POWER & LIGHT COMPANY

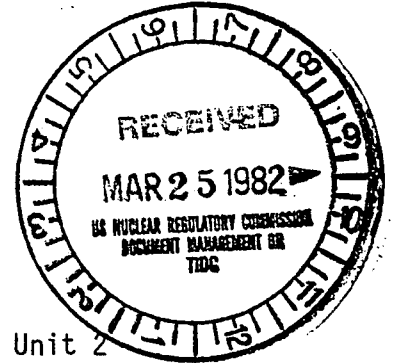
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

March 18, 1982

REG FILE COPY

2CAN038210

Director of Nuclear Reactor Regulation
ATTN: Mr. Robert A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555



Subject: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Environmental Qualification of
Safety-Related Electrical Equipment
(File: 2-1510.6)

Gentlemen:

Per telephone conversations between Mr. Robert Martin of your staff and Mr. Dan Howard of AP&L, AP&L agreed to provide additional information and/or clarification relative to our submittal of February 27, 1982 (0CAN028211), to Mr. D. G. Eisenhut from Mr. J. R. Marshall. The February 27, 1982, submittal provided justification for interim operation pending resolution of outstanding items relative to environmental qualification of safety-related electrical equipment.

Attached are revised justifications for continued operation for several of the components contained in our February 27, 1982, submittal. For ease of reference, these pages are identified with the same page number as used in our previous submittal and vertical bars have been used to note the revised portions.

Per Mr. Martin's request, this information is being submitted under oath and the attached form also references the original February 27, 1982, submittal.

Very truly yours,

John R. Marshall
Manager, Licensing

JRM:DRH:s1

Attachment

A048
S/11

8203260154 820318
PDR ADDCK 05000368
P PDR

STATE OF ARKANSAS)
)
COUNTY OF PULASKI)

SS

I, John R. Marshall, being duly sworn, subscribe to and say that I am Manager, Licensing for Arkansas Power & Light Company; that I have full authority to execute this oath; that I have read the documents numbered 0CAN028211 and 2CAN038210 and know the contents thereof; and that to the best of my knowledge, information and belief the statements in it are true.

John R. Marshall

SUBSCRIBED AND SWORN TO before me, a Notary Public in and for the County and State above named, this 19 day of March, 1982.

Glenn B. Charles
Notary Public

My Commission Expires:

12-20-82

Attachment I

ARKANSAS NUCLEAR ONE

UNIT 2

REVISED JUSTIFICATIONS FOR INTERIM
OPERATION FOR ENVIRONMENTAL
QUALIFICATION DEFICIENCIES

March 18, 1982

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Motor Operator for Steam Supply Valve to the Turbine Driven
Emergency Feedwater (EFW) Pump

TAG NO(S): 2CV-0340-2

SER RESPONSE PAGE NO(S): B003

MANUFACTURER AND MODEL NO.: Limitorque SMB-00

SYSTEM - P&ID NO.: Main Steam System M-2202

LOCATION: Room 2043

• SAFETY FUNCTION:¹

The EFW system provides a means of supplying water to the intact steam generator(s) following a postulated main steam break or loss of main feedwater, for the purpose of decay heat removal and cooldown to conditions where the shutdown cooling system can be placed in operation.

This valve opens automatically on an Engineered Safeguard Features Actuation Signal (ESFAS), admitting steam to the trip and throttle valve of the turbine driven EFW pump. The valve may also be manually actuated from the control room.

• QUALIFICATION DISCREPANCY:

This valve operator utilizes a DC motor for which no traceable qualification data regarding harsh environment is currently available. The maximum harsh temperature environment in this case would be caused by a postulated rupture of a main feedwater line. A conservative HELB analysis² indicates a maximum harsh condition of 214°F and 1.02 psig, and a non-harsh radiation environment.³ The analysis also indicates a return to ambient temperature conditions within one hour.

• JUSTIFICATION FOR INTERIM OPERATION:

1. The significant potential damage mechanism is the effect of high temperature on the motor insulation. The insulation class for this motor is the same as that for the qualified limitorque AC motor. The motors are Class B. They are capable of withstanding a 100°C rise above ambient temperature (40°). The short time HELB temperature is conservatively estimated to be 214°F (Max) for a very short period. This equates to 101°C, which is 29°C below the insulation rating of ±20°C. (Appendix to IEEE 117-1974.)

• JUSTIFICATION FOR INTERIM OPERATION: (continued)

They are totally enclosed motors which gives protection from water, steam, etc. This protection further delays damage due to a steam atmosphere.

Limitorque tested Class B A.C. motors (including two Reliance motors) for over 24 hours at 250°F and 25 PSIG in a steam chamber with no failures. (Report No. B0003) Limitorque also tested a Class B A.C. motor with a Class B brake on an earlier test (F-C3271) at a maximum 212°F for approximately 6 hours with no damage or failure. The motor was a Reliance Class B, Frame P, 56 A.C. motor. Operability of these motors was demonstrated during and after the test.

A Porter D.C. motor with Class H insulation was tested for 25 hours in a steam chamber with a maximum temperature of 343°F and 105 PSIG pressure. (Limitorque B-0009.) This information shows the motor brushes and commutator are not harmed by the steam environment. Operability of the motor was demonstrated during and following the test.

All of the motors in the reports were 56 Frame size or 184 Frame size. The A.C. motors were 4 and 2-pole, giving them a speed of around 3400 or 1700 rpm, and the D.C. motors were compound wound to give approximately 1900 rpm. Their weights vary from around 50 to 75 pounds depending on features such as brakes. All are relatively small motors and are built similarly.

It is therefore concluded that:

- a. Class B (a generic insulation class that applies to motors, coils, etc.) can withstand the steam and temperature environment described.
 - b. The brushes on the motor do not cause malfunction.
2. The motor driven EFW pump could provide adequate cooling capability if the turbine drive EFW pump were not available. Qualification of the EFW pump motor is discussed for item 2PM-7B.

Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

• REFERENCES

1. ANO Unit 2 FSAR, pp. 10.4-24 through 10.4-30a.
2. NUS Report 1957-SA-A9, Rev. 2, "Calculation of Maximum Harsh T/H Environmental Conditions for ANO-2 Auxiliary Building for 79-10B Analysis," pp. 47-51.
3. NUS Report 1957-SA-A12, "Electrical Equipment Integrated Dose Analysis for ANO Units 1 and 2," pp. 26, 27.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Motor Operator for Service Water Supply Valve to Emergency Feedwater (EFW) Pump 2P7A

TAG NO(S).: 2CV-0711-2

SER RESPONSE PAGE NO(S).: B006

MANUFACTURER AND MODEL NO.: Limitorque Mod. No. SMB-000-5

SYSTEM - P&ID NO.: Emergency Feedwater System M-2204

LOCATION: Room 2024

• SAFETY FUNCTION¹:

The EFW system provides a means of supplying water to the intact steam generator(s) following a postulated main steam break or loss of main feedwater, for the purpose of decay heat removal and cooldown to conditions where the shutdown cooling system can be placed in operation.

This backup supply valve provides one of several alternate services of emergency feedwater. If the normal condensate supply is unavailable, this valve is automatically opened (and the corresponding valve from the condensate supply is closed), allowing service water to be supplied to the EFW pump suction. This valve has a redundant counterpart that performs the same function for the other EFW pump.

• QUALIFICATION DISCREPANCY:

This valve operator utilizes a DC motor for which no traceable qualification data regarding harsh temperature environment is currently available. The maximum harsh environment in this case would be caused by a postulated rupture of a main feedwater line. A conservative HELB analysis² indicates a maximum harsh condition of 214°F and 1.02 psig, and a non-harsh radiation environment³. The analysis also indicates a return to ambient temperature conditions within one hour.

• JUSTIFICATION FOR INTERIM OPERATION:

There are several reasons why interim operation is justified:

1. The significant potential damage mechanism is the effect of high temperature on the motor insulation. The insulation class for the motor is the same as that for the qualified Limitorque

• JUSTIFICATION FOR INTERIM OPERATION: (continued)

AC motor. The motors are Class B. They are capable of withstanding a 100°C rise above ambient temperature (40°). The short time HELB temperature is conservatively estimated to be 214°F (Max) for a very short period. This equates to 101°C, which is 29°C below the insulation rating of ±20°C. (Appendix to IEEE 117-1974.)

They are totally enclosed motors which gives protection from water, steam, etc. This protection further delays damage due to a steam atmosphere.

Limatorque tested Class B A.C. motors (including two Reliance motors) for over 24 hours at 250°F and 25 PSIG in a steam chamber with no failures. (Report No. B0003) Limatorque also tested a Class B A.C. motor with a Class B brake on an earlier test (F-C3271) at a maximum 212°F for approximately 6 hours with no damage or failure. The motor was a Reliance Class B, Frame P, 56 A.C. motor. Operability of these motors was demonstrated during and after the test.

A Porter D.C. motor with Class H insulation was tested for 25 hours in a steam chamber with a maximum temperature of 343°F and 105 PSIG pressure. (Limatorque B-0009.) This information shows the motor brushes and commutator are not harmed by the steam environment. Operability of the motor was demonstrated during and following the test.

All of the motors in the reports were 56 Frame size or 184 Frame size. The A.C. motors were 4 and 2-pole, giving them a speed of around 3400 or 1700 rpm, and the D.C. motors were compound wound to give approximately 1900 rpm. Their weights vary from around 50 to 75 pounds depending on features such as brakes. All are relatively small motors and are built similarly.

It is therefore concluded that:

- a. Class B (a generic insulation class that applies to motors, coils, etc.) can withstand the steam and temperature environment described.
 - b. The brushes on the motor do not cause malfunction.
2. For the accident/event scenarios that would reasonably be expected, immediate (therefore electrical) operation is not required to assure safety. The postulated harsh environment would be dissipated in sufficient time for handwheel operation, in the unlikely event that the valve had failed to operate electrically. Hand operation would not be required until all other water supply sources were depleted or rendered unavailable.

• JUSTIFICATION FOR INTERIM OPERATION: (continued)

3. This valve has a redundant seismic category 1 counterpart (2CV-0716-1) which supplies the other EFW pump. The redundant valve has no qualification discrepancies.
4. In addition to the redundant, qualified Category I valve (2CV-0716-1) alternate supply paths for emergency feedwater are available from valves 2CV-0706 (normal suction path) and 2CV-0707 (condensate storage tank).

Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

• REFERENCES

1. ANO Unit 2 FSAR, pp. 10.4-24 through 10.4-30a.
2. NUS Report 1957-SA-A9, Rev. 2, "Calculation of Maximum Harsh T/H Environmental Conditions for ANO-2 Auxiliary Building for 79-10B Analysis," pp. 47-51.
3. NUS Report 1957-SA-A12, "Electrical Equipment Integrated Dose Analysis for ANO Units 1 and 2," pp. 26, 27.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Motor Operator for Emergency Feedwater (EFW) Pump 2P7A
Suction Valve (normal supply)

TAG NO(S): 2CV-0795-2

SER RESPONSE PAGE NO(S): B013 (see also B006)

MANUFACTURER AND MODEL NO.: Limitorque Model SMB-00-7½

SYSTEM - P&ID NO.: Emergency Feedwater System M-2204

LOCATION: Room 2024

• SAFETY FUNCTION:

The EFW system provides a means of supplying water to the intact steam generator(s) following a postulated main steam break or loss of main feedwater, for the purpose of decay heat removal and cooldown to conditions where the shutdown cooling system can be placed in operation.

This valve is normally open, providing the normal EFW suction path from the startup and blowdown demineralizer effluent or condensate storage tank. The valve closes on low condensate suction line pressure if condensate becomes unavailable, and suction is obtained from the service water system. This valve has a redundant counterpart that performs the same function for EFW pump 2P7B.

• QUALIFICATION DISCREPANCY:

This valve operator utilizes a DC motor for which no traceable qualification data regarding harsh temperature environment is currently available. The maximum harsh environment in this case would be caused by a postulated rupture of a main feedwater line. A conservative HELB analysis² indicates a maximum harsh condition of 214°F and 1.02 psig, and a non-harsh radiation environment.³ The analysis also indicates a return to ambient temperature conditions within one hour.

• JUSTIFICATION FOR INTERIM OPERATION:

There are several reasons why interim operation is justified:

1. The significant potential damage mechanism is the effect of high temperature on the motor insulation. The insulation class for this motor is the same as that for the qualified Limitorque

• JUSTIFICATION FOR INTERIM OPERATION: (continued)

AC motors. The motors are Class B. They are capable of withstanding a 100°C rise above ambient temperature (40°). The short time HELB temperature is conservatively estimated to be 214°F (Max) for a very short period. This equates to 101°C, which is 29°C below the insulation rating of ±20°C. (Appendix to IEEE 117-1974.)

They are totally enclosed motors which gives protection from water, steam, etc. This protection further delays damage due to a steam atmosphere.

Limitorque tested Class B A.C. motors (including two Reliance motors) for over 24 hours at 250°F and 25 PSIG in a steam chamber with no failures. (Report No. B0003) Limitorque also tested a Class B A.C. motor with a Class B brake on an earlier test (F-C3271) at a maximum 212°F for approximately 6 hours with no damage or failure. The motor was a Reliance Class B, Frame P, 56 A.C. motor. Operability of these motors was demonstrated during and after the test.

A Porter D.C. motor with Class H insulation was tested for 25 hours in a steam chamber with a maximum temperature of 343°F and 105 PSIG pressure. (Limitorque B-0009.) This information shows the motor brushes and commutator are not harmed by the steam environment. Operability of the motor was demonstrated during and following the test.

All of the motors in the reports were 56 Frame size or 184 Frame size. The A.C. motors were 4 and 2-pole, giving them a speed of around 3400 or 1700 rpm, and the D.C. motors were compound wound to give approximately 1900 rpm. Their weights vary from around 50 to 75 pounds depending on features such as brakes. All are relatively small motors and are built similarly.

It is therefore concluded that:

- a. Class B (a generic insulation class that applies to motors, coils, etc.) can withstand the steam and temperature environment described.
 - b. The brushes on the motor do not cause malfunction.
2. For the accident/event scenarios that would reasonably be expected, immediate (therefore electrical) operation is not required to assume safety. The valve is normally open to allow the EFW pump to draw suction from the Condensate Storage Tank. It is closed only as that tank becomes depleted. At that time, the postulated harsh environment would be dissipated in sufficient time for handwheel operation, in the unlikely event that the valve failed to operate electrically.

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

3. This valve has a redundant, seismic category 1 counterpart (2CV-0789-1), which will supply condensate to EFW Pump 2P7B.
4. Valve 2CV-0716-1 opens to supply emergency feedwater from the service water system.

Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

- REFERENCES

1. ANO Unit 2 FSAR, pp. 10.4-24 through 10.4-30a.
2. NUS Report 1957-SA-A9, Rev. 2, "Calculation of Maximum Harsh T/H Environmental Conditions for ANO-2 Auxiliary Building for 79-10B Analysis," pp. 47-51.
3. NUS Report 1957-SA-A12, "Electrical Equipment Integrated Dose Analysis for ANO Units 1 and 2," pp. 26, 27.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Motor Operator for Steam Supply Valve from Steam Generator
2E24A to Emergency Feedwater (EFW) Pump Turbine

TAG NO(S).: 2CV-1000-1

SER RESPONSE PAGE NO(S).: B025

MANUFACTURER AND MODEL NO.: Limitorque SMB-00-10

SYSTEM - P&ID NO.: Steam Generator Secondary System M-2206

LOCATION: Room 2155

• SAFETY FUNCTION:¹

The EFW system provides a means of supplying water to the intact steam generator(s) following a postulated main steam break or loss of main feedwater, for the purpose of decay heat removal and cooldown to conditions where the shutdown cooling system can be placed in operation.

This valve is one of two series valves (the other is a check valve) supplying steam to the turbine driven EFW pump from steam generator 2E24A. The valve is normally open, and remains open following EFW initiation.

• QUALIFICATION DISCREPANCY:

The motor operator was qualified to a temperature environment of 250°F maximum. Conservative T/H HELB analysis² indicates a maximum harsh temperature condition of 292°F. The analysis also indicates that this temperature would be sustained for 7 minutes or less, and would return to ambient within one hour.

Except for this temperature discrepancy, the actuator has been shown to be fully qualified.

• JUSTIFICATION FOR INTERIM OPERATION:

1. This valve is not required to operate during EFW operation; it is aligned in the safe position prior to and during operation of the EFW system.
2. A redundant qualified valve (2CV-1050-2), also normally open, can supply motive steam to the turbine driven pump if steam generator 2E24B is intact.
3. The motor-driven EFW pump is available to serve the decay heat removal and cooldown functions. Its qualification status is discussed in the Sept. 12, 1981 submittal and this submittal.

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

4. While the actuator is only shown qualified to 250°F, the qualification test allows the entire actuator to reach thermal equilibrium at 250°F for a prolonged period. Hand calculations were performed to determine the temperature rise in this valve operator when exposed to 292°F steam for a period of 7 minutes. These calculations indicate the valve operator internals would not exceed 225°F.

Based on the above analysis, justification for continued operation has been demonstrated.

- REFERENCES

1. ANO Unit 2 FSAR, pp. 10.4-24 through 10.4-30a.
2. NUS Report 1957-SA-A9, Rev. 2, "Calculation of Maximum Harsh T/H Environmental Conditions for ANO-2 Auxiliary Building for 79-10B Analysis," pp. 47-51.
3. NUS Report 1957-SA-A12, "Electrical Equipment Integrated Dose Analysis for ANO Units 1 and 2," pp. 26, 27.
4. IEEE Std 275-1966, "Thermal Evaluation of Insulation Systems for AC Electric Machinery Employing Form-Wound Pre-Insulated Stator Coils, Machines Rated 6900V and Below".
5. ANO Unit 2 Emergency Operating Procedure 2202.06 Rev. 6, "Loss of Reactor Coolant".

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Control Room Emergency Cooling Unit Water Control Valves

TAG NO(S).: 2CV-1506-2, 2CV-1509-2

SER RESPONSE PAGE NO(S).: B076, B078

MANUFACTURER AND MODEL NO.: ITT General AH 93

SYSTEM - P&ID NO.: Service Water M-2210

LOCATION: RM 2139

• SAFETY FUNCTION:

These valves control the flow of cooling water for condensing the refrigerant in the control room emergency cooling units.

• QUALIFICATION DISCREPANCY:

The units have been qualified to more severe conditions than required, except that test Relative Humidity was not 100%.

• JUSTIFICATION FOR INTERIM OPERATION:

Humidity was the only discrepancy. Information recently received from the manufacturer indicates that the valves are capable of operation in a 100% RH environment since they are housed in a NEMA 4 (watertight) enclosure. Based on information now available we now consider these components to be adequately qualified.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Pressurizer Manually Controlled ECCS Vent Valves With
Internal Position Switch

TAG NO(S).: 2CV-4698-1, 2CV-4740

SER RESPONSE PAGE NO(S).: A039

MANUFACTURER AND MODEL NO.: Limitorque SMB-00-10

SYSTEM - P&ID NO.: Reactor Coolant M-2230

LOCATION: Top of Pressurizer, Reactor Building

• SAFETY FUNCTION:

These vent valves provide the capability to manually vent the reactor coolant system (RCS) through the pressurizer. This capability is referenced in the operating procedures as a means of providing core cooling in the event that RCS pressure is above the high pressure injection (HPI) pump shutoff head and no other means of core cooling is available. These valves are installed in series and supplied by separate safety power trains.

• QUALIFICATION DISCREPANCY:

Documentation does not exist to qualify the valve operator for the specified chemical spray of 15000 PPM boric acid, pH of 10.5.

It is qualified to an integrated radiation dose of 1.0×10^7 rads, while the specified dose is 3.3×10^7 rads.

• JUSTIFICATION FOR INTERIM OPERATION:

Although these valves are referenced in the operating procedures as a backup method of core cooling, the FSAR accident analysis shows they are not required since the emergency core cooling system (ECCS) provides adequate cooling over the entire range of postulated break sizes. In addition, the Emergency Feedwater (EFW) System provides a redundant means of providing core cooling and depressurization via the steam generators and atmospheric dump valves.

The radiation specification is for the full dose calculated for 40 years of plant operation plus the 30 day integrated dose resulting from a LOCA.

For the near term, the integrated dose from plant operation is small. Reference to FSAR Table 3.11-1 shows that the accident dose

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

rates are such that the qualified dose level of 1.0×10^7 rad would not be reached until several days into the postulated LOCA. During this time the valve could serve its required function and the unit brought to a safe stable condition.

Chemical spray is also considered an open item for these valves. A drawing review indicates these valves are located beneath the pressurizer missile shield, a 2 inch thick steel plate located over the top of the pressurizer, and are not exposed to chemical spray. However, as the drawings show the valves located near the edge of the pressurizer missile shield, we plan to visually verify the valve location during the upcoming refueling outage. In any event, many other Limitorque SMB type valve operators have been tested and shown not to be affected by chemical spray.

Based on these facts, it is concluded that continued operation of the unit is justified with this component.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Motor Valve Operator and Position Switch for Refueling Water Storage Tank Discharge Valve to Containment Spray and Safety Injection

TAG NO(S).: 2CV-5630-1, 2CV-5631-2

SER RESPONSE PAGE NO(S).: B165 and B166

MANUFACTURER AND MODEL NO.: Rotork 40A

SYSTEM - P&ID NO.: Containment Spray M-2236

LOCATION: Room Number 2062

• SAFETY FUNCTION:

The valve motor operators must close the discharge valves from the refueling water tank 2T3 when the tank has emptied at the end of the injection phase of a LOCA. The position switches indicate the position of the valve to the plant operator.

• QUALIFICATION DISCREPANCY:

Temperature qualification is the only outstanding item. The specified temperature is 212°F, while the motor valve operators and position switches have been qualified to 163°F. This problem is due to a postulated HELB in the auxiliary building, not a LOCA.

• JUSTIFICATION FOR INTERIM OPERATION:

These valves are normally open and are required to close following depletion of the refueling water storage tank (RWST) in the event of a LOCA. The high temperature resulting in a qualification discrepancy is due to a HELB outside containment. In this event the valves serve no safety function since they are normally open and the inventory of the RWST is sufficient to make up for any possible shrinkage of the reactor coolant.

A check valve in line with each of these valves prevents backflow to the tank.

It is therefore concluded that continued operation of the unit is justified.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Control and Penetration Room HVAC Electro Hydraulic Damper
Control Valves with Position Switches

TAG NO(S).: 2E/H-8829-1, 2E/H-8830-2,
2E/H-8831-1, 2E/H-8832-2

SER RESPONSE PAGE NO(S).: B188, B189, B190, B191

MANUFACTURER AND MODEL NO.: ITT General AH96

SYSTEM - P&ID NO.: HVAC - Penetration Rooms M-2264

LOCATION: Room 2049

• SAFETY FUNCTION:

These damper motors control the selection of the redundant emergency ventilation and filtration system. The primary safety function is to remove possible airborne radioactive contamination from the penetration areas and other rooms under LOCA conditions; thereby reducing release of airborne radioactivity to the atmosphere.

• QUALIFICATION DISCREPANCY:

At the time of the original SER response documentation was not available to establish qualification for 100% relative humidity. Information was obtained at a later date removing the discrepancy.

• JUSTIFICATION FOR INTERIM OPERATION:

The standard specifications for this class of operator is NEMA 4 watertite. The operating humidity range is 0-100%, as stated on the manufacturer's data sheets. Based on the above information, we now consider these components to be adequately qualified.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Electrical Penetration

TAG NO(S): 2GEN-1001A

SER RESPONSE PAGE NO(S): A109

MANUFACTURER AND MODEL NO.: Amphenol Sams - Medium Voltage

SYSTEM - P&ID NO.: N/A

LOCATION: Reactor Building

• SAFETY FUNCTION:

- 1) Provide electrical power to medium voltage loads and
- 2) Maintain containment integrity during and after LOCA.

• QUALIFICATION DISCREPANCY:

The containment penetrations are required to operate in the long term recirculation phase following LOCA (30 days). The penetrations must function in the LOCA environment of 289°F maximum temperature. ANO-2 qualification tests were 24 hours in duration with 251°F maximum temperature.

• JUSTIFICATION FOR INTERIM OPERATION:

Generic tests performed on Amphenol-Sams penetrations in 1972 showed that the penetrations were suitable for use at 350°F.¹ In 1975, LOCA tests were performed specifically for ANO-2.² These tests were conducted at temperatures lower than those performed in 1972. The 1972 tests included 4 cycles of thermal transients including one transient at 300°F for 1 hour followed by 250°F for 23 hours. Both the ANO-2 and the generic tests resulted in no electrical degradation or loss of leak tightness.

The ANO-2 containment temperature response after LOCA peaks at 289°F in 50 seconds. The temperature is above 250°F for approximately 15 minutes of the 28 hour transient.³ At no time does the LOCA temperature transient exceed the 1972 test maximum temperature. The LOCA transient temperature exceeds the ANO-2 test temperature for approximately 15 minutes. The short duration of the temperature differential between the ANO-2 test and the LOCA induced transient and the favorable results of the 1972 generic tests give adequate assurance that the penetrations will perform their safety function in the LOCA environment.

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

The containment vapor temperature returns to normal in approximately 28 hours (10^5 seconds) after LOCA.³ The containment environment before and after LOCA is within the normal range. The ANO-2 tests lasted for 24 hours and the generic tests spanned 29 hours when the 4 cycles of transients are considered. Electrical and leak tightness measurements performed before and after the environmental tests confirmed operability in ambient environments. The penetrations will, therefore, perform in the long term ambient environment following LOCA.

The qualification of these penetrations has been previously reviewed by the NRC staff and has been the subject of several previous submittals.^{4,5,6}

- REFERENCES

1. Sorenson, C. C., "Design Verification Test Report No. 123-1275", Amphenol-Sams Division, May 5, 1972
2. Yue, D. D., "Special Prototype Radiation and Environmental (LOCA) Tests of Medium and Low Voltage Electric Penetration Assembly Used on Arkansas Power and Light Company, Arkansas Nuclear One, Unit 2 . . . No. 123-2045," Amphenol-Sams Operation, March 28, 1975
3. "Arkansas Nuclear One, Unit 2, FSAR," Fig. 6.2-13.
4. Letter from D. H. Williams to J. F. Stolz dated May 17, 1978.
5. Letter from D. H. Williams to J. F. Stolz dated July 13, 1978.
6. Letter from D. H. Williams to J. F. Stolz dated May 4, 1978.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Containment Sump Level Indicator

TAG NO(S).: 2LE-5641-2

SER RESPONSE PAGE NO(S).: A080

MANUFACTURER AND MODEL NO.: GEMS XM-54854-56-2000

SYSTEM - P&ID NO.: Containment Spray M-2236

LOCATION: Reactor Building Sump

• SAFETY FUNCTION:

The level transmitter indicates the Reactor Building Sump level by an alarm in the control room. The instrument starts reading at approximately 3½ inches of fluid, and alarms at 5½ inches of fluid in the sump. It indicates level up to the top of the sump. Readings from floor level to 12 feet are obtained from two additional level monitors each consisting of two similar instruments with ranges of 72 inches.

The level transmitter is to indicate sump filling initially which would give warning of a leak or break in the reactor building.

• QUALIFICATION DISCREPANCY:

Documentation does not exist to verify qualification to the following conditions:

Operating time	30 days
Temperature	289°F
Pressure	48 psig
Humidity	100%
Chemical spray	15,000 ppm boric acid at pH 10.5 (77°F)
Radiation	3.3E7 rads
Submergence	

• JUSTIFICATION FOR INTERIM OPERATION:

This instrument was installed during the last outage per requirements of NUREG 0737. Due to the time constraints imposed, the instrument was installed prior to completion of environmental qualification testing. Testing is currently underway and is scheduled for completion by mid 1982. Although documentation does not exist to establish qualification, the instrument was designed to function in an environment exceeding that specified for ANO-2.

• JUSTIFICATION FOR INTERIM OPERATION: (continued)

In the unlikely event of a LOCA, or HELB this instrument would provide verification that adequate level existed in the sump to allow initiation of recirculation and/or containment spray from the sump.

Other instruments located in a mild environment outside the Reactor Building may be used to verify recirculation adequacy. They include the Refueling Water Storage Tank level transmitters, and containment spray flow instruments.

Based on the above information, it is concluded that continued operation is justified.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Containment Spray Pump Motors
TAG NO(S).: 2PM-35A, 2PM-35B
SER RESPONSE PAGE NO(S).: B158, B159
MANUFACTURER AND MODEL NO.: ALLIS CHALMERS GV
SYSTEM - P&ID NO.: Containment Spray M-2236
LOCATION: Room 2007, 2014

• SAFETY FUNCTION:

Provide containment pressure suppression and air cooling during LOCA and post-LOCA conditions.

• QUALIFICATION DISCREPANCY:

The listed discrepancies are operating time, 30 days; temperature, 107°F; pressure, 2.22 psig; humidity, 100%; and radiation, 1.1E7 Rads.

The rating of class B motors envelopes all of the conditions except pressure and radiation. (NEMA MG-1, Section 20-40)

• JUSTIFICATION FOR INTERIM OPERATION:

A temperature of 40°C (104°F - See NEMA MG-1 Sec. 20-40) has been specified for the Class B insulation of these motors. The 3°F differential between the specified and the peak temperature as a result of steam line break is of short duration (less than 1 hr.) and is negligible with respect to both Class B ambient (40°C) and Class B rise (80°C). Maximum pressure and humidity conditions are mild when compared to normal operating conditions.

The motors are open and drip proof. This construction coupled with internal heat generation will preclude moisture damage from condensation. The sole potential damage mechanism is, therefore, radiation. Note that these pumps are not required for mitigation of the steam line break which causes the high temperature, pressure, and humidity conditions. The radiation environment does not occur at the same time as the other elevated conditions, since the high radiation dose occurs during recirculation, at which time temperature, pressure, and humidity are within the normal range.

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

Allis Chalmers catalog information shows that non-hygroscopic impregnated, form-wound coils are used for motor insulation in Class B or Class F applications. Dacron-glass tape, mylar, mica, and polyester varnish are mentioned as materials used for insulating the motors.

Mica is an inorganic compound with a threshold value of 10^8 rads.¹ Dacron-glass tape and mylar are both polyethylene terephthalate² with a radiation damage threshold of 10^8 rads.³ Polyester resins have a damage threshold of between 10^5 and 10^6 rads.² This value was determined from tests on the elastomer rather than on varnish. Other tests on polyester - glass laminates show a threshold of 10^9 rads.⁴ The primary purpose of the varnish is to exclude moisture during non-operating periods. Since the polyester varnish produces a laminated insulation and since the motors will be running when receiving the accident radiation dose, the motors will not fail due to radiation. Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

- REFERENCES

1. Nuclear Engineering Handbook
2. "Radiation Effects of Organic Materials in Nuclear Plants", EPRINP-2129
3. Broadway, N.J. et. al. "Effects of Nuclear Radiation on Elastomeric and Plastic Components and Materials", Battelle Memorial Institute, 1964.
4. Bolt and Carroll, "Radiation Effects on Organic Materials", Academic Press, 1963.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: High Pressure Injection (HPI) Pump Motors

TAG NO(S): 2PM-89A, 2PM-89B, 2PM-89C

SER RESPONSE PAGE NO(S): B153, B154, B155

MANUFACTURER AND MODEL NO.: Allis Chalmers RG

SYSTEM - P&ID NO.: Safety Injection M-2232

LOCATION: Rm. 2009

• SAFETY FUNCTION:

- 1) Provides cooling water to core during a LOCA.
- 2) Provide makeup for reactor coolant shrinkage due to steam line break.
- 3) Provide recirculation to core after LOCA. This function is initiated by the Recirculation Actuation Signal (RAS) on low level in the Reactor Water Tank (RWT). HPI pumps start on low pressurizer pressure or high containment pressure signals (see FSAR Table 7.2.4).

• QUALIFICATION DISCREPANCY:

The listed discrepancies are operating time, 30 days; temperature, 107°F, pressure, 2.22 psig; humidity, 100%, and radiation, 7.0E6 RADS. The rating of class F motor envelopes all of the conditions except pressure and radiation. (NEMA MG-1 Sec. 20-40).

• JUSTIFICATION FOR INTERIM OPERATION:

A temperature of 40°C (104°F - See NEMA MG-1 Sec. 20-40) has been specified for the Class F insulation of these motors. The 3°F differential between the specified and the peak temperature as a result of steam line break is of short duration (less than 1 hr) and is negligible with respect to both Class F ambient (40°C) and Class F rise (115°C). Maximum pressure and humidity conditions are mild when compared to normal operating conditions.

The motors are open and drip proof. This construction coupled with internal heat generation will preclude moisture damage from condensation. The sole potential damage mechanism is, therefore, radiation. Note that the radiation environment does not occur at the same time as the elevated temperature, pressure, and humidity conditions. The latter environments are caused by steam line break

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

during which there is no recirculation. Recirculation occurs during the post-LOCA phase, at which time temperature, pressure, and humidity are within the normal range. Also note that Class F has more thermal margin than Class B, resulting in a longer expected life.

Allis Chalmers catalog information shows that non-hygroscopic impregnated, form-wound coils are used for motor insulation in Class B or Class F applications. Dacron-glass tape, mylar, mica, and polyester varnish are mentioned as materials used for insulating the motors.

Mica is an inorganic compound with a threshold value of 10^8 rads.¹ Dacron-glass tape and mylar are both polyethylene terephthalate² with a radiation damage threshold of 10^8 rads.³ Polyester resins have a damage threshold of between 10^5 and 10^6 rads.² This value was determined from tests on the elastomer rather than a varnish. Other tests on polyester - glass laminates show a threshold of 10^9 rads.⁴ The primary purpose of the varnish is to exclude moisture during non-operating periods. Since the polyester varnish produces a laminated insulation and since the motors will be running when receiving the accident radiation dose, the motor will not fail due to radiation. Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

- REFERENCES

1. Nuclear Engineering Handbook
2. "Radiation Effects of Organic Materials in Nuclear Plants", EPRINP-2129
3. Broadway, N.J. et. al. "Effects of Nuclear Radiation on Elastomeric and Plastic Components and Materials", Battelle Memorial Institute, 1964.
4. Bolt and Carroll, "Radiation Effects on Organic Materials", Academic Press, 1963.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Sodium Hydroxide Addition Pump Motors

TAG NO(S).: 2PM-136A, 2PM-136B

SER RESPONSE PAGE NO(S).: B160, B161

MANUFACTURER AND MODEL NO.: Westinghouse TBFC CLF

SYSTEM - P&ID NO.: Containment Spray M-2236

LOCATION: Room No. 2014

• SAFETY FUNCTION:

The safety function of this motor is to drive Sodium Hydroxide addition pump B (2P136B) which pumps from NaOH addition tank 2T10 into the containment spray system during a LOCA. It must run until the tank is drained. The addition of NaOH to the containment spray is for chemically removing the Iodine from the reactor building gases.

• QUALIFICATION DISCREPANCY:

Documentation does not exist to verify qualification for the following documents:

Operating time	8 hours
Temperature	107°F
Pressure	2.22 psig
Humidity	100%
Radiation	1.1E7 rads.

The rating of class F motor envelopes all of the conditions except pressure and radiation. (NEMA MG-1 Section 20-40).

• JUSTIFICATION FOR INTERIM OPERATION:

An ambient temperature of 40°C (104°F - See NEMA M6-1 Section 20-40) has been specified for the Class F insulation of these motors. The pressure and humidity requirement are for a steam line break not a LOCA. The totally enclosed fan cooled system is designed for harsh industrial environment. The specified conditions are mild compared to the motor's capability. The class F insulation system is designed to accommodate a rise of 115°C above 40°C. Totally enclosed motors are expected to operate in harsh environments and a pressure change of 2.2 psig would be insignificant.

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

The sole potential damage mechanism is, therefore, radiation. Note that these pumps are not required for mitigation of the steam line break which causes the high temperature, pressure, and humidity conditions. The radiation environment does not occur at the same time as the other elevated conditions, since the high radiation dose occurs during recirculation, at which time temperature, pressure, and humidity are within the normal range.

Dacron-glass tape, mylar, mica, and polyester varnish are mentioned as materials used for insulating the motors.

Mica is an inorganic component with a threshold value of 10^8 rads.¹ Dacron-glass tape and mylar are both polyethylene terephthalate² with a radiation damage threshold of 10^8 rads.³ Polyester resins have a damage threshold of between 10^5 and 10^6 rads.² This value was determined from tests on the elastomer rather than on varnish. Other tests on polyester - glass laminates show a threshold of 10^9 rads.⁴ The primary purpose of the varnish is to exclude moisture during non-operating periods. Since the polyester varnish produces a laminated insulation and since the motors will be running when receiving the accident radiation dose, the motors will not fail due to radiation. The motors will have completed most of their function before radiation appears since radiation begins during the recirculation phase of the spray system function. Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

- REFERENCES

1. Nuclear Engineering Handbook
2. "Radiation Effects of Organic Materials in Nuclear Plants", EPRINP-2129
3. Broadway, N.J. et. al. "Effects of Nuclear Radiation on Elastomeric and Plastic Components and Materials", Battelle Memorial Institute, 1964.
4. Bolt and Carroll, "Radiation Effects on Organic Materials", Academic Press, 1963.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Solenoid Pilot Valve for Isolation Valve in Reactor Building
Sump Line

TAG NO(S).: 2SV-2061-2

SER RESPONSE PAGE NO(S).: B111

MANUFACTURER AND MODEL NO.: ASCO

SYSTEM - P&ID NO.: Liquid Radioactive Waste M-2213

LOCATION: Room No. 2013

• SAFETY FUNCTION:

The safety function of this solenoid valve is to control the valve which isolates the Reactor Building Sump from the Auxiliary Building Sump. This valve is de-energized by a containment isolation signal, closing it and causing the isolation valve to close.

• QUALIFICATION DISCREPANCY:

Documentation is not available to demonstrate justification for operating time, temperature, pressure, relative humidity and radiation.

• JUSTIFICATION FOR INTERIM OPERATION:

The solenoid pilot valve will de-energize to close the isolation valve upon receipt of a Containment Isolation Actuation or Safety Injection Actuation Signal. The isolation valve will also close upon loss of air and this, coupled with the de-energize to close design of the pilot, ensures a safe failure mode of the valve.

For the LOCA conditions under which the valve is required to operate, it is not exposed to harsh temperature, pressure or humidity conditions. Because of the short time specified (1 minute) between the initiating event of the postulated LOCA and the completion of valve operation, radiation exposure would also be negligible.

There is a redundant valve (2CV-2060-1) which provides isolation inside containment. The redundant valve is only exposed to a harsh environment in the event of LOCA or HELB inside containment, while this valve is only exposed to harsh environments due to HELB outside containment, thus ensuring operability of the isolation

- JUSTIFICATION FOR INTERIM OPERATION: (continued)

valve in the mild environment. Based on the above analysis, it is concluded that justification for continued operation has been demonstrated.

EQUIPMENT ENVIRONMENTAL QUALIFICATION
JUSTIFICATION FOR INTERIM OPERATION
ANO-2

COMPONENT: Position Switch - Emergency Feedwater (EFW) Pump 2P7A
Discharge Isolation Valve

TAG NO(S).: 2ZS-1076-2

SER RESPONSE PAGE NO(S).: B023

MANUFACTURER AND MODEL NO.: NA

SYSTEM - P&ID NO.: Emergency Feedwater System M-2204

LOCATION: Room 2048

• SAFETY FUNCTION:

This limit switch indicates the position of EFW pump discharge isolation valve 2CV-1076-2.

• QUALIFICATION DISCREPANCY:

The outstanding discrepancies listed were:

Operating Time	8 hours
Temperature	218F
Pressure	1.71 psig
Humidity	100%

• JUSTIFICATION FOR INTERIM OPERATION:

This component has been determined to be an integral part of 2CV-1076-2 which is qualified for its postulated accident environment. Thus, consistent with other valves of this type, the limit switch should not be listed as a separate component.