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March 11, 1988

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Subject: Catawba Nuclear Station
Docket Nos. 50-413 and 50-414
IE Report 50-413,-414/88-07
RII:NM
Environmental Qualification Inspection

Dear Sir:

Attached is supplemental Duke Power Company documentation addressing certain unresolved items identified at the Exit Interview on February 5, 1988 at the conclusion of the subject Inspection.

Very truly yours,

Hal B. Tucker

LTB/6000/sbn

Attachment

xc: Dr. J. Nelson Grace, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. P. K. Van Doorn
NRC Resident Inspector
Catawba Nuclear Station

A047
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CATAWBA NUCLEAR STATION

EXIT INTERVIEW - FEBRUARY 5, 1988

POTENTIAL ENFORCEMENT ITEMS;

1. Wide range RTDs termination enclosures located below flood level.

   BACKGROUND: On September 2, 1987, during a station inspection of Raychem splices, a discrepancy was discovered in that the installed configuration of the wide range Rdf RTDs was not "as-tested." Subsequent investigation indicated that the seal on the RTD cable assembly had been compromised.

   DUKE ACTION: Duke Power Company initiated a Problem Investigation Report (PIR) concerning the RTDs. Subsequently, Unit 1 was shut down and the RTDs replaced. Unit 2 was in an outage and the RTDs have been replaced. The inspection team reviewed and found acceptable the solution for terminating the RTDs.

2. VX system Limitorque valves

   BACKGROUND: From June 1984 to January 1986, commercial Limitorque actuators were installed on Hydrogen Skimmer System valves 1VX1A, 1VX2B, 2VX1A and 2VX2B. The subject valves/actuators were specified as inside containment, active, to the valve manufacturer (Fisher Controls). In 1984, Duke Power discovered the actuators were not nuclear grade. Duke Power decided to evaluate acceptability of the actuators in light of the moderate accident environment (upper containment) and design similarity between safety-related and commercial actuators. The commercial actuators were subsequently replaced with fully qualified actuators in Janaury 1986. Upon review of the acceptability analysis of the commercial actuators, the inspection team found the analysis unacceptable.

   DUKE ACTION: Duke Power Company is providing in Attachment I a "Past Operability Statement" which provides additional information not contained in the original acceptability analysis. It is Duke Power Company's position that the condition that existed until January 1986 in no way jeopardized safety of the plant, personnel or public.

3. Hydrogen Recombiner Splice Configuration

BACKGROUND: Upon inspection of the Unit 2 Hydrogen Recombiner main power cable splices, it appeared that the splices were not in a qualified configuration. Subsequently, two splices were cut open and it was verified that a breakout was used in the splice which had not been seen during the inspection. The inspector inquired as to the splice configuration used on Unit 1. The Unit 1 splice utilizes a taped/sealant termination method. Review of the qualification documentation for the taped/sealant termination method was found to be acceptable. However, that specific configuration had not been addressed in the files.

DUKE ACTION: Duke Power Company has assembled and placed on file "Environmental Qualification Package for Termination Method of Main Power Cables of the Westinghouse Model B Electric Hydrogen Recombiner." This document provides auditable documentation which demonstrates the qualification of the tape/sealant termination method and is available for review.

4. VE System Heater Wires

BACKGROUND: Upon review of Problem Investigation Report No. 0-C87-0024, the inspector indicated that the documentation supporting the qualification of the VE heater wire was deficient.

DUKE ACTION: Additional documentation was presented to the inspector and was found acceptable. This supplemental documentation will be placed in the appropriate qualification package (CNM-1211.00-1544-001 & 002).

UNRESOLVED ITEMS

1. NAMCO Limit Switch 2NCLL0251

BACKGROUND: Upon inspection of 2NCLL0251 during the walkdown, the inspector noticed that the cover gasket on the limit switch was not visible on one side. Subsequently the cover was removed and the cover gasket was found to be installed incorrectly.

DUKE ACTION: 2NCLL0251 provides closed indication for valve 2NC025A. The valve is normally open during normal operation and fails to the open position. It is not required to function during or after an accident. The limit switch provides non-essential position indication which will not mislead the operator. Problem Investigation Report 2-C88-0054 has been

initiated and the gasket has been replaced. Furthermore, additional clarification will be included in the installation procedure for the cover gasket. Duke Power Company's position is that the incorrect installation of the cover gasket was an isolated incident with no generic implications.

2. Limitorque T-drains

BACKGROUND: During the walkdown inspection, the inspector reported that T-drains on inspected Limitorque Valve actuators had been painted over.

DUKE ACTION: Duke Power Company inspected and repaired, if required, all Limitorque Valve actuators on both Units 1 and 2. The results of that inspection are contained in Attachment II. Also contained in Attachment II is the operability evaluation for those valves which had improperly installed T-drains. Additionally, corrective actions, as outlined in Attachment II, have been initiated to prevent future occurrences of this type.

3. Air Return Fan Motors and Hydrogen Skimmer Fan Motors-Drains

BACKGROUND: During the walkdown of the subject motors, it was noted that ARF2B motor drain was located on the conduit box of the motor. It was also noted that HSF2B motor contains a solid plug instead of a drain. This configuration is not the "as-tested" configuration.

DUKE ACTION: Duke Power Company agreed to contact the manufacturer (Joy/Reliance) to verify the acceptability of the "as-installed" configuration. The worse case accident parameter for the "as-installed" configuration would be pressure as the drains allow the motor to breathe as well as provide a drain for condensation. One Design parameter of the motor (with no drains) is 5 psig/sec. The pressure profile for upper containment worse rate of change is approximately 4.5 psig/sec which occurs within the first second of the transient. Therefore, the postulated pressure rate of change is within the design parameters of the motors. Condensation build-up within the motor would be insignificant as the temperature in upper containment is relatively constant and the inside ambient temperature of the motor is held at or above the surrounding ambient. Additionally, a calculation was performed to quantify the amount of condensation which could build up following an accident and it was determined that this volume of moisture would be insignificant and will not effect the operation of the motor. This information and additional supporting documentation has been assembled in Calculation CNC-1381.05-00-0094 and is attached for review (Attachment III).

4. Air Return Fan Motor 2B (ARF2B)

BACKGROUND: During the walkdown inspection, the inspector noted nicks in the motor lead wires and also questioned the sizing of the splice.

DUKE ACTION: Design Engineering provided information to the inspector which verified the sizes of the splice materials used in this specific installation and was found acceptable to the inspector.

The nicks in the motor leads were confined to the outer braided sleeve which provides mechanical protection of the leads with the primary insulation system contained under the outer braid. It should be noted that moisture intrusion for this application is insignificant as these motors are not located below flood level and the field cable entrance is sealed at the terminal box. Subsequently, these splices were reterminated utilizing sleeving over the nicked outer braid per installation procedures. It should be noted that the other Unit 2 Air Return Fan Motor (ARF2A) was inspected and found acceptable as installed.

5. MINCO TRD Termination

BACKGROUND: Documentation was not available to demonstrate that MINCO RTDs used for density compensation in the Reactor Vessel Level Instrumentation System (RVLIS) had been terminated above flood level. Duke committed to perform a field survey to determine actual locations of the junction boxes for the RTD terminations.

DUKE ACTION: The field survey revealed that contrary to the design intent, three RTDs per train, per unit, had been terminated in junction boxes below flood level. This information was verbally provided by phone to Steve Alexander and Norm Merriweather on February 8, 1988 and February 9, 1988 respectively. It was also stated that Duke felt the existing condition was considered to be qualifiable.

Data and reports have subsequently been assimilated concerning the materials used by MINCO to seal the RTD lead wires, the lead wire insulation, and the Duke splice and cable associated with the RTD circuits. The Duke splice (Raychem, see reports referenced below) and cable (Rockbestos Firewall III 1LXPE, test report CNM-1354.00-0072 and Okonite FMR, test report CNM-1354.00-0068) are qualified for submergence based on respective test reports contained in Duke qualification files.

The seal of the MINCO RTD consists of a welded glass to metal hermetic seal at the connection end of the mineral insulated cable and a Stycast 2850-FT epoxy potting over the glass seal. The Stycast 2850-FT epoxy creates a redundant seal for the M1 cable and serves as electrical insulation for the RTD lead wires and braised connection to the pigtail wires.

The Stycast epoxy used with the MINCO RTDs has superior properties to another Stycast epoxy that has been qualified in accordance with IEEE 323-1974 for submergence in a similar configuration (lead wire sealing and connection insulation of a transmitter, Rosemount test report D 8400336).

The RTD lead wires are BIW EPR/Hypalon insulated wire. BIW test report #B915 (MCM-1354.00-0057) gives the results of long term accelerated water absorption testing for EPR (52 weeks at 167 degrees F and EPR/HYP (48 weeks at 194 degrees F) insulated wire. No degradation of either was indicated during the tests. Other long term submersion tests (OM-316-0198 for Samuel Moore EP/HYP cable) for cables with the same insulation materials and of a similar construction also show no degradation. Additionally, immersion testing to ANSI C119. 1-1972 (CNM-1354.00-0038, Raychem test report #E 5008) and post LOCA 30 day immersion testing (Raychem test report #E 5011) of the splice materials to cables with EPR/Hypalon insulation did not show any degradation.

Based on the information summarized above, it is Duke's position that the RTD terminations are qualified. Submergence will not result in any significant leakage currents and the RVLIS accuracy will remain within design specifications. The test reports, material specifications and similarity evaluations, and documentation supporting qualification of the terminations for submergence are being incorporated into the Duke EQ files. Reports already contained in the Duke files will be appropriately referenced in the RTD qualification file.

6. Rosemount Transmitters

BACKGROUND: During the walkdown, the inspector noted that the transmitter name plate was missing.

DUKE ACTION: Design Engineering provided documentation which demonstrated the procedural controls that verified the manufacturer, model and serial number of the installed equipment. (Reference Catawba EQ Inspection Worksheet pages 13 and 14). The inspector additionally requested a copy of the receipt inspection which is provided in Attachment V.

Also provided in Attachment V are the Catawba EQ Inspection Worksheets.

ATTACHMENT I

CATAWBA NUCLEAR STATION
PAST OPERABILITY STATEMENT

VALVE TAG NO. 1 & 2 VX1A, 2B

EQ Concern

Commercial grade electric motor operators in safety related applications inside containment.

Statement of Problem

From June 1984 to January 1986, commercial grade Limitorque actuators were installed on Hydrogen Skimmer System valves 1VX1A, 1VX2B, 2VX1A and 2VX2B. These valve applications were considered functionally safety related (active). Test verified documentation does not exist for safety related application of commercial grade actuators inside containment.

Background

Subject valves/actuators were specified as inside containment, active to the valve manufacturer (Fisher Controls). In 1984 Duke Power discovered the actuators were not qualified for this service. Duke Power decided to evaluate acceptability of the actuators in light of the moderate accident environment analyzed for the valve locations, and design similarity between safety related and commercial actuators. Acceptability was achieved and documented. However, in January 1986, as the result of concern by NRC inspectors, we elected to replace the actuators with ones qualified by test.

Conclusion

For reasons presented below, we do not consider the condition that existed until January 1986 to have jeopardized safety of the plant, personnel or public.

Operability Evaluation

A. **Safety Significance of Inoperable VX Valves on Hydrogen Skimmer System Performance:**

10CFR50.46 requires that the amount of fuel element cladding that chemically reacts with water or steam does not exceed 1 percent of the total amount of zircaloy in the reactor. In accordance with this requirement, the Catawba design basis analysis indicates that the total metal/water reaction is less than 0.3 percent for all breaks (FSAR, pg. 15.6-17). Standard Review Plan (NUREG-0800), Section 6.2.5, required that the hydrogen control and mitigation system be designed for five times the amount of hydrogen released in the FSAR analysis of a DBA assuming at least one train of ECCS operable. For an accident of this type, virtually no radioactivity would be released from the fuel.

As stated in NUREG-0800, a lower flammability limit of four volume percent hydrogen in air or air-steam atmospheres is well established and is adequately conservative. Research has shown that relatively low levels of turbulence in containment promote sufficient mixing that stratification of hydrogen will be minimized (EPRI NP-2669). Based on the FSAR analysis of hydrogen production in a postulated DBA, with no hydrogen control measures at all, it would be approximately eight days before the lower flammability limit was exceeded (FSAR, Figure 6.2.5-6). Since very little radioactivity is released to the containment, the hydrogen can be purged to the annulus using the Containment Purge Blower Sub-System if the hydrogen concentration approaches four volume percent. Therefore, the hydrogen recombiners, hydrogen skimmer fans, and VX hydrogen skimmer isolation valves are not needed to mitigate the consequences of hydrogen produced during a design basis accident.

B. Operability Evaluation of VX System Valves:

Even though operability of the VX System valves is not required, we contend that they would have been operable in the DBA environment for the following reasons:

1. Commercial grade Limitorque actuators are identical to outside containment actuators (qualified under Limitorque qualification report B0003) with the exception of control wiring.

   The subject actuators were assembled using TEW (CSA) control wiring. Use of this wire on inside containment actuators was discontinued after 1970. TEW is a PVC insulated wire rated by UL for continuous duty at 221°F, and EPRI-NP-2129 report indicates negligible degradation at radiation levels below 5×10^6 Rads. Also, Duke Power has tested and qualified(1) a similar type PVC insulation system to the following parameters:

Peak Temperature:	380°F
Peak Pressure:	29.3 PSIG
Humidity:	100%
Radiation:	8.26×10^7 Rads
Qualified Life:	40 years & 1 year Post-Accident

   The required DBA qualification parameters are as follows:

Peak Temperature:	180°F
Peak Pressure:	15 psig
Humidity:	100%
Radiation (2):	$(1.2 \times 10^7) \times (0.05) = 6 \times 10^5$ Rad

   The safety function of the valves was to open 10 minutes subsequent to receiving an SP signal (Containment High Pressure). Stroke time was 1 minute, requiring a total operability time of 11 minutes. Therefore, the TEW wire would have survived during its installed normal environment plus the DBA environment, and would have been able to perform its control function.

(1) Duke Power Memo-to-File dated 7/25/86, by R. J. Smith.
(2) 20 months normal environment plus DBA for 11 minutes. Factor equals 0.05 from CEQCM Table 8.0-1.

2. Qualified outside containment operators (B0003) test parameters exceed the DBA parameters for the VX valves except for spray.

Because of the short duration into the accident environment, the only possible concern would have been chemical attack on the aluminum limit switch gear frames noted in Limitorque's 600198 report. Failure of the frames occurred 24 hours after start of the test. Since operability was only required for 11 minutes, the frames would have survived long enough for the valves to complete their safety function.

Prepared By K R Kovacs 2-12-88

Checked By J W Gardner 2-12-88

Approved By D M Collins 2-12-88

ATTACHMENT II

EQ CONCERN: Plugged or missing T-Drains on Limitorque valve motor operators.

STATEMENT OF PROBLEM: During NRC equipment Environmental Qualification audit (weeks of February 1, 1988) certain Limitorque actuators were discovered with motor T-drains plugged with paint. A complete investigation of both Catawba units was initiated. A total of 42 actuators were discovered with plugged T-drains or with T-drains not installed at all. Table 1 is a list of the affected tag numbers.

Functional T-drains have since been installed on all the affected actuators. The purpose of this report is to evaluate the operability of the station while the degraded condition existed.

BACKGROUND: The principal purposes for use of T-drains are, 1) to provide drainage of interal actuator condensation; and 2) to serve as the primary vehicle for internal-to-external actuator pressure equalization.[1]

At the time these deficiencies were discovered, procedures existed to ensure correct installation and maintenance of T-drains plugs. The deficiencies were attributed to personnel oversight and missed communication.

CONCLUSION: While T-drains must be installed for the Limitorque "containment chamber" actuator to be in its qualified configuration, it is demonstrated that clogged or missing T-drains on the affected actuators (See Table 1) did not compromise nuclear safety for the period this situation existed.

OPERABILITY EVALUATION:

A complete list of tag numbers discovered with clogged or missing T-drains is provided in Table 1. The valves are broken into categories for evaluation as follows:

1. Actuators Outside Containment:

   Auxiliary Building HELBs are not as severe as those postulated for containment. Further, they are much shorter-lived and are not associated with a pressure spike as are containment HELBs. Also, Auxiliary Building HELBs are bounded by Limitorque B0003 qualification parameters; B0003 motors do not employ T-drains. By the above reasoning, we conclude Auxiliary Building Limitorques do not require T-drains. Auxiliary Building Limitorques with clogged or missing T-drains are noted in Table 2.

2. Containment Isolation Actuators:

   Valves listed in Table 3 serve containment isolation function. They receive an ST signal at 1 psig containment pressure and are required to close within one minute. Repositioning thereafter is not required. Addressing the two functions served by T-drains: 1) Pressure equalization is not a consideration since cable entrances are not sealed and the limit switch compartment is vented to the motor via the motor lead wire-way; and 2) Required operability time during the accident is so short (< one minute) that the amount of condensation accumulating would be negligible. For a further discussion on potential condensation in motor/limit switch compartment, see Attachment 1. For a more detailed explanation of the required operation of these valves, see Attachment 2.

3. Actuators That Do Not Receive A afety Signal:

   Table 4 lists actuators which do not receive safety signals to reposition and are not required post-accident as outlined in Attachment 2.

4. Reactor Vessel Head Vent Valves

   Table 5 lists the Reactor Vessel Head Vent Valve actuators. A safety significance evaluation is presented in Attachment 3.

5. Hydrogen Skimmer Fan Inlet Isolation Valves:

   Table 6 lists the Hydrogen Skimmer Fan inlet isolation valve actuators. A safety significance evaluation is presented in Attachment 4.

CORRECTIVE ACTION:

Procedures exist to ensure correct and complete T-drain installation and maintenance. As stated previously, the deficiencies (clogged and missing T-drains) appear to be personnel oversights and missed communication. Construction and Maintenace Department has committed to retrain painter craft by **March 30, 1988**. Station I&E has committed to revise procedures to clarify T-drain installation requirements by **February 25, 1988**. Station I&E has further committed to conduct formal T-drain specific training with applicable personnel by **March 30, 1988**.

REFERENCES:

1) Nuclear Utility Group on Environmental Qualification, Clarification of Information Related to the Environmental Qualification of Limitorque Motorized Valve Operators, April 1986.

PREPARED BY: S R Kotay 2-12-88

CHECKED BY: T. E. Edwards 2/12/88

APPROVED BY: D M Collins 2/12/88

TABLE 1

TOTAL LIST OF LIMITORQUE ACTUATORS WITH PLUGGED OR MISSING T-DRAINS

1KC364B	1NM201A	1VX002B	2KC394A	2NC253A	2NV055A
1KC394A	1NV055A	1VE004	2KC413B	1NM187A	2VC007B
1NI115A	1NV066A	1VE009	2KC429B	2NM190A	2WL450A
1NI183B	1NV236B	1ND024A	2NC054A	2NM197B	2VE009
1NM007B	1NW035A	1ND059B	2NC250A	2NM200B	2VE004
1NM026B	1VF001A	1NI047A	2NC251B	2NM207A	2NM025A
1NM200B	1VX001A	2KC345A	2NC252B	2NM210A	2NI183B

(42 Total)

TABLE 2

LIMITORQUES WITH PLUGGED OR MISSING T-DRAINS LOCATED IN THE AUXILIARY BUILDING

1NI115A	1NM201A	1NV236B	1VE004	1ND059B	2VE009
1NI183B	1NV055A	1NW035A	1VE009	1NI047A	2VE004
1NM007B	1NV066A	1VF001A	1ND024A	2VC007B	2NI183B
1NM026B					2NV055A

(20 Total)

TABLE 3

LIMITORQUES SERVING CONTAINMENT ISOLATION FUNCTION

1NM200B	2NC054A	2NM190A	2NM207A	2NM197B	2NM025A
2KC429B	2NM187A	2NM200B	2NM210A	2WL450A	

(11 Total)

TABLE 4

LIMITORQUES NOT RECEIVING A SAFETY SIGNAL AND NOT REQUIRED POST-ACCIDENT

2KC345A	1KC394A	2KC394A	2KC413B	1KC364B

(5 Total)

TABLE 5

REACTOR VESSEL VENT VALVE ACTUATORS

2NC250A	2NC251B	2NC252B	2NC253A

(4 Total)

TABLE 6

HYDROGEN SKIMMER FAN INLET ISOLATION VALVE ACTUATORS

1VX001A	1VX002B

(2 Total)

ATTACHMENT 1

This calculation is to quantify the amount of water that could be condensed inside an operator on a unit volume basis.

The worst case containment conditions are 15 psig at 330°F. The density of vapor at these conditions is taken from steam tables as:

$$.065 \frac{lb}{ft^3} \text{ vapor}$$

Assuming all of the water in the volume is condensed would provide a worst case unit volume ratio of:

Saturated liquid at 15 psig is .017 ft^3/lb (steam tables)

Therefore, .065lb $\frac{\text{vapor}}{ft3}$ x .017 $\frac{ft^3}{lb \text{ water}}$ = .001105 $\frac{ft^3 w}{ft^3}$ = 1.9 $\frac{in^3}{ft^3}$ water.

or approximately .1% water by volume.

The internal volume of the largest actuator involved (SMB-00) is approximately .66 ft^3. This includes both the limit switch and motor compartments and assumes these spaces are completely empty.

Assuming the existing operator atmosphere is totally and instantly replaced with the new conditions (330°F at 15 psig) and all water vapor is completely consensed would result in:

$$(1.9 \frac{in^3 \text{water}}{ft^3} \times .66\ ft^3) = 1\ 1/4\ in^3 \text{ water}$$ or approximately 1 1/2 tablespoons.

This small amount of water would begin to condense inside the actuator and be evenly distributed on all exposed surfaces with the majority occurring in the large limit switch housing.

As shown by these very conservative assumptions, only a small amount of water is involved, and would practically be much smaller than shown for the time intervals (< minute) involved. Hence, the operability of the actuator would not have been compromised.

February 10, 1988

MBCE-88-069

D. G. Gardner

Subject: Catawba Nuclear Station
Post Operability Evaluation of Limitorque Valves
File: CN-1225.00-00, CN-1223.02-00

Based on conversations with R. R. Kovacs, we have evaluated a list of valves for post-accident (LOCA or MSLB inside containment) operability.

The following valves all receive ST (Phase A containment isolation) signals to close and are not required to reposition following their initial closure. These valves are required to close within one minute of receipt of an ST signal. Their safety function is to isolate containment.

1NM200B	2NM190A	2NM207A
2KC429B	2NM197B	2NM210A
2NC54A	2NM200B	2WL450A
2NM187A		

The following valves do not receive automatic signals to reposition. However, their position is not an issue in a LOCA or MSLB event since they are inside containment and their portion of the system is isolated on an SP (Phase B containment isolation) signal through valves upstream and downstream of these (2KC338B and 2KC425A). Therefore, failure of these valves to reposition is of no consequence in a LOCA or MSLB event.

2KC3[illegible]A	2KC394A	2KC413B

The following valve receives an ST (Phase A containment isolation) signal to close but may be useful post-accident for sampling. While this valve could be used for post-accident sampling, there are other sample paths available which can allow sampling. Therefore, failure of this valve to reposition following its initial closure is of no significant consequence.

2NM25A

The following valves do not recieve automatic signals to reposition. However, they are required to operate post-accident (LOCA) for the purpose of venting noncondensible gases from the reactor vessel head. Therefore, failure of these valves to be capable of operating can significantly exacerbate accident conditions.

2NC250A	2NC252B	2NC253A
2NC251B		

If there are any questions, please call.

E. W. Fritz, Design Engineer II

/kdw

cc: B. L. Peele
P. R. Herran
D. L. Ward
D. M. Collings
R. R. Kovacs
Central Records

Safety Significance Evaluation - Reactor Vessel Vent Valves

The "tee drain" issue has created a past operability concern for the reactor vessel vent valves. These valves are desirable to cycle following a small break LOCA in order to regain controlled reactor coolant circulation in the event a non-condensible bubble has formed in the upper head. The main concern in this scenario is cooling the core. Removing the non-condensible gas provides for a controlled cooldown by allowing subcooled liquid to freely flow through the reactor vessel and remove decay heat. There will not be a significant amount of hydrogen generated during a DBA. This is a result of the emergency procedures which focus on subcooled margin. This implies the core remains covered and no saturated conditions exist in the core. This along with some coolant circulation and feedwater in the S/G's will cool the core via natural or forced circulation. Therefore, assuming accidents within design basis assumptions, there will be no need to cycle the reactor vessel vent valves.

In a TMI-type scenario in which multiple operator errors and equipment malfunctions may have resulted in a pressurized RCS with a non-condensible void in the reactor vessel head, the core can be adequately cooled by alternate means such as opening the PORVs and operating NV and NI pumps.

In a "beyond design basis" moderate to large break LOCA with severe core damage the reactor vessel vent valves are of little value because non-condensibles are vented out the break and RCS saturation conditions can not be avoided.

In conclusion, the absence of the drain capability renders the valves "questionably operable". However, for DBAs these valves are not required to cycle. Beyond design basis scenarios can be mitigated via other means independent of the vent valves.

Prepared by R C Bruno

Approved By P M Graham

Safety Significance Evaluation of Hydrogen Skimmer System
EQ Deficiency in Design Basis Accidents

10CFR50.46 requires that the amount of fuel element cladding that chemically reacts with water or steam does not exceed 1 percent of the total amount of zircaloy in the reactor. In accordance with this requirement, the Catawba design basis analysis indicates that the total metal/water reaction is less than 0.3 percent for all breaks (FSAR, pg. 15.6-17). Standard Review Plan (NUREG-0800), Section 6.2.5, requires that the hydrogen control and mitigation system be designed for five times the amount of hydrogen released in the FSAR analysis of a DBA assuming at least one train of ECCS operable. For an accident of this type, virtually no radioactivity would be released from the fuel.

As stated in NUREG-0800, a lower flammability limit of four volume percent hydrogen in air or air-steam atmospheres is well established and is adequately conservative. Research has shown that relatively low levels of turbulence in containment promote sufficient mixing that stratification of hydrogen will be minimized (EPRI NP-2669). Based on the FSAR analysis of hydrogen production in a postulated DBA, with no hydrogen control measures at all, it would be approximately eight days before the lower flammability limit was exceeded (FSAR, Figure 6.2.5-6). Since very little radioactivity is released to the containment, the hydrogen can be purged to the annulus using the Containment Purge Blower Sub-System if the hydrogen concentration approaches four volume percent. Therefore, the hydrogen recombiners, hydrogen skimmer fans, and VX hydrogen skimmer isolation valves are not needed to mitigate the consequences of hydrogen produced during a design basis accident.

Prepared By H O Brewer

Approval By J. M. Abraham

ATTACHMENT III

Form 01077 (R10-86) | FORM 101.1 | REVISION 10

CERTIFICATION OF ENGINEERING CALCULATION

STATION AND UNIT NUMBER Catawba Nuclear Station - Unit 2

TITLE OF CALCULATION Hydrogen Skimmer and Air Return Fan Motors - Drain/Breather Analysis

CALCULATION NUMBER CNC-1381.05-00-0094

ORIGINALLY CONSISTING OF:

PAGES CEC1,2,3, TOC-1, Page 1 THROUGH 6

TOTAL ATTACHMENTS 3 (4 pages) TOTAL MICROFICHE ATTACHMENTS 0

TOTAL VOLUMES 0

THESE ENGINEERING CALCULATIONS COVER QA CONDITION 1 ITEMS. IN ACCORDANCE WITH ESTABLISHED PROCEDURES, THE QUALITY HAS BEEN ASSURED AND I CERTIFY THAT THE ABOVE CALCULATION HAS BEEN ORIGINATED, CHECKED OR APPROVED AS NOTED BELOW:

ORIGINATED BY JEC JE Vaglewede DATE 2/11/88

CHECKED BY RF Smith DATE 2/12/88

APPROVED BY DJ Roberson DATE 2/12/88

ISSUED TO GENERAL SERVICES DIVISION RF Smith DATE 2/15/88

RECEIVED BY GENERAL SERVICES DIVISION CMas DATE 2-15-88

MICROFICHE ATTACHMENT LIST:

M1 ID# _____ # OF SHEETS _____ M4 ID# _____ # OF SHEETS _____

M2 ID# _____ # OF SHEETS _____ M5 ID# _____ # OF SHEETS _____

M3 ID# _____ # OF SHEETS _____ M6 ID# _____ # OF SHEETS _____

REV. NO	CALCULATION PAGES (VOL)			ATTACHMENTS (VOL)			VOLUMES		ORIG	CHKD	APPR	ISSUE DATE
	REVISED	DELETED	ADDED	REVISED	DELETED	ADDED	DELETED	ADDED	DATE	DATE	DATE	REC'D DATE

Calculation No. CNC-1381.05-00-0094

REVISION DOCUMENTATION SHEET

REVISION NUMBER	REVISION DESCRIPTION
0	Original issue

CERTIFICATION OF ENGINEERING CALCULATION - CONTINUATION

STATION AND UNIT NUMBER Catawba Nuclear Station - Unit 2

TITLE OF CALCULATION Hydrogen Skimmer and Air Return Fan Motors - Drain/Breather Analysis

CALCULATION NUMBER CNC-1381.05-00-0094

REVISION/ADDENDA LOG:

REV NO	CALCULATION PAGES (VOL)			ATTACHMENTS (VOL)			VOLUMES		ORIG	CHKD	APPR	ISSUE DATE
	REVISED	DELETED	ADDED	REVISED	DELETED	ADDED	DELETED	ADDED	DATE	DATE	DATE	REC'D DATE

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Calculation/Analysis Information

Calculation/Analysis No. CNC-1201.05-00-0094
Originator: Initial MPV Date 2/11/88
Revision: Initial MPV Rev. No. 0 Rev. Date 2/11/88

A. **PROBLEM:** This analysis shows that the Catawba Hydrogen Skimmer Fan (HFS) Motors will operate properly without drains/breathers on the conduit box or on the frame/endbell of the motor. Also, drain/breather ports are addressed on top of conduit boxes as installed on the Catawba Air Return Fan (ARF) Motors.

B. **RELATION TO QA CONDITION:** These fan motor assemblies are important to safety and are QA Condition 1.

C. **DESIGN METHODS:** This analysis will document an engineering justification showing that the Catawba Hydrogen Skimmer Fan Motors will operate properly without drains/breathers. Also, drain/breather ports on top of the Catawba Air Handling Unit Fan Motor conduit boxes are addressed.

D. **APPLICABLE CODES AND STANDARDS**
NEMA MG1- 1978, Motor and Generator Standard; IEEE 323-1974 Qualifying Class 1E Electric Equipment for Nuclear Power Generating Stations; IEEE 334-1974, IEEE Standard for Type Tests of Continuous Duty Class 1E Motors for Nuclear Power Generating Stations.

E. **OTHER DESIGN CRITERIA:** Duke Power Company Environmental Qualification Criteria Manual - Rev. 13, 1987; Equipment Qualification Reference Index, Rev. 6, 1988

F. **RELATED SAR CRITERIA:**
Duke Power Company, Catawba Nuclear Station, Final Safety Analysis Report, Rev. 12-31-86, Sections 6 and 9.4.10.

G. **CALCULATIONS/ANALYSIS**

1.0 Purpose:

The purpose of this analysis is to show that the Catawba Nuclear Station Hydrogen Skimmer Fan Motors can perform their intended function without the Drains/Breathers that would normally be installed. Also, an analysis is included to show that the drain installed on top of the main lead box of the Catawba Nuclear Station Air Return Fan Motors is acceptable as installed.

2.0 Identification of Equipment:

2.1 Catawba Nuclear Station Hydrogen Skimmer Fan Motors

2.2 Catawba Nuclear Station Air Return Fan Motors

3.0 Environmental Considerations:

3.1 The fan motors listed in section G-2.0 were environmentally qualified by Joy Manufacturing Company as a fan/motor assembly (Reference CNM-1211.00-1009)

3.2 The worst case pressure transient profile after an accident is shown in attachment 1 for the Hydrogen Skimmer Fan Motors. They are located in the upper compartment.

3.3 Drains/breathers were installed during LOCA testing on the endbells but not on the conduit box. The main lead terminations were made up outside the test chamber.

4.0 Background

4.1 During an NRC Equipment Qualification audit on February 3, 1988, an audit team member questioned two items that will be addressed in this analysis; namely, (1) documentation showed that drains/breathers should be installed on the Hydrogen Skimmer Fan Motors conduit box and stator frame/endbell and an inspection showed that the conduit box and the endbell opposite the drive end were hard plugged (no drain or vent holes) and (2) the drain/breather installed on the Air Return Fan Motors were on top of the box rather than on the bottom.

NOTE: Drains/Breathers were installed on the ARF motors that were inspected.

4.2 The Hydrogen Skimmer Fan Motors are used to pull air from dead space cavities in the lower compartment and mix that air with the rest of the containment air to keep the Hydrogen levels below explosion limits. They are generally tested for operation once every three months for approximately 15 minutes and are required to operate during the post accident scenario approximately 10 minutes into the accident. The Hydrogen Skimmer Fan Motors are 75 HP, 3460 rpm, 575 volt, TEFC, Horizontal Reliance Electric Company motors (CNM-1211.00-0738-001). They were qualified for In-Containment Post Accident use by Joy Manufacturing Company (See CNM-1211.00-1009).

The Joy Manufacturing Company qualification test was performed with a prototype fan and motor assembly similar to the assembly used in the Hydrogen Skimmer Fan application.

4.3 The Air return fans are used to provide energy to move air from the containment lower compartment to the upper compartment and through the ice beds. These fan assemblies are also located in the upper compartment of the Containment Building. They are generally tested for operation once every three months for approximately 15 minutes and are required to operate during the post accident scenario approximately 10 minutes after the accident.

The Air Return Fan Motors are 60 HP, 1170 rpm, 575 volt, TEFC, Vertical, Reliance Electric Company motors (CNM-1211.00-0388). They were qualified for In-Containment Post Accident use by Joy Manufacturing Company (CNM-1211.00-1009).

5.0 Analysis of drains on conduit box (vertical application): Reference should be made to P M White's 2/5/88 telephone conversation report (attachment 2). Per the telecon, the main reason for the drain is to prevent condensation build up in cases where the user installs the motor such that the conduit box is at the low point.

Condensation is not a concern during normal idle/testing modes because the temperature in the upper compartment is generally constant and the motor would be at or above the dew point while idle/running.

6.0 Analysis of drains/breathers not on Hydrogen Skimmer Fan Motor (horizontal application):

Reference should be made to P M White's 2/5/88 telephone conversation report (attachment 2) and J P Voglewede's memo to file dated 2/5/88 (attachment 3).

6.1 Normal operation/idle

Generally, the Hydrogen Skimmer Fan Motor will remain idle except for normal maintenance and performance testing running. This testing is normally 15 minutes every three months.

After the motor is started, it continues to heat up (motor temperature rise) until it reaches equilibrium. As the motor is heating up the motor exhales some portion of the air inside its enclosure through its bearing and through a labyrinth seal along the shaft. As the motor cools down, it inhales the surrounding ambient air along the same path. Since the temperature in the upper containment where the motors are located is fairly constant, the inside ambient of the motor is held at or above the surrounding ambient and this would prevent significant condensation from forming on the volume of air exchanged during the cooldown cycle.

NOTE: A plug on the Hydrogen Skimmer motor was removed and inspected for moisture on 2/11/88 by Catawba site personnel. No evidence of mositure was found.

6.2 Post Accident Operation.
During the period following an Accident, the motors would be subjected to a worst case pressure change per attachment 1. As can be seen from attachment 1, the most significant rate of change on pressure occurs within the 1st second of the accident and is less than 5 psig. This rate is below the 5 psig/sec pressure rate (attachment 2) which is one of the design parameters of the motor. Grease is not packed tight in the bearing cavity and thus several paths of relief are available such that grease implosion would not occur.

The quantity of possible condensation buildup inside the motor during the post accident situation is shown in calculation CNC-1211.00-00-0068. The quantity is not significant and will not affect the operation of the motor.

H. ASSUMPTIONS: NONE

I. REFERENCES:

1.0 NEMA MG1-1978, Motor and Generator Standard.

2.0 Duke Power Company, Catawba Nuclear Station, Final Safety Analysis Report, Rev. 12/31/86.

3.0 Duke Power Company, Catawba Nuclear Station, Equipment Qualification Reference Index, Rev. 6, 1988.

4.0 Duke Power Company, Catawba Nuclear Station, Environmental Qualification Criteria Manual, Rev. 13, 1987.

5.0 IEEE 334-1974, IEEE Standard for Type Tests of Continuous Class 1E Motors for Nuclear Power Generating Stations.

6.0 CNM-1211.00-1009, Joy Manufacturing Company Qualification Test Report, X-604.

7.0 CNM-1211.00-1065-0001, Operation and Maintenance Manual for Joy Manufacturing Company Fan Assemblies.

8.0 CNC-1211.00-00-0068, Determination of Moisture Potential for the Catawba Hydrogen Skimmer Fan Motor.

9.0 Catawba Nuclear Station, Problem Investigation Report, Serial No. 2-C88-0057.

10.0 CNM-1211.00-0738, Hydrogen Skimmer Fan Motor - Motor Data Sheet.

11.0 CNM-1211.00-0388, Air Return Fan Motor - Motor Data Sheet

12.0 CNM-1211.00-1010, Reliance Electric Company Motor Report - NUC-9.

13.0 J P Voglewede 2/11/88 memo to file: CN1320.00, - Notes relating to Hydrogen Skimmer Fan Motor and Air Return Fan Motor.

J. **CONCLUSION:**

1.0 This analysis and CNC-1211.00-00-0068 has shown that the Hydrogen Skimmer Fan Motors are qualified to perform their intended function without drains/breathers. However, since the Joy Manufacturing Company LOCA testing was performed with drains/breathers installed, a PIR has been generated to have the drains installed (Reference PIR # 2-C88-0057).

2.0 This analysis has shown that the Air Return Fan Motors are qualified to perform their intended function with drains in the top of the main lead conduit box.

K. **ATTACHMENTS:**

1.0 Catawba Nuclear Station typical upper and lower compartment pressure transient - Figures 6.2.1-18 and 6.2.1-19 of Volume 6 of the FSAR (2 pages)

2.0 P M White 2/5/88 telephone conversation report (1 page).

3.0 J P Voglewede 2/5/88 memo to file: CN1320.00 (1 page).

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ATTACHMENT 1.0
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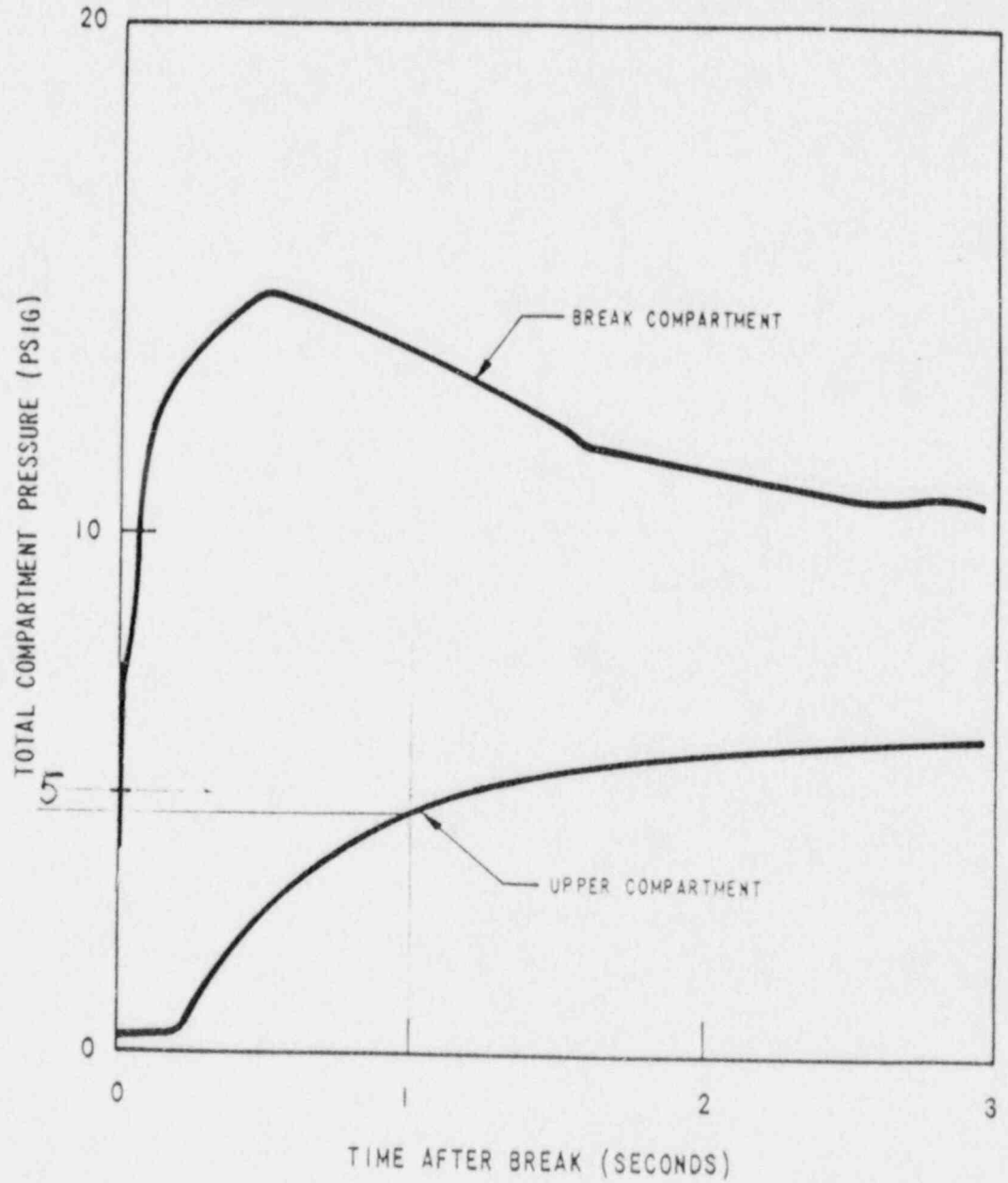
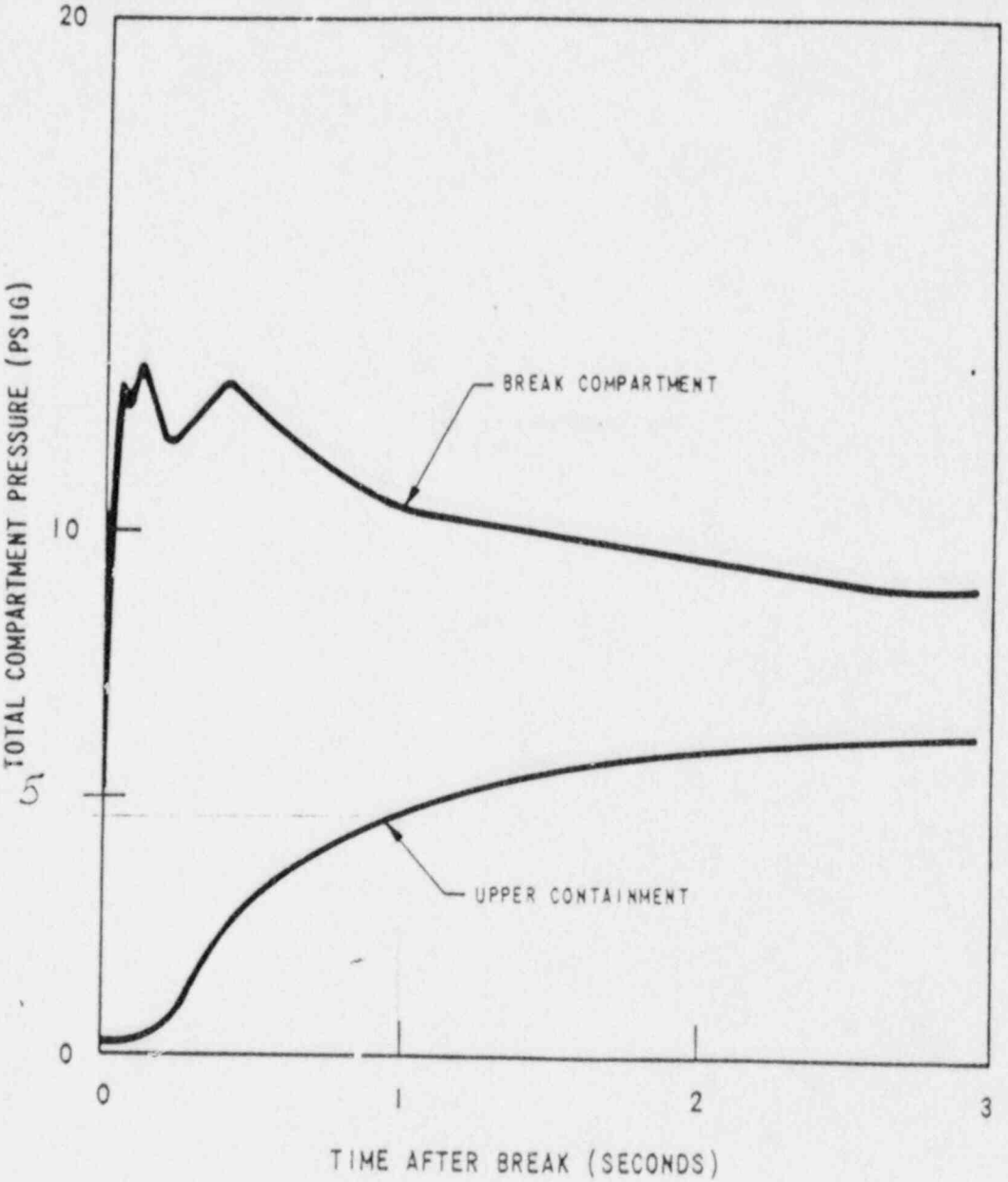


TYPICAL UPPER AND LOWER COMPARTMENT
PRESSURE TRANSIENT FOR BREAK
COMPARTMENT HAVING A DECL BREAK

CATAWBA NUCLEAR STATION

Figure 6.2.1-19
REV 12/31/86

FSAR - VOL 6



TYPICAL UPPER AND LOWER COMPARTMENT PRESSURE TRANSIENT FOR BREAK COMPARTMENT HAVING A DEHL BREAK

CATAWBA NUCLEAR STATION

Figure 6.2.1-18
REV 12/31/86
FSAR - VOL 6

Form 1021

CNC 1381.05-00-0014
ATTACHMENT 2.0
PAGE 1 OF 1
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DUKE POWER COMPANY

TELEPHONE CONVERSATION REPORT

PROJECT Catawba Nuclear Station FILE NO. CN-1211.00-19

SUBJECT Joy Fan Motors Used inside Containment

PERSON CALLED Dick Foote/Tom Bissett (216) 339-1111

DATE 2/4/88 TIME 4:00 p.m.

PERSON CALLING Paul White Russ Lytton

SPECIFICATION NUMBER CNS-1211.00-00-0006

SUBJECT DISCUSSED Discussed Conduit Box Drain - Breathers (Joy P/N 1388776) and Motor Drain - Breathers (Joy P/N 505549-1638) as Noted in the Maint. & Operation Manual Bill of Material No. #525180-29. The Drain-Breather function, Design and Assembly were discussed for the Air Return Fans and Hydrogen Skimmer Fans.

RECOMMENDATION OR RESOLUTION Joy adds drains to main conduit boxes (Reliance Item) due to varied fan orientations making it possible to have the conduit box the low point in the motor casing. In the air return fan (vertical flow down) application, the motor end bell drain breather is the low point. Joy Reliance FAn-Motors were qualified with Joy designed drain-breathers installed. Therefore, all in-containment applications should have the drain-breathers installed for safety related applications (simply because other drain, breather or plug combinations have not been tested).

SIGNED: P. M. White 2/5/88

JPV 2/11/88

February 5, 1988

Memo to File: CN1320.00

Subject: Catawba Nuclear Station
Hydrogen Skimmer Fan Motor/Air Return Fan Motor
Drain/Breather information

Ref: Telecon 2/5/88 between P M White, JPV, JEC (Duke Power Company) and Gary Wheeler (Reliance)

During the referenced telecon, we discussed some of the design features of the type motors driving the subject fans. Listed below are some of the more pertinent discussion items:

- Motors furnished to Joy Manufacturing Company for Safety Related In-Containment use are of the Explosion Proof type construction. They are not UL labeled, however.
- Motors are normally shipped to Joy with drain/breather holes plugged. Joy installs drain/breather fittings prior to shipping to the user.
- Joy uses a Crouse-Hinds type drain/breather.
- These motors have labyrinth seals along the shaft on the endbells. The labyrinth seals make any air flowing parallel to the shaft centerline change direction before entering or exiting the motor housing.
- Design parameters for a motor of this type include a 5 psig/sec. transient capability.
- With the heaters energized, the motor would maintain a 5 degree C above ambient temperature after cooldown while idle.

J P Voglewede
Supervising Design Engineer

7HYDSKIM.JPV/csc

ATTACHMENT IV

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT Catawba 1.

1a. SERIAL NO. _____
b. FILE NO. _____

RECEIVING INSPECTION REPORT

2. DUKE REQ./ITEM NO.	2. MILL POWER ORDER NO.	3. MFG. ORDER NO.	3. VENDOR & LOCATION
1210-04-00-0011	F9084	396447	Rosemount

5. DESCRIPTION & IDENTIFICATION

4 ea. Model 1153DD4 Electronic Differential Pressure Transmitters
Tag # INVLT5740 S/N 406503
INVLT6070 406504
2NVLT5740 406505
2NVLT6070 406506

6. SHIPMENT NUMBER	7. P-18 NUMBER, REV.	8. QA REQUIRED ☒ YES ☐ NO	9. COMPONENT NUMBER
94993	MR Rev 2	CONDITION 1	

10. RECEIVING INSPECTION VISUAL EXAMINATION REMARKS:
☒ MATERIAL RECEIVED IN SATISFACTORY VISUAL CONDITION
☐ OTHER (DESCRIBE) _____

4. STORAGE LOCATION
Hold #4

QUALITY ASSURANCE DOCUMENTATION RECEIVED: C of C

11. STORAGE REQUIREMENTS: LEVEL ☐ A ☐ B ☐ C ☐ D ☐ SPECIAL NA

12 STATUS OF ITEM	DATE	SIGNATURE	
[ ] ☐ Postponed ☐ Documentation ☐ Inspection Requirements Q.C. HOLD S/N _____	NA	NA	DO NOT ISSUE OR USE
[ ] NON-CONFORMING ITEM S/N _____	NA	NA	
[ ] Q.C. INSPECTION ACCEPTABLE	7-12-83	Don Howgatte	RELEASED FOR ISSUE
[ ] Q.A. SITE RECORDS ACCEPTABLE (May be released from "Q.C. HOLD" if applicable)			
[ ] Q.A. TECHNICAL SERVICES VENDOR RECORD REVIEW: COMPLETE AND ACCEPTED			

Original - Record Copy - Yellow - QA Technical Services Stub - QA Engineer

CATAWBA EQ INSPECTION WORKSHEET **ATTACHMENT V**

ITEM NO.: _____ SUBJECT/EQUIPMENT: Training DATE: 02/08 / 88

FILE#: N/A PAGE: 1

RESP. INDIVIDUAL/GROUP: _____ / N/A REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	What training has been provided to site QA Personnel	EQ requirements are addressed in the Installation Specification (CNS-1390.01). QA personnel are trained in the Installation Specifications. QA personnel are not formally trained in EQ requirements they are, through job experience, familiar with EQ requirements. Formal training in the EQ manual will be provided in the QA Technical Support Training Plan to QA Tehcnical Support personnel.	Yes	
2a	What provisions have been made in the ETQS program for EQ training for craft personel?	Tasks that are performed by I&E Technicians at Catawba are performed in accordance with approved procedures. These procedures contain appropriate guidance to assure that EQ requirements are maintained during maintenance work performed under these	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
		procedures. Technicians who perform work under these procedures are OJT trained and qualified to these procedures and tasks, prior to being allowed to perform the work unsupervised. This OJT training and qualification process assures that the EQ provisions of the procedures are implemented by the technicians. A need has been identified to develop and deliver a formal classroom session on the EQ program. Lesson plans are presently being developed by the Production Support Department to address the Equipment Qualification Program and its affect in the IAE Maintenance area. Preliminary review has been completed by the IAE EQ SME. This lesson plan will be conducted in a classroom setting and covered with		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: _____ SUBJECT/EQUIPMENT: Training DATE: 02/08 / 88

FILE#: N/A
RESP. INDIVIDUAL/GROUP: _____ / N/A

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
		all appropriate IAE personnel, stressing the following: History of Equipment Qualification Design Engineering Process to Meet Regulatory Requirements Catawba Nuclear Station Equipment Qualification Process Importance of Equipment Qualification Requirements		
2b	Have craft personnel been trained on the EQ program?	OJT training and qualification has been administered to the technicians performing EQ related work unsupervised (as described in 2a above). Crew meetings were conducted by I&E supervisors or PIR C87-0045 (Improper Part Replacement Affecting Operability)	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: _____ SUBJECT/EQUIPMENT: Training DATE: 02/08 / 88

FILE#: N/A PAGE: 4

RESP. INDIVIDUAL/GROUP: _____ / N/A REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
		which explained the need to follow proper procedures when replacing parts during maintenance activities. Additional classroom training is planned per item 2a above.		
3	What is the scheduled date for implementation of the EQ lesson plan (for craft) which is due to be completed by 3-15-88	A lesson plan on EQ is being developed and will be delivered to appropriate I&E Technicians. The lesson plan is scheduled to be completed by 3/15/88. The classes will be scheduled to deliver this training in accordance with the I&E training cycle schedule.	Yes	
4	What specialized training in the EQ programs have the Qualified Reviewers listed for the I&E department received?	EQ is addressed in Catawba's Qualified Reviewer Personnel Training.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [redacted]ECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Training DATE: 02/08 / 88

FILE#: N/A PAGE: 5

RESP. INDIVIDUAL/GROUP: _____ / N/A REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
		The training package was reviewed with the inspector on 2/3/88.		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ INSPECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: PIR's DATE: 02/08 / 88

FILE#: N/A PAGE: 6

RESP. INDIVIDUAL/GROUP: _____ / N/A REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	PIR-0-C87-002A has determination of root cause been made and has it been reviewed for generic applications. (Other units, other sites)	Resolution has been stated, however it does not appear to address root cause. Note that the PIR was written by Design Engineering. Subsequent discussion with Design Engineering personnel indicated no generic consideration review was required because it was discovered during a Design review of EQRI items.		
2	PIR-0-C87-0033 and special surveillance CN-87-17 identifier deficiencies of EQ equipment; specifically, improperly torqued bolts and/or absence of bolts and clamps for equipment enclosures. What is root cause of problems? What is root cause of problems? What corrective adtions have been developed and implemented?	All Rosemount transmitters included in the EQRI have been reviewed for compliance with EQ requirements and Procedure changes were initiated where necessary. Work request were written for affected instruments Root cause appears to be an inadequate procedure.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ[illegible]PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: PIR's DATE: 02/08 / 88

FILE#: N/A PAGE: 7

RESP. INDIVIDUAL/GROUP: _____ / N/A REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
3	PIR-0-C87-0137 what is status of the corrective action developed for the resolution of the identified deficiency? What was the root cause of the problem?	An SPR (Station Problem Report) has been written by Design Engineering. This will invoke a review of the EQRI manual by station personnel. The SPR has recently been received at the station and is awaiting review by the Superintendent of Technical Services Root cause appear to be personnel error.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [redacted]PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: QA Condition Level for EQ Equip. DATE: 02/08 / 88

FILE#: N/A
RESP. INDIVIDUAL/GROUP: _____ / N/A

PAGE: 8
REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	What QA levels are used for procurement of EQ equipment?	QA condition 1 is used in procuring all safety-related equipment.		
2	Where is it documented (i.e. QA conditions of EQ equipment)?	There are no 10CFR50.49(b)(2) equipment at Catawba. Therefore, all EQ equipment is Safety-Related, QA condition 1 and procured and maintained per QA procedures.		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [redacted]PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Hydrogen Recombiner Splices DATE: 02/08 / 88

FILE#: CNM-1399.36-10 PAGE: 9
RESP. INDIVIDUAL/GROUP: _____ / N/A REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	What is the qualification basis for the Hydrogen Recombiner qualified splices?	The qualification basis for the Hydrogen Recombiner splices is contained in several test reports. These test reports will be added to the Recombiner file along with a similarity analysis which will demonstrate qualification of the installed splices.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [redacted]PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Limitorque Terminal Blocks DATE: 02/08 / 88

FILE#: CNM-1205.19-001 PAGE: 10
RESP. INDIVIDUAL/GROUP: RJS / ECTS REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	What promoted investigation of terminal blocks on Limitorque actuators	NRC tentative rejection of Limitorque Test Report B0119 and impending issue of IE Notice.	Yes	
2	Why was it not known terminal blocks were installed on Limitorque actuators?	We did know that the terminal blocks were installed through connection diagrams. This is how we identified the problem. Note: NUREG-0588 has been updated to reflect information that valves are not required to function after a DBE.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ INSPECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Electrical Penetrations DATE: 02/08 / 88

FILE#: IE Notice 81-020&029 PAGE: 11
RESP. INDIVIDUAL/GROUP: RPD / ECTS REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	Please address IE Notice 81-020 & 029. What resolution is there to the thermal aging failure of model "K" penetration grommets.	The type "K" electrical penetration plugs were retested at Wyle Laboratories (Wylie Report No. 45869-1). More emphasis was placed on accurately simulating the actual station environment under accident conditions. The qualification of the type "K" electrical penetration plugs was re-verified as documented in file CNM1361.00-0016-001, pages 5-1 through 5-335, pages 6-1 through 6-91 and pages 7-1 through 7-25.		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [redacted] PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Conax Penetrations/All DATE: 02/08 / 88

FILE#: CNM-1361.00-48 PAGE: 12

RESP. INDIVIDUAL/GROUP: RPD / ECTS REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	During the walkdown of Conax penetration 121 was noted that plastic caps were used on the connectors not being used outside of the enclosure box. Please discuss this item. Should they be sealed?	Caps (metal or plastic) are used on spare electrical penetration connectors as dust caps for housekeeping purposes only. Environmental sealing is not required since the penetration conductors are solid wire and the connector is potted. Moisture incursion into the electrical penetration cannot occur. The caps are not required for equipment qualification.	Yes	
2	Provide the documentation which determined the qualified life of the Conax Penetrations.	The documentation which determines the qualified life of the Conax electrical penetrations is in files CNM1361.00-0048-001 and CNM1361.00-0062-001 (IPS.325).	Yes	
3	Provide documentation showing qualification of the Litton connectors associated with the Conax penetrations.	The Litton connectors used with the Conax electrical penetrations were qualified with the core exit thermocouple system by Combustion Engineering. The qualification documentation for the Litton connectors is in file CNM1354.12-0026-001.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ SECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Rosemount 1153 Series B DATE: 02/08 / 88

FILE#: CNM-1210.04-0262 PAGE: 13
RESP. INDIVIDUAL/GROUP: LBC / ESES REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	For devices CN2NVLT5740/6070, the NRC field survey did not note the manufacturer name plate which identifies the transmitter model type.	For Safety Related transmitters the purchase is made by specification CNS-1210.04-00-0011. In paragraph 8.1.3 the manufacturer is required to provide a metal tag with certain information. The paragraph reads "8.1.3 Each transmitter and each sensor shall have a metal tag (not aluminum) with the appropriate Duke Mark Number, Item Number 1210.04-00-0011 and the factory calibrated range. In addition, each electronic transmitter assembly and cover plate shall have a serial number that is accessible on the fully assembled instrument. (DPU and electronic housing are one unit, inseparable, therefore, need not have individual serial numbers). The manufacturer's name, model number, and the available process range should also appear on the instrument." Upon receipt of ordered devices Duke personnel inspect the devices in accordance	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: _____ SUBJECT/EQUIPMENT: Rosemount 1153 Series B DATE: 02/08 / 88

FILE#: CNM-1210.04-0262 PAGE: 14
RESP. INDIVIDUAL/GROUP: LBC / ESES REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**

with QA procedures. The inspection form P-1A is completed and filed. At installation, QA Installation Inspection Procedure M-61 was used to inspect the installation. Both the receipt and installation inspections verify the Duke tag number (i.e. Duke mark number) and the device model number from the manufacturer supplied tags. If either inspection cannot verify both tag number and model number against purchase order (receipt inspection) or I&C List (installation inspection) then corrective action is required.

After installation, calibration/maintenance procedures use the Duke tag number as the means of device identification for all work activities including EQ maintenance and end-of-qualified life change-out. Transmitter model number can be verified in the field by use of either the EQRI or the I&C List.

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: _____ SUBJECT/EQUIPMENT: Rosemount 1153 Series B DATE: 02/08 / 88

FILE#: CNM-1210.04-0262 PAGE: 15
RESP. INDIVIDUAL/GROUP: LBC / ESES REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
2	What procedural method is used to ensure that the spare cable entrance is properly environmentally sealed?	The Equipment Qualification Reference Index (EQRI) calls for Duke Power Specification requires the spare cable entrance to be sealed environmentally. Also referenced by the specification is the Rosemount instruction manual (CNM-1310.04-0245) which requires the spare cable entrance be environmentally sealed.	Yes	
3	Provide NRC with a copy of EQRI pages for Rosemount 1153 series B.	Copy of EQRI pages were provided.	Yes	
4	Report 108026, page 74 - paragraph 15.4.1, describes a failure of the fill tube closure solder for the high static pressure housing (3000 psig). Also discussed is a recommended fix of spot welding the fill tube closed. Has this been incorporated into the transmitter qualification of the high pressure housing design?	Supplemental testing of high static pressure housing has been finished by Rosemount and referenced in Report 108025, Revision D (page 19 - paragraph 7.1.9) and Report 88114 (reference 2.24 of Report 108025). Rosemount has stated verbally that the fill tube qualification fix was	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: _____ SUBJECT/EQUIPMENT: Rosemount 1153 Series B DATE: 02/08 / 88

FILE#: CNM-1210.04-0262 PAGE: 16
RESP. INDIVIDUAL/GROUP. LBC / ESES REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**

implemented prior to any transmitters of the high static pressure design being sold, and Rosemount is to send Duke Power written confirmation of this and this information will be placed in the appropriate files.

As additional information, Duke Power has only one application of the high static pressure housing which is 2NVFT6150 (1153HD5PA). The process piping design pressure is 2750 psia. Note however, that the transmitter is not in a high temperature area (annulus-maximum DBE temperature is 147°F) and the equipment failure during the test was at LOCA temperature of 318°F.

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [redacted]PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: VE System Heater Wire DATE: 02/08 / 88

FILE#: PIR 0-C88-002[redacted] PAGE: 17
RESP. INDIVIDUAL/GROUP: [redacted] / MDHV REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	What promoted investigation of VE system wiring which resulted in PIR 0-C87-0024?	The VE wiring qualification was discovered during a review of all EQ files which were initiated as a result of QA Audit.	Yes	
2	Was VE wiring that was removed tested for qualification? If so, what were results?	No, DPCo. had provided a Justification for Continued Operation.	Yes	
3	Electric heater wire was not qualified to the postulated post-accident environment.	Design Engineering provided additional documentation to demonstrate the qualification of the wire. This documentation will be formally placed in the appropriate EQ package.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ INSPECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Rotork Valve Actuator/NA-1 (Pre-78) DATE: 02/08 / 88

FILE#: CNM-1205.19-65 PAGE: 18
RESP. INDIVIDUAL/GROUP: JHH / MEVL REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	2ND002A-Rotork -Found several wires with nicks on insulation	The unconnected wires are spare conductors, which are grounded at the terminal box end per installation procedures.	Yes	
	-6 wires unconnected to terminal box found to have exposed conductors (EW0520)	Duke Power Company provides tracibility of cables from device to qualification test report.	Yes	
	a. Determine if the wires with exposed conductors carry any load.			
	b. Traceable wires to qualification Report			

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ INSPECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Rotork Oil _____ DATE: 02/08 / 88

FILE#: CNM-1205.19-65&67 PAGE: 19
RESP. INDIVIDUAL/GROUP: JHH / MEVL REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	What type of oil is used in Rotork actuators?	Duke Power Company uses Spartan EP150 oil per Rotork Maintenance Manual (CNM-1205.19-002)	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ [illegible]PECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: CE Thermocouple Cable Part 21 DATE: 02/08 / 88

FILE#: CNM-1354.12-19 PAGE: 20
RESP. INDIVIDUAL/GROUP: RGM / ESES REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	Provide documentation which resolves the CE Thermocouple Cable part 21.	Duke Power Company provided the CE Test Report which was reviewed and accepted.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ INSPECTION WORKSHEET

ITEM NO.: _____ SUBJECT/EQUIPMENT: Raychem Splices DATE: 02/08 / 88

FILE#:
RESP. INDIVIDUAL/GROUP: _____/_____ PAGE: 21
REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1	Address Bend Radius.	Duke Power Company provided supplemental information (CNM-1354.00-78) which was reviewed and accepted.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

CATAWBA EQ INSPECTION WORKSHEET

ITEM NO.: 1 SUBJECT/EQUIPMENT: Barton 764 Transmitter (BOP) DATE: 02/08 / 88

FILE#: CNM-1210.04-0261 PAGE: 22
RESP. INDIVIDUAL/GROUP: LBC / ESES REV. 0

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
1A	Report FR-032175, Section 6 suggests replacement of copper wire with stainless steel. How have these suggestions been incorporated into the qualification of the transmitter?	The suggestion of HI-REL Laboratories to use stainless steel wiring is a recommendation based only on the review of the gland seal and did not consider the testing facility set-up. The use of stainless steel wiring has not been, nor does it need to be, incorporated into the transmitter design or qualification. The instrusion of water and steam to pin connections of the gland seal was caused by a test set-up method weakness not a device qualification weakness (see Report R3-764-11 in the Addendum to Report R3-764-9. The lead wire penetration from inside to outside the LOCA chamber was not a pin termination type, thus the transmitter lead wire penetrated the LOCA chamber to the outside without a physical discontinuity.	Yes	

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
		This means that from transmitter end of the lead wire to the DBE test instrumentation connection end, there was [illegible] psig pressure differential. The high pressure differential forced steam and water into the pin area of the gland seal and along the entire length of the lead wires (under the lead wire insulation) until water exited at the DBE test instrumentation connection. The test set-up anomally does not affect Duke Power installations because the containment penetrations cause a physical discontinuity at the vessel pressure boundary. The lead wire from the transmitter does not penetrate to outside containment, therefore, both ends of the lead wire are at the same pressure		

NO.	QUESTION	RESPONSE	ACC.*	A.R **
		resulting in a zero pressure differential along the lead wire axis. With no pressure driving force there will not be any intrusion of water or steam into the pin connection area of the gland seal.		
1B	Verify that accuracy calculations are consistent with the installed configurations (i.e., eight feet of stainless steel wiring).	As discussed in Response 1A, the HI-REL Laboratories' suggestion to use stainless steel wiring is not required or implemented. Therefore, there is no calibration or accuracy variations due to higher resistances of stainless steel wiring. The Duke Power accuracy calculations do reflect the installed configurations.	Yes	
2	Provide copies of responses to IE Notices 81-029, 82-052, and 83-072.	Copies of responses to IE Notices 81-029, 82-052, and 83-072 have been provided.		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: 1 SUBJECT/EQUIPMENT: Barton 764 Transmitter (BOP) DATE: 02/08 / 88

FILE#: CNM-1210.04-0261
RESP. INDIVIDUAL/GROUP: LBC / ESES

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
3	R3-764-9, page 5, Footnote '*' and Addendum to Report R3-764-9, page 7-3 describe technical justification to show that the DBE 5 minute error specification (±5%) has been met for transmitters 764-327 and 764-1501.	Duke Power has not used a ±5% accuracy for any Barton 764 (BOP) transmitter in a LOCA environment. All Balance-of-Plant Barton 764 transmitters in a LOCA or HELB environment would have a ±10% accuracy used for environmental effects. Additional Information: For pressurizer level (located in containment) there is no 5 minute accuracy requirement. For pressurizer level the required accuracy is ±25% and the demonstrated accuracy is ±15%. For steam generator wide range level (located in the annulus) there is no 5 minute accuracy requirement. For steam generator wide range level the required accuracy is ±20% and the demonstrated accuracy is ±16%.		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED

ITEM NO.: 1 SUBJECT/EQUIPMENT: Barton 764 Transmitter (BOP) DATE: 02/08 / 88

FILE#: CNM-1210.04-0261
RESP. INDIVIDUAL/GROUP: LBC / ESES

NO.	QUESTION	RESPONSE	ACC.*	A.R.**
		For auxiliary feedwater flow (located in the doghouse) there is no 5 minute accuracy requirement. For auxiliary feedwater flow the required accuracy is ±16.4% and the demonstrated accuracy is ±15.6%. For steam generator narrow range level (located in the annulus) there is a 5 minute accuracy requirement. Note that these transmitters are all NSSS supplied Barton devices. For steam generator narrow range level the required accuracy is +5% (5 minute-trip function) and the demonstrated accuracy is less than +5% (5 minute). The PAM function required accuracy is ±25% and the PAM function demonstrated accuracy is °15%. Also note that for the annulus locations there is not a high temperature steam environment as a result of a DBE.		

* ACC.: ACCEPTED
** A.R.: ACTION REQUIRED