UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

2 FEB 1987

Docket Nos.: 50-315
and 50-316

Mr. John Dolan, Vice President
Indiana and Michigan Electric Company
c/o American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43216

Dear Mr. Dolan:

During the period of September 15-19, 1986 a survey was conducted of the control room ventilation system at the D.C. Cook Nuclear Power Plant. The survey was performed by John Driscoll, Malcolm Carnes, and Roger Evans of Argonne National Laboratory and Jack Hayes of the Plant Systems Branch, Division of PWR Licensing-A. The survey team gathered flow rate data in various portions of the Unit 1 and Unit 2 control room ventilation systems with the systems operating in their normal mode of operation. In addition, data were also gathered with each ventilation system operating in its emergency radiological and toxic gas operating modes.

The survey team concluded that:

(1) The utility's staff was knowledgeable, and plant management seemed to take the approach of doing what needs to be done rather than the minimum necessary to meet regulations.

(2) System design is the best design surveyed to date. The normal ventilation system is segregated from the emergency ventilation system which minimizes potential interaction problems observed at other facilities.

(3) While design is the best observed to date some questions or problems do exist. They include:

(a) the present system appears subject to single failure e.g. single normal intake, emergency recirculation, and toilet exhaust dampers and a single Cl_2 detector of each unit.

(b) interconnection of drains between each air handling unit and between each reactor's air handling units may present a common mode failure.

(4) Technical specifications prepared for the control room may require some changes to be consistent with the Cook III.D.3.4 analysis (See specific comments in Attachment A).

(5) Present operation of the control ventilation system is such that it is imperative that the mechanical equipment room be maintained positive to a degree that infiltration into the room is not a problem. Merely maintaining it slightly positive does not appear to be enough. If this room is negative, sources of unfiltered air in this room would include 2000 cfm of normal makeup and inleakage through the drain in the idle air handling unit. A definitive pressure should be established for the equipment room. An appropriate value might be 1/8 inch water gauge.

(6) It does not appear that the toxic gas analysis presented as part of the III.D.3.4 analysis reflects actual system operation.

(7) Since the SER was issued on III.D.3.4 in 1982 the licensee has altered in at least two instances the amount of filtered makeup flow, the amount of filtered recirculation flow and the amount of assumed unfiltered inleakage into the control room envelope. The licensee's 50.59 evaluations should be reviewed to ensure the 50.59 discussions demonstrated that:

    (a) the consequences of accidents previously evaluated in the safety analysis report were not increased by the changes made in makeup flow; and

    (b) the margin of safety as defined in the basis of technical specifications 3/4.7.5.1 was not reduced.

(8) The training manuals need to be updated to describe the present operating system. Some of the information contained in them is very out-of-date.

(9) Highlights of the analysis of the flow data from the two units indicate:

    (a) there appears to be an interaction between the Unit 1 and Unit 2 control rooms. Flow appears to go from Unit 2 to Unit 1.

    For Unit 1

    (b) outleakage ranging from 1100 - 4100 cfm occurs from the air handling units ACRA-1 and ACRA-2 under all modes of operation.

    (c) ductwork downstream of ACRA-1 showed an outleakage rate of 900 - 2400 cfm in all but one case.

    (d) supply to the computer room and control room was 400-500 cfm less than exhaust except when ACRA-1 was operating with the east emergency filter fan.

    (e) east emergency filter fan seems to show a considerable amount of inleakage when in operation.

    (f) west emergency filter fan seems to show a considerable amount of outleakage when in operation. This may be caused by penetrations in the east emergency filter fan.

    (g) leakage through the bubble tight damper appears to be approximately 500 cfm, maximum.

For Unit 2

(h) outleakage ranging from 1100-3700 cfm occurs from each air handling unit.

(i) a considerable amount of inleakage seems to occur in the ductwork between the electrical heater on the discharge side of the air handling units and the sampling ports in the supply ductwork to the control room and computer room.

(j) inleakage to the emergency filter fans ranges from 1100-3600 cfm.

(k) leakage through the bubble tight damper appears to be less than 40 cfm.

This survey was conducted as the result of our request to IMEC and we are informed that the Cook Plant personnel were extremely cooperative and pleasant to work with. The results of our survey are being made available to you for your information and appropriate action. If you have any questions on the results of the survey, please contact the licensing project manager, D. Wigginton.

Sincerely,

B. J. Youngblood

B. J. Youngblood, Director
PWR Project Directorate #4
Division of PWR Licensing-A

Enclosure: As stated

cc: See next page

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ATTACHMENT 1

NRR REPORT ON D.C. COOK UNITS 1 AND 2 CONTROL ROOMS

By: Jack Hayes
X27471

A. SYSTEM OPERATION

Flow measurements were made in various portions of the Unit 1 and 2 control room ventilation systems with each unit's system operating in its normal mode. Each unit has two air handling units (ACRA-1 and ACRA-2) which are 100% capacity systems. Measurements were made with each air handling unit operating. Following these measurements, the system was placed in the emergency mode of operation associated with a radiological challenge. Again, each air handling unit was operated and outside makeup air and control room recirculation flow was passed through the emergency filtration unit. There is only one emergency filtration unit per control room ventilation system but there are two-100% capacity emergency fans with each unit. Flow data was taken with each emergency filtration fan (ACRF-1 and ACRF-2) operating. Thus, four data sets were collected for each control room ventilation system.

The system was placed in the emergency mode of operation associated with a toxic gas challenge. During this mode of operation, the control room envelope was isolated from outside air and normal air handling units ACRA-1 and ACRA-2 were operated in the internal recirculation mode. Emergency filter trains do not operate in this mode.

Tables 1 and 2 of Attachment 2 present the flow data for Units 1 and 2 respectively. Differential pressure measurements with respect to the adjacent areas, each control room, and each mechanical equipment room were made in each operating mode and for each different combination of operating fans are contained in Table 5 of Attachment 2.

<u>Evaluation of System Operation</u>

Based upon the flow measurement data presented in Attachment 2 and the system flow balance calculations presented in Tables 3 and 4 of Attachment 2, the following conclusion can be drawn concerning operation of the D.C. Cook Units 1 and 2 control room ventilation systems.

Interaction of Units 1 and 2 (All Operating Conditions)

1. For Unit 2, the flow to the control room and computer room remain relatively constant and within 1000 cfm of the supply and makeup to the air handling units. For Unit 1, the flows to the computer room and the control room are much less and as much as 3900 cfm less than the return and makeup flows to the air handling units.

2. The return air from the control room is about 17,700 cfm for Unit 2 in all modes of operation and 14,800 cfm for Unit 1.

3. The amount of emergency makeup air varies considerably for each unit.

4. Supply to the Unit 2 control room is greater than the return. The situation is reversed for Unit 1. Interaction is suspected between control rooms.

Unit 1 Normal Operation

1. Outleakage from the air handling units appears to be 2800 cfm for ACRA-1 and 1050 cfm for ACRA-2.

2. Ductwork leakage appears to be 1800 cfm from the point at the heaters in the exhaust of the air handling units to the point of the measurement ports for the control room supply and computer supply.

3. Return from the computer room is much greater than supply (2090-2200 cfm versus 1480-1770 cfm).

4. Return from the control room is considerably greater than supply (3450-4800 cfm greater).

Unit 1 Toxic Gas Mode of Operation

1. Outleakage from the air handling units appears to be 1500 cfm for ACRA-1 and 2500 cfm for ACRA-2.

2. Ductwork leakage appears to be 2400 cfm from the exhaust of the air handling units to the measurement ports of the control room supply and computer room supply when ACRA-1 is operating and 2800 cfm when ACRA-2 is operating

3. Exhaust from the computer room remains relatively constant.

4. Supply to the control room is less than exhaust from the control room with the deficiency being 4900 cfm when ACRA-1 is operating and 3600 cfm when ACRA-2 is operating.

Unit 1 Radiological Mode of Operation

1. Considerable amount of leakage occurs from the air handling units based upon a comparison of supply flows and exhaust flows. Range is 3000-4100 cfm.

2. The sum of flow in the ductwork to the computer room and the control room always showed 400-500 cfm less flow than the exhaust from the air handling units except when ACRA-1 was operating with the east emergency filter fan.

3. With the west emergency filter fan operating, the supply to and exhaust from the computer room seemed to balance. With the east fan operating supply was 300-700 cfm less.

4. Flow measurements in ductwork from the emergency filtration train showed very poor agreement with the flow measurements at the supply grill of the control room. Measurements at the supply grill were fairly consistent when the west emergency fan was operating. Ductwork measurements, on the other hand, showed good consistency with the east fan operating

5. There seemed to be good agreement on flows between the multi-port pitot tube measuring device and the downstream ductwork test point when the east fan was operating but not the west fan. It appears that the west fan has a significant amount of outleakage. However, when the comparison is made based upon the amount of return and makeup flow to the filter, there

appears to be significant inleakage into the system when the east fan is operating. When the west fan is operating the sum of the return and makeup flow is almost equal, if not greater than, the flow measured in the ductwork downstream of the emergency train. The sum of the return and makeup flow is always much less than the flow measured by the multi-port pitot tube measurements.

6. With the west fan operating, the supply to the control room and the return from the control room were constant. With the east fan operating, as the return increased, the supply decreased.

Unit 2 Normal Operation and Toxic Gas Mode of Operation

1. A significant amount of outleakage occurs from the air handling units (1850 cfm from ACRA-1 and 3275 cfm from ACRA-2).

2. Supply to the control room and computer room always measured more than the exhaust from the air handling units. This suggests considerable ductwork leakage between the exhaust from the air handling units downstream of the electrical heaters and the sample ports for measuring flow to the computer room and the control room. Leakage is estimated as 600-2300 cfm.

3. Supply to the control room was always less than return flow except for the toxic gas mode when ACRA-2 was operating. In that case, the flows were approximately equal.

4. Return air from the computer room and the control room was relatively constant when ACRA-2 was operating. This was not the case with ACRA-1 operating.

5. Supply to the control room was 300-1700 cfm greater for the same air handling unit when operated in the toxic gas mode than when operated in the normal mode.

6. Exhaust flows from the air handling units were 1400 cfm less in the normal mode compared to the toxic gas mode.

Unit 2 Radiological Mode of Operation

1. The supply to the computer room was 200 cfm less when the east emergency filter fan was operating versus when the west fan was operating.

2. Flow from the emergency filter unit as measured in the discharge ductwork exceeded design flow by over 3500 cfm in three of the four data sets.

3. Return flow from the computer room was constant in all four configurations.

4. The makeup air from the mechanical equipment room was greater when ACRA-1 was operating versus when ACRA-2 was operating and was greatest when the east emergency filter fan was operating.

5. Flow to the air handling units remained constant based upon measurements in the return grills to the air handling units. Discharge flows from the air handling units varied.

6. Considerable outleakage occurs from the air handling units (2050-3800 cfm).

7. Considerable inleakage occurs in the ductwork from the point downstream of the electrical heaters in the air handling units to the sampling ports for the supply to the control room and the computer room (1700-2750 cfm).

8. The supply to the control room did not vary when ACRA-1 was operating.

9. Inleakage to the emergency filter housing ranged from 1100 - 3600 cfm.

B. III.D.3.4 Analysis Reflecting System Operation

One of the purposes of the survey was to determine whether the actual operation of the control room ventilation reflected the III.D.3.4 submittal for the facility and the NRC staff's associated SER. Based upon the survey team's assessment of the D.C. Cook system flow data and a review of their III.D.3.4 analysis, the team has concluded that the present operating system resembles the system described in a July 10, 1986 letter to the NRC staff for radiological challenges but not for toxic gas challenges.

In a February 9, 1981 letter from the licensee, the licensee indicated that the emergency filter train would be operated during a Cl_2 gas challenge. This was further detailed in an NRC staff SER issued in 1982. Observation of the actual operation of the control room ventilation system while in the toxic gas mode and a review of plant operating procedures showed that the emergency filter train is not operated and is not intended to be operated during a toxic gas challenge. Therefore, a new toxic gas evaluation should be performed based upon the present operating scheme and the associated infiltration rates into the control room envelope through damper leakage, ingress/egress, etc. Since damper ACRDA-2 allows a minimum flow of 800 - 1000 cfm even when closed, the capability of the impregnated charcoal to remove the Cl_2 for a period of time should be evaluated along with the capability of the operator to tolerate this additional quantity of toxic gas. Since isolation of the control room is not an automatic function, and since an operator is required to go outside the control room envelope to isolate the control room envelope, the reanalysis must take into account the time the operator is outside the control room envelope.

The survey team determined that the number of self-contained breathing apparati is insufficient to ensure that the Regulatory Guide 1.95 criterion is met. The licensee should ensure that a sufficient quantity exists for the operators.

It is clear from the analysis of the system flow data and discussions with the Cook staff that the present mode of operation for a radiological challenge incorporates parameters that are different than those presented in the III.D.3.4 analysis. The present operating scheme was presented in the July 10, 1986 letter to the staff. Since the manner in which the control room ventilation system presently operates is based upon a greater quantity of filtered flow and unfiltered inleakage and a different amount of recirculation flow than was presented in the III.D.3.4 analysis, it appears that the consequences of an accident may be greater than those previously evaluated in the safety analysis report. Consequently, the licensee's 10 CFR 50.59 determination should be reviewed to ensure that a proper evaluation was completed.

Review of the III.D.3.4 analysis and the July 10, 1986 letters also shows that the licensee omitted the leakage from the ECCS equipment in their calculation of the control room operator doses. The analysis should have included this source.

C. Technical Specifications

In the performance of these surveys technical specifications are reviewed to determine whether they reflect the assumptions utilized by the licensee in their III.D.3.4 submittal and the conclusions reached by the NRC staff in their SER. In addition, the technical specifications are reviewed as to their capability to adequately demonstrate system operability. However, in the survey of the D.C. Cook Plant, present technical specifications were not reviewed but rather those provided in the licensee's July 10, 1986 letter were. This was because the licensee has recognized certain deficiencies and errors in the present technical specifications and the need to modify them. Therefore, commenting on the present ones would not be relevant. Based upon this review the following comments seem appropriate:

1. The designation of the components of the control room emergency ventilation system which shall be OPERABLE should be modified such that technical specification 3.7.5.1.c specifies the emergency filter train and 3.7.5.1.d specifies the control room envelope.

   The portions of the control room emergency ventilation system which are proposed to be required as OPERABLE appear ambiguous. For example, item a, independent heating and cooling systems, does not ensure that the air handling units associated with the heating and cooling system are included. Therefore, air handling units ACRA-1 and ACRA-2 should be included in 3.7.5.1.a.

   The filter train should not be limited to the charcoal adsorber and HEPA filter. Rather it should include the prefilter, filter housing, etc. Therefore, 3.7.5.1.c should state, "One emergency filter train, and ..". It should be made clear that the pressurization fans in item 3.7.5.1.b are emergency filtration system fans ACRF-1A and ACRF-1B for Unit 1 reactor and ACRF-2A and ACRF-2B for Unit 2.

The pressure boundary for the GDC-19 doses is the control room envelope and not just the control room. Therefore, 3.7.5.1.d should state "... control room envelope."

2. The action statements should account for the fact there is only one emergency filter train and that limitations on fuel handling are not addressed.

For modes 1-4 if the filter train is inoperable, then the reactor should be in hot standby in 6 hours, cold shutdown etc. if the filter unit cannot be restored to operable after 24 hours. Seventy-two hours would only be appropriate if the licensee could demonstrate that Unit 2 is capable of maintaining both the Unit 1 and Unit 2 control room envelopes pressurized as required by plant technical specifications and vice versa. For modes 5-6, the licensee must address fuel handling operations with the various portions of the control room emergency ventilation system inoperable.

3. Surveillance reouirement 4.7.5.1.a should take into account the actual equipment oualification temperature for control room instrumentation and should be measured at the location of the most temperature sensitive equipment.

The proposed surveillance requirement 4.7.5.1.a states that control room air temperature should be less than 120°F. This technical specification addresses equipment qualification temperature for the control room instrumentation. It is unclear from discussions with the licensee what the equipment qualification temperature is for the control room instrumentation. However, regardless of what that temperature is, measurement of the ambient control room air temperature is inappropriate for this purpose since when the air temperature is 80°F or greater, panel and cabinet temperatures may approach 120°F or greater. Thus, an appropriate electrical cabinet or panel location must be determined for monitoring temperature. Such a determination should take into account the impact of a lack of or reduced air flow or localized hot spots on sensitive instrumentation important to reactor operation.

4. Surveillance requirements 4.7.5.1.b should have system operation occurring for 1 hour. Operation for 1 hour ensures that the system can function without an early trip.

5. The laboratory test for charcoal should be conducted at 30°C utilizing the ASTM D3803 test method and the acceptance criteria should be an allowable penetration of 0.8% (4.7.5.1.c.3 and 4.7.5.1.d).

   The present laboratory test of charcoal is conducted at an inappropriate temperature (130°C), since the control room environment would never experience this temperature. At 130°C the charcoal would actually show more adsorption capability than it would have at normal operating conditions (30°C). The present test is actually regenerating the charcoal. The proposed acceptance criteria is at a value which does not justify the value assumed in either the III.D.3.4 analysis or the July 10, 1986 analysis in that it does not take into account degradation of the charcoal with time due to weathering and aging.

6. The in-place DOP and freon test acceptance criteria should be 0.05% penetration for the HEPA filter and the charcoal adsorber, respectively (4.7.5.1.c.1, 4.7.5.1.c.2, 4.7.5.1.c.3, 4.7.5.1.f, and 4.7.5.1.g).

   The present surveillance requirement for in-place testing of the charcoal adsorber and HEPA filters should have as an acceptance criteria 0.05% consistent with Regulatory Guide 1.52. An allowable penetration of 1% would negate the III.D.3.4 analysis or any similar dose evaluation since bypass flow of 1% would negate high efficiency credited for the adsorber and filter.

7. Surveillance requirements 4.7.5.1.c.4 and 4.7.5.1.c.5 should verify that the makeup pressurization flow and recirculation flow through the emergency filtration unit total 6000 cfm and are within the bases of Figure 3 of B 3/4.7.5 for unfiltered leakage and filtered flow.

   The conformance to GDC 19 is demonstrated by calculating the dose to control room operators taking into account filtered makeup and recirculation flow and the quantity of unfiltered flow. By proposing Figure 3 the licensee avoids the necessity of having to request a technical specification change every time the quantity of filtered flow or unfiltered inleakage changes. A test should be performed periodically to demonstrate that degradation has not occurred to the system. In addition, a test should be performed when work is performed on the normal and/or emergency ventilation systems which could affect the integrity of the system or flow rate.

8. The technical surveillance requirements 4.7.5.1.e.2 should demonstrate automatic initiation of the emergency filtration unit on a high radiation signal.

   Procedures and the system description indicate that the control room emergency filtration unit is automatically initiated on a high radiation signal. The proposed and present technical specifications only address actuation on a safety injection signal. It is appropriate that the surveillance requirements actually reflect the as-built system.

9. Present positive pressure of 1/16 inch W.G. is minimal and should be increased (4.7.5.1.e.3).

   It is necessary that the control room be maintained at as positive a pressure as possible while operating in the radiological challenge mode. The present value of 1/16 inch W.G. seems to be a minimal or a degraded value. Measurements made seemed actually to show pressure greater than 1/8 inch W.G.

10. A value for positive pressure in the mechanical equipment room and the computer room should be stated (4.7.5.1.e.5).

    If the mechanical equipment room does not remain positive with respect to the surrounding boundaries, the control room operator dose evaluation is no longer valid. This would occur because the amount of inleakage into this room significantly increases. Since the air handling units draw over 1300 cfm of supply from this area, and since there is a significant inleakage through the drain of the air handling units, the control room would be subject to a significant source of unfiltered air. To minimize this potential, the mechanical equipment room should be made as positive as possible, with a goal of 1/8 inch W.G. Just committing to maintain the mechanical equipment room positive is insufficient.

D. PROCEDURES

Some plant procedures were reviewed by the survey team. Most were surveillance procedures. The survey team did not really have any substantive comments on these procedures. They did not review any operating procedures. They did review one training instruction. This instruction was revised in March 1986 and was not at all current. Since this would be one of the first sources an individual would refer to in order to obtain information on the system, the information should be current.