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January 28, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Generating Station Units 1 and 2
Braidwood Generating Station Units 1 and 2
Control Room Pressurization
NRC Docket Nos. 50-454/455 and 50-456/457

Dear Mr. Denton:

This letter is to inform the NRC of changes to the Byron/Braidwood control room HVAC systems and to propose appropriate revisions to the Technical Specifications. NRC review of these changes is necessary to finalize the Technical Specifications which will be incorporated into the Byron 1 full power operating license.

Recent testing at Byron Station indicates that the makeup air supply fans in the control room HVAC system do not have adequate capacity to maintain a positive pressure of 1/8" w.g. in the entire control room HVAC envelope during all situations. Most of the relevant test data is summarized in Attachment A to this letter. The required pressure cannot be maintained in all areas during the period when Unit 1 is in operation and Unit 2 is still under construction. Completion of Unit 2 requires that penetrations be opened for the installation of cables, etc. The installed supply fans do not have the capacity to compensate for the extra air loss through those open penetrations. Administrative limits on the number or size of open penetrations would delay the completion of Unit 2.

Pressurization of certain rooms within the control room HVAC envelope is not needed for any safety reason. The cable spreading areas are not continuously manned and have no significant internal heat load. Eliminating these areas from the pressure boundary will make it possible to meet the 1/8" w.g. pressurization requirement with no adverse impact upon safety.

The lower cable spreading rooms will no longer be ventilated by the control room HVAC systems. The connecting ducts will be blanked off or removed. Without air conditioning the temperatures in these rooms may be slightly higher. Our calculations indicate it could be as high as 106.5°F in the limiting design basis situation. This will not pose an environmental qualification problem for any of the components (principally cable) in this area. The temperature limit imposed in Table 3.7-6 of the Byron Technical Specifications should therefore be revised from 90°F to 108°F. An appropriately



A003
1/1

revised version of this table is included in Attachment B to this letter. Because air will no longer be supplied to this space, the minimum capacity of the HVAC recirculation system should also be revised. That revision is also included in Attachment B.

The upper cable spreading rooms will remain as part of the control room envelope, however, on a temporary basis this area will be maintained at a slight positive pressure. This will allow the installation of Unit 2 cables to proceed without delay. A reduction in the positive pressure in the upper cable spreading rooms will not threaten plant safety. Fire protection research has shown that small differential pressures will eliminate air inflow through large openings such as doors. This is discussed in more detail in Attachment A to this letter. To assure that there is no infiltration into the upper cable spreading rooms during Unit 2 construction, the pressure of these areas will be maintained at least 0.02" w.g. above the adjacent auxiliary building and turbine building areas. The appropriate revised pages for the Technical Specifications are provided in Attachment B.

In the event that potentially contaminated air did infiltrate the upper cable spreading rooms, it is unlikely that the control room operators would be exposed to it. This space is not continuously manned and there is no ductwork returning air directly from these areas to the control room HVAC system. Although control room return air ductwork passes through this space, these ducts are sealed and during an accident all return air is filtered by charcoal adsorbers prior to entering the control room.

These matters have already been discussed by telephone with the NRC Staff. Please direct questions regarding these matter to this office.

One signed original and fifteen copies of this letter and the Attachments are provided for NRC review. Appropriate revisions to the FSAR will be made at the earliest opportunity.

Very truly yours,

B. Rybak

for T. R. Tramm
Nuclear Licensing Administrator

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cc: Byron Resident Inspector

9684N

# ATTACHMENT A

Background information is provided explaining the process of establishing the differential pressure in the Byron Station Control Room envelope to a level $\geq$ 0.125" WC.

Recognizing that Unit #2 is still under construction, information is presented to show that in the interim between Unit #1 start-up and Unit #2 completion the requirement for maintenance of $\geq$ 0.125" WC pressure in the upper cable spreading room can be relaxed to 0.02" WC.

## BACKGROUND

In evaluating the incremental changes in average control room pressure, a review of selected test points was made. This is discussed in Appendix A, "Control Room Pressure Evaluation". The changes in pressure as various tests were performed is summarized in Table 1, "History of Byron Control Room Pressure".

The Control Room envelope consisted of:

- Control Room, Auxiliary Electric Equipment Room, HVAC Equipment and other miscellaneous rooms on the 451'-0" elevation.
- The Upper Cable Spreading Room on the 463'-5" elevation.
- The Lower Cable Spreading Room on the 439'-0" elevation.

These are shown in Figure 1 and Figure 2.

This analysis began with the re-test of the Control Room HVAC System pre-operational test, at which time the average pressure in the Control Room was 0.04" WC.

Since the Control Room HVAC System appeared marginal in establishing a minimum pressure of 0.125", Byron Station Construction Department began a comprehensive staged review of all penetrations of the Control Room envelope. The first review identified door seals that needed improvement and it was visually apparent that a number of penetrations and construction joints needed improvement. Once these items were finished, the average pressure in the Control Room rose to 0.08" WC (Table 1, Item B). At this time, the construction access hatch between the Control Room and the Upper Cable Spreading Room was open. This hatch was sealed and the average Control Room pressure rose to 0.15" WC (Table 1, Item C).

During our meeting with the NRC in Bethesda on December 18, 1984, it was agreed that in order to improve the ability of the Control Room HVAC System to pressurize the Control Room Envelope, the Lower Cable Spreading Room was deleted from the Control Room Envelope (reducing the Control Room volume by approximately 1/3 and increasing the air available for pressurization by approximately 22%), in addition, the local area exhaust from the toilet, storage and locker rooms and kitchen was removed and replaced with odor absorbing recirculation units (increasing the air available for pressurization by approximately 17%). This represented a combined increase of approximately 39% in air available for

pressurization. The supply duct to the lower cable spreading room and the exhaust fan discharge ducts were blanked-off. This resulted in an average control room pressure of 0.18" WC (Table 1, Item D).

The Control Room Envelope was then surveyed utilizing a portable smoke generator to detect leaks that were not visually identifiable. The identified leaks were sealed and this resulted in an average control room pressure of 0.20 WC (Table 1, Item E).

Experience has shown that once primary leak paths are sealed, secondary or minute leak paths become evident. Recognizing this, the control room envelope was surveyed again. As expected, additional leak paths were identified with the portable smoke generator. These were sealed and the average control room pressure rose to 0.28" WC (Table 1, Item F), which is 125% greater than the minimum 0.125" WC required.

The results of this test also demonstrated that the upper cable spreading room pressure was 0.21" WC with respect to the Turbine and Auxiliary Buildings. We, therefore, have physically demonstrated that the control room envelope is capable of being maintained at greater than the design minimum pressure of 0.125" WC.

UNIT 2 CONSTRUCTION

On December 20, 1984, Byron Station Construction Department issued a Site Instruction to all Site Contractors, advising them of the requirement for requesting and/or identifying impairments in all fire/radiation barriers specifically identifying the Control Room Envelope. This was done to ensure that Station personnel are advised of any such impairments so that compensatory measures could be taken to maintain plant Technical Specifications and Rad/Chem requirements.

In order to complete Unit #2 construction, there are approximately 1100 electrical cables that must be pulled into the Control Room. To provide a reasonable degree of flexibility in the maintenance of Control Room pressure we propose the following:

1. The Control Room complex on elevation 451'-0" will be maintained at an average positive pressure of 0.125" WC.
2. The Upper Cable Spreading Room on elevation 463'-5" will be maintained at an average positive pressure of approximately 0.02" WC.

JUSTIFICATION

In a series of tests on building stairwell pressurization conducted by the Center for Fire Research of the National Bureau of Standards (NBS) (Refer to Appendix B, "Stairwell Pressurization"), it was determined that under a smoke candle test, with two doors open (approximately 42 ft.$^2$), the average stairwell pressure was 0.014" WC. This was sufficient to demonstrate that smoke was not visible in the stairwell and that only the faint odor of smoke could be detected in the stairwell. The researchers state that a pressure of 2.5 Pa (0.01" WC) was sufficient to prevent infiltration of cold smoke.

This information is presented to show similarity in design concept between the stairwell design (typically masonary construction with fire doors) and the Upper Cable Spreading Room (masonary and concrete construction with fire doors).

Since the date of the final average pressurization readings in this report (12/27/84) construction of Unit #2 has progressed. On January 14, 1985 we performed pressure test similar to what we performed by NBS (without the smoke candle) utilizing two doors on 463'-5" elevation. Several openings in the control room envelope had been made to facilitate cable pulling. Of these openings, the two most notable were 17" x 38" (4.5 ft.$^2$) on elevation 463'-5" and 18" x 12" (1.5 ft.$^2$) on elevation 451'-0". The Control Room HVAC System was operating without the emergency make-up air filter unit running (4400 CFM of make-up air rather than 5700 CFM). During the initial set of readings the average pressure in the Upper Cable Spreading Room was 0.035" WC with a local pressure of 0.01" WC across one of the fire doors on elevation 463'-5" near the 4.5 ft.$^2$ penetration. At this time, the airflow from the Upper Cable Spreading Room to the adjacent stairwell could be felt three to four feet from the opening.

This test is summarized in Appendix C, "Upper Cable Spreading Room (UCSR) Pressure Test". Although the initial pressure was low (due to construction openings), the results paralleled the NBS tests.

The information presented demonstrated that large penetrations (approximately 20 ft.$^2$) can be made in the control room envelope and still maintain the desired pressure level. Our intention is not to limit penetration areas but rather use average differential pressure to gauge the extent of penetrations allowed.

The design of the Control Room HVAC System is such that all air supplied to the Upper Cable Spreading Room is expended in pressurization. There is no return air from the upper cable spreading room to the system. In the unlikely event that any contaminants migrate into the upper cable spreading room and are induced into the return ductwork, this air will be passed through the 90% efficient recirculation charcoal adsorber befor re-entering the Control Room Envelope.

Ensuring that the Upper Cable Spreading Room is under a positive pressure should pose no threat to Control Room operator safety under normal or accident conditions.

# APPENDIX A

## CONTROL ROOM PRESSURE EVALUATION

In order to provide a consistent basis for the evaluation of the relative changes in Control Room pressure four measurement points were selected. These points were chosen because the Control Room pressure would not be affected by the operation of other HVAC Systems. These points are:

| INSTRUMENT NO. | Δ P RELATIONSHIP |
|---|---|
| OPDI-VC38 | Control Room - Turbine Building |
| OPDI-VC37A | Control Room - Turbine Building |
| OPDI-VC38D | Train B Equipment Rm. - Misc. Elec. Equip. Rm. Div. 21 |
| Manometer | Control Room - Lower Cable Spreading Room |

All readings were taken with the Control Room B train running and the corresponding emergency make-up air filtration unit operational.

## APPENDIX B

## STAIRWELL PRESSURIZATION

- Building tested included a thirteen story stairwell
- The stairwell pressurization flow rate was 8250 CFM
- Pressure measurements were made at each floor elevation
- Initial corridor average pressure - 0.252" WC
  (63 Pa)

  Minimum 0.24" WC

  Maximum 0.27" WC
- Pressure with two doors open (approximately. 42 $FT^2$) = 0.014" WC
  (3.4 Pa)

  Minimum 0.01" WC

  Maximum 0.03" WC

Reference:

"Stairwell Pressuriztion"
John Klote
ASHRAE TRANSACTIONS LA-80-4
PP. 604-622

## APPENDIX C

## UPPER CABLE SPREADING ROOM (UCSR) PRESSURE TEST

| Pressure Reference | TEST A | TEST B | TEST C | TEST D |
|---|---|---|---|---|
| | Pressure in WC | | | |
| Control Room/Turb. Bldg. | 0.13" | 0.13" | 0.10" | 0.06" |
| UCSR/Turb. Bldg. | 0.02" | 0.04" | 0.04" | 0.01" |
| UCSR/Aux. Bldg. | 0.05" | 0.04" | 0.03" | 0.005" |
| Across Door | 0.01" | 0.02" | negligible | negligible |

TESTS

A. All doors closed - 4.5 ft.$^2$ penetration open

B. All doors closed - 4.5 ft.$^2$ penetration closed

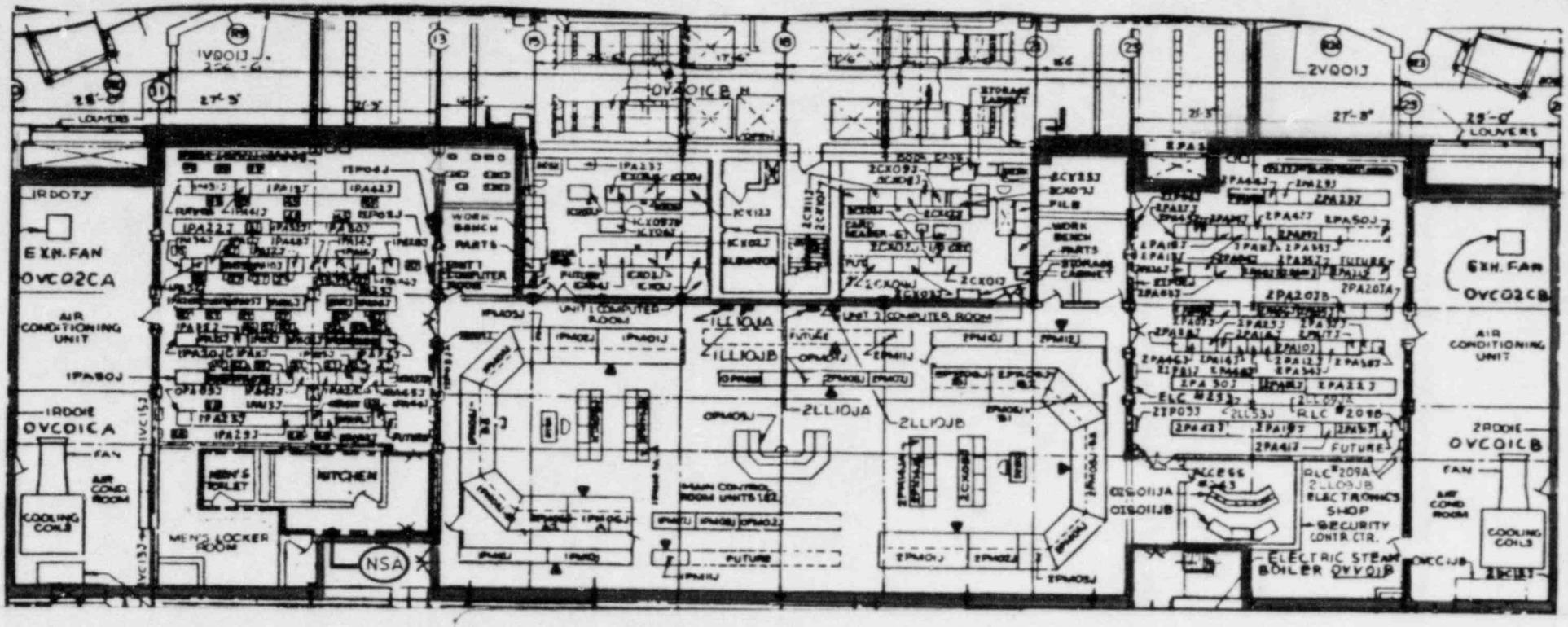
C. One door open (16.3 ft.$^2$ open area)

D. Two doors open (30.4 ft.$^2$ open area)

TABLE 1

HISTORY OF BYRON CONTROL ROOM PRESSURE

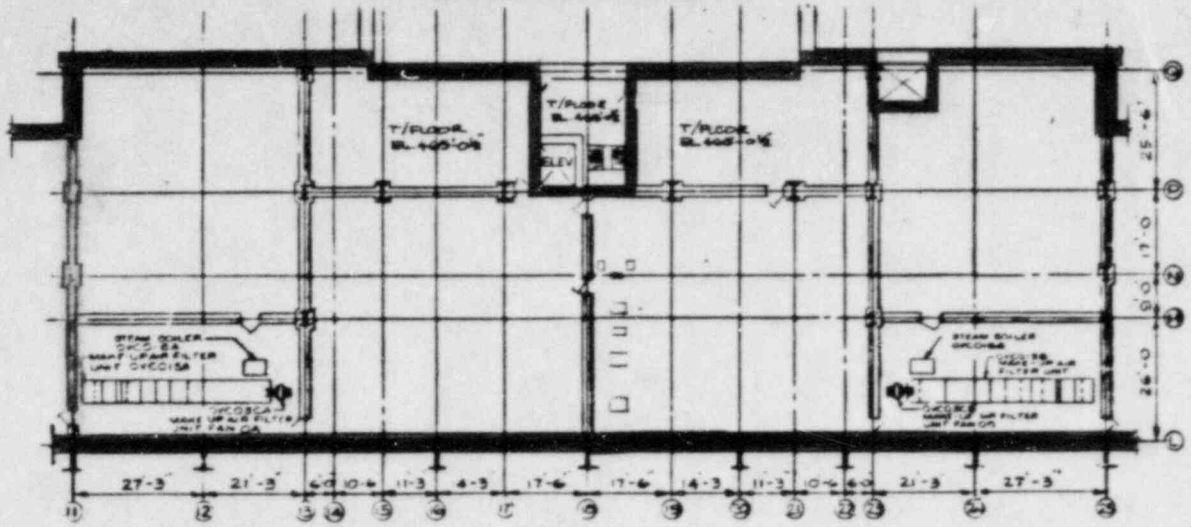
| TEST | DATE | AVERAGE CONT DIFFERENTIA Inches W.C. |
|---|---|---|
| A | 10/12/84 | 0.04 |
| B | 12/05/84 | 0.08 |
| C | 12/05/84 | 0.15 |
| D | 12/17/84 | 0.18 |
| E | 12/20/84 | 0.20 |
| F | 12/27/84 | 0.28 |



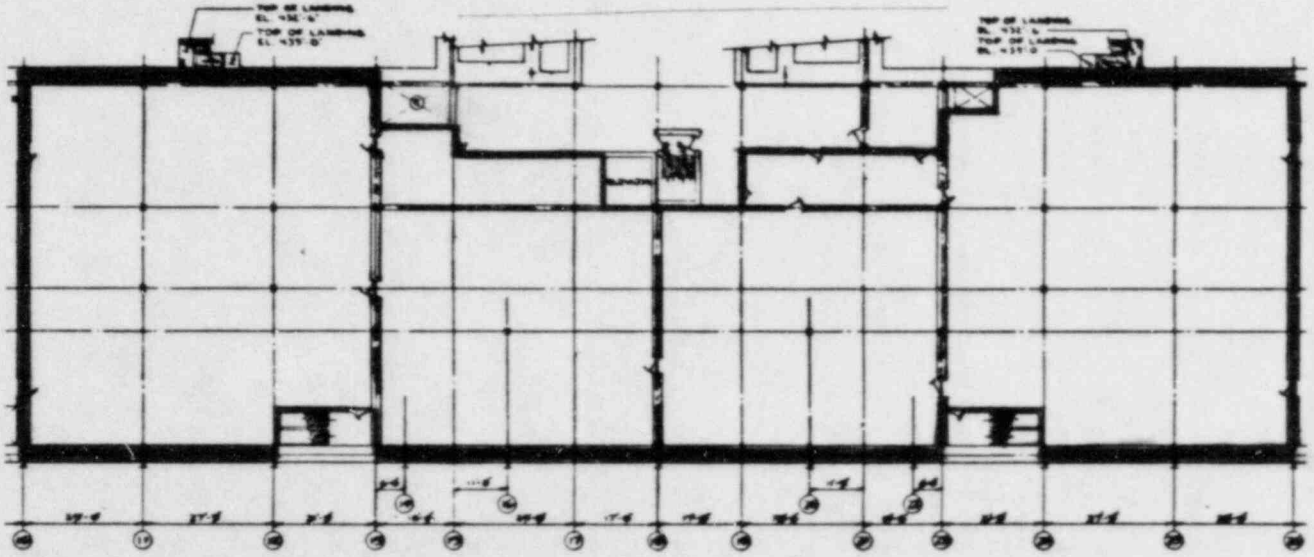

# MAIN CONTROL ROOM
# EL. 451'-0"

FIGURE 1

# FIGURE 2



UPPER CABLE SPREADING ROOM
EL. 463'-5"



LOWER CABLE SPREADING ROOM
EL. 439'-0"