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DMB

February 28, 1984

Mr. James G. Keppler
Regional Administrator
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
Battery Area Woven Wire Fences
NRC Docket Nos. 50-454/455 and
50-456/457

Reference (a): R. C. Knop letter to Cordell Reed
dated February 3, 1984

Dear Mr. Keppler:

Reference (a) provided the Commonwealth Edison Company with IE Inspection Report Nos. 50-456/83-17 and 50-457/83-16 concerning Braidwood Station battery maintenance issues, and documented the Region's concerns regarding the existing battery area woven wire fences at both Byron and Braidwood Stations. The purpose of this letter is to address the wire fence issue for Byron and Braidwood Stations. The Commonwealth Edison response to the inspection report item of noncompliance will follow in the usual manner.

The Enclosure to this letter provides the requested information. An inordinate number of man-hours have been expended both informally and formally in our attempt to resolve this matter to the Region's satisfaction with little success. Our enclosed response addresses the origins of the wire fence design and the Region's misconceptions concerning same. We address the ventilation system adequacy, hydrogen control, explosion protection, metal corrosion, and our compliance with IEEE 484, Regulatory Guide 1.128, and our FSAR and Fire Protection Report commitments.

In summary, concrete block walls were never part of the Byron and Braidwood battery area approved design nor in our judgement desirable, and the existing ventilation system is adequate and conservatively designed. The use of woven wire fencing in the Byron and Braidwood battery areas complies with IEEE Standard 484 requirements, and with certain documented exceptions approved by NRR, complies with both Regulatory Guide 1.128 and the Standard

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IE01

Review Plan BTP 9.5-1, Section C.7-g. Our existing woven wire fence design has been adequately described in the Byron and Braidwood FSAR and Fire Protection Report which have each gained NRR acceptance.

We believe that the enclosed information supports our existing installations and should provide final closure of the battery area wall issue. Please address any further questions concerning this matter to this office.

Very truly yours,

E. Douglas Swartz

E. Douglas Swartz
Nuclear Licensing Administrator

Enclosure

cc: J. A. Stevens LB-1
L. N. Olshan LB-1

RIII Inspector - Braidwood

8224N

Commonwealth Edison Company

NRC Region III (10/3 - 12/16/83)

Inspection Report Nos. 50-456/83-17; 50-457 (83-16)

Item 3 - Inspection of Safety-Related 125 Volt DC Battery Areas for Unit 1 and 2

a. Design

NRC Inspection Report:

"The auxiliary building floor plan, elevation 451, as shown on drawing A-266, dated August 1974, included a battery room (an interior space enclosed by walls and separated from other similar spaces by walls) with Category I three hour fire rated floor, ceiling and walls. As designed, these safety-related battery rooms included a ventilation system for an air supply and an exhaust system to remove hydrogen gases liberated by the battery cells. The concrete floors, walls and ceiling supporting the designed 111 and 112 battery rooms, 451 foot elevation, were poured during a four month period from March 21, 1978, through July 11, 1978, at Braidwood and essentially during the same time frame one year earlier at Byron. On March 24, 1978, Revision B to drawing A-266 was completed. This revision removed one twenty-two foot concrete Category I block wall from each safety-related battery room and replaced it with an expanded metal wire mesh fence.

"On February 20 and 25, 1981, the safety-related batteries were installed in alcoves 111 and 112 at Braidwood; and a wooden supported 'chicken wire' fence was erected. Plant personnel complained that the fence did not afford adequate protection or cleanliness standards for the batteries, and the present heavier wire mesh fence was installed.

a. Design (continued)

NRC Inspection Report:

During the following year, continued 'battery ground' alarms were received in the control room, the cause of which was directly attributable to the dirty condition of the battery banks. 'Monthly cleaning and washing' of the cells was necessary to remove the electrical ground conditions. In late 1981 or in the early months of 1982, plastic sheeting was installed to cover approximately three-fourths of the open area of the metal mesh fence to provide additional protection from concrete dust, debris, metal grindings, welding sparks and slag, and other air transported contaminates from entering the battery alcove."

CECo Response:

Although this section of the report is entitled "Design," the only concern described therein relates to the adequacy of a temporary "wooden supported chicken wire fence" and temporary plastic sheeting which were used to protect the batteries from the dust, etc. generated during construction; neither of which were ever a part of the battery area design.

The following additional corrections and clarifications (of statements in the report) should be noted:

(1) Drawing A-266, dated August 7, 1974, (referenced by the inspector) copy attached, did show a concrete block wall on the south side of Batteries 111 and 112 (the wall in question); however, it should be noted that this issue of this drawing was a preliminary, unsigned drawing showing one (of several) alternate conceptual designs (being considered at the time) which was issued only for "Ref. for bids Spec. F/L-2722" (i.e., this issue of this drawing was utilized only to hire a concrete contractor for the project). Drawing A-266 was not signed (approved) nor released

a. Design (continued)

CECo Response:

(1) (continued)

for construction until Rev. B, dated March 24, 1978 (copy attached). This issue (Rev. B), and all subsequent issues, of this drawing shows a "wire mesh door and partition" on the south side of Batteries 111 and 112.

(2) Contrary to the report, which states that "This revision removed one twenty-two foot concrete Category I block wall from each safety-related battery room and replaced it with an expanded metal wire mesh fence," the concrete block wall was not "removed" because it never existed on a drawing released for construction; i.e., the only approved design ever shown on A-266 was (and still is) a "wire mesh door and partition."

b. As Built Conditions

NRC Inspection Report:

"The 'as built' condition of the 125 volt dc safety-related battery banks at Byron and Braidwood are not enclosed by a battery room with three hour fire rated wall as recommended by Appendix A of Branch Technical Position 9.5-1 paragraph C.7.8. The battery alcove which now has become a part of the electrical equipment and switchgear room may permit hydrogen and other gases liberated from the battery cells to free flow in undetermined directions. Air and gas movement in the battery alcove is dependent upon the operation of the designed battery room and electrical and switchgear room exhaust systems; however, these systems do not have a positive suction on the total battery area, or all cells. Further, the ventilation system as designed for the battery alcove drops three and one half feet below the ceiling thus leaving

b. As Built Conditions (continued)

NRC Inspection Report:

a dead air space for the possible accumulation of hydrogen gas. The adjacent electrical equipment and switchgear rooms have ceiling areas with as much as eight foot of dead air space and are not equipped with explosive-proof electrical circuits and/or explosion-proof electrical motors for the exhaust fans. These fans are now part of the ventilation system committed to remove hydrogen gas.

"In February 1981, an unresolved item (Braidwood Report 81-02-01) was issued regarding 'whether Battery Room designs would afford adequate protection from hydrogen gas accumulation and possible explosion resulting from operation of the equipment in the battery rooms.' The licensee's reply took credit for the two exhaust fans, one of which (electrical equipment room exhaust fan) was never designed for the movement of hydrogen gas. The statement was made that, 'With modern batteries and chargers, the amount of hydrogen generated from day-to-day float-charge operation is insignificant.' Lead-calcium cells are not modern but in fact have been produced and placed in operation for at least twenty years. The amount of hydrogen gas generated daily by 58 Lead-Calcium cells will be 2.215 cubic feet when the battery bank is on a float-charge of 2.25 (Braidwood normal operation) volts per cell. These cells will generate 6.645 cubic feet of hydrogen gas per day when the battery bank is placed on equalization charge (2.33 volts per cell). The exact hydrogen generation by a completely charged battery bank when connected to a run-away charger of 140 volts would reach capacities of 26.832 cubic feet of hydrogen per day. The amount of hydrogen generated is usually not significant when properly diluted and dispersed through an approved ventilation system and vented to the atmosphere. However, when hydrogen gas is allowed to accumulate over a period of time, it is significant because it becomes an explosive force. When batteries are recharged, a secondary problem or additional risk

b. As Built Conditions (continued)

NRC Inspection Report:

occurs when trace amounts of acid vapor are liberated into the atmosphere above. Though the vapors will not be present in toxic quantities, the acid may corrode nearby metalwork thus producing more hydrogen. Rotating electrical equipment, switchgear and electrical connections in nearby areas are also subjected to this corrosive atmosphere."

CECo Response:

The title ("As Built Conditions") of this section of the report infers that the battery area (as constructed) differs from the design, but the report does not identify any such discrepancies.

The primary concern, as described in this section of the report, relates to the adequacy of the design of the battery area ventilation system; i.e., the ability of the ventilation system to prevent the accumulation of hydrogen gas in the battery area, and in the adjacent Miscellaneous Electric Equipment Room, in sufficient quantities to create a potentially explosive mixture. The following discussion is intended to resolve that concern.

Figure b-1 illustrates the equipment arrangement and air flow for the Miscellaneous Electric Equipment Room ventilation system. As previously noted, the safety-related 125V DC Battery Area is a part of the Miscellaneous Electric Equipment Room, which is enclosed by a three-hour fire-rated barrier. The battery area exhaust ventilation system will remove 475 CFM from the battery area. Based on the volume of the battery area, and on the calculated maximum hydrogen evolution rate (which could occur with a failure of the battery charging system), the ventilation system will limit the hydrogen concentration in the battery area to 1.44%; 28% less than the "2% of the total volume of the battery area" allowed by IEEE Std. 484-1981 (which itself is conservative). All of the make-up air for the battery area exhaust is drawn

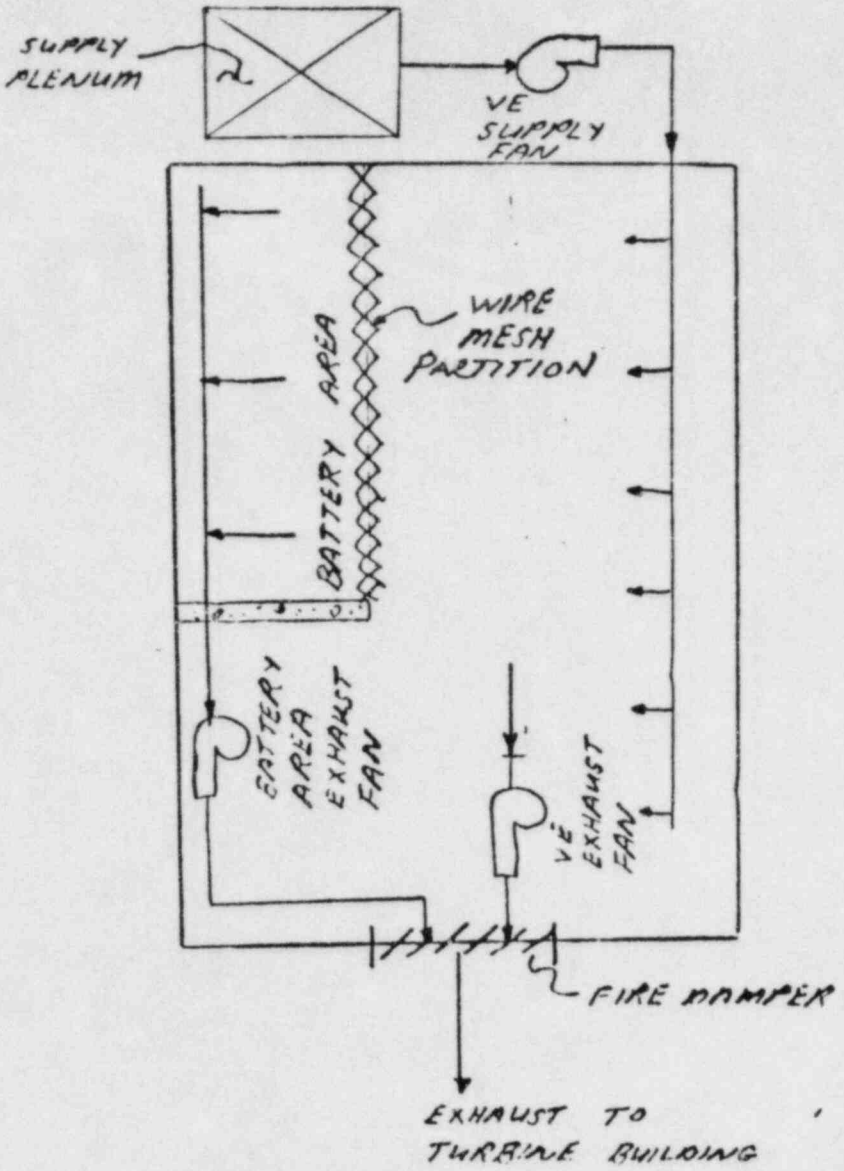


Figure b-1: Miscellaneous Electric Equipment Room (and Battery Area) Ventilation System (Typical)

b. As Built Conditions (continued)

CECo Response:

from the Miscellaneous Electric Equipment Room. In order to purge (i.e., sweep) the total volume of the battery area, the exhaust duct is located adjacent to the wall opposite the wire mesh partition. The exhaust ductwork is located at the highest practical point in the room (i.e., immediately under the intermediate roof structural steel) and extends over the entire length of the rear battery rack.

Even if it is assumed that a fraction of the hydrogen gas (say 30%) escapes to the Miscellaneous Electric Equipment Room, the maximum concentration of hydrogen in this room is 0.022%, which is insignificant in comparison to the maximum allowable design concentration of 2%.

Since this ventilation system will limit the hydrogen concentration in the battery area to less than 2%, "the battery area (per IEEE Std. 484-1981) . . . should be considered non-hazardous, thus special electrical equipment enclosures to prevent fire or explosions should not be necessary." However, to provide additional conservatism, spark-proof fans with explosion-proof motors are provided for the Battery Area Exhaust Fans (1/2VE02C and 1/2VE03C).

With regard to the "secondary" concern (metal corrosion due to trace amounts of acid vapors) identified in the report, the Commonwealth Edison Company has many years of experience with numerous installations (Dresden 2 & 3, Quad Cities 1 & 2 and many transmission substation relay houses) where the batteries are installed in open areas (i.e., not enclosed by walls) and have not experienced any problems with corrosion of adjacent equipment which could be attributed to battery acid vapors.

c. Establishment of Design Records

NRC Inspection Report:

"The inspector received full cooperation from site personnel in regard to review of site records associated with the installation of the safety-related battery banks.

"The Commission has requested the licensee to provide documentation to establish the basis for the design change which removed the Category I concrete block fire wall and substituted an expanded wire fence and if the engineering review and approval of this design change took into account the affect on the ventilation system and justified deviation from Branch Technical Position 9.5-1. The licensee recently explained to the Region III office that their Architect Engineer, Sargent & Lundy, had these records and that they would be made available for NRC review as soon as they could be located.

"We note that the Byron/Braidwood Stations Fire Protection Report issued prior to October 1983 contained a statement of compliance with position 3.7.g of Appendix A to BTP APCSB 9.5-1 (which later became BTP CMEB 9.5-1 position C.7.g). This statement was changed in October 1983, well after the design change removed the Category I concrete block fire wall.

"This item remains unresolved pending receipt and review of the requested documents (50-456/83-17-01; 50-457/83-16-01)."

CECo Response:

As previously noted (in Section "a") there was no "design change which removed the Category I concrete block fire wall and substituted an expanded wire fence." There is no requirement for documenting the basis for changes in preliminary, unreleased and unapproved designs. The following discusses the basis for the approved design.

c. Establishment of Design Records (continued)

CECo Response:

The industry standard applicable to this installation is IEEE Std. 484-1981, "IEEE Recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Substations." The present battery design complies with all requirements and recommendations of this industry standard. It should be noted that this standard neither requires nor recommends that the battery be enclosed in a separate room; in fact, it meticulously (and purposely) avoids the term "battery room" and, instead, uses the term "battery area." In Sections 5.1.1(7) and (9), the standard specifically suggests that the charger and main power distribution center be located "as close as practical to the battery" provided that nearby equipment with arcing contacts is located so "as to avoid those areas where hydrogen pockets could form." In addition, Section 5.1.4 states that a battery area which is provided with the recommended ventilation "should be considered non-hazardous; thus, special electrical equipment enclosures to prevent fire or explosion should not be necessary."

Regulatory Guide 1.128 (Revision 1, dated October 1978) is the NRC's endorsement of IEEE Std. 484-1975 with several "Regulatory Positions." Appendix A (to the FSAR, copy attached) states that CECo will comply with all Regulatory Guide 1.128 requirements with certain specific exceptions which are identified and justified and, in the process, describes the present battery area design very accurately.

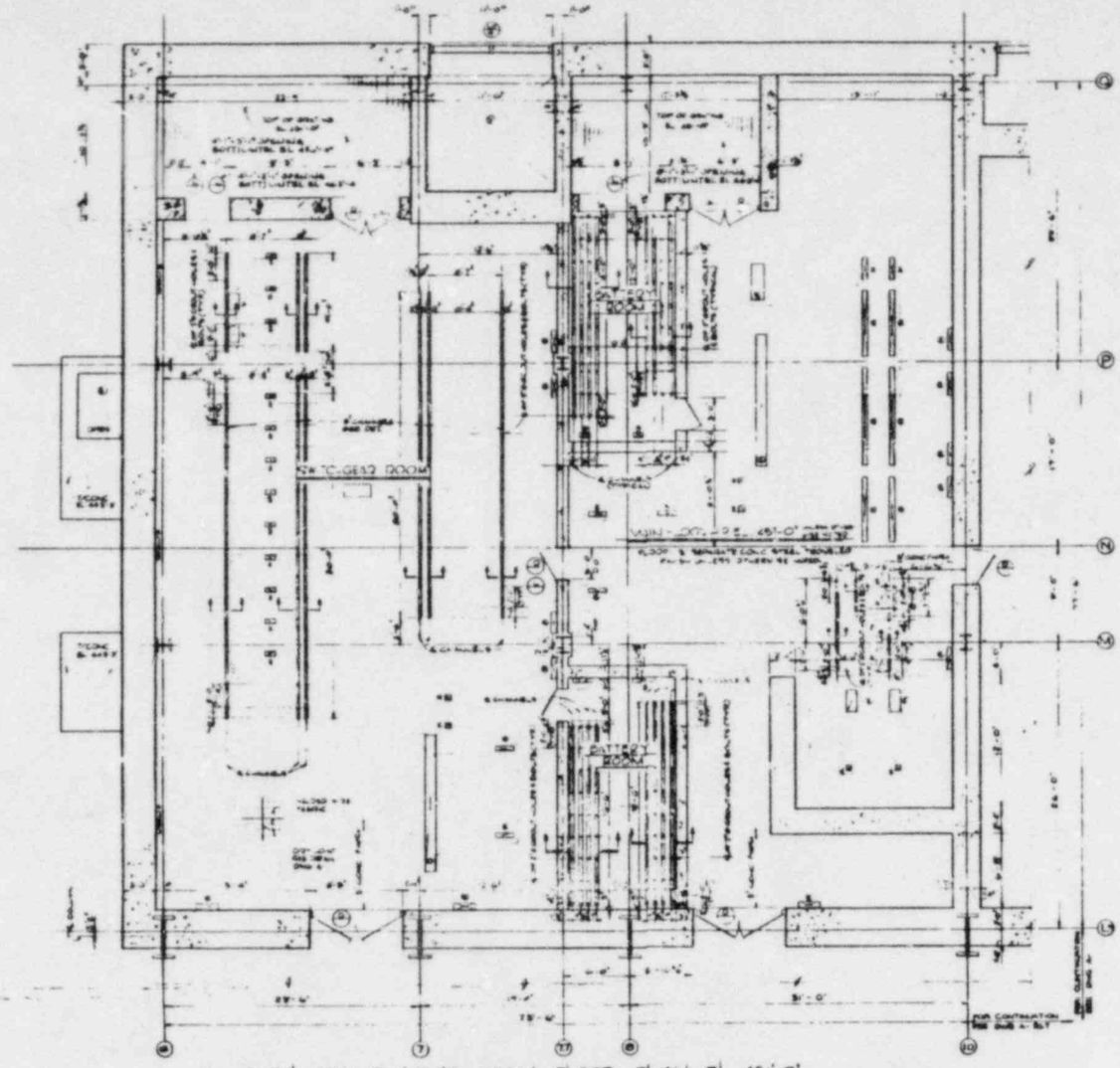
Section 2.3 of the Byron/Braidwood Fire Protection Report has accurately reflected the design of these Miscellaneous Electrical Equipment and Battery Rooms from its original issuance in November 1977. Subsection 2.3.5 describes these rooms and clearly indicates that the batteries are not separated from the other electrical equipment by any fire barriers. Figure 2.3-8, "Main Floor at Elevation 451'-0"," clearly shows that there

c. Establishment of Design Records (continued)

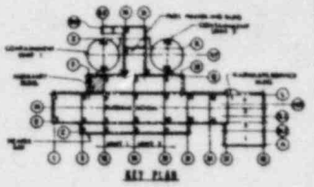
CECo Response:

are no barriers between the batteries and the other electrical panels in these rooms. The Byron/Braidwood Fire Protection Report did contain a discrepancy in that Section 3.7-g on page 3.7-3 incorrectly stated that the Byron/Braidwood design complied with position C.7-g of Branch Technical Position 9.5-1. When this discrepancy was discovered, page 3.7-3 was amended in Amendment 2, October 1983, to correctly describe the deviation from the Branch Technical Position requirement.

In summary, it is CECo's position (a) that the concrete block wall (questioned in the report) was never part of an approved design and that it is neither required nor desirable, (b) that the battery area ventilation design is more than adequate for the application, (c) that the battery area design complies with all requirements of the industry standard (IEEE Std. 484) and, with certain documented exceptions, complies with the requirements of the NRC Regulatory Guide (1.128) and Standard Review Plan (BTP 9.5.1, C.7-g), (d) that this design was adequately described in the FSAR, in Appendix A, and the Fire Protection Report and (e) that this design has been accepted by the NRC (NRR) as evidenced by the Byron and Braidwood SER's.



AUXILIARY BUILDING MAIN FLOOR PLAN EL 451'-0"



KEY PLAN

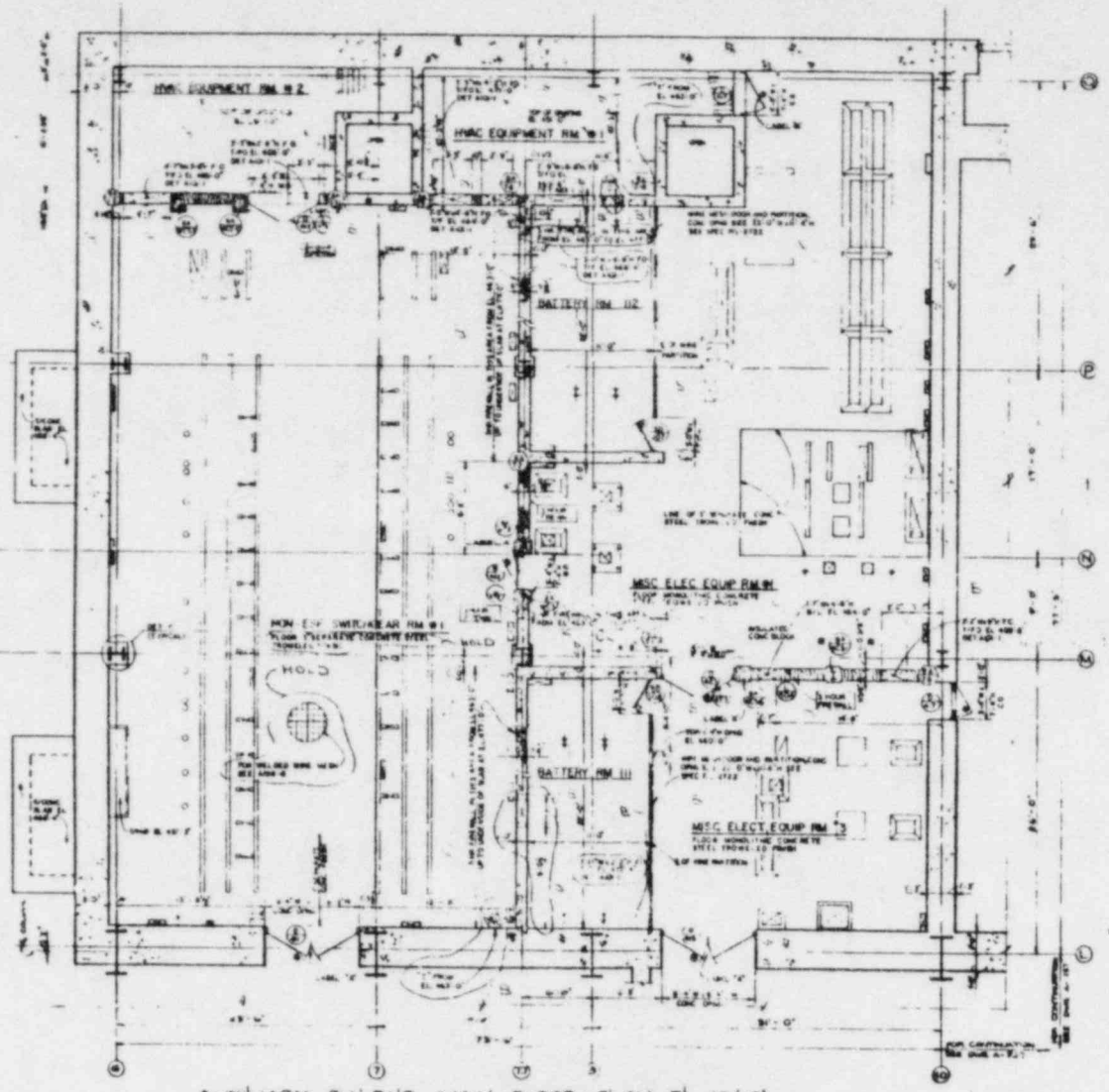
NOTES

REFERENCE DRAWINGS

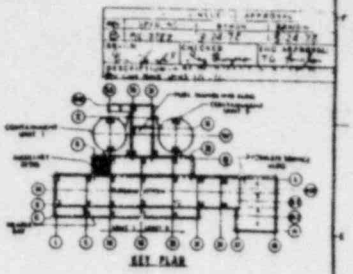
AUXILIARY BLDG. MAIN FLOOR PLAN
AREA 1
BYRON/BRAIDWOOD STATION UNITS 1 & 2
COMMONWEALTH EDISON CO.
CHICAGO, ILLINOIS

SARGENT & LUNDY

A-266



AUXILIARY BUILDING MAIN FLOOR PLAN EL 426'-0"



KEY PLAN

AUXILIARY BLDG MAIN FLOOR PLAN
AREA 1
BYRON/BRAIDWOOD STATION UNIT 1
COMMONWEALTH EDISON CO.
CHICAGO, ILLINOIS

BARGENT & LINDBY

A-296

REGULATORY GUIDE 1.128

Revision 1, October 1978

INSTALLATION DESIGN AND INSTALLATION OF LARGE LEAD STORAGE BATTERIES FOR NUCLEAR POWER PLANTS

The Applicant complies with the requirements of this guide with the exceptions and/or clarifications to the Regulatory Positions identified and justified below:

Regulatory Position C-1

In Subsection 4.1.4, "Ventilation," instead of the second sentence, the following should be used:

> "The ventilation system shall limit hydrogen concentration to less than two percent by volume at any location within the battery area."

Applicant's Position

The ventilation requirements set forth in IEEE Std. 484-1975 are adequate.

Justification of Applicant's Position

IEEE 484-1975 requires that the ventilation system limit hydrogen accumulation to less than 2% of the total volume of the battery area. This Regulatory Position would require that hydrogen accumulation be limited to less than 2% at any location within the battery area. The ventilation requirements as set forth in IEEE 484-1975 are entirely adequate. The "2% at any location" requirement would be almost impossible to verify and might even require the installation of ducts, vanes, and/or auxiliary fans so as to ensure that every "nook and cranny" is thoroughly purged.

The battery area ventilation system is designed to maintain the hydrogen concentration below 2% with a "run-away" charger (i.e., a charger delivering its full-rated output into a fully-charged battery, thereby causing gasing of all cells). Thus, any significant hydrogen build-up in the

battery area would require two failures (a failure of the ventilation system, and a failure of the charger), both of which will be annunciated in the main control room.

Regulatory Position C-2

In Subsection 4.2.1, "Location," Item 1, the general requirement that the battery be protected against fire should be supplemented with the applicable recommendations in Regulatory Guide 1.120, "Fire Protection Guidelines for Nuclear Power Plants."

Applicant's Position

The reference to Regulatory Guide 1.120 is inappropriate because this Regulatory Guide is presently only in the "comment" stage.

Justification of Applicant's Position

The battery location and protection against fire will be described in the Fire Protection Report in Response to Branch Technical Position APCSB 9.5.1 in lieu of Regulatory Guide 1.120. The location and fire protection requirements set forth in IEEE 484-1975 are adequate.

In reference to Regulatory Guide 1.120, Revision 1, (November 1977), Section C.6(g), Page 20, "Safety-Related Battery Rooms," Applicant's comments are as follows:

(a) This paragraph seems to imply that all safety-related batteries are to be located in separately-enclosed rooms. It is Applicant's position that it should not be necessary that battery rooms be separated from other areas of the plant by barriers having a minimum fire rating of three hours. Such barriers would be necessary only if the batteries were in a separate fire protection zone. There is nothing wrong with a design wherein the battery is located in an open area so long as the battery is protected from mechanical damage; e.g., the battery may be located in an Electrical Equipment Room but protected by an enclosing fence.

(b) The location of dc switchgear and inverters in the Electrical Equipment Room described above is a satisfactory arrangement.

Regulatory Position C-3

Items 1 through 5 of Subsection 4.2.2, "Mounting," should be supplemented with the following:

"6. Restraining channel beams and tie rods shall be electrically insulated from the cell case and shall also be in conformance with Item 2 above regarding moisture and acid resistance."

In addition, the general requirement in Item 5 to use IEEE 344-1975 should be supplemented by Regulatory Guide 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants."

Applicant's Position

Restraining channel beams and tie rods need not be electrically insulated from the cell case.

Justification of Applicant's Position

The expense for the addition of electrical insulation to the restraining channel beams and tie rods is unwarranted. Heat from an accident that can damage lead plates and vaporize electrolyte could also melt insulation on restraining channels and tie rods. In addition, rubber or plastic for insulation purposes will significantly increase the combustible fuel loading in the battery area and thus add to the fire hazard.

SECTION	NRC POSITION	IMPLEMENTATION OR JUSTIFICATION FOR NONCOMPLIANCE
	room that do not terminate or perform a function there should be kept at a minimum to minimize the combustible loading. These rooms should not be used for any other purpose. Fire hose stations and portable fire extinguishers should be readily available outside the area. Equipment should be located to facilitate access for manual firefighting. Drains should be provided to prevent water accumulation from damaging safety-related equipment (see NFPA 92M, "Waterproofing and Draining of Floors"). Remote manually actuated ventilation should be provided for venting smoke when manual fire suppression effort is needed (see Position C.5.f).	
f.	Remote Safety-Related Panels Redundant safety-related panels remote from the control room complex should be separated from each other by barriers having a minimum fire rating of 3 hours. Panels providing remote shutdown capability should be separated from the control room complex by barriers having a minimum fire rating of 3 hours. Panels providing remote shutdown capability should be electrically isolated from the control room complex so that a fire in either area will not affect shutdown capability from the other area. The general area housing remote safety-related panels should be provided with automatic fire detectors that alarm locally and alarm and annunciate in the control room. Combustible materials should be controlled and limited to those required for operation. Portable extinguishers and manual hose stations should be readily available in the general area.	Comply, with exception noted below. The remote shutdown panels are electrically isolable from the control room by transfer switches located on the panels. This is accomplished in such a way that the panels in the remote shutdown control room can be fully isolated from control room panels. However, the remote shutdown panels cannot be isolated from the control room panels without rendering the control room panels inoperable.
g.	Safety-Related Battery Rooms Safety-related battery rooms should be protected against fires and explosions. Battery rooms should be separated from each other and other areas of the plant by barriers having a minimum fire rating of 3 hours inclusive of all penetrations and openings. DC switchgear and inverters should not be located in these battery rooms. Automatic fire detection should be provided to alarm and annunciate in the control room and alarm locally. Ventilation systems in the battery rooms should be capable of maintaining the hydrogen concentration well below 2 vol-%. Loss of ventilation should be alarmed in the control room. Standpipe and hose and portable extinguishers should be readily available outside the room.	Comply, with exception noted below. The safety-related batteries are located in the same room with their associated battery charger, inverter, and dc switchgear and distribution panels. The battery itself is located in a separate area of the room with its own ventilation system, but is not separated from the associated electrical panels by a rated fire barrier. Each battery and electrical equipment room is separated from its redundant counterpart and other plant areas by 3-hour rated fire barriers.