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Exelon Nuclear

RS-10-094

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Additional Information Supporting License Amendment Request to Change Fire Protection Program Requirements for Upper Cable Spreading Rooms

References:
1. Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "License Amendment Request to Change Fire Protection Program Requirements for Upper Cable Spreading Rooms," dated March 26, 2009

2. Letter from M. J. David (U.S. Nuclear Regulatory Commission) to C. G. Pardee (Exelon Nuclear), "Braidwood Station, Units 1 and 2, and Byron Station, Unit Nos. 1 and 2 – Request for Additional Information Related to Upper Cable Spreading Room Fire Protection Requirements (TAC Nos. ME0971, ME0972, ME0973, and ME0974)," dated April 22, 2010

In Reference 1, Exelon Generation Company, LLC (EGC) requested a license amendment for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2. The proposed change revises the Fire Protection Program to eliminate the requirement for the backup manual carbon dioxide fire suppression system in the upper cable spreading rooms. The NRC requested additional information to complete review of the proposed license amendment in Reference 2. In response to this request, EGC is providing the attached information. Reference 2 requested a written response to be submitted by May 24, 2010. However, in a telephone discussion between Patrick Simpson (EGC) and Marshall David (NRC) on May 24, 2010, it was agreed that EGC would submit the written response by May 27, 2010.

Reference 2 discusses a recent event at Byron Station, which is documented in EGC's Corrective Action Program. That event involved water from the Fire Protection system that

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leaked onto the upper cable spreading room floor, then into an Auxiliary Electric Equipment Room cabinet located below in a separate fire area. Details regarding this event are provided in the Attachment.

In addition, at Byron Station, two additional issues related to the upper cable spreading room Halon system have recently been documented in the Corrective Action Program. The first issue (i.e., documented in Issue Report 1019527) was related to foreign material that was found in two Halon selector valves during preventive maintenance activities. The second issue (i.e., documented in Issue Report 1073218) was related to the need to enhance procedures associated with manual actuation of the Halon system in the upper cable spreading room for smaller fires that do not have sufficient heat to automatically actuate the Halon system. Appropriate actions to address each of these issues, including reviews for applicability to Braidwood Station, are being performed in accordance with Corrective Action Program procedures to ensure that the Halon system continues to meet the applicable licensing basis requirements.

EGC has reviewed the information supporting a finding of no significant hazards consideration, and the environmental consideration, that were previously provided to the NRC in Attachment 1 of Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the additional information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 27th day of May 2010.

Respectfully,

Patrick R. Simpson
Manager – Licensing

Attachment: Response to Request for Additional Information

**ATTACHMENT**
**Response to Request for Additional Information**

**NRC Request 9.a**

In light of the potential impact from the use of water suppression in the UCSR, provide the basis for not discussing, in the March 26, 2009, LAR, that the floor seals in the UCSRs are not watertight and for not assessing in the LAR the water leakage events into the Main Control Rooms and AEER that have occurred over the life of the plants.

**Response**

A search of the Corrective Action Program was performed to identify water leakage events into the Main Control Rooms (MCRs) and Auxiliary Electrical Equipment Rooms (AEERs) over the life of the plants. Two instances of water leakage at Byron Station from the upper cable spreading rooms (UCSRs) into either the MCR or the Unit 1 AEER were identified, as documented in Issue Reports (IRs) 934040 and 1046792 (note that IR 1046794 was related to the same event described in IR 1046792). These IRs were initiated on June 23, 2009, and on March 24, 2010, respectively. These IRs were not discussed in the license amendment request (LAR) since they were initiated after the LAR was submitted to the NRC, and subsequent reviews determined that the IRs did not directly affect the LAR. As discussed in greater detail below, the water leakage resulted from some quantities of standing water on the UCSR floor that leaked between the fire seal sheet metal collar and the floor interface. Both Byron Station and Braidwood Station are implementing actions in accordance with the Corrective Action Program to address this issue. The actions to address the identified issues would have been taken regardless of abandonment of the CO2 system in the UCSR.

In addition, as discussed below in response to NRC Request 9.b, modifications were implemented at Braidwood Station in 1987 due to water leakage issues identified during original construction activities.

No new hose stations or other water suppression equipment are being added to the UCSRs as a result of the abandonment of the UCSR carbon dioxide (CO2) system. Also, no changes to the installed fire seals or floor drains are being made as part of the LAR. Thus, the consequences of using the backup manual hose stations and/or fire extinguishers are not being changed.

The UCSR seals are rated for fire and ventilation. Using water, CO2, or Halon for suppression in the UCSR has no impact on the seal rating. Thus abandonment of the CO2 system in the UCSR has no impact on the seal rating. Therefore, a review of the fire seals was not performed to support the LAR.

As discussed in the LAR, the automatically actuated Halon 1301 gaseous suppression system is designed to be reliable and capable of suppressing postulated fires in the UCSRs. The Halon system includes two separate detection circuits, and is automatically actuated by two trains of actuation logic. The Halon bottle discharge valve actuators include a pair of pilot valves, each connected to one of the two trains of actuation logic, and either of which can actuate the Halon bottle discharge valves. The system can also be actuated manually from outside of the rooms in the event of failure of the automatic actuation capabilities, or in response to smaller fires that do not have sufficient heat to automatically actuate the Halon system. The Halon system is designed to provide a Halon concentration of at least 6% for a minimum soak time of 20

minutes. According to NUREG/CR-3656, "Evaluation of Suppression Methods for Electrical Cable Fires," the Halon system would be effective and capable of suppressing a deep-seated cable tray fire in the UCSRs. In the event of a fire in the UCSRs, the Halon system would suppress the fire, and any potential remaining smoldering items would be controlled by the limited and localized use of the water hose stations and/or fire extinguishers. With only limited and localized use of water spray, it is not expected that a large amount of water would be discharged into the areas. The abandonment of the CO2 system in the UCSRs has no impact on the original design of the fire rated barriers.

**NRC Request 9.b**

Provide an analysis of the impact of using firefighting water in the UCSR in light of the design of the UCSR floor fire seals, or justify why such an analysis is not necessary.

**Response**

The configuration of a typical cable riser floor fire seal in the UCSRs is shown in the figure below. The configuration of the subject fire seals consists of a 5" high, 18 gauge, sheet metal collar anchored to the floor surrounding the floor opening. The collars are approximately 1" to 2" longer and wider than the opening, creating a horizontal overlap between the gypsum and the concrete. During installation, damming material was installed inside the opening below the collar, and the gypsum material was then poured into the collar, starting flush with the surface of the concrete floor, overlapping the concrete horizontally approximately 1" to 2" around the perimeter of the seal, and rising up within the collar to form a seal around the penetrating items. The installed gypsum overlaps the opening on each side, but does not extend below the top surface of the floor into the opening.

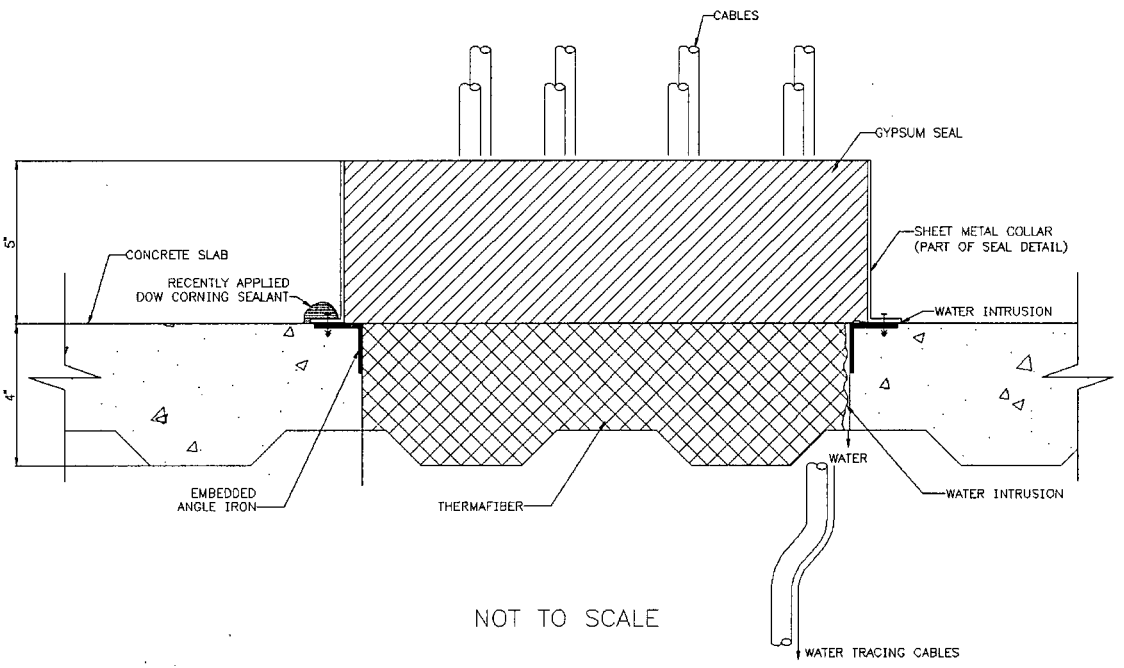


**Figure:** Typical UCSR Cable Riser Floor Seal

The seals have been qualified as 3-hour fire seals per IEEE 634, "Standard Cable-Penetration Fire Stop Qualification Test," and ASTM E119, "Standard Test Methods for Fire Tests of Building Construction and Materials." The fire seal testing included multiple hose stream tests per ASTM E119, which verified that a hose stream would not dislodge a fire seal and would not project water beyond the unexposed surface of the fire seal. Note that these fire seals are also rated as ventilation seals; however, these seals do not have a flood seal rating.

Flood-rated seals were not installed in this application since the UCSR elevation 463'-5" floor is not designed as a flood rated barrier. This is due to the only source of water being the Fire Protection piping to the installed hose stations. The probability of failure of this system is considered low since it is a low pressure system not subject to transients. Flood calculations performed for each of the UCSR compartments show that the floor drains are sized for expected releases or in-flow of water to the area without significant buildup of standing water. The calculated height (i.e., less than two inches) is less than the height of the metal collars surrounding the penetrations; therefore, leakage is not expected.

Recently, two instances of water leakage at Byron Station from the UCSRs into either the MCR or the Unit 1 AEER were documented in IRs 934040 and 1046792. These IRs were initiated on June 23, 2009, and on March 24, 2010, respectively. Water leakage from hose stations resulted in some quantities of standing water on the UCSR floor. The standing water was able to migrate between the metal surfaces of the concrete embedded angle iron and the sheet metal fire seal collar. The seal installation details, as shown in the above figure, call for the gypsum seal to overlap the surface of the concrete opening. It is this interface that eventually allowed water to pass through the seal. The standing water then leaked into the MCR or AEER. The identified leakage path was at the fire seal-floor interface, and not through the depth of the poured gypsum.

Since the recent events at Byron Station, both stations have taken actions in accordance with the Corrective Action Program to improve the water resistance of the UCSR floor penetrations. Byron Station recently completed the process of applying sealant at the floor to collar interfaces, bolt holes, and vertical seams. During this process, additional potential sources of in-leakage (i.e., conduit sleeves, ventilation ducts, and support base plates with through-bolted floor attachments) were also sealed.

The fire/ventilation seal configuration was modified at Braidwood Station in 1987 via the design change process due to water leakage issues identified during original construction activities. The design change added a requirement to provide a sealant at floor to collar interfaces, bolt holes, and vertical seams to provide a barrier to prevent water intrusion/in-leakage. This requirement is documented on drawing 20E-0-3600, Note 208 BR, and was implemented in 1987. Additionally, sealant was also applied to various ventilation and equipment hatch configurations during this evolution. The application of this sealant eliminates the leakage/seepage paths between the collar to floor interfaces. Additional information regarding the 1987 Braidwood Station events is provided below in response to NRC Request 9.c, along with a discussion of Byron Station's review of the events.

In addition, Braidwood Station has recently performed a 100% inspection of previously sealed barriers and is in the process of performing minor repairs to limited areas. Braidwood Station is also identifying any additional potential leakage pathways, and will apply sealant as required.

Additionally, both stations are implementing a preventive maintenance requirement for the subject sealed penetrations to maintain their water resistant capabilities.

If the Halon system did not successfully extinguish an UCSR fire, the fire brigade would use manual fire suppression tactics consisting of the use of fire hoses and/or extinguishers. If necessary, water would be sprayed into the room to cool and then ultimately extinguish the fire. The cables are IEEE 383 rated and are not likely to catch on fire. However, in the event that the cables in a cable riser were burning, water would be directed toward that riser to put out the fire. As discussed above, the fire seals are qualified for hose stream use and are not expected to become dislodged by fire suppression activities or project the hose stream to the cold side. Therefore, gross water leakage through the fire seal is not expected. The tops of the installed gypsum fire seals are horizontal. The configuration of the fire seals would cause water from hose streams to run off the tops of the fire seals to the floor. Once the hose stream has been stopped, there would be only a minimal quantity of water on top of the seals. Since the gypsum forms a tight seal with the cable insulation, the minimal quantity of water is not expected to leak through the entire depth of the gypsum fire seal material itself. Water from fire fighting activities is expected to run toward the UCSR floor drains. After fire suppression activities have been completed, there may be some quantities of standing water on the floor. The floor drains would limit the amount of standing water to a height less than the top of the fire seal collars, thus preventing standing water from leaking through the gypsum itself. Functionality of the UCSR floor drain system is periodically tested at both Byron and Braidwood in accordance with station procedures.

A potential leak path for the standing water would be through the interface between the collars and the floor. However, actions are being taken to caulk this interface to address the concern about water leakage through the collar/floor interface. Since water levels above the top of the curbed openings or fire barrier collars are not expected, the caulked fire/ventilation seal configuration will be sufficient to prevent potential water intrusion/leakage events during normal plant operation (i.e., postulated line breaks or hose station leakage) and during fire fighting conditions where water spray may be used.

Given the actions to verify the proper operation of the floor drain systems and to caulk leakage points at the floor-seal interfaces, as well as ASTM E119 qualification testing that demonstrates the installed seals will not project hose stream water to the cold side of the seal, potential mechanisms for leakage of water through the seals have been addressed. Therefore, an analysis of the impact of using firefighting water in the UCSR in light of the design of the UCSR floor fire seals is not necessary.

**NRC Request 9.c**

The NRC staff notes that, prior to the early events when water entered the Main Control Room, the NRC issued a generic communication and summarized the lessons learned from the interaction between fire protection water systems and safety-related structures, systems, and components. The information was documented in NRC Information Notice (IN) 85-85, "Systems Interaction Event Resulting in Reactor System Safety Relief Opening Following a Fire-Protection Deluge System Malfunction," October 31, 1985 (ADAMS Accession No. ML031180210). In light of IN 85-85 and to satisfy GDC 3, discuss what actions EGC

considered, including any corrective actions taken, at Braidwood and Byron to avoid problems with operating experience as discussed in IN 85-85.

**Response**

IN 85-85 discussed a serious systems interaction event involving the Fire Protection Deluge system located in the Control Room ventilation charcoal filter housing at Hatch Nuclear Station. During this event, water from the inadvertently actuated Fire Suppression Deluge system backed up into the ventilation header. This backup, which was caused by plugged drains in the filter housing, leaked down onto the analog transient trip system, shorting out a power supply. The shorted power supply caused a low-low-set safety relief valve to stick open forcing the operator to scram the reactor.

Byron Station and Braidwood Station reviewed IN 85-85 shortly after it was issued. The review noted that the Byron and Braidwood charcoal filter deluge systems are manually initiated systems. These systems do not have automatic valves and are not subject to inadvertent automatic actuation. Therefore, no additional actions were deemed necessary to address IN 85-85.

Subsequent to IN 85-85, on two occasions in 1987, during initial construction at Braidwood Station, water leaked from the UCSRs into the MCR. The water had leaked through the interface between the fire seal collars and the floor. The source of the water was from the flushing of a neutralized floor etching solution and from hydrolazing of floor drains above the UCSRs. The water accumulated on the floor due to floor drains in the UCSRs that had become clogged with construction debris. To address this issue, Braidwood Station cleaned the floor drains in the UCSRs and applied caulk to the fire seal collars. Byron Station performed a review of this event, and noted that floor sealing and flushing activities had already been completed and no new actions were required at Byron Station to address this issue.

In 1988, IN 88-60, "Inadequate Design and Installation of Watertight Penetration Seals," was issued. This IN discussed potential problems resulting from inadequate design and installation of penetration seals whereby the seals may not provide watertight barriers between redundant safe shutdown trains. In this event, an inadvertent pressurization of the Fire Protection system caused 1/4 to 1/2 inch of water to accumulate around cable penetrations on a cable spreading room floor at Vogtle Unit 1. The water then seeped through the floor into the Control Room below. The water entered process control cabinets that caused a spurious Pressurizer high level signal and alarm, a spurious Pressurizer level deviation signal that caused the Pressurizer backup heaters to cycle on and off, and also spuriously caused the Pressurizer power-operated relief valve to open.

In 1988, Byron Station and Braidwood Station reviewed IN 88-60 and concluded that the condition discussed in this IN was enveloped by the Fire Hazards and Safe Shutdown Analyses and did not represent an unanalyzed condition. Use of the manual hose stations is a backup line of defense for fire protection of the UCSRs. Accumulation of standing water would not be likely due to the presence of floor drains. However, in the event that water did leak into the MCR, the effects of this event would be bounded by the MCR Safe Shutdown Analysis. The alternative safe shutdown equipment and procedures provided for a Control Room fire could be used if water in-leakage from the UCSR caused damage to redundant safe shutdown

equipment in the MCR. Thus, use of the manual hose stations would not significantly impair the safety capability of structures, systems, and components required for post-fire safe shutdown, which satisfied General Design Criteria (GDC) 3. Therefore, no changes to enhance the water resistance of the fire seals were made in 1988.

Based upon the recent water leakage events at Byron Station in 2009 and 2010, both stations determined that even though the consequences of potential water leakage from the UCSR into the MCR or AEER were previously evaluated as acceptable, additional steps to reduce the possibility of water leakage, and thereby reduce the operational challenges that could occur as a result of water leakage, were necessary. As stated previously, Byron Station has completed caulking of fire seal collar to floor interfaces in the UCSR. Braidwood Station has completed an inspection of their fire seal caulking for fire seals located in the UCSR floors and is in the process of performing minor repairs and installation of additional caulking, as required.