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RS-09-126

September 10, 2009

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 July 22, 2009

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.

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 10th day of September 2009.

Respectfully,

Patrick R. Simpson
Manager – Licensing

Attachment: Response to Request for Additional Information

NRC Request 1

Your letter dated March 26, 2009, Attachment Page 2, states that,

"...Each of the upper cable spreading rooms has an automatically actuated Halon fire suppression system that is designed and tested to provide sufficient Halon 1301 gas to suppress a surface or deep seated cable fire in any of the upper cable spreading rooms..."

"...With the proposed change, fire suppression capability would continue to be maintained by the Halon gaseous suppression system, with manual backup fire fighting capabilities that utilize hose stations and fire extinguishers dedicated to the upper cable spreading rooms..."

To evaluate the adequacy of the Halon 1301 system and to verify system performance, provide the following:

- Most recent full discharge test results including:
  - National Fire Protection Association 12A, "Standard on Halon 1301 Fire Extinguishing Systems," Edition (Year) of Code of Record for both station installations
  - Halon 1301 concentration levels in UCSRs
  - Number, location, and height of sensors in UCSRs
- Have any Halon 1301 system or other plant modifications, subsequent to the original discharge tests of the Halon 1301 fire suppression systems, been made in the UCSRs that could potentially affect Halon 1301 concentrations, such as new dampers or penetrations that might leak? If such modifications have been made, what subsequent testing or evaluation was performed to ensure that proper concentrations were maintained for the required soak time?
- In the absence of the backup CO_2 fire suppression system, do the UCSR primary automatic Halon 1301 fire suppression systems maintain a backup or secondary Halon 1301 supply?
- Further, discuss operating experience related to the Halon 1301 fire suppression systems at both stations.
- Provide details of any fires that have occurred in the UCSRs at either station.

Response

The code of record for National Fire Protection Association (NFPA) 12A is 1985 for Braidwood and 1980 for Byron.

Discharge testing was originally performed as part of the original system installation. The testing verified that the Halon concentration would be maintained above 6 percent for 20 minutes. Since then, no additional discharge testing has been performed. However, as discussed below, a room leakage test was performed in accordance with NFPA 12A-1992, Appendix B, "Enclosure Integrity Procedure," for Byron fire zone 3.3A-1 in 1993. The room leakage test was performed to determine if the extended Halon bottles for Byron fire zone

3.3A-1 were still required. Results from the discharge tests for Braidwood and Byron are shown below. The values listed below are for the Halon sensor that had the lowest reading in each zone.

Braidwood Station Results of Halon System Discharge Test			
Zone	**Bottles**	**Initial Concentration**	**Soak**
3.3A-1	4	>10.0%	>6% for 25 min
3.3B-1	8/8	8.8%	>6% for 17 min (Note 2)
3.3C-1	8	8.6%	>6% for 25 min
3.3D-1	4/4	8.8%	>6% for 23+ min (Note 1)
3.3A-2	4	10.0%	>6% for 28 min
3.3B-2	8	8.8%	>6% for 27 min
3.3C-2	8/8	8.6%	>6% for 13 min (Note 2)
3.3D-2	4	8.6%	>6% for 20 min

Note 1: During testing, concentration was maintained above 6% for 13.5 minutes. Extended discharge was initiated to discharge additional Halon into area. The amount of Halon added with the extended discharge is equal to initial number of bottles discharged. Concentration increased above 10% and remained above 10% at 23 minutes when test was terminated and room purged. Extended discharge set for 10 minutes.

Note 2: Extended discharge capability added to zone to address soak time. The amount of Halon added with the extended discharge is equal to initial number of bottles discharged. Based on results of extended discharge capability from zone 3.3D-1, the extended discharge was not tested for zones 3.3B-1 and 3.3C-2. Extended discharge set for 15 minutes for 3.3B-1 and 10 minutes for zone 3.3C-2.

Byron Station Results of Halon System Discharge Test			
Zone	**Bottles**	**Initial Concentration**	**Soak**
3.3A-1	4	>10.0%	>6% for 24 min (Note 1)
3.3B-1	8	>10.0%	>6% for 22 min
3.3C-1	8	9.0%	>6% for 22 min
3.3D-1	4	>10.0%	>6% for 22 min
3.3A-2	4	>10.0%	>6% for 23 min
3.3B-2	8	9.8%	>6% for 25 min
3.3C-2	8	9.6%	>6% for 20 min
3.3D-2	4	8.6%	>6% for 25 min

Note 1: Three extended discharge bottles were originally provided for this zone to ensure that the Halon concentration would remain above 6 percent for at least 20 minutes. The first extended discharge bottle was set to discharge at 8 minutes, the second extended discharge bottle was set to discharge at 14 minutes 50 seconds, and the third extended discharge bottle was set to discharge at 19 minutes 30 seconds following the discharge of the initial four Halon bottles.

A room leakage test was performed in accordance with NFPA 12A-1992, Appendix B, "Enclosure Integrity Procedure," for Byron fire zone 3.3A-1 in 1993. The room leakage test was performed to determine if the extended discharge bottles for Byron fire zone 3.3A-1 were still required. This test is used to measure room leakage and to determine how long the required Halon concentration can be maintained. Due to ozone layer concerns, NFPA now recommends room leakage tests instead of performing full discharge tests. The room leakage test results demonstrated that fire zone 3.3A-1 would maintain a 6 percent Halon concentration for about 63 minutes without requiring use of the extended discharge bottles. This value was calculated for a minimum protected height of 9.1 ft, which was the location of the upper Halon sensor during the initial Halon concentration test. Based upon these test results, it was determined that the extended discharge bottles were no longer required, and the extended discharge bottles were subsequently removed.

The upper cable spreading room (UCSR) is divided into four separate fire zones for each unit. Three Halon sensors were used during each full discharge test to monitor the Halon concentration. The fire zones, room heights, and sensor heights above floor level are listed below.

Braidwood				
Zone	**Room Height (ft)**	**Sensor A (ft)**	**Sensor B (ft)**	**Sensor C (ft)**
3.3A-1	11.5	10.0	8.0	4.0
3.3B-1	11.5	8.75	6.0	4.5
3.3C-1	12.5	7.0	5.0	3.5
3.3D-1	12.5	7.8	6.0	2.0
3.3A-2	11.5	8.8	5.0	4.0
3.3B-2	11.5	9.7	6.0	3.0
3.3C-2	12.5	7.0	5.0	4.0
3.3D-2	12.5	8.5	6.0	3.0

Byron				
Zone	**Room Height (ft)**	**Sensor A (ft)**	**Sensor B (ft)**	**Sensor C (ft)**
3.3A-1	11.5	9.1	4.4	0.9
3.3B-1	11.5	7.2	4.4	1.1
3.3C-1	12.5	5.8	3.1	1.1
3.3D-1	12.5	7.4	4.6	2.6
3.3A-2	11.5	9.0	7.0	3.0
3.3B-2	11.5	8.0	6.0	3.0
3.3C-2	12.5	7.7	4.0	Not Specified
3.3D-2	12.5	8.7	4.5	2.0

A design change was performed at Byron for the removal of the extended discharge bottles at Byron for fire zone 3.3A-1. As discussed above, results of the room leakage test demonstrated that the extended discharge bottles were no longer required to maintain the 6 percent Halon concentration for a soak time of 20 minutes. There have been no other modifications made to the Halon 1301 suppression system installed in the Byron and Braidwood UCSR that would affect the amount of Halon discharged into the area by the system. The only other modification to the Halon system at both stations was the addition of a pre-discharge time delay to address Occupational Safety and Health Administration (OSHA) safety requirements.

There have been no modifications to the UCSR that installed new dampers or ventilation openings into the UCSR area or between rooms in the UCSR.

There have been modifications to the UCSR that added penetrations into the area for cable installations. The penetrations added are designed and sealed using installation details consistent with the original penetrations into the area. Quality Control inspections are used to verify proper installation of the penetrations and seals. The penetrations/seals are rated for the three hour fire rating of the barriers used in the UCSR area. The penetrations/seals are appropriately rated and are not expected to result in Halon leakage from the area after actuation of the Halon system. The original and any new penetrations/seals are periodically inspected to ensure there is no degradation of the seals.

In addition, modifications have been installed that have required opening of existing penetrations to add cables. The penetrations are resealed per the original design requirements and have the same rating as the original seals. Quality Control inspections are used to verify proper reinstallation of the seals. The seals are appropriately rated and are not expected to result in Halon leakage from the area after actuation of the Halon system. The seals are periodically inspected to ensure there is no degradation of the seals.

The UCSR primary automatic Halon 1301 fire suppression systems do not have a backup or secondary Halon 1301 supply. However, several changes were made to the UCSR Halon system during construction to enhance system reliability and effectiveness, and to mitigate the concern that a single failure could render the Halon system inoperable. These changes included the addition of one Halon storage bottle above the minimum that would normally be required for any area. This additional bottle was added to provide redundancy to the Halon supply in the event of a failure of one bottle to discharge.

Periodic Halon system activation testing is performed to verify availability of the Halon fire suppression systems. This testing consists of actions to: (1) initiate airflow through system discharge headers and nozzles to verify no blockage (i.e., commonly referred to as puff testing), (2) verify that the system, including the electrical signal to associated ventilation dampers, actuates automatically upon receipt of a simulated actuation signal, (3) verify continuity of damper electro-thermal links (i.e., Braidwood only), (4) verify proper electrical timer setpoints, and (5) verify receipt of appropriate system alarms. The fire dampers associated with the Halon systems are also inspected periodically by another surveillance to verify that the electro-thermal links are intact and that the fire dampers are in good condition, and that there are no obstructions that would prevent the fire dampers from closing.

For Braidwood, a formal review of UCSR Halon system puff tests between the years of 1996 and 2004 was performed. All of the testing activities completed by the Halon system tests during the review period (i.e., 1996-2004) contained the following acceptance criteria, as a minimum.

1. The associated Halon Fire Suppression Zone actuated.
2. An electrical signal was initiated for the associated ventilation dampers.
3. No flow blockage of system piping or nozzles verified.
4. Appropriate alarms generated locally, and in the Main Control Room.
5. Continuity of the associated fire damper electro-thermal links verified.
6. If applicable, the extended discharge time delay verified within tolerance.

Review of the 40 listed work orders/surveillances performed for this period revealed that all components tested in each of the surveillances were found to be satisfactory, generating the expected response. The only failure experienced during the reviewed Halon puff testing occurred on June 16, 2004, while performing the puff test for Zone 1EE2 (1S-34) when no electrical signal was generated to the closure of fire damper 0VC79Y. The damper control relay was replaced and the retest was performed satisfactorily. Based on these test results, the UCSR Halon systems reliability has been satisfactorily demonstrated through repeated, successful completion of system functional testing.

For Byron, a formal review of UCSR Halon system puff tests between the years of 1997 and 2005 was performed. All of the testing activities completed by the Halon system tests during the review period (i.e., 1997-2005) contained the following acceptance criteria, as a minimum.

1. The associated Halon Fire Suppression Zone actuated.
2. An electrical signal was initiated for the associated ventilation dampers.
3. No flow blockage of system piping or nozzles verified.
4. Appropriate alarms generated locally, and in the Main Control Room.

Review of the 41 listed work orders/surveillances performed for this period revealed that most of the components tested in each of the surveillances were found to be satisfactory, generating the expected response. The following two items were noted during the review. On September 5, 2000, a fire damper control relay with high contact resistance was identified while performing the puff test for Zone 1EE4 (1S-36). The fire damper control relay was replaced and the test was completed satisfactorily. On August 11, 2005, a power supply with low output voltage was identified in panel 0FP04J (i.e., one of two Halon actuation panels) while performing the puff test for Zone 2EE3 (2S-35). Due to the redundant nature of the controls, the system remained functional without this power supply. This power supply was replaced and the test was completed satisfactorily. Based on these test results, the UCSR Halon systems have demonstrated high reliability through repeated, successful completion of system functional testing.

Test failures are documented within the Corrective Action Program. Review of Corrective Action Program documents for testing failures since the formal reviews performed in 2004/2005 also shows that the Halon system is a reliable system with no additional test failures reported.

There have been no fires in the UCSRs at Braidwood or Byron.

NRC Request 2

Your letter dated March 26, 2009, Attachment Page 4, states that,

"...Halon 1301 gaseous suppression system is highly reliable and capable of suppressing postulated fires in the upper cable spreading rooms without compromising the ability to achieve and maintain safe shutdown in the event of a fire..."

Provide a basis for why you believe that the installed Halon 1301 fire suppression systems are highly reliable and capable of suppressing postulated fires, and that they will deliver and maintain 6 percent concentration in the entire volume of the UCSRs for 20 minutes.

Response

The UCSRs are protected by automatically actuated Halon 1301 gaseous suppression. The systems are designed and have been tested to provide a 6 percent concentration and a soak time of 20 minutes. The Braidwood and Byron Halon systems were designed to NFPA 12A for Halon systems and were installed by qualified personnel. The Halon system is classified as an augmented quality system. Augmented quality classification is part of the Exelon Generation Company, LLC (EGC) Quality Assurance program to ensure that design, procurement, instruction, procedures, drawings, inspection, installation, testing, maintenance, operations, etc. provides a high degree of availability and reliability for the subject systems. During construction, several enhancements were made to the Halon system design to improve the reliability and effectiveness. These modifications included changes to the automatic Halon suppression systems to make it resistant to single failures by providing a parallel train of actuation logic, two redundant Halon bottle solenoid pilot valves (i.e., one from each actuation logic train), each UCSR zone is provided with two parallel zone discharge valves and the UCSR zones are provided with an additional Halon bottle to provide redundancy to the Halon supply, assuming a single bottle fails to discharge. Halon system trouble alarms were also installed in the Main Control Room to alert operators for any actuation logic loss of power or other circuit trouble conditions. The Halon system does not have any manual isolation valves that could adversely affect the operation of the Halon system.

Tests and studies documented in NUREG/CR-2607, "Fire-Protection Research Program for the U.S. Nuclear Regulatory Commission 1975-1981," and NUREG/CR-3656, "Evaluation of Suppression Methods for Electrical Cable Fires," were performed to determine the effectiveness of various fire suppression systems. The testing included exposure cable tray fires and fully developed cable tray fires. The fully developed cable tray fires were intended to produce flaming and fully developed cable tray fires (i.e., deep-seated cable fires). One of the criteria for evaluating the results of the suppression system tests was the ability of the suppression system to suppress the fire – no reignition of the fire after oxygen is reintroduced into the test enclosure (soak time). Testing was performed on horizontal and vertical cable tray arrangements. The testing also evaluated the soak time necessary for IEEE-383 qualified cable and unqualified cable. The testing demonstrated that qualified cable requires a longer soak time than unqualified cable to ensure a deep seated fire once suppressed does not reignite. Tests showed that Halon permanently extinguished a fire after only a 10-minute soak time, whereas the same time limit on simple oxygen deprivation was insufficient to keep the flame from returning upon ventilation. Table 9 of NUREG/CR-3656 considered the 10-minute soak time demonstrated by testing and added a 50% safety factor concluding that a 15-minute soak time would adequately extinguish both a flaming fire and a fully developed fire (i.e., deep seated fire) and that the fire would not reignite once oxygen is reintroduced into the protected room.

At the conclusion of the Halon 1301 system installation, testing was performed on each of the systems to ensure that the design Halon concentration could be achieved and that the design soak time could be maintained. Testing confirmed that the UCSR Halon systems could maintain the necessary 6 percent concentration for the soak time recommended in NUREG/CR-3656. As shown in the response to NRC Request 1 above, the discharge testing that was performed verified that a soak time of 20 minutes could be maintained. Since the 15 minute soak time recommended in NUREG/CR-3656 was based on providing a 50 percent safety factor over the soak times determine in the testing, the 20 minute soak time for the rooms provides an additional safety factor over the original tested soak time of 10 minutes. Therefore, the installed Halon systems are effective and capable of extinguishing a cable tray fire in these rooms.

Given the sensitivity of the detection actuation system, it is not expected that a fire as severe as those shown in NUREG/CR-3656 "Fully Developed" cable fire examples could occur prior to actuation of the Halon system. The "deep seated" fire phenomenon described in the NUREG requires significant pre-burn time (i.e., 10-15 minutes) to pre-heat the exposed cables enough to still be smoldering after the Halon discharge. Because the systems are capable of responding during the early "exposure fire" phase described in NUREG/CR-3656, overall room temperature rise is not expected to be significant, and any cables that have been heated by the fire are expected to cool-down relatively quickly, preventing re-ignition. However, as discussed above, the system is designed to adequately suppress postulated "deep seated" fires with margin with regards to concentrations and soak times.

NRC Request 3

Your letter dated March 26, 2009, Attachment Page 6, states that,

"...The fire brigade is adequately equipped and trained to manually fight a fire in any of the upper cable spreading rooms. This conclusion is based on brigade experience, walkdown of the upper cable spreading rooms, and actual fire scenarios in other plant areas with conditions similar to those present in the upper cable spreading rooms..."

Manual fire-fighting of large amounts of burning cables is a considerable challenge even to the most well-trained and equipped fire brigade. Further, many rooms of this nature have cable trays located high above the floor which may be inaccessible to the fire brigade personnel. Describe how the facility fire brigade personnel have been instructed about the potential for deep-seated fire hazards associated with cable re-ignition. Further, discuss the methods to manually extinguish or control and minimize the effects of a deep-seated fire located high above the floor in inaccessible locations (if Braidwood and Byron UCSRs have any inaccessible locations).

Response

There are no inaccessible locations with respect to ceiling height. As discussed in response to NRC Request 1, the ceiling height of the UCSRs is 11.5 or 12.5 ft. The highest cable trays in the UCSR are approximately 5 ft to 6.5 ft from the floor level. Training for the fire brigades includes the following material for addressing electrical fires.

FBP07, "Hose Streams, Appliances and Tools," discusses the use of water on energized electrical fires and basic guidelines aimed at the safe application of water.

FBP11, "Tactics and Strategies," discusses the types of fires that may be encountered. The following material is provided for fires in cable trays:

a. De-energize the electrical equipment; and
b. Extinguishing agents: water, dry chemical and/or CO_2.

The lesson plan also identifies the basic tactical priorities for any fire as follows.

- Rescue
- Exposure
- Confinement
- Extinguishment
- Overhaul – includes establishment of a fire watch until additional resources would be available to verify all cables de-energized.

Braidwood and Byron fire fighting strategies would use "Water fog stream" as the preferred extinguishing agent for energized cabling (cable pans). Dry chemical and CO_2 are identified as the second choice. Water application would be from a safe distance by bouncing water streams off walls and ceilings into horizontal cable trays. Flooding of cable trays would be another option.

As stated above, the Fire Brigade training program includes lesson plan modules addressing the tactics and strategies for extinguishing Class C, energized electrical fires, including cable tray fires. These strategies are periodically reinforced through the continuing training program.

NRC Request 4

Your letter dated March 26, 2009, Attachment Page 6, states that,

"...Additionally, because the cables in these rooms are IEEE-383 qualified, a self-ignited fire is not postulated. A fire in qualified cable trays is difficult to start and spreads at a slow rate, providing ample time for an automatically actuated Halon system to suppress a fire in the early stages before the fire becomes fully developed..."

Provide a basis for not postulating a self-ignited fire and why a fire in qualified IEEE-383 cables is difficult to start and spreads at a slow rate. Further, confirm that there are no non-IEEE-383 qualified cables installed in the UCSRs.

Response

IEEE Standard 383-1974 is an industry established standard for type test of Class 1E electric cables, field splices, and connections for nuclear power generating stations. The fire test identified in IEEE 383 demonstrates that the cable does not propagate fire even if its outer covering and insulation have been destroyed in the area of flame impingement. Cables that self-extinguish when the flame source is removed or burn out pass the testing requirement. Cables that propagate the flame and burn the total height of the tray above the flame source fail the test.

Cable specifications require power and control cable to meet IEEE-383 or equivalent flame tests. In some limited applications, specialty instrumentation cables have been used that are not certified to IEEE-383 testing, though some flame testing is done on all cable. The cable raceway system segregates power, control and instrument cables into separate trays. Therefore, non-IEEE 383 cables will only be present in trays with other instrument cables. Due to the low energy in instrument cables, an instrument cable failure is not likely to result in ignition of any cables present.

In addition, as discussed in Appendix F, "Guidance for Selection of Equipment Damage Criteria," of the Electric Power Research Institute (EPRI) Fire PRA Implementation Guide (i.e., EPRI Report No. TR-105928), IEEE-383 rated cables will not be damaged by a fire unless the fire temperature exceeds 700 °F and piloted ignition will not occur unless the fire temperature exceeds 932 °F. As stated previously, when the pilot fire is extinguished, the IEEE-383 cables will self-extinguish and will not continue to burn.

NRC Request 5

Your letter dated March 26, 2009, Attachment Page 6, states that,

"...In the unlikely event a fire did start, and the suppression systems failed to operate, the fire would be contained within the room by the fire barriers..."

Your evaluation did not specify the number and types of ignition sources present in the UCSRs. Identify the types and locations of all ignition sources within the UCSRs at both stations.

Response

The Braidwood and Byron fire analyses identify the following ignition sources in the UCSRs.

Ignition Sources in UCSRs	
Zone	**Ignition Sources**
3.3A-1	1 Electrical Control Cabinet 1 Ventilation Subsystem (i.e., 0A VC Makeup Filter Unit) Transient Ignition Sources
3.3A-2	1 Electrical Control Cabinet 1 Ventilation Subsystem (i.e., 0B VC Makeup Filter Unit) Transient Ignition Sources
3.3B-1	Transient Ignition Sources
3.3B-2	Transient Ignition Sources
3.3C-1	Transient Ignition Sources
3.3C-2	Transient Ignition Sources
3.3D-1	Transient Ignition Sources
3.3D-2	Transient Ignition Sources

Note: The VC Makeup Filter Units have a separate automatic water deluge system.

<u>NRC Request 6</u>

Your letter dated March 26, 2009, Attachment Page 6, states that,

"...the control room heating, ventilation, and air conditioning (HVAC) ductwork inside the room may be damaged and/or the fusible link fire dampers inside the ductwork or electro thermal link fire dampers would close and restrict the flow of air..."

The March 26, 2009, LAR did not discuss effects of fire damage on equipment required for safe-shutdown. Discuss the effects that fire damage would have on the equipment that is associated with cables likely to sustain damage, and provide a basis for adequacy of damage, i.e., provide a basis for determining that, in spite of damage, adequate safe-shutdown will be maintained.

<u>Response</u>

The Fire Safe Shutdown Analysis for the UCSRs is contained in Sections 2.4.2.19 thru 2.4.2.26 of the Fire Protection Report. The analysis for each of these rooms assumes the total loss of all cable and component functions for the affected room due to a design basis type of fire. Each of the UCSRs has been designed and constructed such that they are bounded on all sides, floor and ceiling by 3-hour fire rated construction. The combustible loading analysis for these rooms has a maximum fire equivalent fire severity of less than 2 hours for each room. Due to the fact that each UCSR is contained within its own fire area and bounded on all sides by 3-hour fire rated construction, a design basis fire initiated in any one of these rooms would be confined to that room and not propagate to any adjacent room.

The Safe Shutdown Analysis includes a review of the effects of a fire in each UCSR on cables and components required to support the following functions: Common Systems, Essential Electric Power (AC/DC) Support, RCS Inventory Control (Including Boration), Hot Standby Decay Heat Removal, Essential Support, and Cold Shutdown Decay Heat Removal. The UCSRs contain primarily Division 1 control and instrumentation cables. Most Division 2 safe shutdown equipment and cables are not affected by a UCSR fire and are, therefore, credited for safe shutdown. There is an exception for cables associated with the Main Control Room Ventilation (VC) System. In some of the UCSRs, a fire may affect Division 1 and 2 control cables for the VC System; however, the Safe Shutdown Analysis provides direction to use pre-staged temporary ventilation equipment to ensure that adequate cooling is provided for the Main Control Room.

In conclusion, the Fire Safe Shutdown Analysis has evaluated each of the UCSRs to assure that a design basis fire in any one room would not adversely affect the ability of either Unit 1 or Unit 2 to safely achieve and maintain safe shutdown.

NRC Request 7

Your letter dated March 26, 2009, Attachment Page 7, states that,

"...Based on the multiple echelons of fire safety provided for the upper cable spreading rooms, the ability to achieve and maintain safe shutdown in the event of a fire is maintained with the removal of the manually actuated CO_2 system from the upper cable spreading rooms..."

Removing the manually-actuated backup CO_2 fire suppression system from the UCSRs could be viewed as compromising a second element of defense-in-depth (DID) involving fires in the UCSRs, resulting in the reduction of DID required by the regulation (Section II of Appendix R to 10 CFR Part 50).

The NRC staff requests that you provide a description of the remaining DID features in the UCSRs at both stations as well as a discussion of how the required level of DID will be maintained despite the removal of the backup CO_2 fire suppression systems.

In your response, discuss why the CO_2 fire suppression system was originally installed as backup to the Halon 1301 fire suppression system (i.e., why was it deemed necessary for the original licensing basis). Also explain why you now believe that the backup CO_2 system is not required, such that suppression capability would be maintained by the Halon 1301 fire suppression system only. What has changed in terms of the fire protection needs and licensing basis for the UCSRs since the original installation that now apparently renders the backup CO_2 fire suppression system as unnecessary.

Response

With regards to the mitigation element of defense-in-depth strategy, the detection capabilities for the UCSRs have not been altered. Two trains of fire detection are still available and either train will initiate an alarm in the Main Control Room if a fire is detected. The detector circuits are designed that if either of the redundant detection zones failed, the remaining detection zone could then solely initiate the automatic suppression system. The number of hose stations has not been changed and portable extinguishers are still available to provide backup fire fighting capabilities for the areas.

NRC Branch Technical Position – Chemical Engineering Branch (BTP CMEB) 9.5-1 provides guidance that the primary fire suppression in cable spreading rooms should be an automatic water system. In lieu of a water suppression system, Braidwood and Byron installed a standard automatic Halon 1301 system with a manual CO_2 backup system. However, this original design was not considered acceptable and the original NRC review identified that the fire protection for the cable spreading rooms did not meet the specified guidelines. The NRC was concerned that this design would not be sufficiently reliable to provide reasonable assurance that a fire in these areas would be suppressed. This resulted in several enhancements to improve the overall reliability of the originally installed Halon system.

The originally installed manual CO_2 system was not discussed in the associated correspondence regarding the need to improve the overall reliability of the Halon system. The need to maintain the backup CO_2 system following the enhancements made to the Halon system was also not established. It is recognized that the removal of the backup CO_2 system does eliminate a potential fire fighting capability for dealing with fires in the UCSRs. The design of the Halon system is in compliance with applicable NFPA codes and enhancements made to the system provides capacity in excess of that required to suppress a deep-seated cable fire. Periodic testing of the Halon system has demonstrated the reliability of the installed system. Therefore, the relative additional capabilities provided by the CO_2 system was considered minimal. Based on the above, the elimination of the backup CO_2 system is not considered a significant reduction in the fire mitigation element of the defense in depth strategy for the UCSR and would not adversely affect the ability to safely shutdown the plant in the event of a fire.

The remaining elements of the defense in depth strategy, prevention and protection of safe shutdown capability, are not affected by the change.

A fire hazards analysis has been performed for the UCSR and potential consequences have been determined. The UCSRs are limited access areas and there is no storage of combustible material allowed in these areas. Transient combustibles introduced into the area are controlled by station administrative procedures. Hot work performed in the UCSRs is also controlled by station administrative procedures. The UCSR areas are periodically inspected as part of the station housekeeping zone inspection program. This program assigns area owners who ensure housekeeping standards are being maintained in the areas, including monitoring for compliance with transient combustible control requirements.

As discussed in the response to NRC Request 6 above, the design is such that disabling of one full cable spreading room would not prevent safe shutdown of the plant due to the redundancy and separation criteria used in design. This fire barrier construction ensures a long residence time in the event of a fire and the rating of the barriers is greater then the fire severity for the areas.