VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

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NL&OS/ETS R1
Docket Nos. 50-338/-339
License Nos. NPF-4/-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION
HALON FIRE SUPPRESSION SYSTEM IN ESGR

In a telephone conference call with the NRC staff on February 13, 2001 to resolve questions identified during a site visit in January 2001, the NRC requested additional information with regard to the design and operation of the manual Halon fire suppression system installed in the Emergency Switchgear Rooms (ESGR) of North Anna Units 1 and 2. The attachment to this letter provides the requested additional information regarding the system design and operation information.

If you have any further questions, please contact us.

Very truly yours,

Leslie N. Hartz
Vice President - Nuclear Engineering and Services

Attachment

Commitments made in this letter:

1. None

A006

cc: U.S. Nuclear Regulatory Commission
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Attachment

Request for Additional Information
Regarding the Manually Actuated Halon 1301 Fire Suppression System Installed
In The Emergency Switchgear Rooms
North Anna Power Station Units 1 and 2

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

Question 1: IEEE-383 Cable

Could you please indicate the approximate percentage of IEEE-383 cable that is routed in "Cable Trays" located in both Fire Areas 6-1 and 6-2. This goes to the issue of deep-seated fire potential.

Response:

Some of the cable installed at North Anna was purchased prior to the issuance of IEEE-383. However, as stated in our IPEEE submittal all cables installed have been specified to meet, as a minimum, the fire propagation test outlined in IEEE-383. Therefore, we would consider 100% of the cable routed in cable trays located in the Units 1 and 2 ESGR to be IEEE-383 cable or meet as a minimum the fire propagation test outlined in IEEE-383.

Question 2: Hose Stations Hydraulic Using Extra Lengths of Hose

The Fire Pre-Plans for Fire Areas 6-1 & 6-2 indicate that the fire hose used to manually fight a fire in these fire areas needs extra fire hose to reach all areas of the room. One of the hoses needs 300' of hose while the other needs 200' of hose. Please, confirm that hydraulic calculations exist that have confirmed that with the extra hose lengths attached, the hose nozzle has adequate pressure and flow necessary to meet the hose nozzle operational characteristics. Whenever extra hose is connected to an existing hose station arrangement, the hydraulic characteristics need to be checked and confirmed.

Response:

The hose stations in question are located in the basement of the Turbine Building (TB). The static pressure on the hose station in the basement of the TB is in excess of 150 psi. (Actual reading is 166 psi). The fire brigade will use an Akron, Model 1715, Turbo Jet nozzle set at 60 gpm. Based on the manufacturer's literature, at 60 gpm the nozzle requires 100 psi at the nozzle tip. A formal calculation was not completed to determine nozzle operation characteristics. Information provided in "Hydraulics for Fire Protection," by Dr. Harry E. Hickey, copyright 1980, indicates that there is approximately a 9 psi drop for each 100 ft. of 1 1/2" hose flowing at 60 gpm. Therefore, the pressure at the nozzle of the hose with a total length of 300 feet will be approximately 27 psi lower. With a 27 psi drop system pressure is maintained well above the minimum required by the Akron design. Likewise, the other hose with 200 ft of hose total would involve an 18 psi loss that would not hinder fire fighting.

Question 3: Halon 1301 Concentration Probe Locations

The Halon 1301 Pre-Operational test strip charts for Fire Areas 6-1 & 6-2 indicate the elevation that the probes were located. Please identify in which room probes A-1, A-2,

A-3; B-1, B-2, B-3; C-1, C-2, C-3 are located and exactly where the probes were positioned in each respective room.

Response:

Based on a review of the test strip charts, the probes were distributed as follows:

Unit 1

Probes A1-A3 were in the J ESGRs, at elevations 18'6", 10', and 4' 6", respectively.
Probes B1-B3 were in the H ESGRs, at elevations 18'6", 2'5", and 3'8", respectively.
Probe C1 was in the Air Conditioning room, at elevation 9'.
Probes C2-C3 were in the Instrument rack room, at elevations 16' and 8', respectively.

Unit 2

Probes A1-A3 were in the J ESGRs, at elevations 22', 2'11", and 3', respectively.
Probes B1-B3 were in the H ESGRs, at elevations 15', 8', and 5'6", respectively.
Probe C-3 was in the Air Conditioning room, elevation 12'.
Probes C1-C2 were in the Instrument rack room, at elevations 17' and 11'6", respectively.

The Halon concentration testing was performed in accordance with NFPA-12A. NFPA 12A does not provide definitive guidance on probe location. The strip charts indicate the elevation at which the probes were placed but do not indicate horizontal location within the rooms.

Question 4: FA 6-1 & 6-2 Combustible Loading

During the walkdown, I was informed that the combustible loading for this area is now considered "High" which means that it exceeds 90 minutes. I have read documents that say the loading is 65 minutes and others that say the loading is 75 minutes. I was also told that the combustible loading in this area is no longer tracked because it has passed the "High" combustible loading threshold. Please provide me with the combustible loading analysis for Fire Areas 6-1 & 6-2. Also, please indicate what measures are in place to limit what combustibles are permitted to be added to these fire areas. I believe I was told that since the "High" threshold was crossed that there is no longer any restraint on what can be added to this room because it will not affect the "High" classification. If I have misunderstood anything please set me straight.

Response:

Exemption Request # 14 indicated the fuel loading for the ESGR, which includes the AHU part of the room, was "High." At the time, "High" was considered to be a fire severity greater than 90 minutes. Our program did not have a classification that distinguished fuel loadings above "High." Therefore, upon exceeding the limit for

designation as a "High" loading area, updating the combustible loading table for the ESGR to assess classification was deemed unnecessary and discontinued.

Other references to a 65 or 75 minute fire loading from other documents are typically associated with more limited evaluations that were assessing fire exposure in portions of the room and contain certain specific assumptions.

Independent of these above-mentioned evaluations, we do monitor transient combustibles in the ESGR through station administrative controls. Loss Prevention performs monthly walkdowns of the ESGR, which includes checks for transient combustible material. Station supervision also performs monthly plant housekeeping walkdowns. In addition, our design control process requires us to consider the impact additional combustibles have if added in the vicinity of the fire barrier that separates the Chiller Room and AHU part of the ESGR.

Question 5: Air Handler (AHU) Operation

If both AHUs are vulnerable to damage as a result of fire in the ESGR they must be assumed lost as a result of fire in that area. From your response it appears that both AHUs may be damaged. Is this a valid interpretation of your response?

Response:

The premise of the assumed fire event must be described first in order to address this question. There are two events or types of fire with two different sets of design assumptions that are addressed by evaluation. First there is the Appendix R fire. North Anna deterministically assumes in the event of an Appendix R fire that everything is lost in the one ESGR where the fire starts. For this evaluation, the station (both units) can safely shutdown using equipment outside the fire area. However, since we assume loss of all equipment in the room, this would include all the AHUs. And, since everything in the fire area is deterministically assumed unavailable, there is no equipment for the Halon system to protect and hence the performance of the Halon mitigation system is a moot point.

For the IPEEE fire or realistic fire, we would not expect the fire to destroy everything in the room. Based on fire modeling performed to support the IPEEE, fire damage is expected to be limited to within a small radius of the point of origin. Since only one AHU is normally operating and the AHUs get their power from different sources, a non-Appendix R type fire would not cause both AHUs to be lost. Therefore, the fire may disable one AHU, but the other AHU would most likely be available.

Question 6: Halon Concentration with Air Handler Operation

If both AHUs are, in fact, subject to loss and the Halon acceptance test was conducted with one AHU operating, how does the loss of all AHUs affect the conclusions/results of the Halon acceptance test program?

Response:

The question erroneously assumes total loss of AHU capability for anticipated fire scenarios. As noted above, the case where both AHUs are assumed lost is the Appendix R fire for which the entire room is deterministically assumed lost and, therefore, the Halon mitigation system and hence Halon concentration is of no consequence. The more likely fire scenario concludes that one AHU will remain available and, therefore, the Halon system acceptance test was properly conducted using a realistic system setup. Both AHUs are in fact not likely to be subject to loss in a fire.

However, to directly address the specific question regarding assumed operation without air circulation, the Halon would begin to migrate after being discharged to the lower elevations of the ESGR. Correspondingly, it would be reasonable to assume that the Halon concentration would begin to decline over time under these conditions. How fast the Halon would migrate to the lower elevations and the impacts on the conclusions of the acceptance test are not known.

Question 7: Loss of Air Handlers – Halon Actuation

Has the scenario (loss of AHUs prior to Halon system actuation) been evaluated? If so, what is the impact on plant risk? If not, why?

Response:

Yes, loss of AHUs prior to Halon system actuation has been evaluated. A detailed analysis of risk from fire in the ESGR was performed as part of the North Anna IPEEE effort. A specific scenario was analyzed that failed both AHUs in the ESGR and assumed the Halon system did not actuate. The contribution from fire for this scenario was determined to be 4.13 E-8 CDF/Yr. This and other ESGR fire sequences can be found in Chapter 4 of the North Anna IPEEE Report.

Question 8: Charging Pump Cross Connect

Chapter 4 of the North Anna Appendix R Report (pg. 4-10) describes the consequences of a postulated fire in the Emergency Switchgear Rooms of both units (Fire Areas 6-1 and 6-2). With regard to reactor coolant makeup, this section of the report states that all 3 Unit 1 Charging Pumps (1-CH-P-1A, 1B and 1C) are susceptible to loss as a result of fire in "this area". From the description provided in this section of the report it is not clear which pumps would be lost as a result of fire in each specific area. That is, would the U1 pumps only be lost as a result of fire in 6-1? Or would a fire in either area cause their loss? Are Unit 2 pumps only susceptible to loss in 6-2? Please clarify.

Response:

The Appendix R scenario for a fire in Unit 1 ESGR (FA 6-1) assumes the loss of the Unit 1 Charging Pumps. It credits being able to use the opposite unit's pumps through the cross connect for safe shutdown (i.e., in this case Unit 2, Charging Pumps). The converse would be true for a fire in the Unit 2 ESGR (FA 6-2). Section 4.4 of the Appendix R Report indicates the discussions on how safe shutdown is achieved for the different fire areas is based on Unit 1, but are equally applicable to the Unit 2 fire areas.

Question 9: Unit Shutdown in the event of unmitigated fire

Is a shutdown of both units procedurally required in the event of an unmitigated fire (Appendix R fire scenario) in either ESGR? If so, why?

Response:

Shutdown of both units is not procedurally required for the sole event of a fire in either ESGR. Specifically, the Fire Contingency Action Procedure (FCA) does not direct Operations to automatically trip the reactor on the unaffected unit upon entry into the procedure for the affected unit. The FCA does however have a number of steps, depending on the assumed plant status, which could result in tripping the reactor on the unaffected unit. For example, in responding to a fire in either ESGR, the FCA has entry conditions for loss of all AC power or loss of charging which requires an opposite unit shutdown. If there is no loss of off-site power or total loss of charging the FCA will direct the operator to manually trip the reactor on the fire affected unit only.

Question 10: Administrative control for shutdown in the event of a fire

It is our understanding that the alternative shutdown strategy for an unmitigated fire in the ESGR is completely independent of the affected fire area. However, unaffected unit equipment would be relied on (e.g., in the event a fire in the ESGR causes a loss of all charging pumps of the affected unit). Describe the administrative controls and/or compensatory measures in place that assure the availability of the unaffected unit equipment in the event a fire occurs at a time when the unaffected unit equipment is out of service (e.g., shutdown/maintenance).

Response:

Administrative controls consist of Technical Specifications Limiting Condition for Operation (LCOs) and compensatory measures required by the Technical Requirements Manual (TRM). The LCOs will limit the mode at which a unit can be operating depending on the availability of various components associated with the unit's safe shutdown systems. The TRM will typically require the posting of fire watches as a compensatory measure for inoperable components relied upon for Appendix R safe shutdown. Specifically, for the HHSI pumps, the T.S. LCO requires a HHSI pump on the shutdown unit when the opposite unit is in modes 1 through 4 for charging cross

connect capability. If one is not available, then it must be restored as soon as possible. The TRM provides for fire watches in the ESGR, Auxiliary Building, and Cable Vault if the charging cross-connect is inoperable after a specified period of time.