

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
EXELON GENERATION COMPANY, LLC
THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1
DOCKET NO. 50-289
EXEMPTION
[NRC-2009-0154]

1.0 BACKGROUND

The Exelon Generation Company (Exelon, the licensee, formerly AmerGen Energy Company, LLC) is the holder of Facility Operating License No. DPR-50 which authorizes operation of the Three Mile Island Nuclear Station, Unit 1 (TMI-1). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a pressurized water reactor (PWR) located in Dauphin County, Pennsylvania.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.48, requires that nuclear power plants that were licensed before January 1, 1979, must satisfy the requirements of 10 CFR Part 50, Appendix R, Section III.G, "Fire protection of safe shutdown capability." TMI-1 was licensed to operate prior to January 1, 1979. As such, the licensee's Fire Protection Program (FPP) must satisfy the established fire protection features of 10 CFR Part 50, Appendix R, Section III.G. NRC Regulatory Information Summary (RIS) 2006-10, "Regulatory Expectations with Appendix R Paragraph III.G.2, Operator Manual Actions," noted that NRC inspections identified that some licensees had relied upon operator manual

actions, instead of the options specified in 10 CFR Part 50, Appendix R, Section III.G.2 (III.G.2) as a permanent solution to resolve issues related to Thermo-Lag 330-1 fire barriers.

In a letter dated February 4, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML080350369), supplemented by letter dated January 28, 2009 (ADAMS Accession Number ML090280577), the licensee identified one operator manual action that was previously included in correspondence with the NRC and found acceptable in a fire protection-related Safety Evaluation (SE) dated September 7, 1988 (ADAMS Accession Number ML082060262). However, RIS 2006-10 identifies that an exemption under 10 CFR 50.12 is necessary for the use of operator manual actions in lieu of the requirements of III.G.2 even if the NRC previously issued an SE that found the manual actions acceptable.

The licensee also identified a second operator manual action that was previously permitted for use in a fire area covered by 10 CFR Part 50, Appendix R, Section III.G.3 (III.G.3). As such, an exemption was not required because the action was found acceptable as part of a safety evaluation for alternate shutdown. However, since the fire area of origin requiring this manual action was reclassified as a III.G.2 area, the manual action requires approval for use in a III.G.2 area. Since III.G.2 is a separate part of the rule and this action is not considered previously approved for III.G.2, the NRC has performed a new review of this action in accordance with the NRC's current review standard, NUREG-1852, "Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire." Since both operator manual actions require an exemption from III.G.2, the staff has reviewed the request and determined that both operator manual actions are acceptable. This exemption provides the formal vehicle for NRC approval for the use of the two specified operator manual actions in lieu of the requirements specified in III.G.2 for TMI-1.

In summary, by letter dated February 4, 2008, supplemented by letter dated January 28, 2009 (ADAMS Accession Numbers ML080350369 and ML090280577, respectively), Exelon submitted a request for exemption from 10 CFR Part 50, Appendix R, Section III.G, "Fire Protection of Safe Shutdown Capability," for the use of one operator manual action in lieu of the requirements specified in III.G.2 for one previously-approved operator manual action and one new review of an operator manual action that was previously approved as part of a III.G.3 review.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. One of these special circumstances, described in 10 CFR 50.12(a)(2)(ii), is that the application of the regulation in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule.

The underlying purpose of 10 CFR Part 50, Appendix R, Section III.G.2 is to ensure that one of the redundant trains necessary to achieve and maintain hot shutdown conditions remains free of fire damage in the event of a fire. Section III.G.2 provides the following means to ensure that a redundant train of safe shutdown cables and equipment is free of fire damage, where redundant trains are located in the same fire area outside of primary containment:

- a. Separation of cables and equipment by a fire barrier having a 3-hour rating;
- b. Separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards and with fire

- detectors and an automatic fire suppression system installed in the fire area; or
- c. Enclosure of cables and equipment of one redundant train in a fire barrier having a 1-hour rating and with fire detectors and an automatic fire suppression system installed in the fire area.

Exelon indicated that the operator manual actions listed in their February 4, 2008, exemption request are those that were previously included in correspondence with the NRC and were found acceptable in a Fire Protection SE dated September 7, 1988. The first operator manual action included in this exemption is the tripping of all four reactor coolant pumps (RCPs) locally at the 1A and 1B switchgear for a fire in Fire Area CB-FA-1, which is located in the Control Building Health Physics Lab (Lab). The second operator manual action included in this exemption is the transferring of Nuclear Service River Water Pump 1B (NR-P-1B) to its alternate power supply for a fire in Fire Area CB-FA-2b, which is located in the Control Building 1S Switchgear Room (Switchgear Room). This action was described in the January 28, 2009, letter as not previously approved as part of III.G.2. Section 2.1, titled "Fire Hazards Analysis Report Revision 9", of the September 7, 1988, SE states,

By letter dated October 27, 1987, GPU [General Public Utilities] Nuclear, the licensee, submitted Revision 9 to the Fire Hazards Analysis Report (FHAR) for Three Mile Island Nuclear Station, Unit 1. This revision includes a number of modifications which have resulted from an extensive design verification effort by the licensee. As stated by the licensee, Revision 9 represents the "as-built condition of TMI-1". Also, Revision 9 includes a number of modifications involving the addition of references to GPUN and NRC correspondence concerning the justification and subsequent acceptance of exemptions to 10 CFR Part 50 Appendix R and deviations from Appendix A to [Branch Technical Position] APCS 9.5-1. In addition, the FHAR has been modified to specify where certain fire barriers may not be completely rated or contain some non-rated feature but have been analyzed to provide adequate protection. This type of analysis is allowed by Generic Letter 86-10 and the non-rated features included in Revision 9 have generally been evaluated in previous NRC Safety Evaluation Reports.

The FHAR has been reviewed by Science Applications International Corporation (SAIC) under contract to the NRC, and has been found to be in compliance with NRC guidelines. The details of the review are discussed in Enclosure 2, which is the Technical Evaluation Report (TER) prepared by SAIC. The staff concurs with the TER

findings and concludes that the changes to the fire protection program identified by the licensee in Revision 9 are acceptable.

The two operator manual actions in question are listed in attachments 3-0 and 3-3Q of the FHAR where a brief description of the action to be performed and its location is also included. In the January 28, 2009, letter, responding to a request for additional information from the NRC staff, Exelon included a detailed discussion and justification of the two manual actions that describe how defense-in-depth is maintained during the scenarios where these manual actions would be necessary. The licensee outlined the approach that was taken to evaluate and assess the effectiveness of the operator manual actions and provided a justification for why the operator manual actions are appropriate for maintaining equivalency and consistency with the intent of Section III.G.2 of Appendix R.

The NRC staff reviewed the licensee's evaluation in support of the subject exemption request for the use of operator manual actions in lieu of the requirements specified in Section III.G.2 of Appendix R, and concluded that given the existing fire protection features in the affected fire zones in conjunction with the use of the two operator manual actions, in specific instances, Exelon continues to demonstrate equivalence to the underlying purpose of 10 CFR Part 50, Appendix R, Section III.G.2 for TMI-1. The following technical evaluation provides the basis for this conclusion.

3.1 Operator Manual Action to Trip RCPs

3.1.1 Fire Prevention

The Lab area has limited or low combustible fuel loading (equivalent fire severity of less than 45 minutes). The combustible fuel loads consist primarily of stored and transient materials, cable insulation, and Thermo-Lag. Thermo-Lag is a fire barrier material used for the protection of cable raceways that is considered combustible. The primary sources of ignition in the areas are limited to cabling and electrical equipment. The licensee has indicated that in most cases, the cable insulation is qualified to the Institute of Electrical and Electronics Engineering, Inc. (IEEE) 383 flame test, thereby the growth and spread of cable insulation fires would be slow. The redundant cables in this area that are required for safe shutdown are located greater than 25 feet apart, thus providing physical separation. Additionally, the Lab area is of a large volume (90,000 cubic feet) to potentially disperse and stratify heat and smoke within the space to prevent wide area damage due to a damaging hot gas layer forming in the area.

The NRC staff finds that the limited fuel load combined with the number of ignition sources, and spatial characteristics in the Lab area, results in a low likelihood of a fire occurring and spreading within the fire area.

3.1.2 Detection, Control and Suppression

The NRC staff evaluated the fire detection, control and suppression systems in the Lab area. The Lab area has an automatic ionization smoke detection system installed that sends an alarm to the Control Room upon activation of the fire/smoke detections systems.

The area is enclosed by 3-hour rated walls, floors and ceilings to prevent fire from spreading to or from the area and the structural frame is also protected with 3-hour fireproofing material. In addition, all doors, penetrations and ventilation dampers through the fire area boundaries are provided with 3-hour rated fire protection assemblies.

The Lab area also has a wet-pipe fire sprinkler system installed below the suspended ceiling in the area. In this fire area, rated Thermo-Lag fire barriers, with ratings ranging from 39 to 50 minutes, are also provided for circuits of redundant safe shutdown equipment.¹ The active fire suppression systems listed above are supplemented by handheld fire extinguishers and hose lines staged at locations directly outside the fire area. Additionally, fire brigade response time has been estimated to be within 15 minutes.

The NRC staff finds that the fire barriers, fire detection, control and suppression systems are adequate to mitigate and contain the fire hazards in this area.

3.1.3 Feasibility and Preservation of Safe Shutdown Capability

The NRC staff has evaluated the feasibility review provided by the licensee in the January 28, 2009, letter responding to a request for additional information from the NRC staff. The feasibility review documents that procedures are in place, in the form of abnormal operating procedures (AOPs), to ensure that clear and accessible instructions on how to perform the manual action are available to the operators. The instructions outline the number of fully trained, dedicated operators that are required and the procedures they are to follow to perform the action including any tools or equipment necessary to complete the action. Several potential environmental concerns were also evaluated, such as radiation levels, temperature/humidity conditions, ventilation configuration and fire effects that the operators may encounter during certain emergency scenarios, and were determined not to have a

¹ NRC letter dated April 20, 1999, (ADAMS Legacy Library Accession Number 9905040102) approved the exemption request on these barriers from the requirements of Section III.G.2.c for 1-hour fire barriers where circuits of redundant safe shutdown equipment in the same fire area are enclosed in a 1-hour fire barrier.

material effect on the performance of the manual action. The licensee's feasibility review shows that the operator manual action is feasible because the operators performing the manual actions would not be exposed to adverse or untenable conditions during the operator manual action procedure or during the time needed to perform the procedure, primarily because the manual actions are located in fire areas that are completely separated from the originating fire area. The NRC staff has evaluated the licensee's feasibility review and determined that the operator manual actions can be reasonably completed in time to support the needed mitigative functions. Training, equipment, and procedures are maintained to support the specified actions.

Given the procedures and conditions described above, the NRC staff finds that this operator manual action is feasible and that the operator will be provided with adequate access and egress to the area such that environmental conditions will not preclude completion of the action or result in harm to the operator.

3.1.4 Time to Ensure Reliability

The NRC staff reviewed the time necessary to complete the manual action versus the time before the action becomes critical to safely shutting down the unit as presented in the feasibility analyses. This manual action must be completed within 10 minutes. The action is identified in the AOPs as OP-TM-AOP-001-C01 and requires an operator to travel from the control room to a location in the turbine building, where the 1A and 1B 6900V feeder breakers are located, to trip the reactor coolant pumps (RCPs). The combined time to complete the travel and specified action requires a total of 8 minutes, leaving a 2 minute margin of safety. While a 2 minute margin of safety is considered small, this action is only needed when both of the cables located in the fire area are affected by fire. Based on the protection and spatial separation between the cables, it is highly unlikely that both DC control power cables would be lost before the control room operator could trip the RCPs. Based on information provided by the licensee, this manual operator action will commence immediately upon

detection/confirmation of a fire in CB-FA-1 (Lab) and/or failure to trip the RCPs from the control room. The licensee has indicated that the manual operator action was verified via walkdowns with different operators to verify the reliability of the manual action.

In addition, the fire area where the redundant equipment trains reside is located in a separate building from the fire area where the manual action occurs, with the exception of the portion of travel in the control tower stairwell (to trip the RCPs), which is separated from the control building by 3-hour assemblies. This helps to ensure that operators do not encounter untenable or fire-affected conditions during the operator manual action procedure.

The NRC staff finds that the margin available to perform the action is small. Based on the low likelihood of the damage occurring to both DC control power cables, as well as the procedural controls and walkdowns described, the NRC staff concludes that the small margin is acceptable due to the low likelihood of a fire that impacts both DC control power cables.

3.2 Operator Manual Action to Transfer Nuclear Service River Water to Alternate Power

3.2.1 Fire Prevention

The Switchgear Room has limited or low combustible fuel loading (equivalent fire severity of less than 45 minutes). The combustible fuel loads consist primarily of minor transient materials, cable insulation, Thermo-Lag and electrical equipment. The primary sources of ignition in the area are limited to cabling and electrical equipment. The licensee has indicated that in most cases, the cable insulation is qualified to the IEEE 383 flame test, thereby the growth and spread of cable insulation fires would be slow.

The NRC staff finds that the limited fuel load, combined with the number of ignition sources, results in a low likelihood of a fire occurring and spreading within the fire.

3.2.2 Detection, Control and Suppression

The NRC staff evaluated the fire detection, control and suppression systems in the Switchgear Room. There is an incipient fire detection system², as well as an HVAC duct smoke detection system installed in the space that sends an alarm to the Control Room upon activation of the fire/smoke detections systems.

The Switchgear Room is enclosed by 3-hour rated walls, floors and ceilings to prevent fire from spreading to or from the area and the structural frame is also protected with 3-hour fire proofing material. In addition, all doors, penetrations and ventilation dampers through the fire area boundaries are provided with 3-hour rated fire protection assemblies.

The Switchgear Room does not have a fire suppression system installed but does have 1-hour rated fire barriers provided for circuits of redundant safe shutdown equipment. A 1-hour rated fire barrier is not provided for the transfer of nuclear service water to alternate power cables. Manual suppression capability can be provided by operators and fire brigade by using the handheld fire extinguishers and hose lines staged at locations directly outside of the fire area. Additionally, fire brigade response time has been estimated to be within 15 minutes for this fire area. The NRC approved an exemption on July 11, 1997, (ADAMS Accession No. ML003765666) exempting this area from the requirement to have an automatic suppression system.

The NRC staff finds that the fire barriers, fire detection system and the manual suppression capability, in conjunction with the passive means of protection, is adequate to mitigate and contain the fire hazards in this area.

² An incipient fire detection system is a fire detection system designed to provide more rapid detection than conventional smoke detection systems.

3.2.3 Feasibility and Preservation of Safe Shutdown Capability

The NRC staff evaluated the feasibility review provided by the licensee in the January 28, 2009, letter, responding to a request for additional information from the NRC staff. The feasibility review documents that procedures are in place, in the form of AOPs, to ensure that clear and accessible instructions on how to perform the manual action are available to the operators. The instructions outline the number of fully trained, dedicated operators that are required and the procedures they are to follow to perform the action including any tools or equipment necessary to complete the action. Several potential environmental concerns were also evaluated, such as radiation levels, temperature/humidity conditions, ventilation configuration and fire effects that the operators may encounter during certain emergency scenarios, and determined not to have a material effect on the performance of the manual action. The NRC staff has evaluated the licensee's feasibility review and determined that the operator manual actions can be reasonably completed in time to support the needed mitigative functions. Training, equipment, and procedures are maintained to support the specified actions.

In addition, the fire area where the redundant equipment trains reside is located in a separate building from the fire area where the manual actions occur. This helps to ensure that operators do not encounter untenable or fire-affected conditions during the operator manual action procedure.

Given the procedures and conditions described above, the NRC staff finds that this operator manual action is feasible and that the operator will be provided with adequate access and egress to the area such that environmental conditions will not preclude completion of the action or result in harm to the operator.

3.2.4 Time to Ensure Reliability

The NRC staff also reviewed the time necessary to complete the manual action versus the time before the action becomes critical to safely shutting down the unit as presented in the feasibility analyses. The action must be completed within 4 hours. This action is identified in the AOPs as OP-TM-AOP-001-C2B, which states that AOP OP-TN-541-443 (“Swap NR-P-1B to Alternate Power Supply”), should be performed and instructs an operator to travel from the control room to the intake screen and pump house (ISPH), which is outside the plant protected area. The operator must first pass through a security access gate before traveling to Fire Areas ISPH-FZ-1 and ISPH-FZ-2 where they will energize nuclear service river water pump, NR-P-1B, at the 1R 480V switchgear to provide nuclear river (NR) water flow and support letdown for a fire in Fire Area CB-FA-2b (Switchgear Room). In order to swap the NR pump power supply, the operator manual action entails racking out the NR-P-1B breaker on the 1T 480V bus and racking in the NR-P-1B breaker on the 1R 480V bus. The combined time to complete the travel, including the time required for security to open the access gate, and the specified actions is less than 30 minutes. Additionally, this action is only necessary if the pressurizer heaters are unavailable and is of low complexity with a time margin of 3-1/2 hours.

The NRC staff finds that there is a sufficient amount of time available to complete this proposed operator manual action and that adequate conditions exist for it to be performed efficiently and reliably.

3.3 Evaluation

As stated in 10 CFR Part 50, Appendix R, Section II:

The fire protection program shall extend the concept of defense-in-depth to fire protection with the following objectives:

1. To prevent fires from starting,
2. To detect rapidly, control, and extinguish promptly those fires that do occur, and

3. To provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant.

The NRC staff has evaluated the elements of defense-in-depth used for fire protection at TMI-1, applicable to the fire zones under review. Based upon consideration of the limited fire ignition sources and fire hazards in the affected areas, and the existing fire protection measures at TMI-1, the NRC staff concludes that objective one of defense-in-depth is adequately met.

Based on the evaluation of fire detection and suppression systems provided in the affected fire zones, the NRC staff determined that any postulated fire is expected to be promptly detected by the available automatic fire detection systems in the associated fire areas. The available fire detection and suppression equipment in these fire areas ensure that a postulated fire will not be left unchallenged. In addition, all fire areas are separated from adjacent fire areas by fire-rated barriers and penetrations to provide a level of compartmentalization between the fire areas and buildings. This compartmentalization helps to ensure that fires will not spread to adjacent fire areas and that any fire damage will be limited to the fire area of origin. In addition, when fires are contained in the fire area of origin, the licensee has demonstrated that the manual actions are feasible and reliable. Based on this information, the NRC staff concludes that objectives 2 and 3 of defense-in-depth are adequately met.

Therefore, the NRC staff concludes that the requested exemption to use operator manual actions in combination with the other installed fire protection features in lieu of the requirements of 10 CFR Part 50, Appendix R, Section III.G.2 is consistent with the underlying purpose of the rule and the defense-in-depth concepts necessary at nuclear power plants and will maintain an equivalent level of protection for post-fire safe-shutdown capability at TMI-1.

3.4 Authorized by Law

This exemption would allow TMI-1 the use of operator manual actions in lieu of meeting the requirements specified in 10 CFR Part 50, Appendix R, Section III.G.2. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that granting of the licensee's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

3.5 No Undue Risk to Public Health and Safety

The underlying purpose of 10 CFR Part 50, Appendix R, Section III.G.2 is to ensure that one of the redundant trains necessary to achieve and maintain hot shutdown conditions remains free of fire damage in the event of a fire. Based on the existing fire barriers, fire detectors, automatic and manual fire suppression equipment, and the absence of significant combustible loads and ignition sources in the fire areas associated with this exemption, the NRC staff has concluded that granting of this involves no undue risk to public health and safety.

The NRC staff has determined that this exemption also does not increase the probability or consequences of previously evaluated accidents. This determination is based on the NRC staff finding that the operator manual actions are not the sole form of protection relied upon due to the other fire protection features and procedures in place and the manual actions are considered feasible and reliable to ensure safe shutdown capability following a fire. The combination of the operator manual actions in conjunction with all of the measures and systems discussed above, results in an adequate level of protection. No new accident initiators are created by allowing the use of operator manual actions in the fire areas identified in this exemption and the probability of postulated accidents is not increased. Similarly, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety.

3.6 Consistent with Common Defense and Security

This exemption would allow TMI-1 to credit the use of specific operator manual actions and installed fire protection features in lieu of meeting the requirements specified in 10 CFR Part 50, Appendix R, Section III.G.2. This change, to the operation of the plant, has no relation to security issues nor does it diminish the level of safety from what was intended by the requirements contained in Section III.G.2. Therefore, the common defense and security is not impacted by this exemption.

3.7 Special Circumstances

One of the special circumstances described in 10 CFR 50.12(a)(2)(ii) is that the application of the regulation is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR Part 50, Appendix R, Section III.G.2 is to ensure that one of the redundant trains necessary to achieve and maintain hot shutdown conditions remains free of fire damage in the event of a fire. For the fire areas specified in this exemption, the NRC staff finds that the operator manual actions are feasible, can be reliably performed and that the fire protection features installed in the areas are effective at preventing and suppressing fires. Therefore, the conditions described herein will ensure that a redundant train necessary to achieve and maintain safe shutdown of the plant will remain free of fire damage in the event of a fire in these fire areas. The staff concludes that combination of the operator manual actions, in conjunction with all of the measures and systems discussed above, results in an equivalent level of protection to that intended by III.G.2. Since the underlying purpose of 10 CFR Part 50, Appendix R, Section III.G is achieved, the special circumstances required by

10 CFR 50.12(a)(2)(ii) for the granting of an exemption from 10 CFR Part 50, Appendix R, Section III.G.2 exist.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present such that application of the regulation in these particular circumstances is not necessary to achieve the underlying purpose of the rule. Therefore, the Commission hereby grants Exelon an exemption from the requirements of Section III.G.2 of Appendix R of 10 CFR Part 50, to TMI-1 for the two operator manual actions discussed above.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (74 FR 9437).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 30th day of March 2009.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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