

January 28, 2009  
TMI-09-008

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

Three Mile Island Nuclear Station, Unit 1  
Facility Operating License No. DPR-50  
NRC Docket No. 50-289

Subject: Response to Request for Additional Information  
Request for Exemption from 10 CFR 50, Appendix R,  
Section III.G, "Fire Protection of Safe Shutdown Capability"

References:

1. Letter from P. B. Cowan, AmerGen Energy Company, LLC, to U.S. Nuclear Regulatory Commission, "Request for Exemption from 10 CFR 50, Appendix R, Section III.G, 'Fire Protection of Safe Shutdown Capability'," dated February 4, 2008.
2. Letter from P. Bamford, U.S. Nuclear Regulatory Commission, to C. G. Pardee, AmerGen Energy Company, LLC, "Three Mile Island Nuclear Station, Unit 1 - Request for Additional Information Regarding Proposed Request for Exemption from 10 CFR 50, Appendix R, Section III.G, 'Fire Protection of Safe Shutdown Capability' (TAC No. MD8081)," dated December 23, 2008.

In Reference 1, AmerGen Energy Company, LLC (AmerGen) submitted a request for exemption from the provisions of 10 CFR 50, Appendix R, Section III.G, "Fire Protection of Safe Shutdown Capability," for the use of operator manual actions for Three Mile Island Nuclear Station, Unit 1 (TMI-1) in lieu of the requirements specified in Section III.G.2. The NRC reviewed the exemption request and identified the need for additional information in order to complete their evaluation of the exemption request. Draft questions were sent to AmerGen to ensure the questions were understandable and the regulatory basis for the questions was clear. On December 17, 2008, a teleconference was held between AmerGen and the NRC to further discuss the additional information requested. In Reference 2, the NRC formally issued the request for additional information to AmerGen, now Exelon Generation Company, LLC (Exelon). The attachment to this letter provides a restatement of the questions along with Exelon's responses.

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Exelon has determined that one of the operator manual actions for which an exemption was originally requested, i.e., to transfer pressurizer heaters to their emergency power supply on a loss of offsite power, is no longer required as described in Attachment 1. Therefore, this operator manual action is withdrawn from the exemption request. Exelon has determined that the information provided in response to the request for additional information for the remaining operator manual actions does not impact the conclusions of the original exemption request as stated in Reference 1.

This response to the request for additional information contains no new regulatory commitments.

If you have any questions or require additional information, please contact Glenn Stewart at 610-765-5529.

Respectfully,

9/8/09



Pamela B. Cowan  
Director, Licensing and Regulatory Affairs  
Exelon Generation Company, LLC

Attachment: Response to Request for Additional Information

cc:	Regional Administrator - NRC Region I	w/attachment
	NRC Senior Resident Inspector - TMI-1	"
	NRC Project Manager, NRR - TMI-1	"
	Director, Bureau of Radiation Protection,	
	PA Department of Environmental Protection	"
	Chairman, Board of County Commissioners,	
	Dauphin County, PA	"
	Chairman, Board of Supervisors,	
	Londonderry Township, PA	"
	R. R. Janati, Commonwealth of Pennsylvania	"

## ATTACHMENT

In Reference 1, AmerGen Energy Company, LLC (AmerGen) submitted a request for exemption from the provisions of 10 CFR 50, Appendix R, Section III.G, "Fire Protection of Safe Shutdown Capability," for the use of operator manual actions for Three Mile Island Nuclear Station, Unit 1 (TMI-1) in lieu of the requirements specified in Section III.G.2. The NRC reviewed the exemption request and identified the need for additional information in order to complete their evaluation of the exemption request. Draft questions were sent to AmerGen to ensure the questions were understandable and the regulatory basis for the questions was clear. On December 17, 2008, a teleconference was held between AmerGen and the NRC to further discuss the additional information requested. In Reference 2, the NRC formally issued the request for additional information (RAI) to AmerGen, now Exelon Generation Company, LLC (Exelon). The background and questions are restated below along with Exelon's response.

*Attachment 1, Section II of the February 4, 2008, submittal asserts that the basis for the exemption request per 10 CFR 50.12(a)(2)(ii) is that the referenced operator manual actions have already been found acceptable by the NRC in a prior SER [Safety Evaluation Report]. Title 10 of the Code of Federal Regulations, paragraph 50.12(a)(2), states in part, "The Commission will not consider granting an exemption unless special circumstances are present." Furthermore, 10 CFR 50.12(a)(2)(ii) states, in part, that special circumstances are present whenever, "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."*

*Attachment 2 of the exemption request lists three (3) operator manual actions, in a table format, for which exemptions are being requested. Additionally, AmerGen states that the previously-approved operator manual actions are listed in the tables of Attachment 3 to Revision 9 of the TMI-1 Fire Hazard Analysis Report (FHAR).*

*The first two operator manual actions listed in Attachment 2 of the exemption request refer to Attachment 3-3Q, Page 1, of the TMI-1 FHAR, Revision 9, as the basis for stating that these two operator manual actions were previously approved. Attachment 3-3Q is titled "Safe Shutdown Equipment." There is no indication in this attachment that the operator manual actions listed are due to a postulated fire or why they should be permitted in lieu of the protective measures required by III.G.2. Specifically, there is no description of the special circumstances that are present to warrant the consideration of these operator manual actions. Also, there is no fire area/zone listed that credits these operator manual actions, nor damage to any fire-affected component listed that would require these operator manual actions.*

*The third operator manual action listed in Attachment 2 of this exemption request refers to Attachment 3-0, Sheet 3a, to Revision 9 of the TMI-1 FHAR as the basis for stating that this operator manual action was previously approved. The equipment and required operator manual action cannot be found in Attachment 3-0, Sheet 3a to Revision 9 of the TMI-1 FHAR.*

*Based on this discussion the following information is requested:*

- 1.) *Provide the basis for the special circumstances that are present in this exemption request as required by 10 CFR 50.12(a)(2).*

## **RESPONSE**

The intent of 10 CFR 50, Appendix R, Section III.G.2, is to ensure that one train of systems necessary to achieve and maintain hot shutdown will remain available in the event of a fire. The manual actions discussed in the original exemption request (Reference 1) provide that assurance. If manual actions are not used to meet the underlying purpose of the rule, modifications to: (1) provide additional fire suppression systems, detection systems, or fire barriers, or (2) re-route cables or wrap cables, that involve issues such as accessibility, dose, structural interferences, design limitations, ampacity derating, etc., would be required to achieve compliance. Such modifications represent an unwarranted burden on Exelon since they are not necessary to meet the underlying purpose of the rule. Therefore, the special circumstances for issuance of the exemption are satisfied in accordance with the requirements of 10 CFR 50.12(a)(2)(ii), since application of the rule is not necessary to achieve the underlying purpose of the rule.

- 2.) *Provide the explanation and technical justification for each of the operator manual actions submitted in Attachment 2 of the exemption request or provide an updated exemption request that includes this information.*

*The technical justification should include the documentation or reference to the docketed documentation that the NRC reviewed in support of the referenced SER regarding the manual actions. The documentation may have included the technical criteria for the actions such as calculations, timelines, procedural guidelines, etc., for justifying the operator manual actions and their role in bringing the plant to a hot shutdown condition. References for the fire-affected component should include the number, system, name, and fire area. For the component that is to be operated, information should include the number, system, name, fire area and a brief description of the action required to be taken at the component. Also include the original approved description of the action, and any change or revision to the approved operator manual action since the previous approval. It may be necessary to elaborate on the information that was previously provided in order to adequately describe the basis for the manual actions.*

## **RESPONSE**

The docketed information that was reviewed by the NRC in support of the fire protection SER dated September 7, 1988 (Reference 3) includes the TMI-1 Fire Hazards Analysis Report (FHAR), Revision 9 (Reference 4), and a GPU Nuclear letter dated May 7, 1987 (Reference 5). However, this RAI response includes a summary of information, based on the current TMI-1 FHAR, Revision 23 (Reference 6), drawings, procedures, etc. This RAI response provides a discussion of the initiating fire areas involved, the results of a feasibility review of the operator manual actions based on the criteria specified in NRC Inspection Procedure (IP) 71111.05 (Reference 7), and a discussion of how the manual actions meet the defense-in-depth criteria specified in Appendix R. While IP 71111.05 did not exist at the time the 1988 SER approving the manual actions was issued, it is apparent that NRC Regional Fire Inspectors used similar criteria when reviewing the operator manual actions at that time.

The operator manual actions addressed in this response are limited to those operator manual actions contained in the original TMI-1 exemption request (Reference 1), with the exception of the pressurizer heater manual action (Action #2 in Attachment 2 of Reference 1). The following discussion provides justification for withdrawing this manual action from the original request for exemption from 10 CFR 50, Appendix R, Section III.G.2 (Reference 1).

### **WITHDRAWAL OF PRESSURIZER HEATER MANUAL ACTION FROM EXEMPTION REQUEST**

The manual action to transfer pressurizer heaters to their emergency power supply on a loss of offsite power (LOOP) is withdrawn from the original exemption request for all fire areas/zones. Although this action to re-establish reactor coolant system (RCS) pressure control is desirable and is required to achieve cold shutdown, it is not required to achieve and maintain hot shutdown. As stated in TMI-1 FHAR, Attachment 3-3Q, if both groups of emergency pressurizer heaters (Groups 8 and 9) are unavailable, makeup and letdown can be used for RCS pressure control. This implies a solid pressurizer. Generic Letter (GL) 86-10 (Reference 8) specifically allows solid pressurizer operations in Section 5.3.5 as indicated below:

*Question:*

*“Most PWRs do not require pressurizer heaters to maintain stable conditions. In fact, the Commission does not consider heaters to be important to safety and they are not required to meet Class IE requirements. Are they required for hot shutdown under Appendix R? If yes, then how does a plant meet the separation requirements of Section III.G.2.d,e. or f without major structural alterations to the pressurizer?”*

*Response:*

*“One train of systems necessary to achieve and maintain hot shutdown conditions must be free of fire damage. PWR licensees have demonstrated the capability to achieve and maintain stable hot shutdown conditions without the use of pressurizer heaters by utilizing the charging pump [makeup pump for TMI] and a water solid pressurizer for reactor coolant pressure control.”*

Stable hot shutdown conditions can be achieved in accordance with TMI procedure OP-TM-AOP-043, “Loss of Pressurizer (Solid Ops Cooldown),” using makeup and letdown to maintain subcooling margin. One makeup pump and flow path is always maintained in every fire area/zone. If letdown is not immediately available, it can be restored within four hours per the FHAR. A separate NRC exemption, dated December 30, 1986 (Reference 9), has approved re-establishing letdown within four hours. If the pressurizer heater Motor Control Centers (MCCs) were de-energized due to a LOOP, TMI procedure OP-TM-AOP-020, “Loss of Station Power,” would initiate TMI procedure OP-TM-220-901, “Emergency Power Supply for Pressurizer Heaters,” to transfer the heaters to their emergency supplies. Although it would be desirable to perform this action as soon as possible to achieve stable RCS pressure conditions, it would only be required to proceed to cold shutdown. Actions required for cold shutdown are permitted in accordance with 10 CFR 50, Appendix R, Section III.G.1, as discussed in GL 86-10, Enclosure 1, Item 3.

Therefore, an exemption to 10 CFR 50, Appendix R, Section III.G.2 is not required for this action. Although this action will remain in place as a cold shutdown required action in the FHAR, the action is withdrawn from the request for exemption from the requirements of 10 CFR 50, Appendix R, Section III.G.2.

## **TECHNICAL JUSTIFICATION FOR THE REMAINING OPERATOR MANUAL ACTIONS**

NRC IP 71111.05 was revised on March 6, 2003, to specifically address the feasibility of operator manual actions in support of the proposed manual action rule. The operator manual actions addressed in this exemption request are those that were previously approved in a fire protection SER dated September 7, 1988 (1988 SER). Regulatory Issue Summary (RIS) 2006-10 (Reference 10) directs that operator manual actions that were approved in a fire protection SER should be included in a request for "an exemption under 10 CFR Part 50.12, citing the special circumstances of Section 50.12(a)(2)(ii), citing the SER as the safety basis, and confirming that the safety basis established in the SER remains valid." The 1988 SER does not provide a detailed safety basis for the NRC approval of these operator manual actions. In order to confirm to the NRC that the operator manual actions are feasible, which would support the conclusion that the safety basis established in the 1988 SER remains valid, each of the operator manual actions addressed by this exemption request was reviewed against the feasibility criteria listed in the March 6, 2003 revision of IP 71111.05 and the defense-in-depth criteria provided in Appendix R. The intent is to provide confirmation that the operator manual actions remain safe and feasible to perform.

### **Fire Area Descriptions**

There are two initiating fire areas included in this exemption request. An initiating fire area is the area where a fire that requires the manual action to be performed originates. A description of each fire area is provided below. This information provides a summary of the type of fires that are postulated to occur in each area and the type of combustibles located in each area. Detection and suppression systems that are installed in the fire area are also discussed. The information provided was obtained from the TMI-1 FHAR, Chapter 4 and Attachments 3-0 through 3-7. The description of each initiating fire area below provides a discussion of the fire-affected component, the required operator manual action to be performed and the reason for the operator manual action.

#### **Fire Area CB-FA-1**

##### **Description**

The Control Building, Elevation 306' is known as the Control Building Health Physics Lab Area. The area is 100' long by 60' wide and 15' high. The area encompasses 6,000 ft<sup>2</sup>. Entrance to this fire area is on the north and west walls through Class A fire doors. This Control Building Fire Area is designated as CB-FA-1. All four walls, ceiling and floor are all constructed of reinforced concrete with a 3-hour fire rating. The doors, penetrations, and ventilation dampers through these boundaries into this fire area also all have a 3-hour fire rating. Exposed structural steel is also protected with an approved 3-hour rated fireproofing material.

This fire area is provided with an active automatic ionization fire detection system above the suspended ceiling that will actuate alarms in the Control Room and an active wet pipe sprinkler system below the suspended ceiling. There is no false ceiling in the northeast corner of the area.

Should there be a fire in this area, the fire brigade can suppress the fire with extinguishers staged directly outside of this area, or attack the fire with hose lines from either of two directions. Estimated response time for the fire brigade to commence initial suppression is within 15 minutes.

Rated Thermo-Lag fire barriers in this fire area are provided for circuits ranging from a rating of 39 minutes (minimum required) to one hour. NRC letter dated April 20, 1999 (Reference 11) 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. These barriers were originally installed as 1-hour fire barriers; however, by comparison to accepted tests, the barriers included in the exemption request have fire ratings ranging from 39-50 minutes.

The combustibles in the area consist of stored and transient materials, cable insulation, and Thermo-Lag. The fire loading is low per FHAR combustible loading definition. Postulated fires are a Class A fire due to consuming the office supplies and office furniture or a Class C fire due to electrical cables burning. Most cable insulation in the area is qualified to IEEE 383 flame test; therefore, fires would be slow to develop and spread beyond the ignition source.

#### Manual Action

The manual action for which a 10 CFR 50, Appendix R, Section III.G.2 exemption is being requested as a result of a fire in Fire Area CB-FA-1 is tripping all four reactor coolant pumps (RCPs) locally at the 1A and 1B 6900V switchgear. The 1A and 1B 6900V switchgear are located in the 322' elevation of the Turbine Building (Fire Area TB-FA-1). The RCPs are the only loads powered from these buses.

This action is required because a fire in Fire Area CB-FA-1 could potentially damage both methods of RCP seal cooling, which include thermal barrier cooling and seal injection. Once both these cooling methods to the RCP seals are lost, it is postulated that operators have 10 minutes to trip the RCPs before RCP seal integrity could be compromised. If this action is unsuccessful, increased seal leakage, and therefore, a loss of RCS inventory, would challenge the ability to achieve safe shutdown. The RCPs are normally tripped from the control room; however, DC Control Power cables for both the normal and alternate breaker trip capability for the RCPs are located in this fire area. As a result, manual trip of the RCPs at the 6900V switchgear may be required within 10 minutes following a loss of all RCP seal cooling. While this action is considered required due to both cables being located in this fire area, it is highly unlikely that both DC control power cables would be lost within the timeframe required, since these cables are located greater than 25 feet apart within Fire Area CB-FA-1. Only one DC control power cable is needed for successful trip of all RCPs from the control room. For the types of slow-developing fires expected in this fire area, it is expected that the RCPs would be

successfully tripped from the control room prior to both cables being damaged. Once the RCPs are tripped, the integrity of these cables is no longer required.

The following provides a discussion of the previous approval of the manual action to trip the RCPs. On March 10, 1987 (Reference 12), as a supplement to previously requested exemptions from the requirements of 10 CFR 50, Appendix R, Section III.G.2, TMI notified the NRC of the potential need to manually trip the RCPs within 10 minutes for a fire in Fire Areas CB-FA-2d and CB-FA-2f, which are classified as 10 CFR 50, Appendix R, Section III.G.2 (III.G.2) fire areas, if RCP seal cooling is not restored within that time. This letter provided specific justification to support feasibility of this manual action. By SER dated March 19, 1987 (1987 SER) (Reference 13), the NRC approved the requested exemptions, including the manual action to trip the RCPs for a fire in these fire areas. Subsequently, on May 7, 1987 (Reference 5), TMI notified the NRC of the need to perform the same manual action (i.e., tripping the RCPs), as was previously submitted and approved for Fire Areas CB-FA-2d and CB-FA-2f, for a fire in Fire Area CB-FA-1. At that time, Fire Area CB-FA-1 was classified as a 10 CFR 50, Appendix R, Section III.G.3 (III.G.3) fire area because of the need to perform valve operations associated with RCP seal cooling restoration at the Remote Shutdown Panels. Since Fire Area CB-FA-1 was classified as a III.G.3 fire area, a specific exemption was not required. Nonetheless, as indicated in the May 7, 1987 letter, the manual action to trip the RCPs was included in Revision 9 of the TMI FHAR, which was approved in the 1988 SER. The discussion on Fire Area CB-FA-1 is presented in Enclosure 2 of the 1988 SER. However, as a result of NRC Information Notice (IN) 2005-14 (Reference 14), TMI no longer relies upon restoration of RCP seal cooling once lost. Therefore, the actions at the Remote Shutdown Panels for a fire in Fire Area CB-FA-1 are not required. Fire Area CB-FA-1 was subsequently re-classified as a III.G.2 fire area, and therefore, the manual action to trip the RCPs for a fire in Fire Area CB-FA-1 requires an exemption from Section III.G.2. Although not originally submitted as a III.G.2 action, the action to manually trip the RCPs in Fire Area CB-FA-1 is identical to the exemption approved in the 1987 SER for Fire Areas CB-FA-2d and CB-FA-2f. Furthermore, as indicated previously, the action was approved in the 1988 SER, since it was included in FHAR Revision 9.

The following discussion supports inclusion of this action in Fire Area CB-FA-1 in FHAR Revision 9. FHAR Attachment 3-3Q describes the need to trip the RCPs to prevent seal damage. FHAR Attachment 3-0 indicates which fire areas/zones require RCP trip in order to protect the RCP seals due to a loss of seal cooling. Note 4 of Attachment 3-0 indicates that RCP trip is required in Fire Area CB-FA-1. FHAR Attachment 3-5C also indicates that the normal RCP trip from the control room is not available in Fire Area CB-FA-1. FHAR Attachment 3-6C indicates the cables that are associated with the RCP trip function.

## **Fire Area CB-FA-2b**

### Description

The Control Building Fire Area CB-FA-2b is located at Elevation 322' and is known as the Control Building 1S Switchgear Room. The area is 49' long by 19' wide and 15' high. The floor area is 931 ft<sup>2</sup>. The fire area has a 3-hour fire rating design. The north and south walls as well as the floor and ceiling are constructed of reinforced concrete. The east and west walls are constructed of metal clad sheet rock walls with the

exception of a 480V bus duct. Exposed structural steel is also protected with an approved 3-hour rated fireproofing material. Entrance to this fire area is on the east and west walls through Class A fire doors. All penetrations through walls, floors and ceilings of this fire area are sealed with 3-hour rated fire seals. All ventilation duct penetrations through these walls, floors and ceilings are provided with 3-hour rated fire dampers. The passively ventilated bus duct is sealed around the outside periphery to a 3-hour fire rating. The bus duct internal is sealed with a non-fire rated smoke stop, adequate to prevent passage of smoke and hot gases. Stainless steel tubes that penetrate the west wall of this fire area are sealed around the periphery to a 3-hour rating. The tubes are an integral part of the incipient fire detection system. The tubing is not sealed internally. This condition has been evaluated as acceptable in this configuration. One-hour rated barriers are provided for redundant safe shutdown circuits in this fire area.

Fire protection for this area consists of HVAC duct smoke detectors, which actuate smoke control dampers. NRC letter dated July 11, 1997 (Reference 15), granted exemption from the requirements of 10 CFR 50, Appendix R, Section III.G.2.c for an automatic suppression system in this fire area where circuits of redundant safe shutdown equipment in the same fire area are enclosed in a 1-hour rated fire barrier. These barriers were originally installed as 3-hour rated fire barriers. The request committed to augmenting the HVAC duct smoke detection system for this area by installing an area wide (incipient) fire detection system. The incipient detection system alarms in the presence of incipient particles of combustion that occur below the ignition temperature of the combustible material, thus providing an early warning prior to the HVAC duct smoke detection system. Both systems actuate alarms in the control room.

Should there be a fire in this area, the fire brigade can suppress the fire with portable fire extinguishers staged nearby in the 322' elevation control building patio area, which is Fire Zone FH-FZ-5, and in the stair tower that provides access to the 322' elevation of the Control Building. The fire brigade can also attack the fire with hose lines located in Fire Zone FH-FZ-5 on the 322' elevation. The fire brigade is expected to reach the area and commence initial suppression activities within 15 minutes.

The combustibles in this area consist of cable insulation, Thermo-Lag, electrical equipment, and minor transient materials. The fire loading is low. Most cable insulation in the area is qualified to the IEEE 383 flame test; therefore, fires would be slow to develop and spread beyond the ignition source.

#### Manual Action

The manual action for which a 10 CFR 50, Appendix R, Section III.G.2 exemption is being requested as a result of a fire in Fire Area CB-FA-2b is transferring Nuclear Service River Water pump 1B (NR-P-1B) to its alternate power supply. FHAR Revision 9, Attachment 3-0, shows that NR-P-1B is the only NR pump credited for a fire in Fire Area CB-FA-2b. As shown in FHAR Revision 9, Attachment 3-4, NR-P-1B is a swing pump (dual power supply). It is normally aligned to the 'B' train power source, 1T 480V switchgear; however, a fire in Fire Area CB-FA-2b may de-energize the 1T 480V switchgear. The alternate 'A' train power source for NR-P-1B, 1R 480V switchgear, is available for a fire in Fire Area CB-FA-2b per FHAR Revision 9, Attachment 3-5Q. However, manual action must be taken to align NR-P-1B to the 1R 480V switchgear.

The manual action location is the Intake Screen and Pump House (ISPH), which is where both 1R and 1T 480V switchgear are located (Fire Zones ISPH-FZ-1 and ISPH-FZ-2).

Generally, the Nuclear River (NR) system functions to supply a source of river cooling water to the Nuclear Service Closed Cooling (NS) and Intermediate Closed Cooling (IC) heat exchangers to cool NS and IC required loads. The NS system is not required for a fire in Fire Area CB-FA-2b. The only safe shutdown NS cooling load is Makeup pump 1B (MU-P-1B) and MU-P-1B is not relied on for a fire in Fire Area CB-FA-2b. The action to swap the power supply for NR-P-1B is required to provide a source of river cooling water to the IC heat exchangers in order to restore letdown. Since the fire may damage NR-P-1A and NR-P-1C circuits and de-energize the 1T 480V switchgear, NR-P-1B must be energized from 1R 480V switchgear to provide NR water flow for a fire in Fire Area CB-FA-2b. Letdown restoration, if necessary for RCS pressure control, is required within four hours.

#### **Review of Feasibility Using the Criteria Listed in Inspection Procedure 71111.05**

RIS 2006-10 addresses operator manual actions in which a SER issued by the NRC approves the operator manual actions, but is outside of the 10 CFR 50.12 exemption process. The RIS directs licensees to "request an exemption under 10CFR Part 50.12, citing the special circumstances of section 50.12(a)(2)(ii), citing the SER as the safety basis, and confirming that the safety basis established in the SER remains valid." The 1988 SER that approved the operator manual actions did not list a specific safety basis. At the time the NRC issued the SER, the criteria necessary to establish that operator manual actions were feasible had not yet been created. Subsequently, the NRC created criteria against which the feasibility of operator manual actions should be reviewed and placed the criteria in Inspection Procedure (IP) 71111.05. In order to confirm to the NRC that the operator manual actions are feasible, which would support the conclusion that the safety basis established in the 1988 SER remains valid, each of the operator manual actions addressed by this exemption request was reviewed against the feasibility criteria listed in the March 6, 2003 revision of IP 71111.05. A general explanation of how the manual actions meet the criteria is provided below. Certain configurations are provided with a more detailed explanation.

**Diagnostic Instrumentation:** Available diagnostic instrumentation that has been analyzed for safe shutdown is listed in the fire Abnormal Operating Procedure (AOP) for each fire area. In addition to the explicit steps in the procedure that direct the manual actions submitted in this exemption request, the lack of positive indication or parameter would trigger the need for a manual action.

#### **RCP Trip Action**

Operators do not rely on diagnostic equipment to take this manual action. Steps in the fire AOP, OP-TM-AOP-001-C01 "Fire in Control Building First Floor," direct this action that does not rely on instrumentation. Operators would first attempt to trip the RCPs from the control room. If positive indication was not available to operators to determine if this action was successful, such as trip light indication or amp value indication (which may not be available), operators would direct performance of the local trip manual action. If trip light indication or amp value indication was not available, successful RCP trip could

also be determined from a delta-temperature rise between hot leg temperature ( $T_{hot}$ ) and cold leg temperature ( $T_{cold}$ ), which are both available for a fire in Fire Area CB-FA-1 as indicated in Attachment 2 of the procedure. This would be used to determine the manual RCP pump trip at the switchgear was successful.

#### NR Pump Transfer Action

The action to transfer NR-P-1B to its alternate power source is not dependent upon instrument or indication verification—it is a direct step in the fire AOP, OP-TM-AOP-001-C2B “Fire in 1S 480V Switchgear Room,” that is performed whether or not NR flow can be verified. Several control instruments and indications could be used to detect a loss of NR flow, including high NS and IC cooler outlet flows or lack of running indication for all three NR pumps; however, these may not be available due to the fire. Therefore, this step is directed independent of symptom verification. Once NR-P-1B is transferred to the 1R 480V bus, indicating lights will be available in the control room to show its status. A fire in Fire Area CB-FA-2b does not affect any NR-P-1B control circuit (Refer to FHAR Attachment 3-6M).

**Environmental Considerations:** These are conditions that operators performing the manual actions may encounter while traveling to the manual action location or where the manual action is to be performed. Adverse environmental conditions could prevent the operator from performing the required manual actions within the allotted time.

#### Radiation Levels

The manual actions in this exemption request do not require operators to enter any radiologically controlled areas. Likewise, neither action is performed in a radiologically controlled area. This includes both at power and post shutdown conditions. Therefore, operators would not be subjected to radiation doses close to the 10 CFR Part 20 limits.

#### Emergency Lighting

The availability of emergency lighting at each action location and the access routes to the action location have been confirmed. TMI surveillance procedures periodically test the permanently mounted eight-hour lights to ensure they are operating, have adequate battery water level, and that the lights are properly aimed. Emergency lights are provided on the pathways between the control room and action locations. Walkdowns have been performed to ensure that emergency lighting to illuminate pathways and action locations is available. Additionally, 8-hour portable hand lights are provided at various locations around the plant. These portable hand lights are tested on a periodic basis and replaced as necessary as part of the routine post-fire equipment inventory surveillance test procedure.

#### Temperature and humidity conditions

The manual actions are not performed in any area with elevated temperature or humidity. Temperature and humidity conditions will not be significantly different from normal plant operating conditions in the Turbine Building and ISPH.

#### Fire Effects

This environmental condition considers if the operators will encounter fire effects (smoke and toxic gases) enroute to the location where the action is to be performed or at the location where the action is to be performed. For both actions, the initiating fire area is

in the Control Building, which has 3-hour rated fire doors separating each room from the control tower stairwell from which the operator will be traversing down to get to the Turbine Building. For the RCP trip action, the initiating fire is located in the 306' elevation of the Control Building (Fire Area CB-FA-1), while the action location is in the Turbine Building 322' elevation. For the NR pump transfer action, the initiating fire is located in the 322' elevation of the Control Building (Fire Area CB-FA-2b), while the action location is in the ISPH, which is outside the plant in a separate protected building near the Susquehanna River. In both cases, the traversal path and action location are generally not in the same building as the initiating fire area. The only exception is the small distance in the control tower stairwell, which is separated from the control building fire areas on every floor by a 3-hour fire rated door and walls. Therefore, there is no fire effect on the operator's ability to travel to and take the required action.

**Staffing:** There are two auxiliary operators assigned as safe shutdown operators each shift. The operators assigned as safe shutdown operators are not assigned fire brigade responsibilities and will be responsible for performing the operator manual actions. A single auxiliary operator is needed to perform each of the manual actions in this exemption request. The NR pump transfer action involves racking in and racking out a 480V breaker, which procedurally requires an additional person for industrial safety purposes only. This individual would be available from any site organization not performing fire brigade or safe shutdown duties.

**Communications:** Operators have hand-held radios, which will function with or without repeaters, multiple plant page phones, and other phone systems to communicate with the control room. However, if these are not available, the operator manual actions may be communicated using radios (line of sight) or face-to-face. None of these manual actions require interface with the control room while performing the action. For the RCP trip manual action, the operator is immediately dispatched to the 6900V switchgear, dons Personal Protective Equipment (PPE), and waits for control room direction. After a reactor trip and failed attempt to trip the RCPs from the control room, the control room operator will contact the operator via hand-held radio to locally trip the RCPs. The Operations radio system has been confirmed to be available for hand-held radio use for a fire in Fire Area CB-FA-1. For the NR pump transfer action, no communication with the control room is required since the action is directed by procedure. Upon completion of the action, the operator can report directly back to the control room, if necessary, or use the phone or radio if available.

**Special Tools:** The fire AOP or referenced operating procedure identifies if a key, tool or component is needed and where the key, tool or component is located. Where a specific tool, component or key is needed to perform the operator manual action it is staged for use in a specified location. For the RCP trip manual action, Class 3 PPE and Class 1 rubber gloves are required and are noted in the fire AOP. These are available in a cabinet behind the 6900V buses, which is near the manual action location (same fire area). For the NR pump transfer action, all required PPE and tools are listed in the procedure for racking out or racking in a breaker. The equipment and required procedures are staged in the area of the manual action in the ISPH. There are periodic surveillances that check the inventory of these locations.

**Training:** The operator actions addressed by this exemption request involve actions that operators are adequately trained on.

RCP Trip Action

This action requires opening the 6900V switchgear door and lifting up a solenoid plunger lever to trip the 6900V switchgear. Training is provided in licensed operator initial and re-qualification training for control room operators and is a skill of the craft activity for auxiliary operators.

NR Pump Transfer Action

This action involves racking out a 480V breaker and racking in a 480V breaker. These are standard activities on which auxiliary operators receive job performance measure training.

**Accessibility:** The equipment that needs to be operated is readily accessible and adequate time is allotted to permit access. None of the actions requires re-entering the initiating fire area. In addition, tools needed for the manual action are available and accessible by the operators. The action to trip the RCPs can be done from the floor and the action to transfer the NR pump to its alternate power source is done from a permanent metal-grated platform that includes an access ladder.

**Procedures:** Each initiating fire area has a corresponding fire AOP. The procedure entered for any plant fire is OP-TM-AOP-001. This directs operators to a more specific procedure or attachment depending on which fire area/zone the fire is located. The specific procedures are in the form OP-TM-AOP-001-XXX, where XXX represents the initiating fire area/zone. Therefore, for a fire in Fire Area CB-FA-1, OP-TM-AOP-001-C01, "Fire in Control Building First Floor," would be entered. For a fire in Fire Area CB-FA-2b, OP-TM-AOP-001-C2B, "Fire in 1S 480V Switchgear Room," would be entered. Each fire AOP includes the required actions for safe shutdown in time critical order.

RCP Trip Action

OP-TM-AOP-001-C01 dispatches an operator to the 6900V switchgear with instructions to don Class 3 PPE and Class 1 rubber gloves. This is done immediately upon entry into the procedure. Once the fire has been confirmed in Fire Area CB-FA-1, operators will trip the reactor and then attempt to trip all RCPs first by using the individual RCP pump switches in the control room. If this is unsuccessful, the 6900V bus feeder breakers will be tripped from the control room (alternate DC control power). Finally, if these actions are not successful (i.e., RCPs fail to trip from the control room), the procedure directs operators to locally trip the 1A and 1B 6900V feeder breakers, which trips the RCPs.

NR Pump Transfer Action

OP-TM-AOP-001-C2B initiates a separate procedure, OP-TM-541-443, "Swap NR-P-1B to Alternate Power Supply," to transfer NR-P-1B to its alternate source. The steps in this procedure are all taken from the control room, with the exception of racking out and racking in the breakers for NR-P-1B. Separate generic procedures for performing these tasks are referenced; OP-TM-732-403, "Rack Out 480V ES Breaker," for racking out a 480V Engineered Safeguards (ES) breaker, and OP-TM-732-404, "Rack In 480V ES Breaker," for racking in a 480V ES breaker.

**Verification and Validation:** The actions have been validated by plant walkdowns performed by TMI operators using approved procedures. A summary of action times and travel times within the time available to perform the function is provided below. Travel times and action times were obtained from the walkdowns.

#### RCP Trip Action

As previously mentioned, the time required to trip the RCPs following a loss of all RCP seal cooling is 10 minutes. The action was validated including verification of the fire alarm to identify that the fire is in Fire Area CB-FA-1. After the alarm identifies the fire area, an operator is dispatched to the 6900V switchgear and dons appropriate PPE. Once a fire in Fire Area CB-FA-1 is confirmed and cannot be promptly extinguished, operators will trip the reactor and attempt to trip the RCPs from the control room first by using the individual RCP pump switches in the control room. If this is unsuccessful, the 6900V bus feeder breakers will be tripped from the control room (alternate DC control power). Finally, if these actions are not successful (i.e., RCPs fail to trip from the control room), the control room will communicate to the dispatched operator to locally trip the 1A and 1B 6900V feeder breakers, which trips the RCPs. This entire sequence was timed to take eight (8) minutes. This sequence was performed several times with different operators for additional validation of action reliability.

This time is conservative as it assumes that a loss of RCP seal cooling will occur simultaneous with the fire alarm. Given that multiple cable failures must occur for a loss of all RCP seal cooling and that Fire Area CB-FA-1 is an area with low combustibles, significant time margin would exist before the initiating condition (loss of RCP seal cooling) would occur. Furthermore, the redundant DC control power cables (one that powers the individual RCP breakers and one that powers the 6900V bus feeder breakers) are located greater than 25 feet apart within Fire Area CB-FA-1. Only one DC control power cable is needed for successful trip of the RCPs from the control room. Due to this cable separation and the slow developing nature of a postulated fire in CB-FA-1, it is highly unlikely that both control room methods of tripping the RCPs would be unavailable. Once the RCPs are tripped, the integrity of these cables is no longer required.

#### NR Pump Transfer Action

Transfer of NR-P-1B to the 1R 480V bus is required to support letdown, which must be re-established within four hours. Letdown is only required for RCS pressure control if pressurizer heaters are not available. The action is initiated from OP-TM-AOP-001-C2B, which states to perform OP-TM-541-443 to swap the NR pump power supply. This action is in the ISPH, which is outside the general plant protected area, but in a protected area where security is required to open an access gate. The action was conservatively timed to include time margin for Security to open this gate. Security would be available for a fire emergency. The auxiliary operator would be required to rack out the NR-P-1B breaker on the 1T 480V bus and rack in the NR-P-1B breaker on the 1R 480V bus. As previously mentioned, racking out and racking in a 480V ES breaker is controlled by procedures OP-TM-732-403 and OP-TM-732-404, respectively. The total time to perform these procedures, in addition to travel time and security time, has been verified to take less than 30 minutes. Prior operator manual actions that may be taken in OP-TM-AOP-C2B do not challenge the available time margin and an

additional auxiliary operator is available to perform these prior actions. Therefore, sufficient margin exists to perform this action in adequate time to support re-establishing letdown within four hours.

### **Defense In Depth**

Defense in depth is defined in Appendix R as follows:

- to prevent fires from starting;
- to detect rapidly, control, and extinguish promptly those fires that do occur; and
- 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.

TMI-1 has administrative controls to prevent fires from starting. These controls include:

- controls on hot work activities and ignition sources (involving cutting, welding, grinding, open flames or other heat producing activities);
- controls and limits on combustible materials used in the plant or brought into the plant;
- housekeeping inspection programs;
- use of fire retardant cables and plastics; and
- use of wood is limited and restricted to fire retardant wood (except for large cribbing).

Fire detection and suppression systems are installed in those areas that contain significant combustible hazards. Fire detection includes both smoke and heat detection systems that provide alarms to the main control room. Suppression systems include pre-action, deluge and wet pipe sprinkler systems as well as carbon dioxide systems. A summary of the fire protection features in the initiating fire areas was provided previously within the description of each fire area. When fire protection systems become inoperable, compensatory measures are instituted. The plant has a fire brigade composed of plant operators and maintenance personnel that are currently trained to meet the level of "interior structural firefighters." Hose stations and fire extinguishers are located throughout the plant to facilitate firefighting activities by the fire brigade. These detection and suppression systems, as well as manual fire fighting equipment, are designed to detect fire at the incipient stage to permit a response by plant personnel to the fire, including both operations and fire brigade. The fire brigade would be dispatched and can be expected to respond and commence suppression activities within 15 minutes. The suppression systems are designed to prevent a fire from rapidly growing and involving other areas. Manual suppression can be used to extinguish a fire or to prevent the fire from spreading to adjacent fire areas.

TMI-1 ensures safe shutdown in the event of a fire in several ways. First, the plant has been divided into fire areas. Each fire area is separated from adjacent fire areas with a barrier commensurate with the fire hazard. Typically, the fire barriers have a 3-hour fire resistance rating, including the barrier, the door(s), damper(s) and penetration seals. However, other barrier types, including spatial separation, are used to divide fire areas. These fire area boundaries are described in the TMI-1 FHAR document. In addition, analyses have been performed on how to achieve shutdown following a fire in any given

fire area. The equipment lost and equipment available has been reviewed and actions necessary to ensure shutdown have been identified in the fire AOPs and basis documents for each fire area. The manual actions addressed by this exemption request are part of the actions that may be necessary in a worst-case fire to achieve safe shutdown.

## **CONCLUSION**

The operator manual actions addressed in this exemption request have been reviewed against the existing criteria the NRC has developed to determine the feasibility of these actions to be performed following a fire. This review determined that all of these manual actions could be performed and completed within the required time limits. This provides the confirmation that the considerations used by the NRC to approve these operator manual actions in the 1988 SER remain valid. Defense-in-depth for the fire areas involved in this exemption include administrative controls on ignition sources and combustibles, fire detection and suppression systems are available in areas that present significant hazards, manual fire fighting capability, separation between fire areas to limit fire spread, and safe shutdown procedures. Therefore, the requested exemption will not result in undue risk to the public health and safety.

## **REFERENCES**

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2. Letter from P. Bamford, U.S. Nuclear Regulatory Commission, to C. G. Pardee, AmerGen Energy Company, LLC, "Three Mile Island Nuclear Station, Unit 1 - Request for Additional Information Regarding Proposed Exemption from 10 CFR 50, Appendix R, Section III.G, Fire Protection of Safe Shutdown Capability (TAC No. MD8081)," dated December 23, 2008.
3. Letter from Ronald W. Hernan, U.S. Nuclear Regulatory Commission, to Henry D. Hukill, GPU Nuclear Corporation, "Resolution of Various TMI-1 Appendix R Issues (TAC Nos. 64951 and 68331)," dated September 7, 1988.
4. Three Mile Island Nuclear Station, Unit 1, Fire Hazards Analysis Report, Revision 9.
5. Letter from H. D. Hukill, GPU Nuclear Corporation, to U.S. Nuclear Regulatory Commission, "Reactor Coolant Pump Seal Thermal Barrier Cooling and Injection Additional Information," dated May 7, 1987.
6. Three Mile Island Nuclear Station, Unit 1, Fire Hazards Analysis Report, Revision 23.
7. NRC Inspection Procedure 71111.05, "Fire Protection," March 6, 2003.
8. NRC Generic Letter 86-10, "Implementation of Fire Protection Requirements," dated April 24, 1986.

9. Letter from John F. Stoltz, U.S. Nuclear Regulatory Commission, to Henry D. Hukill, GPU Nuclear Corporation, "Fire Protection for TMI-1," dated December 30, 1986.
10. Regulatory Issue Summary 2006-10, "Regulatory Expectations with Appendix R Paragraph III.G.2 Operator Manual Actions," June 30, 2006.
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12. Letter from H. D. Hukill, GPU Nuclear Corporation, to U.S. Nuclear Regulatory Commission, "Reactor Coolant Pump Seal Thermal Barrier Cooling and Injection," dated March 10, 1987.
13. Letter from John F. Stoltz, U.S. Nuclear Regulatory Commission, to Henry D. Hukill, GPU Nuclear Corporation, "Fire Protection Exemptions for TMI-1," dated March 19, 1987.
14. NRC Information Notice 2005-14, "Fire Protection Findings on Loss of Seal Cooling to Westinghouse Reactor Coolant Pumps," dated June 1, 2005.
15. Letter from Bart C. Buckley, U.S. Nuclear Regulatory Commission, to James W. Langenbach, GPU Nuclear Corporation, "Three Mile Island Nuclear Generating Station, Unit 1, 10 CFR Part 50 Appendix R Exemption Request (TAC No. M96473)," dated July 11, 1997.