

December 1, 2009

MEMORANDUM TO Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Alexander R. Klein, Chief */RA/*
Fire Protection Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON REQUEST FOR
EXEMPTION FROM 10 CFR 50, APPENDIX R, SECTION III.G, "FIRE
PROTECTION OF SAFE SHUTDOWN CAPABILITY" (PHASE 1 AND 2)
AT OYSTER CREEK NUCLEAR GENERATING STATION (TAC NOS.
ME0756 AND ME0780)

By letters dated March 3, 2009, "Request for Exemption from Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR 50), Appendix R, Section III.G., "Fire Protection of Safe Shutdown Capability" (Phase 1)" available at Agencywide Documents Access and Management System, Accession No. ML090630132, and March 4, 2009 "Request for Exemption from 10 CFR 50, Appendix R, Section III.G., Fire Protection of Safe Shutdown Capability (Phase 2)" (ML090640225), Exelon Generation Company, LLC (the licensee) requested an exemption for the Oyster Creek Nuclear Generating Station (OCNGS) from the requirements of 10 CFR 50, Appendix R, Section III.G.2 (III.G.2) for the use of operator manual actions in lieu of meeting the separation requirements contained in III.G.2.

The Fire Protection Branch has reviewed the information provided by Exelon Generation Company, LLC and determined that additional information is needed to complete our review. Enclosed is the request for additional information (RAI). Please note that our review effort on this task (TAC Nos. ME0756 and ME0780) is ongoing. If you have any questions regarding this RAI, please contact us.

Enclosure:
As stated

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REQUEST FOR ADDITIONAL INFORMATION ON REQUEST FOR EXEMPTION FROM 10
CFR 50, APPENDIX R, SECTION III.G, "FIRE PROTECTION OF SAFE SHUTDOWN
CAPABILITY" (PHASE 1 AND 2) AT OYSTER CREEK NUCLEAR GENERATING STATION
(TAC NOS. ME0756 AND ME0780)

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As described in Regulatory Issue Summary 2006-10, "Regulatory Expectations with Appendix R Paragraph III.G.2 Operator Manual Actions," for plants licensed before January 1, 1979, an approved exemption is required for all operator manual actions (OMAs) used to achieve compliance with 10 CFR Part 50, Appendix R Section III.G.2, even those that were accepted in a previously-issued Nuclear Regulatory Commission (NRC) Safety Evaluation Report (SER). Accordingly, the licensee is requesting that the NRC approve an exemption request to allow the use of manual actions for demonstrating compliance with Section III.G.2 of Appendix R, which, it asserts were previously approved in Fire Protection Safety Evaluation Reports (SER) dated March 24, 1986 and June 25, 1990. These specific manual actions are addressed by Attachment 2 of the licensee's March 3, 2009, request (i.e., Phase 1). The licensee also submitted a request for exemption to allow the use of manual actions for demonstrating compliance with Section III.G.2 of Appendix R, dated March 4, 2009, that includes manual actions that have not been previously approved (i.e., Phase 2).

RAI-01 Circumstances for Review

Section II of the submittal Attachments contains background information on the proposed OMAs but does not contain a technical justification for the application of special circumstances in accordance with 10 CFR 50.12. Since, according to Section II, it is the licensee's position that the protective measures prescribed by III.G.2 represent an unwarranted burden on Exelon and are not necessary to meet the underlying purpose of the rule, provide the relevant details to support this position in response to RAI-01.1 and RAI-01.2 below. The response should demonstrate that defense-in-depth is provided such that operators are able to safely and reliably achieve and maintain safe shutdown capability. Note that it is the NRC staff's position that operator manual actions alone, regardless of their feasibility and reliability, do not meet the underlying purpose of the rule without specific consideration of the overall concept of defense-in-depth that is being applied in a particular fire area.

RAI-01.1: Provide a technical justification of how the proposed arrangement achieves the underlying purpose of the rule.

RAI-01.2: Provide an analysis that substantiates the claim of unwarranted burden and demonstrates that the hardship or other costs associated with the modifications

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noted as being required to achieve compliance are significantly in excess of those contemplated at the time the regulation was adopted, or are significantly in excess of those incurred by others similarly situated.

RAI-02 Ensuring That One of the Redundant Trains Is Free of Fire Damage

Section IV.A of the March 3, 2009, request and Section III.A of the March 4, 2009, request identifies 34 and 35 fire areas or zones, respectively, which are not in compliance with Appendix R, Section III.G.2 because hot shutdown OMAs would be required to align redundant train systems to achieve safe shutdown. The requests also state that the analyses assume a worst-case fire. In fact, Section III.B of the March 4, 2009, request states that the analysis assumed that all of the potential loss of equipment that could occur in a fire area would occur concurrently.

The method described in the request appears to demonstrate safe shutdown capability independent of the fire area of origin consistent with III.G.3, yet the request is for an Exemption from the requirements of III.G.2. III.G.2 specifically states that measures must be taken to ensure that one of the redundant trains remains free of fire damage within the fire area. Section III.G.3 of Appendix R addresses alternative or dedicated shutdown capability independent of the fire area of origin and establishes a series of requirements to achieve and maintain safe shutdown capability.

- RAI-02.1: Confirm and state whether an Exemption from III.G.2 requirements is the appropriate request, since safe shutdown capability is provided independent of the fire area of origin.
- RAI-02.2: State the specific requirements of III.G.2 that are not met for each of the requested exemptions, e.g., a lack of fire barriers, spatial separation, automatic suppression, etc.
- RAI-02.3: Provide a summary of the plant specific features that compensate for the lack of III.G.2-required features, identified in RAI-02.2, for each of the requested exemptions. For example, note any enhanced defense-in-depth measures such as a lack of ignition sources or combustibles, more robust or supplemental detection and suppression systems and other physical or administrative controls.
- RAI-02.4: Appendix R establishes the concept of defense-in-depth and III.G.2 requires operators be able to safely and reliably achieve and maintain hot shutdown capability from the control room. Provide a technical explanation that justifies how the proposed methods will result in a level of protection that is commensurate with that intended by III.G.2.

RAI-03 Other Evaluations

Fire areas may have other exemptions or engineering evaluations that affect fire protection systems or safe shutdown capabilities.

For example, Section III.A of the March 4, 2009, request states that the staff's approval of an exemption for a lack of automatic fire detection in Fire Zone TB-FZ-11D was based on the following:

- the fire will not be of significant magnitude or duration,
- it will be promptly extinguished by one of the two automatic sprinkler systems installed in this fire zone, and
- the flow alarms will promptly alert the fire brigade who will respond to manually fight the fire.

As described in Section 6.2 of the June 25, 1990 SER, however, this list of considerations is not complete, as it does not include fire protection features provided for the credited train of hot shutdown cables (e.g., a 1-hour rated fire wrap or relocating cables).

In addition, Section III of the March 4, 2009, request states that the manual operator actions are required as a result of:

- a) changes to the original safe shutdown analysis, or
- b) were implied in the original safe shutdown analysis but for which an SER does not exist.

RAI-03.1: Provide a discussion of any other exemptions or evaluations, including licensee-developed evaluations, e.g., Generic Letter 86-10 evaluations, which impact these requests in any way and provide a justification for why such impact should be considered acceptable.

RAI-04 Fire Protection System and Fire Barrier Design Criteria

Attachment 1 of the requests notes that several areas are equipped with various fire detection and suppression systems. However, the requests do not state whether the systems have been designed and installed in accordance with applicable design standards or requirements.

RAI-04.1: Where fire protection features such as detection and suppression systems and fire rated assemblies are installed, describe the technical basis for such installations including the applicable codes, standards and listings.

For example:

The March 3, 2009, request states that Fire Zones DG-FA-15 and OB-FZ-6A are separated from other plant areas by rated fire barriers but does not mention what the rating is or whether openings and penetrations in the assembly are protected.

The requests state that areas such as, Fire Zone OB-FZ-6A, are equipped with smoke detectors but does not state whether the detectors have been installed and maintained in accordance with a particular design standard or basis, e.g. National Fire Protection Association (NFPA) 72: National Fire Alarm Code, 1985 Edition.

Section III of the March 4, 2009, request states that Fire Zone OB-FA-9 is protected by a fixed, total flooding, automatic Halon 1301 extinguishing system but the request does not state whether the Halon system was installed and maintained in accordance with a particular design standard or basis, e.g. NFPA Standard 12A, 1985 Edition.

RAI-04.2: Provide a technical justification for any deviations from codes, standards and listings by independent testing laboratories in the fire areas that could impact this evaluation.

RAI-04.3: Provide a technical justification for any non-rated fire protection assemblies.

RAI-05 Ignition Sources and Combustible Fuel Load

The requests use terms such as “low” or “moderate” to describe the combustible fuel loading in the fire areas included in the request.

RAI-05.1: Provide critical details or assumptions regarding the in situ and transient fire hazards that could threaten redundant equipment for each fire area included in the requests. This information may include, but is not limited to:

- The number, type and location of potential ignition sources,
- The number and types of equipment that may exhibit high energy arcing faults, and the relationship between this equipment and any secondary combustibles,
- The quantity of cables and other secondary combustibles and their relationship to potential ignition sources,
- The cable type, e.g., thermoplastic or thermoset. If thermoplastic cables are used, provide a discussion of self-ignited cable fires,
- Ratings for cables, e.g., IEEE-383, etc. If not rated, justify why fire spread would be assumed to be slow,
- Controls on hot work and transient combustibles in the area, and the proximity of secondary combustibles that could be impacted by a transient fire, and
- Dimensions of the rooms including ceiling heights.

RAI-06 Fire Scenarios

The requests identify the OMAs needed in each fire area or zone, but do not describe the fire scenarios that have been considered for the postulated events.

For example:

In the event of fire in Fire Zones TB-FA-26, TB-FZ-11B, TB-FZ-11C, TB-FZ-11D, TB-FZ-11E (March 3, 2009, request), OMAs may be required to isolate damaged cables and reestablish control locally for 4160V Switchgear 1D. However, no information is provided to describe the

separation between the redundant train cables. It is also not clear where the cables are located relative to the floor, walls and other trains or whether any spatial separation exists between the two trains.

Attachment 2 of the March 4, 2009, request contains a description of a scenario for Action 14, which states:

This action is being performed because there is the potential that the normal ventilation system would not be available due to cable damage.

The description does not provide any further information regarding the fire hazards in the area and their proximity to redundant trains.

- RAI-06.1: Provide a description of the proximity of the redundant train equipment to in situ hazards and the spatial relationship between the redundant trains in the fire area such that if they are damaged, manual actions would be necessary. Note, that this question is distinct from the RAI addressing Ignition Sources and Combustible Loading, which is generally focused on the combustibles in an area, whereas, this RAI addresses the specific relationship between ignition sources and combustibles and the redundant trains.

RAI-07 Initiation of Procedures

Section III.C of the March 4, 2009, request states that the timeline for operator actions for a specific fire area assumes that all potential fire damage identified for that fire area occurs instantaneously at the point of plant shutdown. This section also states that the procedural direction in ABN-29, "Plant Fires," requires that the Fire Support Procedures (FSPs) be entered as soon as the existence of a fire is confirmed.

The requests lack a detailed description of the series of events that may occur prior to initiating the OMA. Specifically, the requests do not describe the conditions that must be satisfied in order for operators to enter the FSP containing the OMA. For example, it is not clear if the analysis assumed an initiating time (i.e., Time 0) as the time at which the fire is detected, the time at which the fire is determined to pose a threat to safe shutdown equipment, the time the reactor is scrammed, the time that a spurious signal or actuation is observed in the control room, or some other point in the fire scenario.

- RAI-07.1: Since the point of plant shutdown could be considerably later than the time the fire was first confirmed, provide a technical justification to support the validity of the chosen time line.
- RAI-07.2: Provide an analysis or technical justification that demonstrates that the ability to detect a fire is sufficient to provide notification of a postulated event before damage to the redundant trains occurs; or provide an analysis and/or technical justification to evaluate scenarios where the redundant components are damaged, before a fire has been detected.

RAI-08 Prompt Actions

The March 3, 2009, request states that the shutdown methodology incorporates both “symptom based” and “prompt” (prescriptive) OMAs.

- RAI-08.1: For each of the OMAs, identify the type of action being performed (prompt or symptom based) and provide a discussion of the required time versus the observed or calculated completion time.
- RAI-08.2: For “symptom based” OMAs, provide a justification to support the time assumed to be available to perform the actions, including confirmation that there is adequate time for the operators to diagnose the need for the actions, travel to action location(s), perform the actions, and confirm the expected response before an undesired consequence occurs.
- RAI-08.3: For OMAs identified as “Prompt Actions,” provide a justification for: (a) selecting 45 minutes for classifying OMAs as “Prompt Actions” and (b) clarification and justification of when this 45 minute time period is assumed to start.

RAI-09 Time and Sequence Assumptions

An action is considered feasible if it is shown that it is possible to be performed within the available time (considering relevant uncertainties in estimating the time available). The tables provided in Section III.B of the March 4, 2009, request do not provide a clear justification for determining feasibility. For example, the notes accompanying the table state that the “allowable time limit” was obtained from safe shutdown calculations and it is not clear whether any diagnosis time has been accounted for.

- RAI-09.1: Provide a justification that demonstrates that the proposed OMAs are feasible.
- RAI-09.2: Provide information that demonstrates that the actions are reliable including a justification that various uncertainties are accounted for in the time margins and that the margins are sufficient to ensure that they provide adequate time to cover potential variations in plant conditions and human performance. If a factor of safety or diagnosis time has been included in the stated times to complete the actions, provide an explanation for how it has been incorporated into the timelines. If not, justify why the stated times are sufficient to assure safety.
- RAI-09.3: For each of the OMAs contained in the requests, describe the circumstances and criteria needed to enter the OMA procedure and identify:
 - 1) **Fire area of fire origin** – the fire area, or zone, in which the postulated fire event occurs.

- 2) **OMA location** – the fire area in which the associated OMA is performed.
- 3) **Time available** - the period of time from a presentation of a cue for an action to the time of adverse consequences if the action is not taken.
- 4) **Diagnosis time** - the time required for an operator to examine and evaluate data to determine the need for, and to make the decision to implement, an action.
- 5) **Implementation time** - the time required by the operator(s) to successfully perform the manipulative aspects of an action (i.e., not the diagnosis aspects themselves, but typically as a result of the diagnosis aspects), including obtaining any necessary equipment, procedures, or other aids or devices; traveling to the necessary location; implementing the action; and checking that the action has had its desired effect.

RAI-10 Fire Zone Proximity and Access

The requests state that the performance of certain OMAs may require the use of a self-contained breathing apparatus (SCBA). The submittal includes a discussion of circumstances and features that may preclude the need for SCBAs.

For example, Section IV.B.6 of the March 3, 2009, request states that for a fire in OB-FZ-8C actions 17 and 18 may require the use of SCBAs for either traveling to the "C" or "D" 4160V Switchgear Rooms, or if CO₂ is present in the area. However, the discussion then provides a rationale for why operators would not be expected to need SCBAs to perform these actions. As a result, it is not clear if the discussion of the use of SCBAs is intended to portray environmental conditions operators may be reasonably expected to encounter or if the request is seeking staff approval of the rationale provided so the need for SCBAs may be eliminated.

- RAI-10.1: State whether operators are procedurally directed to don SCBAs and whether the time needed to don the SCBAs was included in the analysis of the time available to perform the action.
- RAI-10.2: For adjacent fire areas included in the request, provide a technical justification that demonstrates that a fire in the fire area of fire origin would not impact the performance of the OMA.
- RAI-10.3: State whether identified ventilation systems are used for smoke evacuation or fire brigade operations and provide a justification for the systems capabilities.

RAI-11 Fire Area of Origin Re-entry

Section III.B of the March 4, 2009, request states that, depending on the fire scenario, operators may be required to re-enter certain fire areas, including Fire Zone TB-FZ-11C and TB-FA-26 to

perform an action following a fire event. However, Sections III.C.3 and III.C.4 state: “*all operator manual actions addressed in this exemption request are performed in separate fire zones from the initiating fire area (no re-entry required).*”

The March 3, 2009, request states that operators are required to re-enter certain fire areas, including RB-FZ-1E and RB-FZ-1F to perform an action following a fire event and that the assessment of OMAs in fire-affected areas assumes that the area can be reentered within 90 minutes. The request also indicates that all unprotected equipment located in a fire affected area or zone is assumed lost or damaged as a result of the fire.

- RAI-11.1: Confirm whether reentry is required and whether unprotected equipment is assumed lost or provide a justification for why the assumption that all equipment located in the fire area of origin is lost during a fire does not apply.
- RAI-11.2: Provide critical details or assumptions of the analysis that demonstrates that the required safe shut down equipment or component located within the area is maintained free of fire damage and remains accessible and operable following the fire event.
- RAI-11.3: Provide a technical justification for why the assumed 90-minute reentry period is appropriate and an explanation for what is assumed to be included in this time.

RAI-12 Simulator Demonstrations

Section III.C.4.11 of the March 4, 2009, request describes simulator exercises that were performed to demonstrate that the operator manual actions can be performed reliably within the times allotted by the fire safe shutdown calculations. This section also states that Fire Zones TB-FZ-11D and OB-FZ-8C were selected because they include manual actions that are prompt actions in other fire areas and include a number of common operator manual actions to perform within the first 45 minutes.

- RAI-12.1: Provide a detailed justification that demonstrates that the simulator exercises performed for fires in fire zones TB-FZ-11D and OB-FZ-8C bound all other fire scenarios.

RAI-13 Required Operator Stations

The tables provided in Section III.B of the March 4, 2009, request indicate that the 2 field equipment operators were assumed to be located in the main control room at the start of the fire event.

However, the location or activities of required plant personnel when the fire starts could delay their participation in executing the operator manual actions (e.g., they may be in a location that is on the opposite side of the plant from the main control room or may need to restore certain equipment before being able to participate or both).

- RAI-13.1: Provide a justification for the assumption that operators will be located in the main control room, or other assumed locations, when the OMA procedure begins. If there isn't assurance that the operators will be at the assumed locations, provide the times required for them to reach the locations and indicate how these times are reflected in the analysis.

RAI-14 Use of Water Curtains

Section IV.B.4 of the March 3, 2009, request states that a water curtain is installed at openings between the 23' to 51' elevations and 51' to 75' elevations of Fire Zones RB-FZ-1D and RB-FZ-1F2 in the Reactor Building which will provide reasonable assurance of extinguishing any postulated fire and improve overall environmental conditions.

- RAI-14.1: Provide a technical basis to support this statement and the licensee's reliance on water curtains for fire extinguishment.

RAI-15 Spurious Actuation of Containment Spray Pump

Attachment 2 of the March 4, 2009, request states that the purpose of Action 10 (trip two breakers at USS 1B2 and remove the closed fuses) is to prevent spurious start of the Containment Spray Pumps. The Attachment states further that this action has no upper time limit and is only performed to "*ensure their availability for use later in the event*" (i.e., cold shutdown).

- RAI-15.1: Confirm that spurious operation of the containment spray pumps would have no impact on the stated OMA times, expected performance of other shut down systems (e.g., cause an electrical overload) or the operator's ability to achieve and maintain hot shutdown conditions.

RAI-16 Feedwater Regulating Valve Leakage Rate

The description of OMA Item No. 15 provided in the March 3, 2009, request states that the action is needed to stop the pumps at the switchgear since air leakage may cause the feedwater regulating valves to drift back open. Based on an assumed "minor" leakage rate, the analysis further states that there will be 180 minutes to perform this action.

- RAI-16.1: Confirm that the leakage rate will remain "minor" and provide a technical justification for why the leakage will not impact the OMA or the 180-minute time limit.

RAI-18 Diagnostic Instrumentation

Several sections of the requests state that the need for an operator to perform a required OMA can be “*readily diagnosed from the Control Room due to the numerous indications and symptoms available.*”

For example:

The March 3, 2009, request states that for Fire Area OB-FZ-8C, any delay in the entry into the appropriate FSP or delay in suppression of the fire would not significantly affect the performance of the operator actions, *since the EOPs would direct the same actions to be performed, based on system status.*

Section III.C.1 of the March 4, 2009, request states that the FSPs provide a symptom-based approach to achieving safe shutdown and provide the operators with information as to the available equipment (including instrumentation) that can be relied upon following a fire. Because the operator remains within the symptom-based EOP procedure framework, the operator retains the ability to use any mitigating system that is unaffected by the fire.

- RAI-18.1: For each OMA that relies on control room indications to detect the need for the action, provide information which demonstrates that suitable diagnostic instrumentation has been identified and that the credited indications are: (a) known to remain unaffected by a postulated fire, (b) identified in the safe shutdown equipment list and fire response procedures, (c) capable of promptly identifying the need for the action without forcing operators to enter complex diagnosis procedures and (d) sufficient to indicate that the action has achieved its objective.

RAI-19 Enhanced Protective Measures

On page 18 of the March 3, 2009, request, it is noted that an enhancement to the existing automatic sprinkler system is being made in Fire Zone OB-FZ-10A to make the system area-wide.

The requests also state that areas such as, Fire Zone OB-FZ-6A, are equipped with smoke detectors and that an enhancement is being made to OB-FZ-8B to install area-wide smoke detection.

- RAI-19.1: Clarify whether the enhancements are needed as part of this exemption. If so, confirm whether the enhancements have been completed or provide a commitment for its completion. If not, explain why area wide suppression and detection are not necessary.