Response to

Request for Additional Information No.25, Revision 0

8/12/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.05.01 - Fire Protection Program
Application Section: 9.5.1
SFPT Branch

Question 09.05.01-37:

The U.S. EPR FSAR states that “In the annulus, the cables are routed to the connection boxes on both sides of the containment penetrations. Fire protection for redundant divisions is provided to make sure that one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) is free of fire damage. Separation of safety-related divisions is provided by a combination of spatial separation and the use of non-combustible, fire resistive structural barriers consisting of wall and ceiling elements.” RG 1.189 Regulatory Position 6.1.1.1 states that for secondary containment Regulatory Position 4.1.3.3 guidance should be used which states that “Redundant cable systems important to safety outside the cable spreading room should be separated from each other and from potential fire exposure hazards in nonsafety-related areas by fire barriers with a minimum fire rating of 3 hours to the extent feasible.” The U.S. EPR FSAR should state what the fire ratings of these non-combustible, fire resistive structural barriers consisting of wall and ceiling elements are and if they are not 3-hour rated what are the additional features in these areas that would justify not having 3-hour rated barriers. The U.S. EPR FSAR should add a COL information item to provide specific design and certification testing details for these barriers in accordance with NFPA 251, ASTM E-119, and the guidance in RG 1.189.

Response to Question 09.05.01-37:

A response to the question will be provided by December 5, 2008.

Question 09.05.01-38:

The U.S. EPR FSAR states that "The containment contains all four divisions of electrical equipment and cabling. Train separation is provided by a combination of spatial separation, physical barriers, and defense-in-depth fire protection features such as fire detection and suppression systems. Fire protection for redundant divisions is provided to provide reasonable assurance that one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) is free of fire damage. To comply with the criteria of RG 1.189, separation inside the RB is based on separation as previously described or separation of cables and equipment and associated non-safety-related circuits of redundant success paths is provided by a non-combustible radiant energy shield having a minimum fire rating of 30 minutes." The U.S. EPR FSAR is not clear how RG 1.189 Regulatory Position 6.1.1.1 for inside non-inerted containments is met as per FSAR Table 9.5.1-1. The U.S. EPR FSAR should provide specific details of where and how each type of protection is provided or provide the design criteria for the crediting each type of protection and a COL information item for the COL applicant to provide details of the specific applications of each type of protection.

Response to Question 09.05.01-38:

A review of cable separation inside containment will be conducted during performance of the post-fire Safe Shutdown Analysis. As part of the response to Question 09.05.01-2 in RAI 20, the following Combined License (COL) Information Item No. 9.5-16 was added to U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items:

"A COL applicant that references the U.S. EPR design certification will perform an as-built, post-fire Safe Shutdown Analysis, which includes final plant cable routing, fire barrier ratings, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The post-fire Safe Shutdown Analysis will demonstrate that safe shutdown performance objectives are met prior to fuel loading and will include a post-fire safe shutdown circuit analysis based on the methodology described in NEI 00-01."

Refer to response to Question 09.05.01-2 in RAI 20, which was submitted on August 28, 2008.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.05.01-39:

The U.S. EPR FSAR states that "Alternative shutdown capability accommodates postfire conditions where offsite power is available and where offsite power is not available for 72 hours. In evaluating safe shutdown circuits, including associated circuits the availability of uninterrupted power (i.e., offsite power available) may impact the ability to control the safe shutdown of the plant by increasing the potential for associated circuit interactions resulting from fire damage to energized power and control circuits.

Intentional station blackout (SBO) is not relied upon to mitigate potential fire damage to safe shutdown systems or associated circuits." The U.S. EPR FSAR does not define what an associated circuit is. The U.S. EPR FSAR should define that an associated circuit be any circuit whose fire-induced failure could prevent safe shutdown.

Response to Question 09.05.01-39:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1, under "Associated Circuits of Concern" states:

Associated circuits are generally defined as those circuits that do not meet divisional separation requirements and:

- Share a common power source with shutdown equipment.
- Are directly connected to circuits that could affect the shutdown capability.
- Share a common enclosure with shutdown cables, but are not electrically protected or will propagate fire into the common enclosure.

For the purposes of clarity and to more closely align with the definition of 'Associated Circuits of Concern,' in Regulatory Guide 1.189, Rev. 1, this subsection in U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 will be changed to:

"Associated circuits of concern are those circuits containing cables that do not meet separation requirements and:

- Share a common power source with shutdown equipment that is not electrically protected from the circuit of concern by coordinated breakers, fuses or similar devices.
- Are directly connected to circuits of equipment that would adversely affect the shutdown capability if spuriously operated.
- Share a common enclosure with the shutdown cables that (1) is not electrically protected by circuit breakers, fuses or similar devices; or (2) will allow propagation of fire into the common enclosure."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-40:

U.S. EPR FSAR Table 9.5.1-1 states that "Suppression systems inside containment are manually actuated" with no other details given in FSAR Section 9.5.1. The U.S. EPR should briefly describe this manually actuated suppression system in FSAR Section 9.5.1.2.1, Electrical System Design and Electrical Separation, and include if containment access is required to manually operate suppression systems and state if this suppression is being credited for containment separation and how this manually actuated suppression ties in with containment separation guidance given in RG 1.189 Regulatory Position 6.1.1.1.

Response to Question 09.05.01-40:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 under "Automatic Fire Suppression Systems" describes the fire suppression systems provided in the design of the U.S. EPR. The third bullet in this subsection indicates that a "…fixed deluge water spray system is provided for each reactor coolant pump (RCP) and the system is manually actuated from the main control room (MCR)." These systems are the only fire suppression systems located inside the Containment Building.

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 under "Combustible Control Practices" indicates in the last paragraph in this subsection that "…the oil risk areas surrounding the RCPs are protected by fixed deluge (or water spray) systems which are manually actuated from the MCR."

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 under "Electrical System Design and Electrical Separation" states the following in the fourth bullet in this subsection:

"The containment contains all four divisions of electrical equipment and cabling. Train separation is provided by a combination of spatial separation, physical barriers and defense-in depth fire protection features such as fire detection and suppression systems."

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.05.01-41:

The U.S. EPR FSAR states that “A smoke confinement system (SCS) Nuclear Island (NI) is provided to make sure habitability of the access and egress pathways throughout the facility. See Section 9.4.13 for a detail description and operation of the SCS. The design of the smoke removal systems complies with NFPA 92A and NFPA 204.” The U.S. EPR FSAR should change “smoke removal systems” to “smoke confinement systems” to be consistent with the rest of text.

Response to Question 09.05.01-41:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 under “Ventilation System Design Considerations” will be revised to be consistent with the description of the smoke confinement system in U.S. EPR FSAR Tier 2, Section 9.4.13. In the third sentence of the fifth paragraph of this subsection, “smoke removal systems” will be changed to “smoke confinement systems.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-42:

The U.S. EPR FSAR provides a Fire Protection Analysis (FPA), which includes the safe-shutdown analysis, for the areas of the plant included in the scope of the FSAR. A final fire hazards analysis, including a post-fire safe-shutdown circuit analysis must be performed based on the final as-built configuration of the plant and the as-purchased equipment. The fire hazards analysis should be performed in accordance with Regulatory Positions 1.2 and 1.3 of RG 1.189 and fully documented. NEI 00-01 provides guidance for performing and documenting a post-fire safe-shutdown circuit analysis that is acceptable to the NRC. The final fire hazards analysis, including the circuit analysis, must be maintained by each licensee for the life of the plant to reflect any changes to the plant. The U.S. EPR FSAR should address how and when this final analyses will be completed and how it will be documented. If appropriate, a COL information item should be included for the final detailed analyses.

Response to Question 09.05.01-42:

The response to this question is identical to the response provided to Question 09.05.01-2 in RAI 20, which was submitted on August 28, 2008.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.05.01-43:

The U.S. EPR FSAR states that "Conduits are sealed at the barrier with a fire-rated seal, if accessible. Alternatively, conduits are provided with a non-fire-rated smoke and hot gas seal at the first break in the conduit on both sides of the barrier. The fire resistance rating for internal conduit seals is consistent with the designated fire rating of the fire barrier." The U.S. EPR FSAR should clarify that this paragraph is addressing openings inside conduit. RG 1.189 Regulatory Position 4.2.1.4 states that "Openings inside conduit larger than 102 mm (4 in.) in diameter should be sealed at the fire barrier penetration. Openings inside conduit 102 mm (4 in.) or less in diameter should be sealed at the fire barrier unless the conduit extends at least 1.5 m (5 ft) on each side of the fire barrier and is sealed either at both ends or at the fire barrier with material to prevent the passage of smoke and hot gases. Fire barrier penetrations that maintain environmental isolation or pressure differentials should be qualified by test to maintain the barrier integrity under such conditions." The U.S. EPR Table 9.5.1-1 states that RG 1.189 Section C.4.2.1.4 is in compliance while the FSAR has no size or distance away from barrier restriction. The U.S. EPR FSAR should clarify the internal conduit seal requirements and state if the design actually is in compliance with RG 1.189 and if not what is the justification for the non-compliance? Additionally, fire barrier penetrations that maintain environmental isolation or pressure differentials have not been addressed. The U.S. EPR FSAR should address these barriers.

Response to Question 09.05.01-43:

Openings inside conduits that penetrate fire barriers in the U.S. EPR will be sealed in a manner that maintains the integrity of the fire barrier and meets the intent of RG 1.189, Regulatory Position C.4.2.1.4. To achieve this objective, one or more of the following sealing methods may be used:

- A fire rated seal installed inside the conduit at the barrier (whenever accessible).
- A fire rated seal installed at the first access point on both sides of the barrier (when a fire rated seal is required by design).
- A smoke and hot gas seal installed at the first access point on both sides of the barrier (when a fire rated seal is not required by design, but smoke migration is a concern).
- No internal conduit seals installed (when no seal is required by design).
- A combination of the above depending upon the specific conduit seal configuration on each side of the barrier.

The specific design criteria to be followed for the installation of internal conduit seals for the U.S. EPR will be developed based on fire testing, such as the Wisconsin Electric Conduit Fire Test Program or similar fire test.

The installation of internal conduit seals for environmental isolation or pressure differentials will also be defined. Seal designs used to satisfy these requirements will be supported by pressure tested seal assemblies.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.5.1.2.1, 9.5.1.2.2, and Table 9.5.1-1, will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-44:

The U.S. EPR states that "Exceptions include:

- Where approved full-scale fire tests demonstrate that internal conduit seals are not necessary, internal conduit seals are not required.
- Where specialty doors or closure devices are provided because of design considerations other than fire (e.g., flood, pressure or radiation mitigation), such components are not required to be listed or fire-rated.

Additionally, where specialty components are used in lieu of fire-rated penetration seals, such as containment penetration assemblies; these components are not required to be fire-rated." The U.S. EPR Table 9.5.1-1 confirms compliance with RG 1.189 Section C.4.2.1.4. However, the FSAR allows using tests that allow having no internal conduit seal. The U.S. EPR FSAR should clarify the internal conduit seal requirements and state if the design actually is in compliance with RG 1.189 and if not what is the justification for the non-compliance? The U.S. EPR FSAR should state if specialty doors or closure devices are part of a fire barrier and if so how is the component qualified as a fire barrier? U.S. EPR FSAR should state if specialty components used in lieu of fire-rated seals are part of a fire barrier and if so how is the component qualified as a fire barrier?

Response to Question 09.05.01-44:

The U.S. EPR position regarding internal conduit seal requirements has been clarified in the response to Question 09.05.01-43.

Specialty doors, closure devices or sealing components that are part of a fire barrier but are not listed or fire rated will be evaluated and justified as part of the final Fire Hazards Analysis (FHA). This activity will be performed by the COL applicant as part of the final FHA (refer to U.S. EPR FSAR Tier 2, Section 9.5.1.3).

As part of the response to Question 09.05.01-2 in RAI 20, the following COL Information Item No. 9.5-17 was added to U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items:

"A COL applicant that references the U.S. EPR design certification will evaluate the differences between the as-designed and as-built plant configuration to confirm the Fire Protection Analysis remains bounding. This evaluation will be performed prior to fuel loading and consider the final plant cable routing, fire barrier ratings, combustible loading, ignition sources, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The applicant will describe how this as-built evaluation will be performed and documented, and how the NRC will be made aware of deviations from the FSAR, if any."

Refer to response to Question 09.05.01-2 in RAI, which was submitted on August 28, 2008.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.5.1.2.1, 9.5.1.2.2, and Table 9.5.1-1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-45:

The U.S. EPR states that "The classification system uses the same category and naming hierarchy as NFPA 13 (Reference 5) for classification of building occupancies. However, as used herein, these classifications are only intended to be a simplified reflection of the positive correlation between fire severity and the quantity of fuel available to support combustion and the thermal properties (e.g., HRR) of the fuel. The HRR values shown for each fire area hazard classification are only intended to represent the level of intensity that would generally be expected for a fire of this type. These HRR values are not used as a basis for determining worst-case fire scenarios." The U.S. EPR also states that "Based on compartmentation of the plant by three hour rated structural fire barriers, additional fire protection features (e.g., fire detection system capability, fixed fire suppression system capability, electrical raceway fire barrier systems) are generally not required in order to provide adequate separation of redundant trains of safe shutdown systems, components, and cables. Therefore, provision of such fire protection features are based on factors such as regulatory requirements, regulatory guidance, the magnitude of the hazards within the fire area, insights from the probabilistic fire risk assessment and plant damage business interruption considerations). Regulatory requirements and regulatory guidance takes precedent over the other considerations." The U.S. EPR FSAR FPA should clarify how Heat Potential (BTU/sqft) including localized high heat load effects, Fire Severity, PRA, and business interruption is determined and used and how detection, and suppression requirements are determined. Additionally, what is the source of the information given in Table 9A-1 and how is it used?

Response to Question 09.05.01-45:

The U.S. EPR FSAR Fire Protection Analysis (Appendix 9A) does not utilize the equivalent fire severity (BTU/sq ft) methodology. Application of the equivalent fire severity methodology has generally been considered to be limited to light hazard occupancies, where combustible materials are evenly distributed over the floor area, the fuel is normal cellulosic materials such as wood or paper and the combustibles are located solely at the floor level. This is typically not representative of the configuration and distribution of combustible materials located within U.S. EPR structures. The Fire Protection Analysis (FPA) will assess postulated fires on a scenario-by-scenario basis. Where quantitative and computational methods are employed, recognized fire protection engineering practices, methods and analytical tools, such as those promulgated by NUREG-1805 and NUREG-1824, will be utilized and appropriately applied.

A conservative fire probabilistic risk assessment (PRA) was developed to satisfy the requirements of 10 CFR 52.47(a)(v). According to U.S. EPR FSAR Tier 2, Section 19.1.5.3.1.1, the conservative fire PRA concludes that the overall core damage frequency/large release frequency (CDF/LRF), as a result of a more detailed internal fire evaluation, will not change the conclusion that the overall CDF/LRF meets the U.S. EPR design objective. Consequently, the results of the fire PRA were not used as input to the FPA. Additionally, no fire protection features required by RG 1.189 were eliminated as a result of the fire PRA, and no fire protection features were added as a result of the fire PRA.

The decision to provide fire protection features in a given plant area for plant damage business interruption considerations (i.e., non regulatory) will be determined by the COL applicant.

For determination of fire detection and suppression system requirements, compliance with regulatory requirements and guidance take precedent.

The information contained in U.S. EPR FSAR Tier 2, Table 9A-1—Predefined Severities for Common Plant Ignition Source Fires is from Table 2.3.1 of Appendix F, “Fire Protection Significance Determination Process,” of the NRC Inspection Manual. The FPA assigns a hazard classification to each fire area. This classification is used as a broad characterization of the overall hazard assessment of each fire area. The classification system consists of Light Hazard, Ordinary Hazard (OH) (Group 1), Ordinary Hazard (OH) (Group 2), Extra Hazard (EH) (Group 1) and Extra Hazard (EH) (Group 2). The data in Table 9A-1 is used for information purposes only and is intended to provide insight to and characterization of: (1) the types of common ignition sources that may be associated with a given fire hazard classification; (2) the size and intensity of the fire (kW, MW) that may exist for a given hazard classification; and (3) for a given ignition source and hazard classification, an upper bound characterization of the percentage of fires that may be bounded by a fire of that size and intensity. Table 9A-1 is not used to invoke specific fire protection features or requirements for a given fire area or scenario, but could be of value to highlight scenarios where more rigorous or detailed evaluation may be required.

U.S. EPR FSAR Tier 2, Section 9A.2.2 describes the methodology used to meet the fire protection performance objectives for design certification of the U.S. EPR. Portions of this section will be revised to provide clarification of the methodology.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9A.2.2 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-46:

RG 1.189 Regulatory Position 2.1.3 states that "Systems important to safety should be isolated or separated from combustible materials. When this is not possible because of the nature of the safety system or the combustible material, special protection should be provided to prevent a fire from defeating the safety system function. Such protection may involve a combination of automatic fire suppression and construction capable of withstanding and containing a fire that consumes all combustibles present. Examples of such combustible materials that may not be separable from the remainder of its system are EDG fuel oil day tanks, turbine-generator oil and hydraulic control fluid systems, and RCP lube oil systems." RG 1.189 Regulatory Position 7.2, Turbine /Generator Building, states that "Considering the severity of the fire hazards, defense-in-depth may dictate additional protection to ensure barrier integrity and the potential effect of a major turbine building fire on the ability to maintain operator control of the plant and safely shut down should be evaluated." The U.S. EPR FSAR Section 9.5.1.6.1 does not include suppression for the turbine lubrication oil system. As stated in RG 1.189 Regulatory Position 7.2 Turbine building fires can be severe and make it difficult to control the plant and ensure barrier integrity and, therefore, automatic suppression for the turbine lubrication oil system should be part of the U.S. EPR design or provide a justification for not having automatic suppression.

Response to Question 09.05.01-46:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 under "Combustible Control Practices" will be revised to address the Turbine Building in accordance with the guidance in RG 1.189, Regulatory Position 7.2. The following sentences will be added to the end of the sixth paragraph of this subsection:

"In addition, the turbine lubrication oil system is protected with automatic fixed fire suppression systems to maintain barrier integrity and make sure that a major Turbine Building fire does not adversely affect the ability to maintain operator control and safely shut down the plant. Automatic wet pipe sprinkler systems are provided for areas beneath the turbine operating floor, in the oil discharge tank room and lube oil room; and for lube oil lines above the turbine operating floor, including the turbine lagging/skirt and other areas that could accumulate oil as a result of a spill. Automatic pre-action sprinkler systems are provided for the turbine generator/exciter bearings and automatic water spray systems are provided for the hydrogen seal oil unit and lube oil drainage trenches."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-47:

RG 1.189 Regulatory Position 2.1.3 states that "Systems important to safety should be isolated or separated from combustible materials. When this is not possible because of the nature of the safety system or the combustible material, special protection should be provided to prevent a fire from defeating the safety system function. Such protection may involve a combination of automatic fire suppression and construction capable of withstanding and containing a fire that consumes all combustibles present. Examples of such combustible materials that may not be separable from the remainder of its system are EDG fuel oil day tanks, turbine-generator oil and hydraulic control fluid systems, and RCP lube oil systems." Considering the severity of the fire hazards associated with outdoor oil-filled transformers and the adverse affects of an unsuppressed severe oil fire that could damage nearby buildings that contain systems important to safety, defense-in-depth may dictate additional protection to ensure barrier integrity. The U.S. EPR FSAR should provide either an additional barrier between the transformer and any effected buildings or automatic suppression. If not providing this additional protection, the U.S. EPR FSAR should provide a justification.

Response to Question 09.05.01-47:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 under "Combustible Control Practices" will be revised to address combustible materials in accordance with the guidance in RG 1.189, Regulatory Position 2.1.3. The second sentence in the seventh paragraph of this subsection will be replaced in its entirety by the following:

"Outside oil-filled transformers are separated from plant buildings and from each other in accordance with the guidance in NFPA 804 by either distance or two-hour rated fire barriers. Where the distance from transformer to plant building is less than fifty feet, or distance between transformers is less than thirty feet, fire barriers are provided for separation. In addition, each of the outdoor transformers is provided with an automatic deluge water spray system."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-48:

RG 1.189 Regulatory Position 7.3 states that "Outdoor oil-filled transformers should have oil spill confinement features or drainage away from the buildings." The U.S. EPR FSAR does not state that either of these features is provided. The U.S. EPR FSAR should include oil spill confinement features or drainage away from the buildings for outdoor oil-filled transformers.

Response to Question 09.05.01-48:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 under "Combustible Control Practices" will be revised to address outdoor oil-filled transformers in accordance with the guidance in RG 1.189, Regulatory Position 7.3. The following sentence will be added to the end of the phrase that was inserted in this subsection as part of the response to Question 09.05.01-47.

"Oil spill confinement is provided for each transformer by a gravel-filled, secondary containment and drainage system with adequate capacity to collect spilled oil and fire water."

Refer to response to Question 09.05.01-47.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-49:

RG 1.189 Regulatory Position 7.4 states that “Diesel fuel oil tanks with a capacity greater than 4,164 L (1,100 gallons) should not be located inside buildings containing equipment important to safety.” The U.S. EPR FSAR Section 9.5.1.6.1 states that “The diesel fuel oil main storage tanks and the diesel fuel oil service (i.e., day) tanks associated with the EDGs are located within the EPGBs that they serve.” The U.S. EPR FSAR should state the capacity of the diesel fuel oil tanks and if greater than 1,100 gallons, provide a justification for the diesel fuel oil tanks being in an area with safe-shutdown equipment and revise Table 9.5.1-1 as appropriate.

Response to Question 09.05.01-49:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.1 under “Combustible Control Practices” states the following in the eighth paragraph of this subsection:

“The diesel fuel oil main storage tanks and the diesel fuel oil service (i.e., day) tanks associated with the emergency diesel generators (EDG) are located within the emergency power generating buildings (EPGB) that they serve. Each diesel fuel storage tank and diesel day tank is separated from the remaining portions of the building by three-hour rated fire barriers. Potential spills from the tanks are confined by enclosures sized to accommodate more than the entire inventory of each tank. Automatic fire detection system capability is provided throughout the EPGBs. Additionally, each diesel fuel oil main storage tank and diesel day tank is protected by an automatic deluge (i.e., water spray) fire suppression system. Adequate drainage measures are provided for removing fire protection water and diesel fuel oil.”

The design described above satisfies the requirements of RG 1.189, Regulatory Position 7.4, with respect to separation, spill containment and fire suppression.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.05.01-50:

RG 1.189 Regulatory Position 3.5.1.4 states that "A sufficient number of these drills, but not less than one for each shift's fire brigade per year, should be unannounced to determine the firefighting readiness of the plant's fire brigade, brigade leader, and fire protection systems and equipment. Persons planning and authorizing an unannounced drill should ensure that the responding shift fire brigade members are not aware that a drill is being planned until it has begun. At least one drill per year should be performed on a "back shift" for each shift's fire brigade." The U.S. EPR FSAR Section 9.5.1.6.3 does not address unannounced drills. The U.S. EPR FSAR should address unannounced drills as per RG 1.189.

Response to Question 09.05.01-50:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.4 will be revised to address unannounced fire brigade drills in accordance with the guidance in RG 1.189, Regulatory Position 3.5.1.4.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.6.4 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-51:

The U.S. EPR FSAR Section 9.5.1.2, Fire Water Supply System, states that "Threads compatible with those used by local fire departments are used on fire hydrants hose couplings and standpipe system risers." The U.S. EPR FSAR should add an ITAAC to ensure threads compatible with those used by local fire departments are used on fire hydrants hose couplings and standpipe system risers.

Response to Question 09.05.01-51:

During the development of U.S. EPR FSAR Tier 2, Section 14.3, fire hazards analyses were reviewed for safety-significant design features. The results of this review are provided in U.S. EPR FSAR Tier 2, Table 14.3-3—Fire Protection (Safety Significant Features); "threads compatible with those used by local fire departments" was not identified as a safety-significant design feature.

Other integrated reviews performed for U.S. EPR FSAR Tier 2, Section 14.3 also did not identify this item as a safety-significant design feature. In addition, neither the Standard Review Plan (SRP), Section 14.3, Subsections 14.3.1 through 14.3.12, or RG 1.206, Sections C.II.1 and C.III.7, request this information.

Therefore, since "threads compatible with those used by local fire departments" was not identified as a safety-significant design feature during integrated reviews for U.S. EPR FSAR Tier 2, Section 14.3, and neither SRP Section 14.3 or RG 1.206 request this information for Tier 1, it is not necessary for an ITAAC item to be included in U.S. EPR FSAR Tier 1.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.05.01-52:

U.S. EPR FSAR Section 9.5.1.6.1 for Portable fire extinguishers states that “For dry chemical extinguishers, due consideration is given to possible adverse effects on equipment important to safety in the area.” RG 1.189 Regulatory Position 3.4.4 states that “Fire extinguishers should be provided in areas that contain or could present a fire exposure hazard to equipment important to safety. Extinguishers should be installed with due consideration given to possible adverse effects on equipment important to safety installed in the area.” The U.S. EPR FSAR should be reworded to agree with RG 1.189 since dry chemical extinguishers are not the only type of extinguishers that could have adverse effects on equipment.

Response to Question 09.05.01-52:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 under “Manual Fire Suppression Systems” will be revised to address fire extinguishers in accordance with the guidance in RG 1.189, Regulatory Position 3.4.4. The last sentence in the next to last paragraph in this subsection will be changed to:

“Extinguishers are installed with due consideration given to possible adverse effects on equipment important to safety in the area.”

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 will be revised as described in the response and as indicated on the enclosed markup.

Question 09.05.01-53:

U.S. EPR FSAR states that “Provisions are made to supply water at least to standpipes and hose systems for manual fire suppression capability in all plant areas containing systems and components required for safe plant shutdown in the event of an SSE. The piping system serving these hose stations are analyzed for SSE loading and are provided with supports to provide reasonable assurance of system pressure boundary integrity. The piping and valves for the portion of the standpipe and hose systems affected by this functional requirement, as a minimum, satisfy ASME B31.1 (Reference 32) and are capable of providing flow to at least two hose stations (approximately 75 gpm per hose station).” RG 1.189 Regulatory Position 3.2.1.j adds that “The water supply for this condition may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal seismic Category I water system such as the essential service water system.” U.S. EPR FSAR Figure 9.5.1-1 shows that the seismic portion of the fire water distribution system SSCs are seismic class (category) II. How does the U.S. EPR design using seismic class (category) II pumps, water storage tanks and distribution piping provide reasonable assurance that an adequate water supply will continue to be provided to plant areas containing equipment required for safe plant shutdown during and following an SSE? Basis: RG 1.189 Regulatory Positions 3.2.1, 3.2.2.

Response to Question 09.05.01-53:

A response to the question will be provided by December 5, 2008.

U.S. EPR Final Safety Analysis Report Markups

Operator Manual Actions

For the U.S. EPR Plant, an operator manual action is defined as an action that takes place outside of the MCR in support of achieving and maintaining HSB from within the MCR. Operator manual actions associated with the credited shutdown success path are not required to achieve and maintain HSB.

Question 09.05.01-39

Associated Circuits of Concern

Associated circuits ~~are generally defined as those circuits that do not meet divisional~~of concern are those circuits containing cables that do not meet separation requirements and:

- Share a common power source with shutdown equipment that is not electrically protected from the circuit of concern by coordinated breakers, fuses or similar devices.
- Are directly connected to circuits of equipment that would adversely ~~that could~~ affect the shutdown capability if spuriously operated.
- Share a common enclosure with the shutdown cables that (1) is not electrically protected by circuit breakers, fuses or similar devices; or (2) will allow propagation of fire ~~, but are not electrically protected or will propagate fire~~ into the common enclosure.

The U.S. EPR plant provides circuit coordination for non-safe shutdown loads on shared buses and load centers. Cable installed in the plant complies with IEEE Std 1202, or equivalent, to preclude the potential for fire propagation. Non-shutdown cables that share a common enclosure with shutdown cables are electrically protected to provide reasonable assurance that faults are interrupted prior to cable damage. By virtue of this provision, the U.S. EPR plant design provides reasonable assurance that secondary fires do not occur as a result of fire-induced faults.

Shutdown/Low Power Operations

Per RG 1.189, Revision 1, Section 5.6, shutdown operations are defined as refueling or maintenance outages. The U.S. EPR design provides reasonable assurance that fuel integrity is protected by permanent plant systems during refueling operations or maintenance outages. The primary fuel cooling systems are spent fuel cooling and the residual heat removal system. One or both systems are used depending on the location of fuel.

For the U.S. EPR, low power operations is considered to be startup. For the purposes of analysis, startup operation is considered the same as power operation. Therefore, the analysis for postfire shutdown is the same for both modes of operation.

Question 09.05.01-41

smoke ~~removal~~confinement systems complies with NFPA 92A (Reference 17) and NFPA 204 (Reference 19). Access and egress pathways are maintained at higher pressure than adjacent areas to minimize smoke infiltration during a fire. Smoke confinement systems are also provided in large electrical areas such as switchgear rooms and electrical rooms where the potential exists for heavy smoke conditions.

The smoke confinement system is normally in a standby mode and is automatically actuated by the fire alarm system or manually actuated as required. The smoke confinement system consists of four subsystems:

1. The staircase supply air subsystem provides forced airflow through the main access and egress routes of the SBs, FB, Nuclear Auxiliary Building (NAB), Access Building (ACB) and Radioactive Waste Processing Building (RWB). The primary purpose of this system is to prevent in-leakage of smoke from adjacent areas.

2. The SBs 2 and 3 interconnecting passageway supply and exhaust air subsystem provides outside air to pressurize the SBs 2 and 3 interconnecting passageway and the safeguard escape ladder shaft. The primary purpose of this system is to prevent in-leakage of smoke from adjacent areas.

3. The NI interconnecting passageway supply and exhaust air subsystem pressurizes and purges the interconnecting passageway and service corridors of the SBs, FB, NAB, and RWB. These passageways are at ground level and are the main emergency pathways for the NI.

4. The smoke extraction subsystem removes smoke and provides ventilation for large electrical areas such as cable rooms, switchgear rooms and electrical rooms.

Portable smoke exhaust fan systems (i.e., smoke ejectors) are also available for the controlled removal of heat, smoke, and other products of combustion from these and other areas of the plant.

Fire Detection and Alarm System

The plant fire detection and alarm system meets the guidance provided by SRP 9.5.1 of Reference 37, RG 1.189, NFPA 72 (Reference 13), and NFPA 70 (Reference 12). ~~Deviations from the requirements of these standards are identified and suitably justified as part of the fire protection analysis.~~

The plant fire alarm system provides monitoring of all fire alarm detection devices and circuits, suppression system supervision and releasing when applicable, and plant specific area personnel notification. The plant fire alarm system annunciates a fire alarm, suppression and water supply system supervisory alarms, and overall fire alarm system trouble conditions at the main fire alarm panel located in the MCR.

The plant fire alarm system is provided with both an electrically supervised primary and secondary power source that transfers automatically to the secondary source upon

pressure reducers are provided where necessary for the safety of plant fire brigade members and offsite fire department personnel.

The proper type of hose nozzle provided for each hose station is based on the fire hazards in the area. Combination spray or straight-stream nozzles are not used in plant areas where a straight stream could cause unacceptable damage or present an electrical hazard to firefighting personnel. UL listed electrically safe fixed fog nozzles are provided in areas where high-voltage shock hazards exist. All nozzles have full shutoff capability.

Fire hose meets the applicable criteria of NFPA 1961 (Reference 26) and is hydrostatically tested in accordance with the applicable guidance of NFPA 1962 (Reference 27).

Provisions are made to supply water at least to standpipes and hose systems for manual fire suppression capability in all plant areas containing systems and components required for safe plant shutdown in the event of an SSE. The piping system serving these hose stations are analyzed for SSE loading and are provided with supports to provide reasonable assurance of system pressure boundary integrity. The piping and valves for the portion of the standpipe and hose systems affected by this functional requirement, as a minimum, satisfy ASME B31.1 (Reference 32) and are capable of providing flow to at least two hose stations (approximately 75 gpm per hose station).

Failure or rupture of standpipe and hose systems will not significantly impair the safety capability of SSC important to safety.

Question 09.05.01-52

Portable fire extinguishers are provided in all plant areas that contain or could present a fire exposure to equipment important to safety. The number, size, and type of fire extinguishers are provided in accordance with NFPA 10 (Reference 1). In instances where radiological considerations may affect firefighting operations, portable fire extinguishers are pre-staged outside of the immediate area. ~~For dry chemical e~~Extinguishers~~,~~ are installed with due consideration ~~is~~ given to possible adverse effects on equipment important to safety in the area.

Failure or rupture of portable fire extinguishers will not significantly impair the safety capability of SSC important to safety.

9.5.1.2.2 Alternative Compliance With Regulatory Guide 1.189

The following provides a summary of those compliance issues where "Alternate Compliance" is indicated in Table 9.5.1-1.

Question 09.05.01-43

Question 09.05.01-44

Fire Areas

Generally, fire areas comply with RG 1.189, Regulatory Position 4.1.2.1. Alternative compliance is provided for certain specialty doors and certain penetration seals.

Openings inside conduits that penetrate fire rated barriers are sealed in a manner that maintains the fire rating of the barrier. Internal conduit seal locations are substantiated by fire testing. ~~Where approved full-scale fire tests demonstrate that internal conduit seals are not necessary, internal conduit seals are not provided.~~

~~Where specialty doors or closure devices are provided because of design considerations other than fire (e.g., flood, pressure or radiation mitigation) such components are not listed or fire rated. Instances where non-listed or non-fire-rated closure devices or assemblies are installed in fire barrier penetrations are evaluated for equivalency~~Specialty doors, closure devices or sealing components that are part of a fire barrier but are not listed or fire rated will be evaluated and justified as part of the final FHA. This activity will be performed by the COL applicant as part of the final FHA (refer to Section 9.5.1.3).

Electrical Cable System Fire Detection and Suppression

Generally, electrical cable systems comply with RG 1.189, Regulatory Position 4.1.3.3. Alternative compliance is provided due to the lack of a fixed fire suppression system.

The U.S. EPR is a four divisional design. Generally, each of the four divisions outside of the MCR and the Reactor Building are in divisional Safeguard Buildings separated from each other by 3 hour fire-rated barriers. Fire detection is provided in areas containing cables important to safety. Cable trays are accessible for manual fire fighting and manual hose stations and portable extinguishers are provided throughout the facility.

Having each safety division in fully separated buildings from redundant divisions and the fact that there are four safety divisions make it possible for the loss of any one division not to impact safe shutdown capability. There is a high probability that even with loss of one division from fire an extra division beyond the minimum required for safe shutdown will be available.

The U.S. EPR design utilizes electrical cable construction that has met the acceptance criteria of the IEEE 1202 (Reference 34) test standard (or an equivalent standard) for prevention of flame propagation. IEEE 1202 is a vertical flame propagation test protocol. It is widely recognized that a vertical cable orientation represents a more severe fire test exposure than a horizontal cable orientation. Moreover, the NRC RES Fire Research Branch has stated, "The FT-4 / Vertical Flame Test, included in standard(s) IEEE 1202-1991…is the most rigorous of the 20kW (70000 BTU/hr) tests…What makes this test the most difficult to pass of the 20kW (70000 BTU/hr) tests is its low acceptable damage length of 4.9 ft (1.5m)." Therefore, the ability of

important to safety. Use and control of transient combustible and hazardous materials (e.g., combustible liquids, wood and plastic products, dry ion exchange resins, hazardous chemicals) are governed by administrative control measures.

Combustible materials in the RSS and MCR are controlled and limited by administrative procedures to those required for operation.

Plant administrative procedures clearly define the use, handling and storage of flammable and combustible liquids and gases. Flammable and combustible liquids are stored in accordance with NFPA 30 (Reference 9). Compressed and liquefied flammable gases are stored in accordance with applicable NFPA codes.

Storage and use practices for hydrogen are in accordance with guidance from NFPA 55 (Reference 11). Hydrogen lines in safety-related areas are designed to Seismic Category I.

Ventilation systems designed to maintain the hydrogen concentration below one percent by volume are provided for battery rooms.

Question 09.05.01-46

The turbine lubrication oil system, located in the Turbine Building, is separated from areas containing SSC important to safety by three hour rated fire barriers. In addition, the turbine lubrication oil system is protected with automatic fixed fire suppression systems to maintain barrier integrity and make sure that a major Turbine Building fire does not adversely affect the ability to maintain operator control and safely shut down the plant. Automatic wet pipe sprinkler systems are provided for areas beneath the turbine operating floor, in the oil discharge tank room and lube oil room; and for lube oil lines above the turbine operating floor, including the turbine lagging/skirt and other areas that could accumulate oil as a result of a spill. Automatic pre-action sprinkler systems are provided for the turbine generator/exciter bearings and automatic water spray systems are provided for the hydrogen seal oil unit and lube oil drainage trenches.

Question 09.05.01-47

Transformers located within buildings containing SSC important to safety are of the dry type or are insulated and cooled with non-combustible liquid. ~~Outdoor oil-filled transformers are separated from plant buildings in accordance with RG 1.189.~~Outside oil filled transformers are separated from plant buildings and from each other in accordance with the guidance from NFPA 804 (Reference 42) by either distance or two-hour rated fire barriers. Where the distance from transformer to plant building is less than 50 feet, or distance between transformers is less than 30 feet, fire barriers are provided for separation. In addition, each of the outdoor transformers is provided with an automatic deluge water spray system. Oil spill confinement is provided for each transformer by a gravel-filled, secondary containment and drainage system with adequate capacity to collect spilled oil and fire water. NFPA 80A (Reference 15) is

Question 09.05.01-48

shutdown or any personnel required for other essential functions during a fire emergency. The fire brigade consists of a fire brigade leader who is assigned to the fire brigade and is qualified to assume command of a fire emergency and direct fire-fighting activities. The fire brigade also consists of an additional four fire brigade members who are qualified, trained, and equipped to respond to fire related emergencies.

Fire brigade drills are performed in the plant so that the fire brigade can practice as a team. Drills are performed at least quarterly for each shift fire brigade and each fire brigade member participates in at least two drills annually. At least one drill for each shift's fire brigade per year is unannounced. Persons planning and authorizing an unannounced drill must make sure that the responding shift fire brigade members are not aware that a drill is being planned until it has begun. At least one drill per year is performed on a "back shift" for each shift's fire brigade.

The drills are preplanned to establish training objectives and the drills are critiqued. Members of the management staff responsible for plant safety and fire protection plan and critique unannounced drills. Performance deficiencies of a fire brigade or of individual fire brigade members are remedied by scheduling additional training. Unsatisfactory drill performance is followed by a repeat drill within 30 days. At three-year intervals, qualified individuals independent of the plant staff critique a randomly selected unannounced drill.

Drills include the following:

- The effectiveness of the fire alarms, time required to notify and assemble the fire brigade, and selection, placement and use of equipment and firefighting strategies are assessed.
- Each brigade member's knowledge of his or her role in the firefighting strategy for the area assumed to contain the fire and the brigade member's conformance with established plant firefighting procedures and use of firefighting equipment, including self-contained emergency breathing apparatuses, communication, lighting and ventilation is assessed.
- The simulated use of firefighting equipment required to cope with the situation and type of fire selected for the drill is evaluated. The area and type of fire chosen for the drill vary from drill to drill to simulate fires in various areas of the plant. The situation selected simulates the size and arrangement of a fire that could reasonably occur in the area selected, allowing for fire development during the

Question 09.05.01-50

time required to respond, obtain equipment and organize for the fire, assuming loss of automatic suppression capability.

- The brigade leader's direction of the firefighting effort is assessed with regard to thoroughness, accuracy and effectiveness.

The plant fire brigade coordinates training with the local fire department so that responsibilities and duties are delineated in advance. This coordination is part of the training course and is included in the training for the local fire department staff. The local fire department is invited to participate in drills at least annually.

Fire brigade members receive training as outlined in this section and in Section 9.5.1.6.3. Records of fire brigade member physical examinations, training drills, and critiques are maintained on file for a minimum of three years. NFPA 600 (Reference 24) is used as guidance in the organization and training of the fire brigade.

Question 09.05.01-50

Fire brigade equipment, including personal protective equipment for structural firefighting, is provided for the plant fire brigade in accordance with RG 1.189. Each fire brigade member is equipped with a helmet (with face shield), turnout coat, bunker pants, footwear, gloves, protective hood, emergency communications equipment, portable lights, portable smoke removal equipment, self-contained breathing apparatus and portable extinguishers. All equipment conforms to appropriate NFPA standards and is stored in accordance with manufacturer's recommendations. An adequate inventory of firefighting equipment is maintained to outfit a full complement of brigade members with consideration of the possibility of sustained fire response operations (i.e., multiple crews).

9.5.1.6.5 Quality Assurance

The overall plant quality assurance plan (QAP) includes the QA program for fire protection. The QAP provides reasonable assurance that the fire protection systems are designed, fabricated, erected, tested, maintained and operated so that they will function as intended. As stated in U.S. EPR FSAR, Section 17.5, the QAP for the design of the U.S. EPR is addressed in AREVA NP Topical Report ANP-10266-A (Reference 41). The AREVA QAP implements quality requirements for the fire protection system in accordance with RG 1.189, Regulatory Position 1.7, directly by reference.

As stated in the U.S. EPR FSAR, Section 17.2, a COL applicant that references the U.S. EPR design certification will provide the Quality Assurance Programs associated with the construction and operations phase. The program description to be provided by the applicant also includes a description of the fire protection system quality assurance program to be applied during fabrication, erection, installation and operations. ~~The overall plant quality assurance plan (QAP) includes the QA program for fire protection. The QAP provides reasonable assurance that the FPSs are designed,~~

30. ASTM E119, "Standard Test Methods for Fire Test of Building Construction and Materials," American Society for Testing and Materials, 2007.

31. ASTM E814, "Standard Test Method for Fire Tests of Through-Penetration Fire Stops," American Society for Testing and Materials, 2006.

32. ASME B31.1, "Power Piping" - B31.1ab-2004 (including 2005 & 2006 Addenda), The American Society of Mechanical Engineers.

33. IEEE Std 634, "IEEE Standard Cable Penetration Fire Stop Qualification Test," Institute of Electrical and Electronics Engineers, Inc., 2004.

34. IEEE Std 1202, "IEEE Standard for Flame-Propagation Testing of Wire and Cable," Institute of Electrical and Electronics Engineers, Inc., 2006.

35. UL 555, "Standard for Fire Dampers," Underwriters Laboratories, 2006.

36. UL 1479, "Standard for Fire Tests of Through-Penetration Firestops," Underwriters Laboratories 2003.

37. NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, 2007.

38. SECY-90-016, "Evolutionary Light-Water Reactor (QA) Certification Issues and Their Relationship to Current Regulatory Requirements," U.S. Nuclear Regulatory Commission, 1990.

39. NEI 00-01, Revision 1, "Guidance for Post-Fire Safe Shutdown Circuit Analysis," Nuclear Energy Institute, 2001.

40. NUREG/CR-6850, "Fire PRA Methodology for Nuclear Power Facilities," U.S. Nuclear Regulatory Commission, September 2005.

41. ANP-10266-A, "AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR Topical Report," AREVA NP Inc, June 2007.

42. NFPA 804, "Standard for Fire Protection for Advanced Light Water Reactor Electric-Generating Plants," National Fire Protection Association Standards, 2006.

Question 09.05.01-47

Table 9.5.1-1—Fire Protection Program Compliance with Regulatory Guide 1.189
Sheet 6 of 11

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"[1]	Compliance[2]	U.S. EPR Comment
C.4.1.3.6	Electrical Cabinets	Alternate Compliance	~~See~~Refer to Section 9.5.1.2.~~1~~2 for justification. ~~on "Electrical System Design and Electrical Separation," "Fire Detection and Alarm System," "Manual Fire Suppression Systems" for fire protection system design details, and see the Fire Protection Analysis – Appendix 9A for fire area by fire area description of system features.~~
C.4.1.4	HVAC Design	Compliance	
C.4.1.4.1	Combustibility of Filter Media	Compliance	
C.4.1.4.2	Smoke Control/Removal	Compliance	
C.4.1.4.3	Habitability	Compliance	
C.4.1.4.4	Fire Dampers	Compliance	
C.4.1.5	Drainage	Compliance	
C.4.1.6	Emergency Lighting	Compliance	
C.4.1.6.1	Egress Safety	Compliance	
C.4.1.6.2	Post-Fire Safe-Shutdown	Compliance	
C.4.1.7	Communications	Compliance	
C.4.1.8	Explosion Prevention	Compliance	
C.4.2	Passive Fire-Resistive Features	Compliance	
C.4.2.1	Structural Fire Barriers	Compliance	
C.4.2.1.1	Wall, Floor, and Ceiling Assemblies	Compliance	
C.4.2.1.2	Fire Doors	Alternate Compliance	Refer to Section 9.5.1.2.2 for justification.
C.4.2.1.3	Fire Dampers	Compliance	

Question 09.05.01-44

Table 9.5.1-1—Fire Protection Program Compliance with Regulatory Guide 1.189
Sheet 7 of 11

Question 09.05.01-43

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"[1]	Compliance[2]	U.S. EPR Comment
C.4.2.1.4	Penetration Seals	Alternate Compliance	Refer to Section 9.5.1.2.2 for justification.
C.4.2.1.5	Testing and Qualification	Compliance	
C.4.2.1.6	Evaluation of Penetration Seal Designs with Limited Testing	Compliance	
C.4.2.2	Structural Steel Protection	Compliance	
C.4.2.3	Fire-Resistive Protection for Electrical Circuits	Compliance	
C.4.2.3.1	Electrical Raceway Fire Barrier Systems	Compliance	
C.4.2.3.2	Fire Rated Cables	N/A	For plants licensed before January 1, 1979.
C.4.2.3.3	Fire Stops for Cable Routing	Alternate Compliance	See Section 9.5.1.2.1 on "Electrical System Design and Electrical Separation" for details of alternate compliance for "fire stops for cable routing."
C.4.3	Testing and Qualification of Electrical Raceway Fire Barrier Systems	N/A	Electrical Raceway Fire Barrier Systems are not relied upon to protect post-fire shutdown-related systems and to meet the separation means discussed in Regulatory Position 5.3.
C.5	Safe-Shutdown Capability	Compliance	The U.S.EPR is a new reactor design Cold Shutdown Plant. See new reactor design requirements in this RG Position.

- NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems (Reference 16).
- NFPA 92A – Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences (Reference 17).
- UL 555 – Standard for Fire Dampers (Reference 35).
- NFPA 101 – Life Safety Code (Reference 18).

Except for specialty doors and closure devices, cable openings, piping openings and building joints are provided with penetration seals having a fire resistance rating consistent with the designated fire rating of the fire barrier. Such penetration seals meet the requirements of ASTM E814 (Reference 31), UL 1479 (Reference 36), or IEEE Std 634 (Reference 33) and IEEE Std 1202 (Reference 34). Materials used for penetration seals are a limited-combustible or non-combustible material in accordance with NFPA 259 (Reference 23).

Question 09.05.01-43

~~Conduits are sealed at the barrier with a fire-rated seal, if accessible. Alternatively, conduits are provided with a non-fire-rated smoke and hot gas seal at the first break in the conduit on both sides of the barrier. The fire resistance rating for internal conduit seals is consistent with the designated fire rating of the fire barrier~~Openings inside conduits that penetrate fire rated barriers are sealed in a manner that maintains the fire rating of the barrier. Internal conduit seal locations are substantiated by fire testing.

Openings inside conduits that penetrate barriers required to provide environmental isolation or pressure differentials are sealed with designs subsatantiated by pressure testing.

Specialty doors, closure devices or sealing components that are part of a fire barrier but are not listed or fire rated will be evaluated and justified as part of the final Fire Hazards Analysis (FHA). This activity will be performed by the COL applicant as part of the final FHA (refer to Section 9.5.1.3).~~Exceptions include:~~

- ~~Where approved full-scale fire tests demonstrate that internal conduit seals are not necessary, internal conduit seals are not required.~~
- ~~Where specialty doors or closure devices are provided because of design considerations other than fire (e.g., flood, pressure or radiation mitigation), such components are not required to be listed or fire-rated.~~

~~Additionally, where specialty components are used in lieu of fire-rated penetration seals, such as containment penetration assemblies; these components are not required to be fire-rated.~~

Question 09.05.01-44

4. The in situ plant equipment and components, including electrical cables, housed within each fire area are considered. Any SSC important to safety located within the fire area are considered.

Question 09.05.01-45

5. In situ fire and explosion hazards associated with plant operations, maintenance, and refueling activities within the fire area are identified (e.g., cables, lube oil, diesel fuel oil, flammable gases, chemicals, building materials, and interior finish). In developing postulated fire scenarios for each fire area, the FPA considers the quantity and continuity of combustible materials, susceptibility of the materials to ignition, heat of combustion, heat release rates (HRR), and potential for fire spread.

   In the event that a fire area could be subject to potentially explosive environments from flammable gases or other potentially energetic sources (e.g., chemical treatment systems, ion exchange columns), explosion-prevention features and measures are provided.

   External exposure hazards are identified (e.g., flammable and combustible liquid or gas storage, auxiliary boiler units, natural vegetation) that could potentially expose SSC important to safety to fire effects (i.e., heat, flame, smoke). Wildfire hazards are addressed if the potential for damage to SSC important to safety exists.

6. The credible in situ ignition sources within the fire area are identified. The FPA classifies ignition sources as common or atypical and assign potential fire severity levels on a generic basis using predefined guidance. Most in situ ignition sources are of the common type, which include electrical switchgear cabinets, general electrical and control cabinets, electric motors, pumps (i.e., reactor coolant pumps, feedwater pumps, and other pumps), diesel generators, air compressors, battery banks, boiler heating units, electric dryers, heating, ventilation, air conditioning (HVAC) subsystem components, and others.

   Atypical sources of ignition include arcing electrical faults, hydrogen storage tanks, hydrogen piping, turbine generator exciter hydrogen, outdoor oil-filled transformers, and liquid fuels (i.e., spills). Because of their nature, fires associated with atypical ignition sources are not assigned a generic intensity level.

   Most anticipated fires will involve the common in situ ignition sources as represented by the equipment and components typically found in nuclear power plants. Such fires can be assessed using a fixed fire intensity (i.e., HRR) level for the given fire ignition source. However, consideration of a fixed fire intensity level for a given ignition source may not adequately consider the potential for low-likelihood, high intensity fires. NUREG/CR-6850, (Reference ~~2~~ 4) addressed this concern by assigning a ranking of two HRR values. The first value assigned is the 75th percentile fire intensity. This means that 75 percent of the fires involving a given ignition source would reach an intensity no greater than the cited fire intensity (absent the fire propagating to any secondary combustibles). The second HRR value is the 98th percentile value, which is intended to represent a high-confidence fire intensity value, which based on the industry guidance cited, is expected to bound the vast majority of fires involving a given ignition source. Table 9A-1—Predefined Severities for Common Plant Ignition Source Fires

determination may or may not reflect the need for detailed assessment of transient fire hazards. A THL-3 determination generally reflects the need for detailed assessment of transient fire hazards within the area analysis. In such cases, the material type, quantity, and associated thermal properties comprising the transient hazard package is evaluated. More than one type of transient hazard source may apply to a given fire area. Section 9A.2.3.3 provides additional information regarding the transient fire hazard determination process.

Question 09.05.01-45

8. Based on compartmentation of the plant by three hour rated structural fire barriers, additional fire protection features (e.g., fire detection system capability, fixed fire suppression system capability, electrical raceway fire barrier systems) are generally not required in order to provide adequate separation of redundant trains of safe shutdown systems, components, and cables. However, for provision of fire protection features, ~~Therefore, provision of such fire protection features are based on factors such as regulatory requirements, regulatory guidance, the magnitude of the hazards within the fire area, insights from the probabilistic fire risk assessment and plant damage business interruption considerations). R~~regulatory requirements and regulatory guidance take~~s~~ precedence~~t over the other considerations~~.

9. Based on the previously mentioned considerations, suitable fire protection defense-in-depth features are specified for all plant fire areas.

   The fire protection features provided (e.g., fire barriers and closure devices, fire detection systems, fire suppression systems and equipment) are designed and installed in accordance with applicable regulatory guidance, codes and NFPA standards. Deviations from the above requirements are justified. See Section 9.5.1 for further information regarding fire protection features.

10. Appropriate manual fire suppression capability (i.e., hydrants, standpipe and hose systems, and portable fire extinguishers) are specified and described for each plant fire area.

11. Pursuant to GDC 3, the potentially disabling effects of fire suppression systems, due to normal or inadvertent operation, on SSC important to safety are described for each fire area.

12. The FPA describes the means provided to ventilate, exhaust, or isolate each fire area. Additionally, in accordance with ~~SECY-90-016~~ Reference 2, the ventilation system design provides reasonable assurance that smoke, hot gases, and fire suppressants do not migrate into other fire areas to the extent that they could adversely affect safe shutdown capabilities, including operator manual actions. See Section 9.5.1 for further information regarding the ventilation system design.

13. For each fire area, the capability to protect SSC important to safety from flooding associated with automatic and manual fire suppression activities, including inadvertent operation or fire suppression system failure, is considered. The effects of floor drains on the ability of total flooding gaseous fire suppression systems to achieve and maintain agent concentration upon discharge is considered for applicable fire areas.