ArevaEPRDCPEm Resource

From: DUNCAN Leslie E (AREVA NP INC) [Leslie.Duncan@areva.com]
Sent: Friday, December 05, 2008 4:24 PM
To: Getachew Tesfaye
Cc: John Rycyna; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 25, Supplement 1, FSAR Ch 9
Attachments: RAI 25 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 15 of the 17 questions of RAI 25 on September 9, 2008. The attached file, "RAI 25 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to both of the remaining questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 25 Questions 09.05.01-37 and 09.05.01-53.

The following table indicates the respective pages in the response document, "RAI 25 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 25 — 09.05.01-37	2	4
RAI 25 — 09.05.01-53	5	8

This concludes the formal AREVA NP response to RAI 25, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Les Duncan on behalf of)
Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: WELLS Russell D (AREVA NP INC)
Sent: Tuesday, September 09, 2008 4:10 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V

(AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 25, FSAR Ch 9

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 25 Response US EPR DC.pdf" provides technically correct and complete responses to 15 of the 17 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 25 Questions 09.05.01-39, 09.05.01-41, 09.05.01-43, 09.05.01-44, 9.05.01-45, 09.05.01-46, 09.05.01-47, 09.05.01-48, 09.05.01-50, and 09.05.01-52.

The following table provides the page(s) in the response document, "RAI 25 Response US EPR DC.pdf" containing the response to each question.

Question #	Start Page	End Page
RAI 25 — 09.05.01-37	2	2
RAI 25 — 09.05.01-38	3	3
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RAI 25 — 09.05.01-47	14	14
RAI 25 — 09.05.01-48	15	15
RAI 25 — 09.05.01-49	16	16
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RAI 25 — 09.05.01-51	18	18
RAI 25 — 09.05.01-52	19	19
RAI 25 — 09.05.01-53	20	20

A complete answer is not provided for 2 of the 17 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 25 — 09.05.01-37	December 5, 2008
RAI 25 — 09.05.01-53	December 5, 2008

Sincerely,

(Russ Wells on behalf of)

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694

Cell: 434-841-8788

From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, August 12, 2008 4:00 PM
To: ZZ-DL-A-USEPR-DL
Cc: Edward McCann; Robert Radlinski; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 25, FSAR Ch 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on June 30, 2008, and discussed with your staff on July 16 and August 4, 2008. RAI Questions 09.05.01-53 was added as a result of those discussions. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 6

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From: DUNCAN Leslie E (AREVA NP INC)

Created By: Leslie.Duncan@areva.com

Recipients:
"John Rycyna" <John.Rycyna@nrc.gov>
Tracking Status: None
"Pederson Ronda M (AREVA NP INC)" <Ronda.Pederson@areva.com>
Tracking Status: None
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"Getachew Tesfaye" <Getachew.Tesfaye@nrc.gov>
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Post Office: AUSLYNCMX01.adom.ad.corp

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MESSAGE	4737	12/5/2008 4:24:23 PM
RAI 25 Supplement 1 Response US EPR DC.pdf	143428	

Options
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Return Notification: No
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Response to

Request for Additional Information No. 25, Supplement 1 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:

The Reactor Shield Building (RSB) completely encloses the Reactor Containment Building (RCB). The space between the RSB and RCB forms an annulus that is approximately 6 feet wide. The annulus is an area that provides access for personnel to inspect the outside of the RCB and to route piping, ventilation ducts, electrical cables and other items. A slight negative pressure is maintained in the annulus. All four safety-related electrical divisions are located in the annulus. The combustibles in the annulus consist of electrical cables that meet the acceptance criteria of IEEE Std 1202 or equivalent. Cable routing in the annulus is divided into two zones: lower zone and upper zone. The lower zone is for safety-related divisional and non-safety-related cables, which are routed to the containment through penetrations. There are also safety-related divisional cables routed across divisions in the lower zone. The upper zone is for routing other, non-safety-related cables circumferentially to other buildings such as adjacent Safeguard Buildings, Fuel Building and Nuclear Auxiliary Building.

There are no credible ignition sources in the annulus. Self-ignition of electrical cables that are qualified in accordance with IEEE Std 1202 is not considered credible due to the protective devices (fuses, circuit breakers) provided and analyzed to be properly sized. On this basis, qualified electrical cables are considered as potential damage targets, but not ignition sources. These cables will not propagate fire unless exposed to an external fire involving other combustibles located in the vicinity of the cables.

The annulus represents a situation similar to containment in that all four safety-related electrical divisions are located in the annulus, and that this area cannot reasonably be subdivided into separate fire areas due to its configuration and the need to maintain a negative pressure throughout. To properly assess the separation of safety-related electrical divisions and the fire protection measures necessary to confirm an acceptable post-fire safe shutdown capability, the final design configurations for cable routing within the annulus must be established. When specific cable routes are determined for cables required to support post-fire safe shutdown, either compliance with RG 1.189 through the use of three hour rated fire barriers or alternate compliance with RG 1.189, Regulatory Positions 4.1.3.3, 5.3 and 8.2 will be demonstrated

utilizing a combination of spatial separation and defense-in-depth fire protection features such as fire barriers, fire rated cables, fire detection, and fire suppression to provide assurance, to the extent practicable, that cables required to support post-fire safe shutdown will be free of fire damage.

U.S. EPR FSAR Tier 2, Table 1.8-2—U.S. EPR Combined License Information Items contains the following two information items:

- Combined License Information, Item No. 9.5-16 requires the COL applicant that references the U.S. EPR design certification to perform an as-built, post-fire safe shutdown analysis.

- Combined License Information, Item No. 9.5-17 requires the COL applicant that references the U.S. EPR design certification to evaluate the differences between the as-designed and as-built plant configuration to confirm the fire protection analysis remains bounding.

These two information items were added to this table to support the response to RAI 20, Question 09.05.01-2. These requirements also support arguments presented above in response to Question 09.05.01-37 by providing assurance that cables specifically required to support post-fire safe shutdown are not susceptible to fire damage.

To provide additional clarification, U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 will be revised under “Electrical System Design and Electrical Separation” to include the following sentence:

> “Train separation in the annulus is provided by three hour rated fire barriers or a combination of spatial separation and defense-in-depth fire protection features such as fire barriers, fire rated cable, fire detection, fire suppression and administrative controls to prevent storage of transient combustibles in the annulus.”

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1, under “Architectural and Structural Features,” specifies:

> “Individual fire areas are separated by passive, fire-rated structural barriers (i.e., walls, floors, and ceilings). Structural fire barriers are non-combustible. Structural fire barriers are designed and installed to meet specific fire resistance ratings using assemblies qualified by fire tests. The qualification fire tests are conducted in accordance with, and meet the acceptance criteria of NFPA 251 (Reference 20) or ASTM E119 (Reference 30). The guidance from RG 1.189 was considered for specifying the fire resistance ratings of fire area boundaries.”

Compliance with RG 1.189, Regulatory Position C.4.2, Passive Fire-Resistive Features, is indicated in U.S. EPR FSAR Tier 2, Table 9.5.1-1—Fire Protection Program Compliance with Regulatory Guide 1.189.

A COL information item providing specific design and certification testing details for these fire barriers is not necessary. A COL applicant who references the U.S. EPR standard design certification is required to satisfy requirements in the U.S. EPR FSAR or take a departure and provide suitable justification for the departure.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 will be revised as described in the response and 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:

RG 1.189, Regulatory Position 3.2.1.j requires:

> "Provisions should be made to supply water to at least two standpipes and hose connections for manual firefighting in areas containing equipment required for safe plant shutdown in the event of a safe-shutdown earthquake. The piping system serving such hose stations should be analyzed for safe-shutdown earthquake loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirement should, at a minimum, satisfy ASME B31.1, "Power Piping"…"

U.S. EPR equipment that is required to remain functional during and following a safe shutdown earthquake (SSE) to effect safe plant shutdown is defined to be Seismic Category I because that equipment also meets at least one of the qualifying criteria stated in RG 1.29, Regulatory Position 1 (items 1.a through 1.q, as appropriate).

The U.S. EPR fire protection system (FPS) is not a safety-related system as defined in 10 CFR 50.2; its primary design functions do not include use that effects safe shutdown, or prevents or mitigates the consequences of accidents that could cause offsite exposures in excess of regulatory limits.

The U.S. EPR FPS is not Seismic Category I because it does not meet any of the criteria stated in RG 1.29, Regulatory Position 1.

Pumps, water storage tanks, and distribution piping in the U.S. EPR FPS that provide fire protection capacity to areas of the U.S. EPR containing Seismic Category I equipment required for safe plant shutdown are classified as Seismic Category II because they meet the criteria in RG 1.29, Regulatory Position 2, which states:

> "Those portions of SSCs of which continued function is not required but of which failure could reduce the functioning of any plant feature included in items 1.a through 1.q above to an unacceptable safety level or could result in incapacitating injury to occupants of the control room should be designed and constructed so that the SSE would not cause such failure."

A seismic event up to and including a design basis SSE could require operation of (Seismic Category I) equipment used to effect safe shutdown while simultaneously causing collateral damage to various lube oil, fuel oil, or electrical systems that could initiate a fire in some area of the plant. If a fire is initiated in an area of the plant that contains (Seismic Category I) equipment used to effect safe plant shutdown, the possibility exists that the operation of that equipment may be degraded to an unacceptable safety level due to direct effects (damage) or indirect effects (such as localized thermal binding) from the fire.

If a seismic event up to and including an SSE causes a fire in an area of the U.S. EPR plant that contains (Seismic Category I) equipment used to effect safe plant shutdown (where that equipment is credibly subject to direct or indirect damage by fire), or in an area that could threaten occupants of the control room, then RG 1.29, Regulatory Position 2 requires that the portions of the U.S. EPR FPS that protect those areas must be designed and constructed such that the SSE would not cause the failure of these portions of the FPS to provide fire protection flow via system standpipes in those areas at the flow rates required by RG 1.189.

The portions of the U.S. EPR FPS that are classified as Seismic Category II satisfy, at a minimum, the seismic design criteria set forth in ASME B31.1.

RG 1.189, Regulatory Position 3.2.2.a requires:

> "If fire pumps are required to meet system pressure or flow requirements, a sufficient number of pumps is provided to ensure that 100-percent capacity will be available assuming failure of the largest pump or loss of offsite power (e.g., three 50-percent pumps or two 100-percent pumps). This can be accomplished, for example, by providing either electric motor-driven fire pumps and diesel-driven fire pumps or two or more seismic Category I Class 1E electric motor-driven fire pumps connected to redundant Class 1E emergency power buses."

The U.S. EPR FPS has three 100 percent capacity fire pumps. One fire pump is electrically motor-driven; the other two fire pumps are diesel engine-driven. The fire pumps are normally in a stand-by mode, and are not expected to be running at the time of a seismic event. They would not be started until after the seismic event occurred, a fire has been initiated, and the fire has tripped the fire detection system or was otherwise detected by plant personnel. The U.S. EPR fire pump arrangement is consistent with the first example recommended by RG 1.189, Regulatory Position 3.2.2.a.

To provide additional clarification, U.S. EPR FSAR Tier 2, Section 9.5.1 will be revised as described below:

The following bullet item will be added to the first paragraph in U.S. EPR FSAR Tier 2, Section 9.5.1.1:

- RG 1.29 – Seismic Design Classification, Revision 4

U.S. EPR FSAR Tier 2, Section 9.5.1.1 will be revised to include the following:

> "The FPS is classified as non-safety related. The fire protection containment isolation valves and associated piping are classified as safety-related and are subject to Seismic Category I design requirements per RG 1.29, Regulatory Position 1.o. The FPS portion of the containment isolation system meets the containment isolation requirements of GDC 56. The FPS water supply storage tanks, pumps, and portions of the distribution piping that provide fire protection flow to standpipes located in areas containing Seismic Category I equipment are subject to seismic design requirements per RG 1.29, Regulatory Position 2.
>
> The portions of the FPS that provide containment isolation or water to the standpipes that protect those areas of the plant containing Seismic Category I equipment used for safe plant shutdown are required to remain functional during and following seismic events up to a safe shutdown earthquake. Other portions of the FPS are not required to remain functional following a plant accident or natural phenomena."

The last bullet in U.S. EPR FSAR Tier 2, Section 9.5.1.1 will be revised to read:

- Following an SSE, provide water to hose stations for manual firefighting in areas containing Seismic Category I plant safe shutdown equipment.

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 under "Fire Water Supply System" will be revised to include the following:

> "See information on seismically qualified standpipe and hose systems in the "Manual Fire Suppression Systems" portion within this section for additional requirements on the fire water supply system."

U.S. EPR FSAR Tier 2, Section 9.5.1.2.1 under "Manual Fire Suppression Systems" will be revised to include the following:

> "Standpipe and hose systems in areas containing equipment required for safe plant shutdown following an SSE are designed to be functional following an SSE and capable of providing flow to at least two hose stations (approximately 75 gpm per hose stream). The standpipe and hose stations in these areas, the water supply and distribution piping, and the supports and valves, as a minimum, satisfy ASME B31.1 (Reference 32). This is accomplished by manually realigning valves to isolate non-seismically qualified portions of the FPS from the seismic portions of the system and manually starting the diesel fire pumps.
>
> To comply with this requirement, portions of the fire protection water supply and water distribution system are designed to satisfy, as a minimum, the requirements of ASME B31.1 as follows:
>
> - The two fire water storage tanks (Part of USG) and their associated piping, supports and valves are designed to remain functional following an SSE.
>
> - The fire pump house (Part of USG) is designed to satisfy the requirements of a seismically qualified structure.
>
> - The two diesel fire pumps and associated pipe, supports and valves are designed to

remain functional following an SSE. This includes the diesel day tanks (fuel supply) for each pump and associated piping, valves and supports and the diesel fire pump batteries for each pump which are located in the fire pump house. The diesel pumps are designed to be started manually following an SSE utilizing the pump batteries. Isolation valves which isolate the diesel fire pumps from the motor driven fire pump are designed to remain functional so that the cross connections to the motor driven pump can be manually closed after an SSE.

- The portion of the underground fire main which supplies fire protection water to the seismically qualified standpipe and hose system is designed to remain functional following an SSE. Isolation valves between seismically qualified portions of the underground fire main and non-seismically qualified portions must remain functional following an SSE so that they can be manually closed.

- The portion of the inside fire water distribution system which supplies fire protection water to the seismically qualified standpipe and hose system is designed to remain functional following an SSE. Isolation valves between seismically qualified portions of the inside fire water distribution system and non-seismically qualified portions must remain functional following an SSE so that they can be manually closed."

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.5.1.1 and 9.5.1.2.1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

09.05.01-37

cabling allocated to all four safety divisions. The cable connections between SBs 1-4 and the divisional assigned components inside the RB are routed from the cable rooms in SBs via airtight penetrations to the annulus. 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 that one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) is free of fire damage. Train separation in the annulus is provided by three hour rated fire barriers or a combination of spatial separation and defense-in-depth fire protection features such as fire barriers, fire rated cable, fire detection, fire suppression, and administrative controls to prevent storage of transient combustibles in the annulus.~~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.~~ 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 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.

- Cable trays are constructed of metal. Only metallic tubing is used for conduits. Thin-wall metallic tubing is not used. Flexible metallic tubing is only used in short lengths. Electrical raceways are constructed in accordance with the guidelines specified in SRP 9.5.1 and RG 1.189. Electrical raceways are only used for cables. Safety-related cable trays located outside of containment are separated from redundant divisions and non-safety-related areas by three-hour, fire rated barriers. Cable trays containing safety-related cables located inside containment are enclosed in non-combustible steel or steel composite materials.

The U.S. EPR utilizes cables throughout the plant that have passed the flame propagation criteria of IEEE Std 1202. Self-ignition of these electrical cables is not considered credible because of the protective devices (e.g., fuses, circuit breakers) provided and analyzed to be properly sized. While these cables are still considered combustible, they will not propagate fire unless subjected to an external fire involving other combustibles in the vicinity of the cable trays. In this case, the fire stops would be of little, if any value in stopping the spread of fire. Fire stops would not stop the spread of fire in the area of influence of the exposure fire (i.e., area of the fire where temperatures are high enough to propagate fire along the cable trays) because they are only designed to prevent fire spread in the cable trays. Also, the IEEE Std 1202 qualified cables outside of the area of influence of the exposure fire would keep the fire from propagating and essentially serve the same purpose as the fire stops.

9.5 Other Auxiliary Systems

9.5.1 Fire Protection System

The purpose of the fire protection system (FPS) is to protect other plant systems and equipment which provide the capability to safely shut down the reactor, maintain it in a safe shutdown condition, control radioactive releases to the environment, and to prevent personnel injury and property damage in the event of a fire.

The FPS consists of design features, personnel, equipment, and procedures to provide defense-in-depth protection of public health and safety. The program is implemented during station operations by the prevention, detection, annunciation, confinement, and extinguishment of fire. Administrative controls, training, inspection, testing, and quality assurance (QA) provide reasonable assurance of the operability of the program.

The FPS, including administrative controls and the fire brigade, are implemented prior to receiving fuel on site for fuel storage areas and for the entire station prior to reactor startup.

9.5.1.1 Design Basis

The FPS is designed in accordance with:

- 10 CFR 50.48 - Fire Protection.
- 10 CFR Part 50, Appendix A, GDC 3 - Fire Protection.
- 10 CFR Part 50, Appendix A, GDC 5 - Sharing of Structures, Systems, and Components.
- 10 CFR Part 50, Appendix A, GDC 19 - Control Room.
- 10 CFR Part 50, Appendix A, GDC 23 - Protection System Failure Modes.
- 10 CFR Part 50, Appendix A, GDC 56 - Primary Containment Isolation.
- NUREG-0800, Standard Review Plan 9.5.1 - Fire Protection Program (Reference 37).
- RG 1.29 - Seismic Design Classification, Revision 4.
- RG 1.189 - Fire Protection for Nuclear Power Plants, Revision 1.

09.05.01-53

The FPS is designed to:

- Prevent fire initiation by controlling, separating, and limiting the quantities of combustibles and sources of ignition.

- Isolate combustible materials and limit the spread of fire by subdividing plant buildings into fire areas separated by fire barriers.

- Provide the capability to rapidly detect, control, and promptly extinguish fires that do occur.

- Provide protection for structures, systems, and components (SSC) important to safety so that a fire, not promptly extinguished, will not prevent the safe shutdown of the plant or result in the release of radioactive materials to the environment.

- Maintain one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) free of fire damage assuming all equipment in any one fire area will be rendered inoperable by fire, and post-fire re-entry for repairs or operator actions is not possible. Because of its physical configuration, the main control room (MCR) is excluded from this approach, but an independent alternative shutdown capability that is physically and electrically independent of the MCR is included in the design.

- Provide fire protection features for redundant shutdown systems in the Reactor Building (RB) that will make sure to the extent practicable that that one success path of SSC necessary to achieve safe shutdown conditions (i.e., cold shutdown) is free of fire damage.

- Separate redundant trains of safety-related equipment used to mitigate the consequences of a design basis accident (but not required for safe shutdown following a fire) ~~are separated~~ so that a fire within one train will not damage a redundant train.

- Prevent smoke, hot gases, or fire suppressant agents from migrating from one fire area to another to the extent they could adversely affect safe shutdown capabilities, including operator actions.

- Prevent failure or inadvertent operation of the FPS from impairing the safety capability of SSC important to safety.

- Preclude the loss of structural support, due to warping or distortion of building structural members caused by the heat from a fire, to the extent that such a failure could adversely affect safe shutdown capabilities.

- Provide floor drains sized to remove expected firefighting water flow without flooding safety-related equipment.

- Provide firefighting personnel access and life safety escape routes for each fire area.

- Provide emergency lighting and communications to facilitate safe shutdown following a fire.

- Limit the radiological release to any unrestricted area due to the direct effects of fire suppression activities (but not involving fuel damage) to as low as reasonably achievable and ~~does~~to not exceed applicable regulatory limits.

09.05.01-53

The FPS is classified as non-safety related. The fire protection containment isolation valves and associated piping are classified as safety-related and are subject to Seismic Category I design requirements per RG 1.29, Regulatory Position 1.o. The FPS portion of the containment isolation system meets the containment isolation requirements of GDC 56. The FPS water supply storage tanks, pumps, and portions of the distribution piping that provide fire protection flow to standpipes located in areas containing Seismic Category I equipment are subject to seismic design requirements per RG 1.29, Regulatory Position 2.

The portions of the FPS that provide containment isolation or water to the standpipes that protect those areas of the plant, containing Seismic Category I equipment used for safe plant shutdown, are required to remain functional during and following seismic events up to a safe shutdown earthquake. Other portions of the FPS are not required to remain functional following a plant accident or natural phenomena.

~~The FPS is classified as non-safety related. However, the fire protection containment isolation valves and associated piping are classified as safety related as well as special seismic design requirements that are applied to portions of the standpipe system, per RG 1.189 guidance, located in areas containing equipment required for safe shutdown following a safe shutdown earthquake (SSE), as defined in Section 3.0. Refer to Section 3.2 for the seismic and system quality group classification of fire protection. The FPS portion of the containment isolation system meets the containment isolation requirements of GDC 56.~~

~~The FPS, except for containment isolation and portions of the standpipe system, is not required to remain functional following a plant accident or natural phenomena.~~

The FPS is designed to perform the following functions:

- Detect fires and provide operator indication of the location.
- Provide the capability to extinguish fires in plant areas, to protect site personnel, limit fire damage, and protect safe shutdown capabilities.
- Supply fire suppression water at a flow and pressure sufficient to meet the largest hydraulic demand of any automatic sprinkler or water spray system with an additional 500 gpm for fire hose use, for a minimum of two hours.

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- Maintain 100 percent of fire pump design capacity, assuming failure of the largest fire pump or the loss of offsite power.
- Following an SSE, provide water to hose stations for manual firefighting in areas containing Seismic Category I plant safe shutdown equipment.

A COL applicant that references the U.S. EPR design certification will provide a description and simplified Fire Protection System piping and instrumentation diagrams for site-specific systems.

Plant Fire Prevention and Control Features

Plant Arrangement

In accordance with GDC 3, SSC important to safety must be designed and located to minimize the probability and effect of fires and explosions. The requirements of GDC 3 are met, in part, by compartmentation of the plant into separate fire areas. Specifically, based on the hazards and the need for physical separation of SSC important to safety, the plant is segregated into separate fire areas by passive, fire-rated structural barriers (i.e., walls, floors, and ceilings). In some instances, such as the RB, fire areas may be sub-divided into fire zones based on physical separation, location of plant equipment, or for fire hazard analysis purposes. These fire areas and zones serve the primary purpose of confining the effects of fires to a single compartment or area, thereby minimizing the potential for adverse effects from fires on redundant SSC important to safety. Each of the four divisions of systems in the Safeguard Buildings (SB), Essential Service Water Buildings, and Emergency Power Generating Buildings (EPGB) are separated by three hour rated structural fire barriers. Outside of the MCR and the RB, each of the four redundant trains of emergency core cooling is separated by three hour rated structural fire barriers.

The plant layout also provides adequate means of access to all plant areas ~~is provided~~ for manual fire suppression activities and to allow safe access and egress for personnel. The layout and travel distances of access and egress routes meet the intent of NFPA 101 (Reference 18) to the extent practicable. Potential delays in plant access or egress due to security locking systems are considered.

The MCR is designed to permit rapid detection and suppression of fires, including the sub-floor and ceiling spaces.

Architectural and Structural Features

Materials used in plant construction are non-combustible or heat resistant to the extent practicable in accordance with GDC 3. Walls, floors, roofs, including structural materials, suspended ceilings, thermal insulation, radiation shielding materials, soundproofing, and interior finishes are non-combustible or meet applicable qualification test acceptance criteria unless identified and suitably justified. ASTM E84 (Reference 29), NFPA 253 (Reference 22), and NFPA 703 (Reference 25) are considered when evaluating the qualification of interior surface and finish materials. Concealed spaces are devoid of combustibles unless identified and suitably justified.

protection use is depleted, means are provided to refill either tank within eight hours. Automated tank level indication is provided for both tanks to make sure that the capacity dedicated to fire protection use is available.

A COL applicant that references the U.S. EPR design certification will describe the program used to monitor and maintain an acceptable level of quality in the fire protection system freshwater storage tanks.

The portion of each tank dedicated to fire protection use is based on a 500 gpm outside hose stream allowance plus the largest hydraulic demand of any individual sprinkler system or fixed water spray (or deluge system) in accordance with NFPA 13 (Reference 2) or NFPA 15 (Reference 4).

Failure or rupture of one or both water storage tanks (when the FPS is in standby) will not significantly impair the safety capability of SSC important to safety.

The site fire pump arrangement meets the applicable portions of NFPA 20 (Reference 5). ~~Deviations from the requirements of this standard are identified and suitably justified.~~ Three 100 percent capacity fire pumps (i.e., one electric motor-driven and two diesel engine-driven) are provided. The capacity of each fire pump is adequate to supply a 500 gpm outside hose stream allowance and the largest flowrate required by any individual sprinkler or fixed water spray (or deluge system), with the hydraulically least demanding portion of the underground fire main yard loop assumed to be out of service. Individual fire pump connections to the underground fire main yard loop are provided, with sectionalizing valves between connections. An electric motor-driven jockey pump is provided to automatically maintain fire protection water supply system pressure independent of the fire pumps.

Alarm indication provided in the MCR includes, but is not limited to, these functions:

- Fire protection water storage tank low level.
- Fire pump running.
- Fire pump driver availability.
- Fire pump failure to start.
- Fire protection water supply system low pressure.

Each fire pump and its associated driver and controls are separated from each other and the plant by three hour fire-rated barriers. A separate fuel line and fuel oil storage tank is provided for each diesel engine-driven fire pump. Means other than sight tubes are provided for continuous indication of the amount of fuel oil in each storage tank. The floor around each fire pump and its associated driver and controls is pitched and adequate means for drainage are provided.

An underground fire main yard loop designed in accordance with NFPA 24 (Reference 7) is provided to furnish anticipated water requirements.

Control and sectionalizing valves are provided to isolate portions of the fire main yard loop for maintenance or repair without simultaneously shutting off the water supply to both fixed fire suppression systems, and standpipe and hose systems are provided for manual backup. Fixed fire suppression systems and standpipe and hose systems are connected to the main yard loop so that a single active failure or a pipe crack or break will not impair both primary and backup fire suppression capability.

Failure or rupture of any portion of the underground fire main yard loop will not significantly impair the safety capability of SSC important to safety.

Outside fire hydrants are provided approximately every 250 feet on the main yard loop. Additional hydrants are located near the entrances to the Essential Service Water Pump Building (ESWPB) and the Circulating Water Pump Building (CWPB). Valves are provided to permit isolation of outside hydrants from the fire main for maintenance or repair without interrupting the plant fire protection water supply capability. Hose houses equipped with fire hose and combination nozzle and other equipment specified by Reference 7 are provided at intervals not exceeding 1000 feet, or alternatively, mobile means are provided which contain fire hose and the associated equipment specified by NFPA 24 (Reference 7). Threads compatible with those used by local fire departments are used on fire hydrants hose couplings and standpipe system risers.

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The FPS piping headers, fed from each end, are provided inside plant buildings or groups of buildings to supply both fixed fire suppression systems and standpipe and hose systems. As such, the supply headers are considered as an extension of the fire main yard loop. ~~Where supply headers form part of the seismically analyzed standpipe and hose system, steel piping and fittings used meet the requirements of ASME B31.1 (Reference 32) to a point up to and including the first valve supplying fixed suppression systems.~~

The fire protection water supply system utilizes a three-ring header design as shown in ~~Figure 9.5.1-1—Fire Water Distribution System~~ Figure 9.5.1-1—Fire Water Distribution System.

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Failure or rupture of any portion of building supply headers will not significantly impair the safety capability of SSC important to safety.

See information on seismically qualified standpipe and hose systems in the "Manual Fire Suppression Systems" portion within this section for additional requirements on the fire water supply system.

are integrated into the clean agent system design. The toxicity of the clean agent, including potential corrosive characteristics or effects of thermal decomposition products was considered. Measures are provided to verify the agent quantity of the storage cylinders and containers.

Manual Fire Suppression Systems

Manual firefighting capability is provided throughout the plant to limit the extent of fire damage. Standpipe systems, hydrants and portable equipment consisting of hoses, nozzles, and extinguishers are provided for use by fire brigade personnel. Manual fire suppression systems and equipment are designed and installed in accordance with the guidance from SRP 9.5.1 (Reference 37), RG 1.189, and applicable NFPA standards. ~~Significant deviations from the requirements of these standards are justified as part of the fire protection analysis.~~

Interior manual hose installations are provided so that each plant location that contains, or could present a fire exposure hazard to, equipment important to safety can be reached with at least one effective hose stream. For all plant power block buildings on all floors, Class III standpipe systems, designed and installed in accordance with NFPA 14 (Reference 3) are provided with hose connections equipped with a maximum of 100 feet of 1.5 inch diameter woven-jacket, lined fire hose, and suitable nozzles. Hose stations are located to facilitate access and use for firefighting operations. Alternative hose stations are provided if a fire hazard could block access to a single hose station serving a plant area.

Supply water distribution capability is provided for reasonable assurance of an adequate water flowrate and nozzle pressure for all hose stations. Hose station 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).

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Standpipe and hose systems in areas containing equipment required for safe plant shutdown following an SSE are designed to be functional following an SSE and capable of providing flow to at least two hose stations (approximately 75 gpm per hose stream). The standpipe and hose stations in these areas, the water supply and distribution

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piping, and the supports and valves, as a minimum, satisfy ASME B31.1 (Reference 32). This is accomplished by manually realigning valves to isolate non-seismically qualified portions of the FPS from the seismic portions of the system and manually starting the diesel fire pumps.

To comply with this requirement, portions of the fire protection water supply and water distribution system are designed to satisfy, as a minimum, the requirements of ASME B31.1 as follows:

- The two fire water storage tanks (Part of USG) and their associated piping, supports and valves are designed to remain functional following an SSE.
- The fire pump house (Part of USG) is designed to satisfy the requirements of a seismically qualified structure.
- The two diesel fire pumps and associated pipe, supports and valves are designed to remain functional following an SSE. This includes the diesel day tanks (fuel supply) for each pump and associated piping, valves and supports and the diesel fire pump batteries for each pump which are located in the fire pump house. The diesel pumps are design to be started manually following an SSE utilizing the pump batteries. Isolation valves which isolate the diesel fire pumps from the motor driven fire pump are designed to remain functional so that the cross connections to the motor driven pump can be manually closed after an SSE.
- The portion of the underground fire main which supplies fire protection water to the seismically qualified standpipe and hose system is designed to remain functional following an SSE. Isolation valves between seismically qualified portions of the underground fire main and non-seismically qualified portions must remain functional following an SSE so that they can be manually closed.
- The portion of the inside fire water distribution system which supplies fire protection water to the seismically qualified standpipe and hose system is designed to remain functional following an SSE. Isolation valves between seismically qualified portions of the inside fire water distribution system and non-seismically qualified portions must remain functional following an SSE so that they can be manually closed.

~~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.