Response to

Request for Additional Information No. 84

10/27/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.02 - New and Spent Fuel Storage
SRP Section: 09.03.01 - Compressed Air System
Application Section: Ch 9
SBPA Branch

Question 09.01.02-1:

The applicant has not identified the maximum capacity or provided details of the design of the new fuel storage facility. The new fuel storage facility (NFSF) needs to provide storage for new fuel assemblies in accordance with the design basis. The staff requests the applicant to provide and include in the FSAR the design basis for the new fuel storage facility and identify the maximum number of new fuel assemblies that can be stored.

Response to Question 09.01.02-1:

A response to this question will be provided by February 13, 2009.

Question 09.01.02-2:

The applicant stated that the spent fuel storage facility (SFSF) provides storage for a minimum of 1020 spent fuel assemblies stored in the spent fuel pool (SFP). In accordance with SRP Section 9.1.2, the applicant is requested to include in the FSAR the design basis of the spent fuel storage facility, including the number of fuel assemblies to be offload into the SFP from the core during a typical refueling outage and the number of refueling cycles the SFP is designed to accommodate.

Response to Question 09.01.02-2:

A response to this question will be provided by February 13, 2009.

Question 09.01.02-3:

SRP Section 9.1.2 recommends that low-density storage should be used, at a minimum, for the most recently discharged fuel to enhance the capability to cool it. If low-density storage is not used, the use high-density storage racks needs to be evaluated on a case by case basis. The staff determined that the applicant has not specified in the FSAR what are the density requirements for fuel racks. The applicant is requested to identify and include in the FSAR the density requirements for spent fuel storage and, if applicable, to provide justification.

Response to Question 09.01.02-3:

A response to this question will be provided by February 13, 2009.

Question 09.01.02-4:

Regulatory Guide (RG) 1.13, Regulatory Postion C.1 specifies that all structures and equipment necessary to maintain minimum water levels necessary for radiation shielding, should be designed to Seismic Category I requirements. RG 1.29 also includes the recommendation to design SSCs that need to remain functional following a design basis seismic event (SSE) to Seismic Category I criteria. The spent fuel pool is identified as being designed to Seismic Category 1 criteria. The spent fuel pool includes a stainless steel liner that is provided with leak detection channels in the concrete along the weld seams. The applicant is requested to identify and include in the FSAR the seismic design basis for the spent fuel pool stainless steel liner. In accordance with SRP Section 9.1.2, the following issues need to be discussed by the applicant in the FSAR if the spent fuel pool liner plate is not designed and constructed to seismic Category I requirements:

Confirm that the failure of the liner plate as a result of an SSE will not cause any of the following:

i. Significant releases of radioactivity due to mechanical damage to the fuel.

ii. Significant loss of water from the pool which could uncover the fuel and

iii. lead to release of radioactivity due to heat-up.

iv. Loss of ability to cool the fuel due to flow blockage caused by a complete

v. section or portion of the liner plate falling on the fuel racks.

vi. Damage to safety-related equipment as a result of pool leakage.

vii. Uncontrolled release of significant quantities or radioactive fluids to the environs.

Response to Question 09.01.02-4:

The spent fuel pool stainless steel liner is an integral part of the spent fuel pool structure and is therefore designed as Seismic Category I.

U.S. EPR FSAR Tier 2, Section 9.1.2.2.2, 5th paragraph, 2nd sentence will be revised to read:

> "The concrete structures for the SFP, SFP liner and fuel transfer canal are designed in accordance with the criteria for Seismic Category I structures contained in Section 3.7 and Section 3.8."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.1.2.2.2 will be revised as described in the response and indicated on the enclosed markup.

Question 09.01.02-5:

RG 1.13, Regulatory Position C.3 states that the Spent Fuel Storage Facility should be designed to protect the spent fuel from low-trajectory turbine missiles (i.e. turbine blades ejected from the turbine casing directly toward an essential system) and the storage pool should be designed to retain watertight integrity if struck by such missiles. The FSAR does not specifically address the New Fuel Storage Facility and the SFSF protection from internally generated missiles. It is not clear to the staff that the applicant has properly address the protection of essential systems from turbine blade missiles, as recommended in RG 1.115, "Protection Against Low-Trajectory Turbine Missiles." The staff requests the applicant to discuss in the FSAR how the design of the NFSF and the SFSF address the recommendations of RG 1.115 Regulatory Position C.3.

Response to Question 09.01.02-5:

U.S. EPR FSAR Tier 2, Section 9.1.2 states in the second sentence that the New Fuel Storage Facility (NFSF) and Spent Fuel Storage Facility (SFSF) are both located within the reinforced concrete structure of the Fuel Building. In addition, U.S. EPR FSAR Tier 2, Figure 9.1.2-1 depicts the representative layout of the new fuel and spent fuel storage locations in the Fuel Building.

The Fuel Building along with all safety-related structures, systems and components (SSCs) on the Nuclear Island common basemat are located outside the low-trajectory hazard zone defined by RG 1.115 as stated in U.S. EPR FSAR Tier 2, Section 3.5.1.3. Therefore, all SSCs inside the Fuel Building, including the NFSF and the SFSF, meet Regulatory Position C.3 of RG 1.13.

FSAR Impact:

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

Question 09.01.02-6:

The applicant stated that non-safety-related equipment or structures not designed to Seismic Category I criteria that are located in the vicinity of the NFSF and SFSF are evaluated to confirm that their failure could not cause an increase in the k_{eff} value beyond the maximum allowable. The staff determined that a statement establishing this condition as a design criterion is acceptable at the Design Certification review stage. However, this statement indicates that the evaluation is a site specific requirement of the final design and, as such, the staff considers that this should be included as a COL information item in the FSAR. The applicant is requested to justify that a new COL information item not listed in the FSAR, to confirm that the failure of non-safety related equipment or structures not designed to Seismic Category I criteria, could not cause an increase in the K_{eff} value beyond the maximum allowable.

Response to Question 09.01.02-6:

A response to this question will be provided by January 21, 2009.

Question 09.01.02-7:

The applicant stated that new and spent fuel storage racks will be designed so that it is impossible to insert or jam a fuel assembly between two adjacent storage positions, or between the rack and the wall. The new and spent fuel storage rack design prevents inserting more than one fuel assembly into a single storage cell. The applicant is requested to include these design features of the storage racks in COL Information Items 9.1.3 and 9.1.4.

Response to Question 09.01.02-7:

A response to this question will be provided by January 21, 2009.

Question 09.01.02-8:

The applicant stated that a drainage system is provided to prevent accumulation of water or other moderation media in the NFSF. Flood prevention in the NFSF is needed to prevent submerging fuel in an unintentional moderator which may lead to an unintentional criticality. The floor drainage systems described in FSAR Tier 2, Section 9.3.3 did not contain details of the NFSF system. The applicant is requested to include in the FSAR the design basis for the drainage system credited to prevent submerging the stored fuel, including the sizing requirements, periodic testing, and back-flow protection.

Response to Question 09.01.02-8:

The New Fuel Storage Facility (NFSF) does not rely on the floor drainage system described in U.S. EPR FSAR Tier 2, Section 9.3.3 to prevent accumulation of water or other moderation media. The NFSF has thresholds at the entry doors to prevent flooding into the rooms. The floor on the same level as the NFSF entry doors (+49 ft) has a nearby equipment opening that will direct water to a lower level (+36 ft). At the roof level (+64 ft) of the NFSF, curbs are placed around the hatch covers to direct water/fluid away from the opening.

Floor drains from the nuclear island drain/vent system are located in the NFSF, but they are not credited for flood prevention; therefore, they are not subject to sizing requirements and periodic testing.

U.S. EPR FSAR Tier 2, Section 3.4.3.5 will be revised to clarify the existing flood protection design features for the NFSF.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 3.4.3.5 and 9.1.2.2.1 will be revised as described in the response and indicated on the enclosed markup.

Question 09.01.02-9:

The applicant stated that additional testing requirements for new fuel racks are the responsibility of the COL applicant. The testing requirements for the new fuel racks are site specific and, as such, should be included as a COL information item. The staff requests the applicant to justify the exclusion of a new COL information item in the FSAR that confirms testing requirements for new fuel racks are established.

Response to Question 09.01.02-9:

A response to this question will be provided by January 21, 2009.

Question 09.01.02-10:

The applicant stated that access to the SFSF is provided for periodic inspection as shown in Figures 3.8.4-5 through 3.8.4-13. However, these figures are Figures 3.8-42 through 3.8-46 and Figures 3.8-50 through 3.8-52.

The staff requests the applicant to update the FSAR to correct this editorial error.

Response to Question 09.01.02-10:

The reference to these figures has been corrected in U.S. EPR FSAR Tier 2, Section 9.1.2.3 (Item 4) to state that:

> "Access to the SFSF is provided for periodic inspection as shown in Figures 3.8-42 through 3.8-46 and Figures 3.8-50 through 3.8-52."

In addition, a correction has been made to similar figure cross-references in the SFSF description in U.S. EPR FSAR Tier 2, Section 9.1.2.2.2 as follows:

> "Figures 3.8-42 through 3.8-46 and Figures 3.8-50 through 3.8-52 show the spent fuel pool and other related fuel handling areas."

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 9.1.2.2.2 and 9.1.2.3 will be revised as described in the response and indicated on the enclosed markup.

Question 09.01.02-11:

The staff reviewed the applicant's submittal and determined that the applicant has not specified the elevation of the top of the stored spent fuel. The applicant is requested to provide the elevation of the top of the stored spent fuel and to confirm that the spent fuel storage rack maximum height limitation is included in the FSAR in COL Information Item 9.1.4.

Response to Question 09.01.02-11:

A response to this question will be provided by February 13, 2009.

Question 09.01.02-12:

The applicant has stated that the bottom of the loading pit gate is at elevation 10.9 meters (35'-9"). SRP Section 9.1.2 (iii).2.H.(i) states that the bottoms of any gates should be above the top of the fuel assemblies. The applicant has not provided the elevation of the stored spent fuel; therefore, the staff can not determine that the design of the gates are in accordance with SRP Section 9.1.2.

The staff requests the applicant to specify in the FSAR that the bottoms of the gates are above the top of the fuel assemblies and to include in the ITACC for the SFSF verification that the elevation of the bottom of the loading pit gate are as shown in FSAR Tier 2, Figure 3.8-52.

Response to Question 09.01.02-12:

A response to this question will be provided by February 13, 2009.

Question 09.01.02-13:

The cask loading pit area is normally dry and is filled with approximately 109,776 liters (29,000 gallons) of water during the spent fuel removal and cask loading process. The cask loading pit area is connected to the SFP through the loading pit gates. The loading pit gates are not Seismic Category I components; therefore, they are assumed to fail on a seismic event. The applicant has not addressed the impact on a gate failure on the SFP water inventory. The applicant is requested to determine the reduction in SFP water level if leakage into the adjacent fuel-handling areas were to occur and to confirm that the leakage into these areas would not reduce the SFP coolant inventory to less than 3 meters (10 feet) above the top of the stored fuel assemblies. This information needs to be reflected in the FSAR.

Response to Question 09.01.02-13:

The seismic induced failure of both gates separating the spent fuel pool and transfer compartment and both gates between the spent fuel pool (SFP) and the cask loading pit results in leakage between the three Fuel Building pool compartments until an equilibrium level is reached. Approximately 29,000 gallons of water is maintained in the transfer compartment or the cask loading pit. The equilibrium level of the three pool compartments is 57.2 feet, which is about 24 feet above the active fuel stored in the SFP, and is over two feet above the top of the fuel pool cooling pump suction pipes.

FSAR Impact:

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

Question 09.01.02-15:

The Seismic Category I design and anti-siphon design features prevent inadvertent draining of the SFP to assure that adequate water is available above the active fuel as recommended by SRP Section 9.1.2 (iii).2.H.(ii). However, the demineralized water distribution system (GHC) piping as shown on FSAR Tier 2, Figures 9.1.3.1 is not provided with an anti-siphon device or qualified to Seismic Category Category I criteria. Justify in the FSAR the exclusion of anti-siphon devices and/or qualified to Seismic Category 1 design for the the demineralized water distribution system (GHC) piping.

Response to Question 09.01.02-15:

The demineralized water distribution system pipe will extend to just below the spent fuel pool water surface; therefore, siphoning is not a concern.

FSAR Impact:

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

Question 09.01.02-16:

The applicant has stated that initial spent fuel pool liner testing and liner leakage monitoring is described in FSAR Tier 2, Section 9.3.3. A review of Section 9.3.3 did not find a reference to the SFP liner leak chase system. Provide in the FSAR a description of the initial testing and subsequent liner leakage monitoring requirements.

Response to Question 09.01.02-16:

This question is very similar to RAI 86, Question 09.01.02-20. A response for Items 1 and 2 of RAI 86, Question 09.01.02-20 will be provided by January 21, 2009. Because Question 09.01.02-16 is a similar request to describe the spent fuel pool liner leakage monitoring requirements, in addition to providing information concerning the initial spent fuel pool liner testing, a response will be provided by January 21, 2009.

Question 09.01.02-17:

The applicant has stated in FSAR Tier 2, Section 3.1.6.3, that in compliance with GDC 62, preventing criticality in the new and spent fuel storage areas is accomplished by physical separation of fuel assemblies, the use of borated water and borated neutron absorber panels in the fuel storage pool. However, the applicant has also stated in FSAR Tier 2, Section 9.1.2.2.2, that borated demineralized reactor makeup water is used to fill and to supplement water inventory in the SFP but boration is not essential for maintaining the subcriticality of the stored fuel assemblies. Clarify in the FSAR the U.S EPR design requirements for borated water in the SFP.

Response to Question 09.01.02-17:

A response to this question will be provided by February 13, 2009.

Question 09.01.02-18:

The applicant stated that specific testing requirements for the spent fuel racks are the responsibility of the COL applicant. The testing requirements for the spent fuel racks are site specific and, as such, should be included as a COL information item. Justify the exclusion of a new COL information item in the FSAR to confirm that testing requirements for the spent fuel racks are established.

Response to Question 09.01.02-18:

A response to this question will be provided by January 21, 2009.

Question 09.03.01-1:

Generic Issue 43, “Reliability of Air Systems,” ensures the reliability of safety-related equipment actuated or controlled by compressed air. An air system designed to air quality requirements of ANSI/ISA S7.3-R1981 help ensure that the CAS and connected components will perform their safety-function. Additionally, since the system has the capability to cross connect the instrument air and service air portion of the system, Generic Issue 43 stresses the importance of all system components meeting the same air quality requirements. Discuss in the FSAR the specifications of the major components of the compressed air system that ensure that the CAS and connected components will perform their safety function.

Response to Question 09.03.01-1:

The CAS is not required for any safety function. The CAS does not supply air operators on safety-related valves to perform their safety-related function. The CAS maintains the reliability of safety-related equipment by meeting the following requirements.

The U.S. EPR instrument air is designed to meet ANSI/ISA 7.0.01-1996 to maintain instrument air quality at a level such that the compressed air system (CAS) and connected components satisfactorily perform their safety-function.

The air quality is met by cross connecting the instrument and service air. The service air line is connected upstream of the instrument air dryers and filters (refer to U.S. EPR FSAR Tier 2, Figure 9.3.1-1—Compressed Air Generation System) to maintain acceptable air quality. The air undergoes the same treatment so that it meets the applicable instrument air quality standards.

The CAS contains two 100% compressors that maintain instrument air reliability. The CAS does not adversely impact the performance of safety related components as a result of adherence to ANSI/ISA 7.0.01-1996.

U.S. EPR FSAR Tier 2, Section 9.3.1 will be revised to include the above information.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.3.1 will be revised as described in the response and indicated on the enclosed FSAR markup.

Question 09.03.01-2:

Resolution of Generic Issue 43, “Reliability of Air Systems” stresses the importance of procedures, training and testing related to loss of air system pressure. The applicant has not provided any method to implement the procedures and training addressed by Generic Issue 43. Create a new COL Information Item in the FSAR regarding procedures, training and testing, and provide a schedule as to when these procedures, training and testing will be implemented.

Response to Question 09.03.01-2:

As noted in the response to Question 09.03.01-1, the U.S. EPR instrument air system is designed to meet the criteria specified in ANSI/ISA 7.0.01-1996 to maintain instrument air quality at a level that provides assurance that the compressed air system (CAS) does not adversely impact the performance of safety-related components. Safety-related valves in the U.S. EPR design do not rely on an air supply to perform their safety-related function. To maintain instrument air reliability, the CAS contains two 100% compressors.

Generic Issue 43 states concerns about the reliability of safety-related equipment actuated or controlled by compressed air. The CAS is not required for the performance of any safety function. Therefore, a COL information item concerning the procedures, training and testing addressed by Generic Issue 43 is not necessary.

FSAR Impact:

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

Question 09.03.01-3:

To address Generic Issue 43 regarding reliability of safety-related equipment actuated or controlled by compressed air, the applicant states in FSAR Tier 2, Section 9.3.1.3 that the U.S. EPR does not use air operators on safety-related valves, except for the non-safety function of opening normally-closed containment ventilation dampers. However, the staff identified that the component cooling water system piping and instrumentation diagram (P&ID) (FSAR Tier 2 Figures 9.2.2-1 through 9.2.2-3) shows multiple safety-related, Seismic Category I air operated valves. Update the FSAR to justify and reconcile the conflicting information regarding the use of air operators on safety-related valves throughout the plant.

Response to Question 09.03.01-3:

The compressed air system (CAS) does not supply air operators on safety-related valves to perform their safety-related function. The CAS does supply air to safety-related containment ventilation dampers, which are normally closed. Air is required to perform the non-safety function of opening these dampers.

The valves that were identified in the piping and instrumentation diagrams (P&IDs) in U.S. EPR FSAR Tier 2, Figure 9.2.2-1, Figure 9.2.2-2, and Figure 9.2.2-3 of the component cooling water system are hydraulic operated valves and are not air operated.

The hydraulic valves in U.S. EPR FSAR Tier 2, Figure 9.2.2-1, Figure 9.2.2-2, and Figure 9.2.2-3 are described in U.S. EPR FSAR Tier 2, Section 9.2.2. Specifically, these are described in the eighteenth paragraph in Section in 9.2.2.2.1 and the first paragraph under “Common Header Switchover Valves” in Section 9.2.2.2.2.

FSAR Impact:

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

Question 09.03.01-4:

The applicant provided the seismic design classification for the compressed air system in FSAR Tier 2, Table 3.2.2-1, which shows that the containment isolation valves are the only safety-related components in the compressed air system. The remaining components are classified as non-safety, quality group E and non-seismic. FSAR Tier 2, Section 9.3.1.2.2 states that the compressed air system supplies the opening function of the containment ventilation dampers for the containment building ventilation system (CBVS), a non-safety related function. FSAR Tier 2, Figure 9.4.7-2 shows the CBVS ventilation dampers are safety-related and Seismic Category I. Connecting non-seismic piping to the Seismic Category I dampers may subject the dampers to damage in the event of a seismic event. Provide in the FSAR a justification that demonstrates that a failure of the non-seismic instrument air piping connected to Seismic Category I SSCs will not cause a failure of the Seismic Category I SSCs; therefore, complying with Regulatory Position C.2.

Response to Question 09.03.01-4:

A response to this question will be provided by January 21, 2009.

Question 09.03.01-5:

The staff's review of FSAR Tier 2 Table 3.2.2-1 shows that the non-seismic compressed air system piping is routed in areas with safety-related and Seismic Category I and II components. It's not clear to the staff that the applicant has evaluated the impact of the failure of non-seismic Category I SSCs on the Seismic Category I SSCs. Provide an evaluation of the impact of the failure of non-seismic Category I SSCs on the Seismic Category I SSCs.

Response to Question 09.03.01-5:

A response to this question will be provided by January 21, 2009.

U.S. EPR Final Safety Analysis Report Markups

Excessive water losses from the fuel pool are avoided by locating piping connections near the top of the fuel pool and by the use of siphon breakers. Any released water is directed within the affected division to the lower building levels where it is distributed between the affected FB and the connected SB (i.e., FB-1 and SB or FB-2 and SB-4). If one fuel pool cooling train is lost because of flooding from a leak in its piping, the train located in the other division is still available.

The bounding flooding source is a postulated break in the main piping of the fire water distribution system. The main fire water distribution system ring header is located in the interconnecting passageway between the FB and SBs. In order to avoid water ingress into the adjacent division, a combination of watertight doors and openings for water flow to the lower building levels are provided. Existing openings are considered as water flow paths when available. The volume of released water is based on an assumed full break in the piping, a flow rate limited by the maximum pump capacity, and an operator action time of thirty minutes to isolate the system after receiving the first alarm in the MCR. Based on the available free volume of the building levels in each division, the water can be stored within the affected division. The FB floor drain sump level measurement instrumentation includes an alarm signaling a flooding event.

The loading pit and transfer pit located above elevation +0 feet are designed with features that minimize their potential as flooding sources in the FB. A retention pit is provided for the loading pit that is capable of storing the contents of the loading pit. Leakage through the docking flange is not postulated because it is equipped with a double bellows with permanent intermediate suction. Potential leaks in the drain line of the loading pit are directed to the retention pit. The leak is isolated from the fuel pool by closing a revolving isolation gate between the loading pit and fuel pool, which is equipped with double seals and intermediate suction. Water released from postulated leaks in the drain line of the transfer pit is directed to the opposite side of the FB by features such as thresholds and overflow cross sections. The leak is isolated from the fuel pool by closing the revolving isolation gate and from the pools inside containment by closing the manual isolation valve of the transfer tube. Leaks can be detected visually by the personnel who perform the fuel transfer and also automatically by fuel pool level measurement.

Large flooding events can lead to loss of one FB division. A large flooding event in FB2 that leads to flooding of the EBS pumps in this division does not defeat the boration function because of the availability of the extra boration train in the other division. In case of a postulated single failure or maintenance on the available extra boration train, boration can still be performed by opening the pressurizer valve and injecting with the medium head safety injection pumps.

09.01.02-8

~~The new fuel stores in FB-1 and FB-2 are protected from flooding using a threshold and means to drain water away from the rooms.~~The New Fuel Storage Facility (NFSF) is protected from flooding by door thresholds and the nearby equipment opening in

09.01.02-8

the floor outside the NFSF which drains away any released water in the vicinity of the NFSF. Water is also prevented from entering the NFSF from above by hatch covers and curbing. The water released during manual fire fighting by hose streams is enveloped by the higher flow rates and released water from postulated pipe breaks. Individual extinguishing areas are limited to one safety fire zone (i.e., FB-1 or FB-2); therefore manual fire fighting will be performed from one safety fire zone. Divisional separation for flooding exists for assumed manual fire fighting by hose streams.

3.4.3.6 Nuclear Auxiliary Building Flooding Analysis

There are no safety-related structures, systems or components that must be protected from flooding in the Nuclear Auxiliary Building (NAB). Physical separation exists below elevation +0 feet between the NAB and the FB and between the NAB and SB-4. The building arrangement directs released water from potential internal flood sources to the lowest level of the NAB. Water flows to the lower levels via the building drain system, stairways, and additional drain openings without passing to the FB or SB-4.

Water carrying systems with respect to internal flooding include the fuel pool purification system, steam generator blowdown system, fire water distribution system, CCWS, and the SCWS. Tanks with the highest flooding potential are located below elevation +0 feet.

3.4.3.7 Radioactive Waste Building Flooding Analysis

There are no safety-related structures, systems or components that must be protected from flooding in the Radioactive Waste Building (RWB). The RWB is connected to the NAB below elevation +0 feet. The arrangement of the RWB directs water released from potential sources of internal flooding to the lower levels of the RWB, where it is stored.

3.4.3.8 Emergency Power Generating Buildings Flooding Analysis

The Emergency Power Generating Buildings (EPGBs) house the emergency diesel generators. The station blackout diesels and associated generators are located in the switchgear buildings, which are adjacent to the EPGBs.

The flooding analysis considers postulated pipe breaks in the water-carrying systems located within the EPGBs. Based on the maximum volume of released water, the divisional separation wall between the EPGBs, which includes piping and cable penetrations, is designed as a flood barrier up to the maximum flood level. The penetrations between the EPGBs are watertight.

The level measurements in the building sumps provide leak detection. The water released during fire fighting within one EPGB is enveloped by the higher flow rates and released water volumes in the postulated pipe failures.

- A leak chase and collection system is provided for the detection of leaks in the spent fuel pool liner plate (see Section 9.3.3 for details).

9.1.2.2 Facilities Description

9.1.2.2.1 New Fuel Storage

The NFSF is enclosed by the reinforced concrete structure of the Fuel Building. New fuel storage racks are located in the new fuel dry storage area inside the Fuel Building. These racks are designed to provide vertical storage of new fuel assemblies, either with or without rod cluster control assemblies. The design of the new fuel storage racks are the responsibility of the COL applicant. A COL applicant that references the U.S. EPR design certification will describe the new fuel storage racks, including a description of confirmatory structural dynamic and stress analyses. The racks must be shown to meet Seismic Category I requirements.

The new fuel storage rack location is shown in Figure 9.1.2-1—New Fuel and Spent Fuel Storage Rack Representative Layout. These representative new fuel storage racks provide support for the fuel assemblies and incorporate guide funnels at the top to facilitate insertion of the new fuel assemblies. Figure 9.1.2-2—Typical New and Spent Fuel Storage Rack Cross-Sections, provides a typical sketch of the new and spent fuel storage racks. Fuel assemblies are handled using the auxiliary crane equipped with the new fuel handling tool, as detailed further in Section 9.1.4.

09.01.02-8

A drainage system isBuilding features such as door thresholds, curbs, and floor openings are provided to prevent accumulationentry of water or other moderation media into the NFSF.

Refer to Section 3.2 for the seismic and system quality group classification of the new fuel racks. Non-safety-related equipment or structures not designed to Seismic Category I criteria that are located in the vicinity of the NFSF are evaluated to confirm that their failure could not cause an increase in the k_{eff} value beyond the maximum allowable.

9.1.2.2.2 Spent Fuel Storage

The spent fuel pool provides storage space for irradiated fuel assemblies, including the capability for a full core offload from the reactor. The pool is a reinforced concrete structure (refer to Section 3.8.4) with a stainless steel liner having a normal water volume of approximately 375,000 gallons and a depth of 40 feet (23 feet above the tops of the stored fuel assemblies). Borated water is used in the spent fuel pool and is maintained at 1700 ppm. The concentration required for sub-criticality for spent fuel is approximately 1334 ppm (nominal enriched boron at ≥37 percent B-10). Borated water is used in the spent fuel pool, with a nominal enriched boron (≥37 percent B-10) concentration of 1334 ppm. Figures 3.8.4-5Figure 3.8-42 through 3.8.4-8Figure 3.8-46

09.01.02-10

and Figures 3.8.4-13Figure 3.8-50 through 3.8.4-15Figure 3.8-52 show the spent fuel pool and other related fuel handling areas. Fresh unirradiated fuel assemblies are either stored in the NFSF or in the fuel storage pool (or both). Unirradiated rod control clusters and thimble plug assemblies are normally stored in the fuel assemblies in the SFP.

09.01.02-10

The underwater fuel storage racks are located in the spent fuel storage pool inside the Fuel Building. The design of the spent fuel storage racks are the responsibility of the COL applicant. A COL applicant that references the U.S. EPR design certification will describe the spent fuel storage racks, including a description of confirmatory structural dynamic and stress analyses and thermal-hydraulic cooling analyses. The racks must be shown to meet Seismic Category I requirements. Spent fuel rack materials will be compatible with the pool storage environment. Rack structural materials must be corrosion-resistant and compatible with the expected water chemistry of the SFP.

Figure 9.1.2-1 shows the spent fuel rack storage location within the spent fuel pool.

Figure 9.1.2-2 provides a typical sketch of the new and spent fuel storage racks. The rack modules will be designed as cellular structures so that each storage cell has a square opening with conforming lateral support and a flat horizontal bearing surface. Each storage cell will have a hole in or near the bottom and a rectangular opening on the top of the cell to allow cooling water to flow through the storage cell. To provide reasonable assurance that no fuel can be damaged, each storage cell will be designed to prevent any portion of a fuel assembly or core component from extending above the top of the rack. The spent fuel storage racks will also be designed to withstand the impact resulting from a falling fuel assembly under normal loading and unloading conditions and will be designed to meet Seismic Category I requirements.

09.01.02-4

The design of the SFP is such that inadvertent draining of water from the pool is prevented (see Section 9.1.3). The concrete structures for the SFP, SFP liner, and fuel transfer canal are designed in accordance with the criteria for Seismic Category I structures contained in Section 3.7 and Section 3.8. As such, they are designed to maintain leak-tight integrity to prevent the loss of cooling water from the pool. In addition, all piping penetrations into the pool are designed to preclude draining the pool down to an unacceptable limit, as described in Section 9.1.3.

Borated demineralized reactor makeup water is used to fill and to supplement water inventory in the spent fuel pool, but boration is not essential for maintaining the subcriticality of the stored fuel assemblies.

Adjacent to the SFP is a separate spent fuel cask loading pit. This pit is used when the spent fuel is to be shipped offsite. The pit area is only filled with water during spent fuel removal procedures. A gate separates the cask loading pit from the SFP, and is opened only for cask loading operations.

and show that the NFSF and SFSF can perform their intended function following postulated internal hazards.

3. The NFSF and SFSF are capable of storing the required number of fuel assemblies, in accordance with the design basis. Structures, systems and components (~~SSCs~~SSC) are not shared with other units.

4. The NFSF does not require any shielding and is accessible for periodic inspections. Access to the SFSF is provided for periodic inspection as shown in ~~Figures 3.8.4-5 through 3.8.4-13~~Figure 3.8-42 through Figure 3.8-46 and Figure 3.8-50 through Figure 3.8-52.

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5. A minimum of 23 feet of water above the tops of the spent fuel pool assemblies in the spent fuel racks provides sufficient shielding to limit radiation doses to personnel in the spent fuel pool area to minimal values in keeping with the ALARA approach described in Section 12.1.

6. Containment and confinement are provided in the SFSF by the spent fuel pool liner and by the ventilation system for the Fuel Building (see Section 9.4.2). The joint welds ~~are provided with a leak chase system~~that require ~~for~~ initial testing and subsequent monitoring of weld integrity will be provided with a leak chase system. A monitoring system is provided for the leak chase system~~, as described in Section 9.3.3~~. Any water collected is directed to the floor and equipment drain system and transferred to the liquid radwaste system for processing. Filtering of the spent fuel pool water is provided by the FPCPS (see Section 9.1.3). For the NFSF, appropriate confinement of the new fuel assemblies is provided by the new fuel storage racks located inside the concrete structure of the new fuel vault.

7. The FPCPS maintains the spent fuel pool water temperature and water level within prescribed limits by removing decay heat generated by the stored spent fuel assemblies (see Section 9.1.3).

8. As described in Section 9.1.4.5 for the fuel handling system (FHS), instrumentation, and electrical and mechanical interlocks are provided to prevent movement of loads over the spent fuel.

9. Instrumentation is provided to monitor the pool water level and water temperature (see Section 9.1.3) to provide indication of the loss of decay heat removal and to warn personnel of potentially unsafe conditions. In addition, area radiation monitors are provided near the SFP which will provide a distinct audible and visual alarm to alert personnel in the vicinity of the need to take appropriate action. Refer to Section 12.3.4 for further details on the area radiation monitors.

10. Stresses in the fully loaded new fuel and spent fuel racks must not exceed stresses specified by ASME Code, Section III, Division I, Part NF, as well as guidance given in RG 1.124. The racks will be designed to withstand the maximum uplift force of the auxiliary crane.

11. The spent fuel is stored within a stainless steel lined concrete pool which has no penetrations that can result in an unacceptable loss of water. As described in

9.3 Process Auxiliaries

9.3.1 Compressed Air System

The compressed air system (CAS) consists of compressors, dryers, filters, receivers and other equipment required for performing its non-safety-related functions.

9.3.1.1 Design Bases

The CAS provides compressed air for the following services:

- Instrument air for non-safety-related valves and other equipment located in the Conventional Island (CI).
- Instrument air for opening the containment ventilation purge dampers.
- Instrument air to valves, pumps and other equipment located in the radioactive waste, decontamination, blowdown demineralization, fuel handling and other systems for non-safety-related functions.
- Service air throughout the plant (for using air-operated tools and purging tanks).

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The containment isolation features for the containment penetrations in the CAS are described in Section 6.2.4.

There are no air-operated valves (AOV) or air-operated equipment required to function in response to an accident where the compressed air is provided by the CAS.

The design of the CAS is in compliance with the resolution of NUREG-0933, Generic Safety Issue 43, Reliability of Air Systems (Reference 1).

The CAS is designed for a single unit and is not shared with other units.

Instrument air is designed to meet ANSI/ISA 7.0.01-1996 (Reference 3).

9.3.1.2 System Description

9.3.1.2.1 General Description

The CAS consists of a compressed air generation system and a compressed air distribution system. The compressed air generation system is located entirely in the Turbine Building (TB). It supplies compressed air to the compressed air distribution systems in the Nuclear Island (NI) and CI. The location of the compressed air generation system in the TB minimizes the likelihood of leakage from radioactive systems being ingested into the CAS.

Figure 9.3.1-1—Compressed Air Generation System, shows a schematic diagram of the compressed air generation system while Figure 9.3.1-2—Compressed Air Distribution

System, shows a schematic diagram of the NI and CI compressed air distribution system.

Component Description

Table 3.2.2-1 provides the quality group and seismic design classification of components and equipment in the CAS. The containment isolation valves (CIV) and penetrations are the only safety-related components in the CAS.

Instrument Air

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Two 100 percent oil-free rotary screw compressors are provided. They are connected for parallel operation and provide clean, dry, oil-free instrument air. During normal plant operation, one instrument air compressor operates continuously, loaded and unloaded depending on the system demand. The other instrument air compressor is in standby and is started in the event the operating compressor fails or if the system pressure drops below a preset value. Each compressor is equipped with an inlet air filter, aftercooler and moisture separator to condition the compressed air.

Two instrument air receivers serve as a storage volume to supply a limited amount of compressed air following a compressor failure. Overpressure protection is provided via pressure relief valves located on the air receivers.

Duplex prefilters are provided at the instrument air dryer inlet in order to protect the adsorption dryer units. Prefilter elements are constructed of corrosion-resistant materials.

Duplex afterfilters are provided at the instrument air dryer outlet to prevent the carryover of desiccant dust. These filters also remove rust, scale and dirt. Afterfilter elements are constructed of corrosion resistant materials. The duplex afterfilters have an automatic drain trap to remove accumulated condensate.

An air dryer is installed downstream of each instrument air compressor to remove moisture from the air.

Service Air

A single oil-free rotary screw compressor provides service air. During normal operation, the service air compressor operates continuously, loaded and unloaded depending on the system demand. The compressor is equipped with an inlet air filter, aftercooler and moisture separator to condition the compressed air.

A service air aftercooler–moisture separator is provided immediately downstream of the compressor to cool the flow of air from the air compressor and remove entrained moisture.

The CAS is not required for any safety function. Failure of the CAS does not affect any accident mitigation function. Failure of the CAS does not cause degradation of barriers to radiation releases during normal operation.

9.3.1.4 Inspection and Testing Requirements

The CAS components are inspected and tested during initial plant startup as part of the initial test program. Refer to Section 14.2 (test abstract #054 and #179) for initial plant startup test program.

9.3.1.5 Instrumentation Requirements

The instrument air CIVs are actuated by a safety-related I&C System. The actuator control logic of the CIVs is periodically tested. The CIVs are actuated from the main control room or the remote shutdown station. Section 7.3 describes the safety-related instrumentation associated with containment isolation. All other I&C functions are performed by non-safety-related I&C Systems described in Section 7.1.

9.3.1.6 References

1. NUREG-0933, “A Prioritization of Generic Safety Issues,” U.S. Nuclear Regulatory Commission, Revision 21, September 2007.

2. NUREG-1275, Volume 2, “Operating Experience Feedback Report - Air Systems Problems,” U.S. Nuclear Regulatory Commission, December 1987.

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3. ANSI/ISA 7.0.01-1996, “Quality Standard for Instrument Air,” The Instrumentation, Systems, and Automation Society, 1996.

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