Request for Additional Information No. 135 (1183), Revision 0

11/17/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.04.05 - Engineered Safety Feature Ventilation System
Application Section: SRP 9.4

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

09.04.05-1

1. CRACS figures discrepancies

   A review of the main control room air conditioning system (CRACS) P&IDs in FSAR Tier 2 Figures 9.4.1-1 and 9.4.1-2 shows that figure numbers and titles are incorrect.
   Tier 2 FSAR Section 9.4.1.1 states that all components of the CRACS, are classified Seismic Category I. However, the FSAR Tier 2 Tables 3.2.2-1 and 3.11-1 and Figures 9.4.1-1 through 9.4.1-3 contradict this statement.

   Tier 2 FSAR Figures 9.4.1-1, 9.4.1-2, and 9.4.1-3 show that many of the fire dampers and their associated ductwork are classified as Seismic Category II and electric heaters classified as non-seismic. This is contrary to the statement in Tier 2 FSAR Section 9.4.1.1 that all components of the CRACS are safety-related and designed to Seismic Category I. Additionally, Tier 2 FSAR Table 3.2.2-1 and 3.11-1 list some components NSC, NS-AQ and Seismic Category II.

   Tier 1 FSAR Table 2.6.1-2 and Tier 2 Tables 3.2.2-1 and 3.11-1 lists two motorized dampers in the Division 2 – Air Intake Train 2 and Division 3 – Air Intake Train 3, but FSAR Tier 1, Figure 2.6.1-1 shows only one motorized damper in trains 2 and 3 as does FSAR Tier 2, Figure 9.4.1-2.

   1) Figure numbers and titles in Tier 2 FSAR Figures 9.4.1-1 and 9.4.1-2 should be corrected.
   2) Statements regarding the seismic classification of CRACS components shown in Tier 2 FSAR Figures 9.4.1-1, 9.4.1-2 and 9.4.1-3 and Tables 3.2.2-1 and 3.2.11-1 with Tier 2 FSAR Section 9.4.1.1 should be reconciled.
   3) Reconcile the equipment listed in Tier 2 FSAR Tables 3.2.2-1 and 3.11-1 with Figures 9.4.1-1 through 9.4.1-3.

2. CRACS capacity

   GDC-4 requires the CRACS to be appropriately protected against dynamic effects of missiles and pipe break and be designed to accommodate the effects of, and to be compatible with, the environmental conditions of normal operation, maintenance, testing, and postulated accidents.

FSAR Tier 2 Section 9.4.1.1 states that the CRACS components are appropriately protected against dynamic effects and designed to accommodate the effects of, and be compatible with, the environmental conditions of normal operation, maintenance, testing, and postulated accidents.

In regard to physical separation of system trains, FSAR Tier 2 Section 9.4.1.2.1 provides the following:

- The air intake subsystem consists of two identical fresh air intake trains for each division which are physically separated.
- The two iodine filtration trains located separately in the SB divisions two and three (one train in each division) are in parallel with the associated air intake trains.
- The four recirculation air handling units are located in the SB divisions two and three (two trains in each division).

From the description, it is not clear if the two individual trains in a division are physically separated.

FSAR Tier 2 Section 9.4.1.2.3 indicates that during normal operation two of the four trains are in operation. This would seem to indicate that each train has a capacity of 50%; however, FSAR Tier 2 Section 16 Technical Specification B3.7.10 indicates the capacity of each train is 75%.

The applicant states in Tier 2 FSAR Section 16, Technical specification B 3.7.11, with one division out of service for maintenance and second lost to single failure, the two operable CRACS trains maintain the MCR temperature. However, if both trains in a division are lost, the P&ID (Tier 2 FSAR Figure 9.4.1-3) shows no supply air flow to half the CRE areas.

In view of the above, please respond to the following:

1) Confirm that the recirculation air handling units in each division are physically separated.
2) Confirm that the iodine filtration train are physically separated from the parallel associated intake train.
3) Include the capacity of the individual air recirculation trains in to FSAR Tier 2 Section 9.4.1.
4) Verify that the design temperature is maintained through out the MCR with both trains in a division out of service.

3. Abnormal conditions in CRM

GDC 19 requires adequate protection to permit access to and occupancy of the control room under accident conditions. GDC 60 requires capability to suitably control release of gaseous radioactive effluents to the environment.

Tier 2 FSAR Section 9.4.1.1 states the CRACS outside air intake is capable of detecting radiation, smoke, and toxic chemicals; however, no smoke detectors are identified in the P&IDs.

Tier 2 FSAR Section 9.4.1.2 states in the event of an external fire, external toxic gas release, smoke, or excessive concentration of CO and CO2, outside air to the CRACS is isolated manually or automatically and the system operates in full recirculation mode without fresh air. The stated method of isolation is not clear.

The applicant states in Tier 2 FSAR Section 16 Technical Specification B 3.7.10 that one CREF operating at a flow rate of < 4000 cfm will pressurize the CRE to ≥ 0.125 inches water gauge relative to all external areas adjacent to the CRE boundary. This statement is misleading in several aspects: 1) in order to maintain the CRE pressurized some amount of outside air must be supplied, and 2) the total flow rate has little to do with the ability to pressurize the CRE.

With respect to SRP 9.4.1, a failure modes and effects analysis (FMEA) of the U.S. EPR Main Control Room Air Conditioning System was performed to determine if the safety-related portion of the system is capable of functioning in spite of the loss of any active component. The FMEA reviewed Tier 2 FSAR Figures 9.4.1-1 through 9.4.1-3. The review identified that the loss of a fan in either of the Division 2 or 3 iodine filter trains following a design basis accident will severely limit the ability to clean up any airborne contamination that occurs in the rooms serviced by that train. Although the opposite train is assumed to function, the airflows in and out of each room are balanced, thereby minimizing any mixing between rooms.

The review also identified that there is only a single exhaust path from each of the rooms within the Control Room Envelope (CRE), except the Computer Room. Assuming a single active failure causes an exhaust damper to fail closed, that room would experience a significant reduction of supplied conditioned air. After some period, it would be expected the room design temperature would be exceeded.

The review identified that there is only a single isolation damper between the potentially contaminated inlet air and the recirculation train. When the CRACS system realigns for high radiation in the air inlet, a single failure of damper 30SAB01AA003 or 30SAB04AA003 to close provides a potential path for airborne contamination around the iodine filtration train.

In view of the above, please respond to the following:

a. Identify the locations of smoke detectors on the P&IDs (Tier 2 FSAR Figures 9.4.1-1 through 9.4.1-3).
b. Clarify the reaction of the system to each of the following: external fire, external toxic gas release, smoke, or excessive concentration of CO and CO2.
c. Clarify the Tier 2 Section 16 Technical Specification B 3.7.10 statement regarding pressurization of the CRE by the CREF.
d. Demonstrate that adequate atmospheric cleanup of all CRE rooms when one iodine filtration train is out of service.
e. Demonstrate that there is adequate temperature and humidity control in the CRE rooms when an exhaust path is out of service.
f. Assure that the system does not require modification to eliminate the potential bypass of the iodine filtration train.

4. Two CRACS air conditioning trains fail in the same SB division

   There are two CRACS trains in SB division 2, and another two CRACS trains in SB division 3. If both CRACS trains in the same SB division fail, no supply air flow to half the CRE areas. The air flows in and out of each Control Room area are prebalanced, thereby minimizing any mixing between areas.

   Tech. Spec. B 3.7.11 Control Room Air Conditioning System, Applicable Safety Analysis: ……During emergency operation, one train is assumed to be out for maintenance and a second train is assumed lost to single failure. The two OPEABLE CRACS trains maintain the MCR temperature between 65^{o}F to 75^{o} F.

   Tech. Spec. 3.7.11 Control Room Air Conditioning System, ACTIONS:

   One or two CRACS trains inoperable – Restore the inoperable CRACS train(s) to OPERABLE status in 30 days;
   Three or more CRACS trains inoperable in MODE 5 or 6 or during movement of irradiated fuel assemblies – Suspend movement of irradiated fuel assemblies;

   Three or more CRACS trains inoperable – Enter LCO 3.0.3.

   Justify not addressing in the Tech. Spec. the situation of two CRACS trains in the same SB division are inoperable.

   Propose Tech. Spec. as appropriate, or justify that Tech. Spec. are not required.

5. FBVS drawing discrepancies

   1. There are discrepancies in equipment listed in FSAR Tier 1, Table 2.6.4-1 and FSAR Tier 2, Table 3.2.2-1 as follows:

      FSAR Tier 1, Table 2.6.4-1 (on 3rd sheet) lists the following equipment tag numbers as Seismic I and ASME AG-1, but they are not in FSAR Tier 2, Table 3.2.2-1;

      - Air Cooling Coils; 30KLL61/64AC001-003
      - Moisture Separators; 30KLL61/64AT001-002

   2. There are drawing discrepancies between Tier 1 FSAR Figure 2.6.4.1 and Tier 2 FSAR Figure 9.4.2-1.

      a. In Tier 1 FSAR Figure 2.6.4-1, the Recirculation Cooling Units, Extra Borated Pump Room Cell 4 (lower right of drawing), and Cell 5 (lower left of drawing) indicate SCW as the cooling water interface. For the same equipment depicted in Tier 2 FSAR Figure 9.4.2-1, it indicates QKF as cooling water interface.

      b. Tier 1 FSAR Figure 2.6.4-1, the Recirculation Cooling Units, Fuel Pool Pump Room Cell 4 (lower right of drawing) indicates CCW as the cooling

water interface. For the same equipment depicted in Tier 2 FSAR Figure 9.4.2-1, it indicates KAB as cooling water interface.

c. For the exhaust ductwork connected to SBVS (vertical run on drawings) Tier 1 FSAR Figure 2.6.4-1 indicates ductwork between valve group 30KLL21/24AA004 as seismic class N/A, but Tier 2 FSAR Figure 9.4.2-1 indicates this same ductwork as seismic class I.

Justify or correct these discrepancies.

6. FBVS pool boiling

RG 1.13, Rev 2, Position C.4, Confinement and Filtering Systems recommends that a controlled-leakage building should enclose the fuel to limit the potential release of radioactive iodine and other radioactive materials. If necessary to limit offsite dose consequences from a fuel handling accident or spent fuel pool boiling, the building should include an engineered safety feature filtration system that meets the guidelines outlined in Regulatory Guide 1.52. Additionally, this guide presents the conditions necessary to allow coolant boiling, including the ability of the pool structure and liner to withstand coolant boiling and the ability of the ventilation system to keep safety-related components safe from the effects of high temperatures and moisture.

There is no statement in Tier 1 FSAR or Tier 2 FSAR that FBVS is designed for pool boiling. Provide the impact of pool boiling on the FBVS.

Moisture Removal: There was no evidence of the capability to remove moisture in the ESF Filter Systems as required by RG 1.52. For example, HVAC diagrams do not show moisture removal components such demisters or moisture separators and drains. This is especially important for the FBVS supply to the ESF filters in the Safeguard Building Ventilation System (SBVS) diagrams (e.g., Tier 2 FSAR Figure 9.4.5-2). The FBVS is the ventilation system for the area of the spent fuel pool which is designed for bulk pool boiling. Justify no showing the moisture removal components for the ESF Filters in the SBVS that support FBVS (and the capability for bulk pool boiling) show.

7. NABVS & RWBVS clean up system design

Tier 2 FSAR Sections 9.4.3.1 and 9.4.8 did not include the air-flow rates for the cleanup units and system leakage rates. This information is recommended in Regulatory Guide 1.140.

Provide the maximum air flow rates for the cleanup units (NABVS & RWBVS).

Regulatory Guide 1.140 recommends the monitoring of pertinent pressure drops and flow rates. The P&ID's do show differential pressure measurements across filters for the NABVS and RWBVS. There is very little instrumentation shown with regards to measuring flow rates. Also, there appears to be no system pressure monitoring for the NABVS. Confirm that the pressure and flow indication currently shown on the P&ID's for the NABVS and RWBVS is correct. If this indication is correct, justify that you meet RG 1.140, Position C3.3.

To maintain the radiation exposure to operating and maintenance personnel as low as is reasonably achievable (ALARA), normal atmosphere cleanup systems and components should be designed to control leakage and facilitate maintenance, inspection and testing, RG 1.140, Position C3.4. This information was not provided for the NABVS and RWBVS; therefore, compliance with RG 1.140, Position C3.4 can not be determined. Provide the information required to meet Regulatory Guide 1.140, Position C3.4.

Tier 2 FSAR Section 9.4.8.2.1 on the Radioactive Waste Building Ventilation System did not provide evidence that protective devices such as louvers, grills and screens are used to minimize the infiltration of contaminants from outdoor air intake openings. Provide the information required to meet Regulatory Guide 1.140, Position C3.5.

8. CBVS clean up system design

Tier 2 FSAR Section 9.4.7.1 did not include the air-flow rates for the cleanup units and system leakage rates. This information is required to comply with General Design Criteria 60. Provide the maximum air flow rates for the cleanup units (Containment Building Ventilation System)

To ensure reliable in-place testing, the volumetric air-flow rate of a single cleanup unit should be limited to approximately 30,000 CFM. If a total system air flow in excess of this rate is required, multiple units should be used per Regulatory Guide 1.140, Position C3.2. The applicant did not provide data on the air flow rates for the containment building ventilation system cleanup units. This information should be provided to demonstrate conformance with Regulatory Guide 1.140, Position C3.2.

To maintain the radiation exposure to operating and maintenance personnel as low as is reasonably achievable (ALARA), normal atmosphere cleanup systems and components should be designed to control leakage and facilitate maintenance, inspection and testing per Regulatory Guide 1.140, Position C3.4. This information was not provided for the containment building ventilation system; therefore, compliance with Regulatory Guide 1.140, Position C3.4 cannot be determined. Provide the information required to meet Regulatory Guide 1.140, Position C3.4.

Confirm that an alternative approach selected to meet the requirements of General Design Criteria 60. If an alternative method was selected, then provide the methodology and data used.

9. SCS drawing missing dampers

Tier 2 Section 9.4.13.2.1 ……Staircases Supply Air Subsystem (on page 9.4-121) ……A pressure control damper and motor-operated isolation damper installed on the exhaust ductwork provide pressure control in the staircase.

Tier 2 Section 9.4.13.2.1 ……Supply and Exhaust Air Subsystem for the Interconnecting Passageway between Safeguard Building Division 2 and Division

3 …….(on page 9.4-122) ……A pressure control damper and motor-operated isolation damper installed on the exhaust ductwork provide pressure control in the interconnecting passageway and associated rooms.

Tier 2 Section 9.4.13.2.1 …… Supply and Exhaust Air Subsystem for the Nuclear Island Interconnecting Passageway (on page 9.4-122) ……An outside bypass connection with a pressure control damper and an electric isolation damper is connected to the intake duct to control pressure in the rooms.

All these pressure control dampers described above can not be located on Tier 2 Figure 9.4.13-1 & 2. Provide the location of these pressure control dampers in the Figures.

10. TBVS design information

NUREG 0800 identifies general design criteria applicable to safety related portions of the turbine building ventilation system (such as GDC-60 on controlled release of radioactive material to the environment). However, the FSAR does not provide sufficient detail to make an independent judgment that the system is not safety related.

Regulatory Guide 1.206, page C.IV.1-3, Item 2, with respect to Chapter 9, Auxiliary Systems, states that it is expected that reactors will reflect through their design, construction, and operation an extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products. The descriptions shall be sufficient to permit understanding of the system designs and their relationship to safety evaluations.

Tier 2 FSAR Section 9.4.4, Turbine Building Ventilation System provides a single paragraph description of the TBVS stating what the system does. However, no design information (e.g., number of fans, use of filters or charcoal) or design criteria (redundancy, diverse power supplies, design temperatures of the building equipment) is provided. This section concludes that the TBVS is classified as a non-safety related system, and it does not provide accident response nor radioactive effluent control functions for the U.S. EPR. Sufficient information to confirm this statement is not provided. Also, no interface requirements have been provided to assure an acceptable TBVS will be designed to meet minimum building and component requirements.

Provide the basis for concluding the TBVS is not safety related. For example, reference evaluations that have been performed to conclude that the system is not needed to filter radioactive materials following a steam generator tube rupture. Also, provide the interface requirements for the COL applicants to assure that Turbine Building temperatures will adequately support equipment operations to preclude challenges to reactor safety systems (such as caused by trips of main feedwater pumps on high turbine building temperatures). Interface requirements are also needed to assure that COL applicants submit sufficient design information to confirm minimum TBVS capabilities.

11. SBVSE design information

FSAR Tier 2 Sections 9.4.5.1, 9.4.9.1 and 9.4.11.1 define the design temperature and humidity parameters that the SBVS, EPGBVS and ESWPBVS can maintain. FSAR Tier 2 Section 9.4.6 does not provide any design temperature and humidity values for the SBVSE.

Provide the design room temperature and humidity ranges for the SBVSE.

12. SBVSE seismic definition

The applicant states in FSAR Tier 2 Section 9.4.6.1 the non-safety-related portion of the SBSVE is designated as Non-Seismic. This conflicts with the applicant's statement that the system meets the guidance of RG 1.29 position C.2 for the non-safety-related portions (i.e., Seismic Category II). FSAR Tier 2 Section 3.2.1.5 defines non-seismic as an SSC that does not fall into the RG 1.29 criteria for classification as Seismic Category I or II.

Clarify the seismic classification of the non-safety-related portion of the SBVSE.

13. SBVS moisture separator

GDC 60 requires the Engineered Safety Function Ventilation System (ESFVS) to be capable to suitably control release of gaseous radioactive effluents to the environment.

FSAR Tier 2 Section 9.4.5.1 states that the release of radioactive materials to the environment is controlled by meeting the guidance of RG 1.52 (position C.3). RG 1.52 paragraph C3.1 recommends the installation of a moisture separator prior to the heater to remove entrained water droplets from the inlet air stream, thereby protecting HEPA filters and iodine absorbers from water damage and plugging.

FSAR Tier 2 Chapter 16 Section B 3.7.12 states the pre-filters remove any large particles in the air and any entrained water droplets present to prevent excessive loading of the HEPA filters and carbon absorbers. Installing the heaters upstream of the pre-filters essentially negates the moisture removal function of the pre-filters.

a. Justify the omission of a moisture separator in the SBVS accident exhaust iodine filtration trains.

b. Justify installing a heater upstream of the SBVS pre-filter with the intent to remove entrained moisture.

14. SBVS missiles protection

GDC 4 requires that structures, systems, and components important to safety be designed to accommodate the effects of, and be compatible with, environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents.

Tier 2 FSAR Section 9.4.5.1 indicates the Safeguard Building Controlled-Area Ventilation System (SBVS) vents and louvers are supplied by the SBVSE for

supply and the NABVS for exhaust air and are protected from missiles by locating these components within the safety enclosure areas as described in Section 9.4.3 and Section 9.4.6.

Tier 2 FSAR Sections 9.4.3 and 9.4.6 do not provide any discussion of missile protection for SBVS vents and louvers.

Describe missile protection for the SBVS vents and louvers.