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Your ref: Docket No. 52-006
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Subject: AP1000 Response to Request for Additional Information (SRP 12)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 15. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-SRP12.1-SPCV-01 R1
RAI-SRP12.1-SPCV-02 R1

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
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/Enclosure

1. Response to Request for Additional Information on SRP Section 12

D063
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 12

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP12.1-SPCV-01
Revision: 1

Question:

In accordance with 10 CFR 20.1406, describe the design features provided to prevent or mitigate contamination of the environment from the HVAC equipment drains for supply, recirculation or discharge air handling units from the below grade HVAC Systems, Structures, or Components (SSC), and due to pressure differentials in the ventilation system associated with normal or expected operation in DCD Chapter 9. If design features are not used, in DCD Chapter 12, provide a description of the procedures for operations to be used to prevent or mitigate contamination of the environment and associated justification for not incorporating design features.

Additional Question based on 8/11/09 phone call: (Revision 1)

After reviewing RAI-SRP12.1-SPCV-01, Rev. 0, the NRC staff requested further clarifying information on AP1000 design features used to prevent and mitigate spread of contamination due to HVAC pressure differentials during abnormal operation of the systems.

Westinghouse Response:

1. The AP1000 includes design features to prevent and mitigate contamination of the environment from the HVAC equipment drains for supply, recirculation or discharge air handling units.

   The Containment Recirculation Cooling System (VCS) fan coolers drain to the Liquid Radwaste System (WLS) containment sump. This is illustrated on DCD Figure 9.4.6-1, note 11, and 11.2-2 Sheet 1.

   The Radiologically Controlled Area Ventilation System (VAS) fan coil units serving the Chemical and Volume Control System (CVS) and Normal Residual Heat Removal System (RNS) pump rooms drain to the Radioactive Waste Drain System (WRS) and from there to the WLS. The DCD will be revised as shown below to describe this arrangement.

   These are the only HVAC cooling coils that would be expected to handle potentially contaminated air. Other cooling coils drain to the Waste Water System (WWS) system.

   It should be noted that the only HVAC fan coil units which are below grade and also potentially contaminated are those in the CVS and RNS pump rooms.

The other HVAC systems that serve potentially contaminated areas have once through configurations, so the cooling coils only process air from outside of the buildings. Additional features that reduce the possibility of contaminating the cooling coil condensate are:

- The VAS contaminated area of the nuclear island stops on a high radiation signal.
- The other potentially contaminated systems (health physics/hot machine shop HVAC, containment purge HVAC, and radwaste building HVAC) have radiation alarms on the exhaust. A high radiation signal indicates that there is a problem in the system that requires attention.

HVAC system drains have air gaps and traps to prevent the backflow into air handling units.

2. The AP1000 also includes design features to prevent and mitigate spread of contamination due to HVAC pressure differentials.

   As discussed for in DCD section 9.4.3.1.2, the VAS:

   - Maintains the overall airflow direction within the areas it serves from areas of lower potential airborne contamination to areas of higher potential contamination
   - Maintains each building area at a slightly negative pressure to prevent the uncontrolled release of airborne radioactivity to the atmosphere or adjacent clean plant areas
   - Uses two high quality commercial grade 50% capacity supply air handling units and two companion exhaust fans for each served area. The failure of a fan automatically stops its companion supply or exhaust fan. If this occurs the negative pressure in the served area is maintained by the remaining 50% capacity supply air handling unit and its exhaust fan. If both 50% units are inoperable, one of the diesel backed containment air filtration system (VFS) exhaust units is automatically started and aligned to exhaust air from the area served by the VAS. The VFS exhaust maintains a negative pressure in the area normally served by the VAS when the VAS is not available.
   - The VAS controls automatically isolate selected building areas from the outside environment by closing the supply and exhaust duct isolation dampers and starting the containment air filtration system (VFS) when high airborne radioactivity in the exhaust air duct or inadequate negative pressure differential is detected. During this event, the VFS exhausts from and maintains a negative pressure in the appropriate VAS area, filters the exhaust using charcoal and high efficiency particulate air (HEPA) filters, and discharges the filtered air to the plant vent. Both the VFS exhaust ducting and the plant vent has radiation monitors.

As discussed in DCD section 9.4.8.1.2 and DCD section 9.4.8.1.9 respectively, the radwaste building HVAC and the health physics and hot machine shop area HVAC have similar features, except that there is no automatic isolation of selected building areas for these two systems.

Design Control Document (DCD) Revision:

9.4.3.2.1.1 Auxiliary/Annex Building Ventilation Subsystem

(First three paragraphs unchanged.)

Unit coolers are located in the normal residual heat removal system (RNS) and chemical and volume control system (CVS) pump rooms because they have significant cooling loads on an intermittent basis when large equipment is operating. Each unit cooler is sized to accommodate 100 percent of its corresponding pump cooling load. The unit coolers are provided with chilled water from redundant trains of the central chilled water system (VWS) low capacity subsystem. The normal residual heat removal pump room unit coolers have two cooling coils per unit cooler so that chilled water supplied by either train A or train B alone can support concurrent operation of both normal residual heat removal system pumps. The two chemical and volume control makeup pump room unit coolers are connected to redundant trains of the chilled water system; however, operation of either the train A or train B unit cooler alone maintains the common makeup pump room temperature conditions and supports operation of either makeup pump. Condensation from these cooling coils drains to the WRS.

(Remainder of section unchanged.)

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP12.1-SPCV-02
Revision: 1

Question:

In accordance with 10 CFR 20.1406, describe the design features provided to prevent or mitigate contamination of the environment resulting from equipment configurations such as the:

1) placement of HVAC inlets to prevent contamination by flooding,
2) provision of moisture or resin traps on tank and demineralizer vents prior to connection to the HVAC system duct,
3) design configuration of system components to minimize the potential for contamination transport resulting from switching ventilation modes, and
4) contamination due to filter element failure.

If design features are not used, provide a description in DCD Chapter 12 of procedures for operations to be used to prevent or mitigate contamination of the environment and provide the associated justification for not incorporating design features.

Additional Question based on 8/11/09 phone call: (Revision 1)

After reviewing RAI-SRP12.1-SPCV-02, Rev. 0, the NRC staff requested further clarifying information on the location of the HVAC exhaust air intakes in relationship to spent fuel pool and venting and overflow of the spent resin tanks.

Westinghouse Response:

1) The AP1000 selection of HVAC inlet configuration minimizes the potential for spread of contamination, or of flooding of the HVAC inlets from any source. As stated in DCD section 9.4.1.2.1.1:

   > "Outside supply air is provided to the plant areas served by the main control room/control support area HVAC subsystem through an outside air intake duct that is protected by an intake enclosure located on the roof of the auxiliary building at elevation 153'-0". The outside air intake duct is located more than 50 feet below and more than 100 feet laterally away from the plant vent discharge."

   Other nuclear island HVAC intakes are located at least 100 feet vertically and 60 feet laterally away from the plant vent. This reduces the possibility of recirculation of plant vent discharges into the HVAC intakes.

   Apart from radiological concerns and regarding flooding in general, most of the AP1000 air intakes are located significantly above ground level. The VFS and VHS intakes are located approximately 35 feet above ground level. The VAS and VBS intakes are located

approximately 55 feet above ground level. The VXS and VRS intakes are located at least 17 feet above ground level. Therefore, none of these inlets is likely to flood.

The non-radiologically controlled turbine and diesel generator buildings have HVAC intakes somewhat above ground level. This is appropriate since the diesel generators and the turbine would not be operational if their respective buildings were flooded.

The exhaust air intakes within the nuclear island and the radwaste building are located at least several feet above the floor level. This minimizes the impact of a flooding event on the HVAC system because water from a flooding event has little chance of reaching the exhaust system intake within an area (e.g the spent fuel pool area and waste hold-up tank areas).

2) The liquid radwaste system (WLS) effluent holdup tanks and the radioactive waste drain system (WRS) sump directly interface with the HVAC system. No other radiological tanks, vessels, or sumps have a direct interface to HVAC. Specifically, the spent resin storage tanks vent and overflow to the WRS; DCD section 11.4.2.2.1 will be revised as shown below to reflect this.

As discussed in DCD section 11.2.1.2.4 and Table 11.2-3, provisions are made to prevent and control spills of radioactive liquids due to effluent holdup tank overflows. Furthermore, the effluent holdup tank incorporates an overflow nozzle high on the side of the tank and a separate vent nozzle on the top of the tank. The vent line is routed upward from the tank for several feet before interfacing with the HVAC system. This arrangement prevents incursion of bulk liquids into the HVAC system, since they will preferentially pass through the overflow line. In addition, if any minor vapor carryover condenses in the vent pipe, it will tend to drain back into the tank.

DCD section 9.4.3.2.1.1 will be revised as shown below to describe this interface.

3) As noted in the response to RAI-SRP12.1-SPCV-01, the HVAC systems are designed to minimize the potential for contaminant migration. The systems are segregated into radiologically controlled areas:

- Radiologically controlled area ventilation system (VAS),
- Containment recirculation cooling system (VCS),
- Containment air filtration system (VFS),
- Health physics and hot machine shop HVAC system (VHS), and
- Radwaste building HVAC system (VRS);

  and non-radiologically controlled areas
- Nuclear island nonradioactive ventilation system (VBS),
- Turbine building ventilation system (VTS),
- Annex / auxiliary building nonradioactive ventilation system (VXS), and the
- Diesel generator building heating and ventilation system (VZS).

The only cross connected systems are the VAS and VFS systems. This cross connection is to provide filtration if there is a release, and therefore is beneficial.

4) The AP1000 design and anticipated operating procedures minimize both the probability of an HVAC system filter element failure and the consequences with respect to spread of contamination of such a failure.

As discussed in DCD section 9.4.7.2.2, HVAC filter elements will be procured in accordance with ASME N509, "Nuclear Power Plant Air Cleaning Units and Components", and used in accordance with ASME N510, "Testing of Nuclear Air Cleaning Systems." The elements will be tested by the manufacturer, and are also anticipated to be tested after installation. Thus, any defects would be identified.

The main control room supplemental air handling unit of the VBS only operates for limited periods and recirculates air from outside the radiologically controlled area, and therefore is not considered to present a substantial risk of undetected contamination. Similarly, filtration in the Main Control Room Emergency Habitability System (VES) is used post-accident. The other AP1000 systems that have filtration for radiation control are the VFS and the VHS. HVAC filters in these systems incorporate:

- Pressure drop instrumentation and alarms which would alert the operator to excessive differential pressure across the filter elements, thereby avoiding operation which might create unusual stress on the elements, and
- Pressure drop instrumentation that will provide information for the operator to determine if there was a significant filter failure.

The VHS system is limited to a particulate filter on the hot machine shop exhaust fan. The VHS exhaust has a radiation monitor that will indicate that there is a release.

The VFS system filters all exhaust from containment with charcoal and HEPA filters. There is also a 95% efficient filter downstream of the charcoal filter, reducing the chance of a filter failure causing a release. The VFS exhaust has a radiation monitor that will indicate that there is a release.

Both the VFS and VHS discharge to the plant vent. The plant vent has radiation monitors that will indicate that there a release.

References:

1. "Nuclear Power Plant Air-Cleaning Units and Components," ASME N509-1989 (R1996)
2. "Testing of Nuclear Air Cleaning Systems," ASME N510 1989.

Design Control Document (DCD) Revision:

11.4.2.2.1 Spent Resin Tanks

(First paragraph unchanged).

Resin mixing capability is provided by mixing eductors in each tank, and resin dewatering, air sparging and complete draining capabilities are also provided. The ultrasonic level sensors and dewatering screens are arranged for remote removal. The vent and overflow connections have screens to prevent the inadvertent discharge of spent resin, and are routed to the radioactive waste drain system (WRS).

9.4.3.2.1.1 Auxiliary/Annex Building Ventilation Subsystem

(First paragraph unchanged).

The two 50 percent capacity exhaust air fans sized to allow the system to maintain a negative pressure are located in the upper radiologically controlled area ventilation system equipment room at elevation 145′-9″ of the auxiliary building. The exhaust air ductwork is routed to minimize the spread of airborne contamination by directing the supply airflow from the low radiation access areas into the radioactive equipment and piping rooms with a greater potential for airborne radioactivity. Additionally, the exhaust air ductwork is connected to the radioactive waste drain system (WRS) sump to maintain the sump atmosphere at a negative air pressure to prevent the exfiltration of potentially contaminated air into the surrounding area. The sump vent line is constructed of pipe, which is routed upward from the sump to the interface with the HVAC system. The exhaust air ductwork is connected to the radwaste effluent holdup tanks to prevent the potential buildup of airborne radioactivity or hydrogen gas within these tanks. The effluent holdup tanks have an overflow line to the WRS from a nozzle on the side of the tank, and a vent line from a nozzle on the top of the tank. The vent line is constructed of pipe, and is routed upward from the tank to the interface with the HVAC system. The exhaust fans discharge the exhaust air into the plant vent for monitoring of offsite airborne radiological releases.

PRA Revision:
None

Technical Report (TR) Revision:
None