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Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-12260

Subject: **MHI's Second Response to US-APWR DCD RAI No.883-6063 Revision 3 (SRP 09.04.01)**

References:
1) "Request for Additional Information No. 883-6063 Revision 3, SRP Section: 09.04.01 – Control Room Area Ventilation System Application Section: Section 9.4.1" dated January 3, 2012 (ML120040395).
2) Letter MHI Ref: UAP-HF-12193 from Y. Ogata to U.S. NRC, "MHI's Response to US-APWR DCD RAI No. 883-6063 Revision 3 (SRP 09.04.01)", dated August 2, 2012 (ML12216A376).

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Second Response to Request for Additional Information No. 883-6063 Revision 3 (SRP 09.04.01)".

Enclosed is the response to 3 RAI questions (Questions 09.04.01-29, 31, and 32) contained within Reference 1. The response to the fourth RAI question (Question 09.04.01-30) of Reference 1 was previously submitted by MHI in Reference 2.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
Director- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Second Response to Request for Additional Information No. 883-6063 Revision 3 (SRP 09.04.01)

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NRO

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-12260
Docket No.52-021

Second Response to Request for Additional Information No. 883-6063 Revision 3 (SRP 09.04.01)

September 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/19/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**883-6063 REVISION 3**
SRP SECTION:	**09.04.01 - Control Room Area Ventilation System**
APPLICATION SECTION:	**DCD SECTION 9.4.1**
DATE OF RAI ISSUE:	**1/3/2012**

Question No. : 09.04.01-29

This is a follow-up RAI to RAI No. 689-4976, Question No. 09.04.01-26 (ML110770284). The applicant responded to this eight part question about the design of MCR emergency filtration system with an eight part response. The staff found the applicant's response to parts 1 and 8 as acceptable with no further questions.

The staff found the applicant's response to parts 2 & 3 and the resultant proposed DCD changes to DCD Table 6.4-1 and Table 6.4-2 as acceptable. However, Revision 3 of the DCD does not contain the revised Table 6.4-1 and Table 6.4-2. These two issues will be carried forward as NRC Confirmatory Items in the SER. The staff views the lack of incorporation of these two issues into the DCD as a timing issue since the RAI response was dated within a few weeks before DCD Revision 3 was issued. Please advise the staff if this is not the case. The staff has the following additional requests for additional information about parts 4 through 7.

Part 4

The staff notes that DCD Section 9.4.1 reads that the MCR HVAC system complies with N509. The staff again notes that ASME N509-2002 section 4 "Functional Design" 4.10 reads: " *Where heat of radioactive decay or heat of oxidation or both may be significant, means shall be provided to remove this heat from the adsorbent beds to limit temperatures to values below 300°F (149°C) to prevent significant iodine desorption."*

The applicant responded that ... "*the main control room emergency filtration unit charcoal adsorber is provided with outlet air temperature indication and high, high-high temperature alarms in the control room to alert the operator to an abnormal temperature condition, as described in DCD Section 9.4.1.5 and shown on DCD Figure 9.4.1-1. In the event of a charcoal adsorber high temperature condition, the operator can initiate ventilation flow through the charcoal bed by restarting the filtration unit to remove heat from the adsorber to prevent significant iodine desorption."*

The staff notes that the applicant did not provide calculated values for the maximum component temperatures: (a) in the adsorber section with normal flow conditions and (b) with the unit shutdown & the charcoal adsorbent unit isolated (i.e. post LOCA condition). Based on the applicant's response the staff cannot conclude that the iodine loading post-accident radioactivity-induced heat in the adsorbent will not exceed the design limiting temperature of 300°F. The staff again requests that the applicant provide this information to the staff.

Part 5

The applicant responded (in part) that... " *the manually actuated fire protection water spray system installed within the filter housing, described in DCD Sections 9A.3.68 and 9A.3.69, is provided as fire suppression for the charcoal bed. Fire protection water spray can be initiated in the event of a high-high temperature* (i.e. alarm) *to prevent charcoal ignition."*

While the applicant adequately answered the question asked, the staff requests additional information about the expected maximum expected post-accident radioactively-induced heat in the charcoal filter beds of both the MCR emergency filter trains and the Annulus Emergency Exhaust System. The staff believes that relying on the fire protection system should be the last line of defense if the filter trains can be adequately sized to prevent such a fire in the design phase. In particular, based on the radioactive iodine loading from the most limiting DBA, what are the maximum expected temperatures within the bed and on the leading edge and trailing edge surfaces?

Part 6

The applicant responded that .... *"the outside air intakes for the main control room emergency filtration units are located on the East and West walls of the Reactor Building. The outside air intake opening is designed to comply with RG 1.52, Regulatory Position 3.11 as shown in DCD Table 6.4-2. Therefore, the HEPA filters and iodine adsorbers are protected from water damage and it is not necessary to include demisters in the design of the main control room emergency filtration units."*

The staff finds that the response did not adequately address the guidance of ASME N509-2002 section 4 "Functional Design" 4.1 (d) reads: *"Moisture separators (demisters) are required when entrained water droplet concentration may be greater than 1 lb (0.45 kg) of water per 1,000 cfm (1,700 m3/hr) of airflow."*

As an example, from the "1997 ASHRAE Handbook Fundamentals" it can be determined that for a potential US-APWR plant located near Jackson, Mississippi the latent moisture loading contained in the influent air stream for periods of time of 2% of the year or greater (Table 26.15 page 26.15) could contain 1.29 lbs of water per 1,000 ft3//min. This is based on the following Psychrometric Chart properties of 78F WB, 88F MDB Humidity Ratio = 0.0184 lb H2O/ lb dry air and Specific volume of 14.2 ft3/lb dry air. The 1.29 lbs of moisture clearly exceeds the threshold criteria of ASME N509-2002.

The staff requests that the applicant redress their response based on the staff's observation. The staff suggests that the applicant change the US-APWR DCD to include demisters in the safety related emergency filter trains within the plant or create a COL item to have the COLA applicant's to evaluate this need on an individual plant basis.

Part 7

The staff noted that there is insufficient design information to determine if the HEPA filters have sufficient design margin to accommodate fission product loading without restricting flow rate.

The applicant responded that ..."*Regulatory Guide 1.52, Section 6, In-place Testing Criteria, Regulatory Position 6.3, describes the HEPA filter bank in-place aerosol leak test acceptance criterion of 0.05% or less at rated flow +/- 10%. In accordance with Regulatory Position 6.3, when this criterion is met, a HEPA filter bank can be credited in the accident dose evaluations with 99% removal efficiency for particulate matter. DCD Table 6.4-1* *specifies the main control room emergency filtration units HEPA particulate removal efficiency as 99%, which is consistent with the allowed credit for filter efficiency in Regulatory Guide 1.52. Excessive loading of the HEPA filter bank by larger airborne particulates in the airstream is prevented by the upstream high-efficiency prefilter as described in DCD Section 6.4.2.2.1."*

The staff requests that based on the most limiting DBA in terms of a particulates that the applicant provide the maximum mass loading on the upstream HEPA filters of both the MCR emergency filter trains and the Annulus Emergency Exhaust System filter trains. How do these maximum mass loading values (i.e. in mg) compare with the rated dust loading value of each filter of the filter train and provide a comparison of the magnitude of the impact on the clean versus a fully fouled filter (i.e. maximum design dP)?

ANSWER:

Part 4

Based on an evaluation of the capture of radioactive iodine within the MCR emergency filtration unit charcoal adsorber following the worst-case accident, the maximum radioactive decay-induced heat within the adsorber is 1 Watt. This low heat input is not expected to result in a significant temperature increase of the charcoal bed or filter housing components with the emergency filtration unit operating under normal flow conditions or with the fan shutdown and the charcoal filter isolated. Therefore, the charcoal adsorbent will not approach the limiting temperature for significant iodine desorption of 300ºF.

Part 5

As stated in the response to Part 4 above, the maximum radioactive decay-induced heat within the MCR emergency filtration charcoal adsorber following the worst-case accident is 1 Watt. This low heat input is not expected to result in a significant temperature increase such that the charcoal ignition temperature will not be approached.

Note that, as described in DCD Subsection 9.4.5.2.1, the annulus emergency exhaust system does not include a charcoal adsorber filter.

Part 6

The example conditions cited in the RAI question for Jackson, MS are a measure of the mass of water in the air as water vapor based on humidity ratio. However, the ASME N509 criterion for use of a moisture separator is based on entrained water droplets (i.e., water in liquid form in the airstream) to protect the HEPA filter media from becoming wetted. Demisters/moisture separators are not effective for removing water vapor (humidity) in the air flow stream.

Based on the location of the MCR intakes, and the design per RG 1.52, Position 3.11, water droplets in the airstream are not credible as described in response to RAI 689-4976, Question 09.04.01-26, Part 6.

Therefore, demisters are not required for the MCR outside air intakes. There are no outside air intakes in the annulus emergency exhaust system.

Part 7

Based on an evaluation of worst-case accident particulate loading, the maximum mass loading of the HEPA filtration units are:

MCR Emergency Filtration Unit: 1 g

Annulus Emergency Exhaust System filtration unit: 700 g

A typical single HEPA filter (size 24" x 24" x 11.5") is rated for 2000 cfm and 1140 grams dust loading capacity. As indicated in DCD Table 6.4-1, two HEPA filters are installed in parallel in the MCR emergency filtration unit. The annulus emergency exhaust system filtration unit includes three HEPA filters installed in parallel.

Therefore, the maximum mass loading of the HEPA filters is considerably below the rated dust capacity such that the increase in filter bank pressure drop is expected to have an insignificant effect on filtration unit flow rate.

The bases of the maximum mass loading of the HEPA filtration units are the following:

All containment leakage releases are assumed to consist of leakage filtered by the annulus emergency exhaust system. With the exception of noble gases, all nuclides (including elemental iodine, organic iodine and non-radioactive nuclides) are conservatively accumulated in the HEPA filters. Other assumptions are the same as the dose evaluation in DBA condition.

The result of the calculation for all nuclides (including elemental iodine, organic iodine and non-radioactive nuclides) is about 600 grams of particulate accumulated in the annulus emergency exhaust system filtration unit.

Adding margin to this value, and assuming that only one annulus emergency exhaust system filtration unit works properly and that all accumulated particulates are in only one of the three HEPA filters installed in parallel, the maximum mass accumulated in the HEPA filters is conservatively determined to be 700 grams.

With respect to the MCR emergency filtration unit, with the exception of noble gases, all nuclides (including elemental iodine, organic iodine and non-radioactive nuclides) entering the MCR by intake and inleakage are assumed to be filtered by the MCR Emergency Filtration unit. Considering atmospheric dispersion after release to the environment, the maximum mass loading of HEPA filters in the MCR emergency filtration unit is less than the one gram in the annulus emergency exhaust system filtration unit.

Impact on DCD

DCD Revision 3 Subsection 6.4.1, fifth paragraph, will be added as follows (see Attachment 1):

> **"The rated dust capacity of the MCR emergency filtration HEPA filters will be such that the pressure drop from the maximum mass loading of the filtration units will have an insignificant effect on the filtration unit flow rate."**

DCD Revision 3 Subsection 6.5.1.1, last paragraph, will be added as follows (see Attachment 1):

> "**The rated dust capacity of the HEPA filters of the annulus emergency exhaust filtration HEPA filters will be such that the pressure drop from the maximum mass loading of the filtration units will have an insignificant effect on the filtration unit flow rate.**"

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical / Topical Reports

There is no impact on the Technical / Topical Reports.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/19/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**883-6063 REVISION 3**
SRP SECTION:	**09.04.01 - Control Room Area Ventilation System**
APPLICATION SECTION:	**DCD SECTION 9.4.1**
DATE OF RAI ISSUE:	**1/3/2012**

Question No. : 09.04.01-31

This is a follow-up RAI as RAI No. 689-4976, Question No. 09.04.01-27.

The staff found the applicants response insufficient in that they failed to decide between the two paths towards an acceptable resolution: (1) a minimum credible humidity for the site conditions permitted in the DC with no humidity control to use for the qualification of control room electrical equipment or (2) to change the plant design to include safety-related humidifiers. In addition the staff notes that Revision 3 of the DCD Table 2.7.5.1-3 "Main Control Room HVAC System Inspections, Tests, Analyses and Acceptance Criteria" Item 4.a has been changed to remove any reference to the need of maintaining MCR humidity limits within design specifications.

The staff requests that the applicant redress its response to Question No. 09.04.01-27 and change the DCD to reflect an acceptable resolution per the above. The staff also requests that the applicant reinstate the requirement to demonstrate the capability of the MCR HVAC system to maintain humidity levels within the CRE at acceptable limits during normal operations, abnormal and accident conditions of the plant in Item 4.a of DCD Table 2.7.5.1-3.

ANSWER:

As described in DCD Subsection 9.4.1.2, the humidifier installed in the MCR HVAC system is a non-safety related, seismic category II component. The humidifier functions to maintain the relative humidity within the control room envelope (CRE) in the normal range of 25% to 60%, as indicated in DCD Table 9.4-1, for personnel comfort purposes.

The humidifier is not required to function following an accident.

A reduction of CRE atmosphere relative humidity following an accident will not prevent control room equipment from performing required safety functions. The Safety System Digital Platform - Mitsubishi Electric Total Advanced Controller (MELTAC) has been evaluated for its ability to function under low relative humidity conditions (<10%) and found to be acceptable for the maximum post-accident operational duration of two weeks (DCD Appendix 3D, Table 3D-2) for the following reasons:

• MELTAC modules (CPU module, etc)

MELTAC operation is not affected under temporary low-humidity conditions (for two weeks) by a moisture proof coating on boards.

• MELTAC cabinet

MELTAC operation is not affected under temporary low-humidity conditions (for two weeks) if an appropriate countermeasure against static electricity is taken, such as not placing any static electricity source in the vicinity of MELTAC modules.

Note that this response does not consider low-humidity conditions over two weeks or repetitive low-humidity conditions.

Therefore, it is not necessary to establish a minimum credible CRE relative humidity for qualification of control room electrical equipment or to change the design to include safety-related humidifiers.

Since maintaining the normal range of CRE relative humidity is not a critical parameter credited in accident analyses, DCD Table 2.7.5.1-3, Item 4.a does not include a requirement to demonstrate the capability of the MCR HVAC system to maintain relative humidity levels.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical / Topical Reports

There is no impact on the Technical / Topical Reports.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

9/19/2012

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**883-6063 REVISION 3**
SRP SECTION:	**09.04.01 - Control Room Area Ventilation System**
APPLICATION SECTION:	**DCD SECTION 9.4.1**
DATE OF RAI ISSUE:	**1/3/2012**

Question No. : 09.04.01-32

This is a follow-up RAI to RAI No. 689-4976, Question No. 09.04.01-25. The bases for this follow-up RAI is the review guidance of NUREG-0800 SRP 3.4.1. The staff found that the applicant's response to Question No. 09.04.01-25 provided a lot of useful information as to why a leak from an individual cooling coil tube is unlikely to affect the Main Control Room (MCR). However, the applicant failed to provide sufficient information about the design of the AHU cooling coils and equipment drainage system for the staff to conclude that such a leak, should it occur, will not present a coincidental common mode failure to the instrumentation and controls of the Main Control Room via the common HVAC duct lines (i.e. supply and return).

The staff disagrees with the conclusions of the following passages contained in the applicant's response: "*Therefore, the equipment and floor drain system is not required to be designed for the failure of the main control room air handling unit cooling coils.*" The staff believe the leakage from a cooling coil should not result in unacceptable consequences.

The staff notes that the applicant assumes maximum leakage rates based on an individual tube leak occurring in one of the many cooling coil tubes that make up an AHU heat exchanger. What is it about the design of the AHU cooling coil heat exchanger that prevents a more significant leak (up to 45 gpm per DCD Table 9.2.7-2) from occurring in the piping or on the header that feeds these many cooling coil tubes? In particular, what prevents this larger leakage from reaching the MCR other than the non-safety related equipment drain system? In Question 09.04.01-25, the staff requested that the applicant (1) explain the potential failure of a cooling coil will be directed to the drain system, (2) explain how the bypass of the drain system is precluded and (3) explain how the drain system will be sized, tested and maintained to ensure that it can accommodate the full flow from a cooling coil throughout the life of the plant.

The staff suggests the following as a path to closure of this Open Item. To parts (1) and (2) of the question, the "*robust design of the cooling coils*" should include design provisions to prevent any leakage from carrying over beyond the AHU and into the common (i.e. non-divisional) HVAC supply ductwork to the MCR. For examples, downward air flow across the coils and change of direction of air flows to remove from the airstream any entrained leakage from coil leaks could be part of the robust design. For the part (3) the staff acknowledges that the equipment drain system is not a safety related system but the function of the AHUs is safety related. Therefore, an AHU cooling coil catch basin with a safety related level MCR alarm to annunciate that drain capacity is being exceeded by the flow rate from the coil leak. The alarm if properly designed would give the plant operators time to respond and isolate essential chilled water flow from the coil. Collectively, these staff suggestions provide one (of potentially many) possible remedies.

The staff requests that the applicant amend DCD section 9.4.1 with the relevant design information that would allow this Open Item to be closed.

ANSWER:

In a conference call between MHI and NRC on March 1, 2012, the NRC staff clarified question 09.04.01-32 to request a description of the design requirements applied to the MCR air handling unit cooling coils, and to clarify whether the 'header' is considered to be a part of the cooling coil component. NRC also requested that a DCD reference for the design requirements applicable to the cooling coils be provided in the response or that the information be added to the DCD, as appropriate.

The air handling unit cooling coils are manufactured component assemblies consisting of end fittings, or headers, and finned tubes. Connections are provided on the header for tie-in to the chilled water supply and return piping. The connections are external to the air handling unit. As identified in DCD Table 3.2-2, Classification of Mechanical and Fluid Systems, Components, and Equipment, the main control room air handling unit cooling coils are safety-related, equipment class 3, seismic category I components. As stated in the response to RAI 689-4976, Question 09.04.01-25, the cooling coils are designed to meet the requirements of ASME AG-1- 2003. To assure integrity of the pressure retaining boundary of the cooling coils, hydrostatic pressure testing is performed as described in DCD Section 9.4.1.4.

The air handling unit cooling coils are not piping, and therefore the requirements for postulating piping breaks as described in DCD Section 3.6 are not applicable to the cooling coils. In addition, as stated in the response to Question 09.04.01-25, the failure of the cooling coils are not required to be postulated as an internal flooding source since DCD Section 3.4.1.3 identifies that only equipment or pipe not classified as seismic category I are considered to contribute to flooding due to a seismic event.

The design of the MCR air handling unit cooling coils in accordance with applicable codes and quality requirements, and the pre-service hydrostatic pressure testing, provide assurance that the pressure boundary will not fail in service. In addition, the cooling coils are not subject to postulated failure consistent with regulatory requirements. Therefore, the addition of special design features to protect against cooling coil failure or significant leakage are not warranted.

Moreover, as described in previous RAI responses, leakage from the cooling coil will not cause unacceptable conditions in the main control room.

The MCR air handling unit (AHU) is located above the main control room. The ductwork within the MCR AHU Equipment Room that includes the AHU discharge duct, which is located above the postulated flood level as described in DCD 3.4.1.5.2.2. Water intrusion into the AHU discharge duct is prevented in the event of a cooling coil failure since the AHU discharge opening is located at the top of the AHU.

As discussed above, the chilled water leakage from the cooling coil does not create an unacceptable environmental condition in the main control room via the common HVAC supply ductwork by the combination of ductwork configuration, sealing features and the AHU drain system. If chilled water leakage is greater than the capacity of the AHU drain, the excess leakage would spill from the AHU to the floor of the MCR AHU Equipment Room and would not enter the AHU discharge ductwork. MHI believes that the existing flooding event for this area bounds the cooling coil failure event whether the connections and headers are external to the AHU or not.

Accordingly, the current MCR HVAC system including the cooling coils satisfies GDC 4 for protection of MCR safety-related equipment; however postulated failure of the cooling coil pressure boundary is not required to comply with GDC4 as described in the response to Question 09.04.01-25. As described above, the DCD includes the design information for the MCR HVAC cooling coils and additional design information is not required.

Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical / Topical Reports

There is no impact on the Technical / Topical Reports.

respect to the surrounding areas to minimize un-filtered inleakage during emergency operation in pressurization mode.

The design of the MCR emergency filtration units is based on ensuring that the radiation dose (total effective dose equivalent [TEDE]) to MCR operators is well below 10 CFR 50, Appendix A "General Design Criteria 19" guidelines (Ref. 6.4-1) (5 roentgen equivalent in man [rem] TEDE) while occupying the CRE for the duration of the most severe Chapter 15 accident. The MCR emergency filtration design basis also ensures that control room personnel and equipment are protected in an environment satisfactory for extended performance.

The rated dust capacity of the MCR emergency filtration HEPA filters will be such that the pressure drop from the maximum mass loading of the filtration units will have an insignificant effect on the filtration unit flow rate. DCD_09.04.01-29

As noted in Chapter 3, the MCR HVAC system is designed to Equipment Class 3, seismic category I standards. The CRE is an area of the control room complex in the power block. Accordingly, the CRE is, by definition, the same equipment class and seismic category (e.g., Equipment Class 3, seismic category I) as the MCR.

6.4.2 System Design

The MCR HVAC system has two emergency modes: pressurization mode and isolation mode.

The pressurization mode protects the MCR operators and staff within the CRE during the accident conditions postulated in Chapter 15. The pressurization mode is initiated automatically by the MCR isolation signal (refer to Chapter 7), i.e., any one of the following:

- ECCS actuation signal
- High MCR outside air intake radiation

The isolation mode protects the MCR operators and staff within the CRE from external toxic gas or smoke.

In the normal operation mode, the MCR HVAC system draws in outside air through either of the two ~~tornado-generated~~tornado/hurricane-generated missile protection grids and the tornado depressurization protection dampers. Incoming air is directed to any two of the four 50% capacity MCR air handling units. One of the two 100% capacity MCR toilet/kitchen exhaust fans exhaust a portion of the air supplied to the MCR to the outside, while the majority of MCR ventilation air flow recirculates. Figure 6.4-2 shows the air flow path in the normal operating mode. Normal operation of the MCR HVAC system is discussed in Chapter 9, Subsection 9.4.1. DCD_02-03 S01

The emergency pressurization mode establishes a CRE pressure higher than that of adjacent areas. For automatic initiation in emergency pressurization mode, a portion of the return air flow is directed into the emergency filtration units. Outside air is drawn in through either of the two ~~tornado-generated~~tornado/hurricane-generated missile DCD_02-03 S01

Another ESF filter system is the MCR HVAC system that includes the MCR emergency filtration system described in Section 6.4 and Chapter 9, Subsection 9.4.1. The annulus emergency exhaust system is also described in Chapter 9, Subsection 9.4.5.

6.5.1.1 Design Bases

As described in Chapter 3, the annulus emergency exhaust system is designed to Equipment Class 2 and seismic category I requirements. Fan motors receive Class 1E power. The annulus emergency exhaust system is designed to establish a -1/4 inch water gauge (WG) pressure in the penetration areas and the safeguard component areas within 240 seconds to mitigate a potential leakage to the environment of fission products from the containment following a LOCA. The filtration units operate with at least 99% efficiency for particulate removal. Table 6.5-2 presents design bases and component specifications for the annulus emergency exhaust system.

The rated dust capacity of the HEPA filters of the annulus emergency exhaust filtration HEPA filters will be such that the pressure drop from the maximum mass loading of the filtration units will have an insignificant effect on the filtration unit flow rate. DCD_09.04.01-29

6.5.1.2 System Design

Figure 6.5-1 is a flow diagram of the annulus emergency exhaust system, including ducting shared with the auxiliary building HVAC system. The annulus emergency exhaust system consists of two independent and redundant 100% trains, with each train containing a filtration unit and a filtration unit fan. As shown, each train is protected by normally closed outlet and exhaust dampers. These dampers block the auxiliary building HVAC system flow into each train during normal operation, thus preserving and extending the useful service life of the annulus air filtration media.

Each filtration unit contains, in airflow order:

- A high-efficiency prefilter
- A high-efficiency particulate air (HEPA) filter

The annulus emergency exhaust filtration unit fans direct flow to the vent stack.

The annulus emergency exhaust filtration unit fan in each train automatically starts on an ECCS actuation signal. The ECCS actuation signal also closes auxiliary building HVAC system isolation dampers as follows:

- Supply line to the penetration areas and safeguard component areas
- Exhaust line from the penetration areas and the safeguard component areas

In addition, the signal starting the annulus emergency exhaust filtration unit fans opens the corresponding outlet dampers and the exhaust dampers from the penetration areas and safeguard component areas.