

Ventilation Systems of AHWR

Advanced Heavy Water Reactor (AHWR) plant has many nuclear island and other buildings. The ventilation systems of some of the important buildings are described as under

Reactor Building (RB) Ventilation

Primary containment ventilation system

The primary containment volume is divided into two, namely, V1 which houses reactor core and high enthalpy systems and V2 which houses the low enthalpy systems. There is no heat load to be removed by ventilation air from V1 area during normal as well as DBA conditions. As V1 is a high radioactivity area it is maintained at a negative pressure of 10 mm WC with respect to V2 by purge flow connected to the main ventilation system through balancing and isolation dampers. V1 area will be an occupancy zone only during maintenance activities. During Class IV failure, the ventilation system will continue to operate on Class III power supply. However, during station blackout condition the isolation dampers will close and the ventilation system will not be functional. The system is designed and qualified for Safety class II and Seismic category II.

Secondary containment ventilation system

The secondary containment envelops the primary containment and is provided to reduce ground level release of radioactivity to within permissible limits as per AERB guidelines. The annulus gap between the primary and secondary containments is about 2 m. The secondary containment is maintained at a negative pressure with respect to ambient by an exhaust system. The exhaust is passed through Prefilter and HEPA filter banks and containment isolation dampers in the normal operating mode. During DBE conditions, both the supply and exhaust paths for secondary containment will be isolated by isolation dampers and the Secondary Containment Purge and Recirculation (SCPR) system will be started.

Fuel building & Waste management plant ventilation system

The objectives of ventilation of fuel building and waste management plant are the following:

1. To maintain a negative pressure gradient in the direction of increasing activity levels,
2. To bring down the concentration of radioactive nuclides like iodine inside the building,
3. To minimize the release of activity through ground level as well as through stack.

The building is provided with once through push pull ventilation system with inter zone flow from lower active to higher active zones. Fresh air will be filtered by High Density Poly Ethylene (HDPE) filters and will be evaporative cooled by air washers and delivered to a ducted distribution system by centrifugal fans provided with class IV power supply. Cooling provided by this supply system is supplemented by local air cooling units in areas which are to be maintained at lower temperature. Exhaust system consists of filter banks and blowers and is connected to main stack.

During Class IV power failure, the exhaust system is provided with Class III power supply and exhaust fans will be run at 100% capacity. In the event of high activity level present in the spent fuel bay area, the exhaust from that area is by passed through a set of charcoal filters before being lead to the return air plenum.

Ventilation of Service building

The Service building encompasses the reactor building and is categorized in different zones depending on the level of activity. The Zone I is clean area and Zone II and III are potentially active areas. Zone III includes areas like the decontamination facility, active storage room etc., and Zone II areas includes maintenance room, work shop, change room etc. The other areas of the building are Zone I areas. The chilled water plant and the compressor room are located in the basement of this building. The Zone III and the Zone II areas are provided with once through push pull ventilation system. Fresh air is filtered by HDPE filters, evaporative cooled by air washers and delivered to a ducted distribution system by centrifugal fans provided with Class IV power supply.

Ventilation systems for Control Building

Control building main ventilation system

The objectives of control building ventilation system are:

1. To provide required air changes as per industrial ventilation requirements
2. To maintain temperatures in various areas within specified limits to maintain proper performance of instrumentations and personnel comfort
3. To provide survival ventilation system in case of radiation emergency.

The building is provided with once through push pull ventilation system. Fresh air will be filtered by HDPE filters and will be evaporative cooled by air washers and delivered to a ducted distribution system by centrifugal fans provided with Class IV power supply in all the areas of the building. Cooling provided by this supply system is supplemented by local air cooling units in areas which are to be maintained at lower temperature (about 25 °C). All the ventilated area except battery rooms are kept at slightly positive pressure and the battery rooms will have induced supply and forced exhaust system to mitigate against hydrogen concentration during boost charging.

Survival ventilation system

The control room and computer room of the control building are treated as a survival area during emergency condition, in the event of outside air being vitiated due to release of activity. The normal fresh air supply to the AC system is cut off in case of radioactivity release in the atmosphere and the same will be replaced by survival ventilation scheme. Fresh air requirements of control & computer room AC system will be supplied after filtration through pre filters and combined absolute & charcoal filters. There are two fans, one as stand-by for each units and are connected to Class III power supply. System components like fans, ducting, and dampers in survival ventilation system are Safe Shutdown Earthquake (SSE) qualified.