AIR-CONDITIONING OF THE MAIN CONTROL ROOM (DCL)

8.1. ROLE OF THE SYSTEM

8.1.1. Functional role of the system

The functional role of the air-conditioning system of the Main Control Room (DCL) is as follows:

- to maintain acceptable ambient conditions (temperature and humidity) for staff and equipment in the Main Control Room
- to ensure habitability of the Main Control Room, the Technical Support Centre and associated premises, even in the event of radioactive contamination of the environment.

8.1.2. Safety role of the system

The general safety requirements are provided in Chapter I.4.0 and the specific requirements are given below:

The safety functions of the system are as follows:

- to maintain the temperature of the air within a range compatible with the correct operation of the Instrumentation and Control safety equipment.
- To heat and ventilate the Main Control Room and the adjoining rooms

The other safety functions of the system are as follows:

- Isolation function (damper in the fresh air intake ducts)
- Filtering the air supplying the Main Control Room and the adjoining rooms
- Prevention of contaminated outside air from entering the rooms where staff are located to ensure habitability of the Main Control Room
8.2. DESIGN BASES

The DCL system is designed for the following:

- To remove heat produced by operating equipment, staff, outside supplies and supplies from neighbouring rooms to ensure that maximum authorised temperatures are not exceeded
- To ensure minimum temperature in the rooms
- To control and maintain relative humidity, especially in the Main Control Room, at 50% ±10%
- To supply an air renewal flow rate of at least 0.5 vol/hr
- To maintain the Main Control Room and the associated rooms at a pressure greater than atmospheric pressure in order to ensure habitability in the event of radioactive contamination of the environment.

The basic exterior atmospheric conditions and interior conditions (temperature and humidity) are defined in Chapter I.4.1.

8.3. DESCRIPTION AND CHARACTERISTICS OF EQUIPMENT

The ventilation system of the Main Control Room operates in recycling mode with a fresh air contribution. It supplies the Main Control Room and the adjacent rooms (instrumentation and control maintenance room, meeting rooms, the technical support centre, kitchen and washrooms).

This system comprises the following:

- two redundant air inlets equipped with anti-shock wave check valves
- two 50% iodine filtering trains, identical and physically separate
- two 50% identical and separate trains for air-conditioning facilities
- four steam humidifiers (one for each air-conditioning train)
- a single 100% network of ducts distributing air in the rooms

The four trains are installed 2 by 2, in two divisions.

In each train, the fresh air is taken from the outside through the air inlet and then mixed with recycled air.

In the event of contamination of the site, a substitute path is provided for intake of fresh air, for two trains only. This path is equipped with a heater, a pre-filter, an iodine filter, HEPA filters and a fan. A motor-driven damper is provided for switching the flow.
The recycling part of each train comprises a pre-filter, a cooling coil with droplet separator (supplied with chilled safety water by the DEL system), a fan, and a fine, high-efficiency filter. Two humidifiers (in the two conditioning trains in operation) are used for all parts air-conditioned by this system. An electric heater is used to control the temperature in the Main Control Room. The kitchen and the washrooms have a separate air extraction system.

The main network (air-conditioning trains) is made from galvanised steel. The iodine filtering train is made from decontaminable steel.

### 8.4. OPERATING CONDITIONS

The DCL system operates in all plant operating modes.

#### 8.4.1. Normal state of the system

**Definition:**

The system is used in a normal state when the plant is operating and during plant outages, except during external contamination (see Chapter D.2).

**Description:**

Normal operation is defined by the following:

- two 50% air-conditioning trains (the choice of active trains is made by the operators according to availability of trains and to ensure an equal operating time for all trains)
- the two iodine filtering trains (50%) are bypassed, and for each train the motor-driven damper located upstream of the “iodine fan” is in the closed position
- the air in the Electrical Building at the level of the control room is recycled, with the exception of the air in the kitchen and the washrooms, which is discharged outside
- for each train, the extra air is taken from outside (fresh air) through the air inlet via the electrical heater and the sealed motor-driven damper (in the “open auto position”).

#### 8.4.2. Permanent operating states

##### 8.4.2.1. Operation in the event of site contamination

**Definition:**

The permanent state corresponds to a contaminated environment following an accident on or close to the site. Contamination of the site is detected by the external contamination detection system (KRT [PRMS]).

**Description:**
This permanent operating state is defined by the following:

- the operation of two iodine filtering trains (fans and electrical heaters)
- the automatic closure position of the sealed motor-driven damper located on the fresh air duct intake for each train
- automatic opening of the motor-driven dampers located upstream of the iodine train fans
- two corresponding 50% air-conditioning trains, in operation
- the air in the rooms is recycled in accordance with normal operating state, but with the addition of the kitchen and washroom air flow rate. The air passes through the motor-driven dampers in the automatic opening position (the specific extractor is switched off)

8.4.2.2. Operation during maintenance or unavailability of the ventilation equipment

Definition:

The system is used in this permanent state during maintenance of a division (unit in operation) or during maintenance of two divisions (unit in outage) or during unavailability of one or more ventilation components.

Description:

For this permanent state, the operation of the DCL system is the same as in normal operation (see Chapter D.1), two of the four 50% ventilation trains are needed.

8.4.3. Transient states of the system

8.4.3.1. Partial or total loss of the ultimate heat sink

For the DCL system, the air flow rate is cooled by chilled water from the chilled water system (DEL).

Since only the two air-cooled cooling plants remain available, the chilled water system (DEL) only fulfills the function of cooling two trains.

8.4.3.2. Loss of Offsite Power (LOOP)

The four 50% trains are backed up by the main diesel generators. During a LOOP and in normal operation, only two of the four trains operate continuously. This is a safety requirement for the Main Control Room. The principles of emergency supply are as follows:

- in Division 2, one 50% train is backed up by Division 2 and the other by Division 1
- in Division 3, one 50% train is backed up by Division 3 and the other by Division 4.
8.4.3.3. Station Blackout (SBO)

Two of the four 50% air-conditioning trains are backed up by the ultimate emergency diesel generators. The principles of emergency supply are as follows:

- the 50% train installed in Division 2 powered by Division 1 is backed up by an ultimate emergency diesel generator.
- the 50% train installed in Division 3 powered by Division 4 is backed up by an ultimate emergency diesel generator.

8.5. PRELIMINARY SAFETY ANALYSIS

8.5.1. Compliance with regulations

The system complies with general regulations in force (see Chapter C.2).

8.5.2. Compliance with functional criteria

The DCL system is designed to comply with the temperatures given in Chapter I.4.1.

8.5.3. Compliance with design requirements

8.5.3.1. Safety classification

Compliance of design and manufacture of materials and equipment with requirements derived from classification rules is detailed in Chapter C.2.2.

8.5.3.2. CDU [SFC] or Redundancy

The DCL system is required to meet the single failure criterion. In the event of unavailability of an active or passive component, the 4 train architecture of the F1B trains ensures that the other three F1B trains are available. Since the F1B trains are not connected to each other, the failure will not affect another division.

8.5.3.3. Qualification

The equipment is qualified in accordance with the requirements described in Chapter C.7.

8.5.3.4. Instrumentation and control

The instrumentation and control processing is installed in the same electrical division as the controlled actuators.

The failsafe position required for each actuator in the event of loss of instrumentation and control will be examined at a later date.
8.5.3.5. Emergency electrical supplies

The four DCL air-conditioning trains are electrically independent; each of the trains is powered by a different electrical division, i.e.:

- one of the two trains installed in Division 2 is powered by electrical train 1 and the other by train 2
- one of the two trains installed in Division 3 is powered by electrical train 3 and the other by train 4

This provision ensures the availability of the air-conditioning function, in the event of failure of an electrical train or in the event of preventive maintenance.

In plant outage, during simultaneous maintenance of two electrical trains, two 50% air-conditioning trains remain available.

The two iodine filtering trains are electrically independent, each of the trains is powered from a different electrical train, i.e.:

In the event of failure of the electrical trains, the iodine filtering trains are backed up by the ultimate emergency diesel generators.

8.5.3.6. Hazards

See I.4.8 TAB 1.

8.6. TESTS, INSPECTIONS AND MAINTENANCE

8.6.1. Periodic tests

The safety functions are subject to periodic tests.

8.6.2. Inspection and maintenance

Maintenance may be performed with the plant in operation.

8.7. FLOW DIAGRAMS

See I.4.8 FIG 1.
### I.4.8 TAB 1 - HAZARDS

<table>
<thead>
<tr>
<th>Internal hazards</th>
<th>Protection required in principle</th>
<th>General protection</th>
<th>Specific protection introduced in the design of the system</th>
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</thead>
<tbody>
<tr>
<td>Rupture of piping</td>
<td></td>
<td>Geographical separation of redundant equipment</td>
<td>-</td>
</tr>
<tr>
<td>Failures of tanks, pumps and valves</td>
<td>No loss of more than one train</td>
<td>Geographical separation of redundant equipment</td>
<td>-</td>
</tr>
<tr>
<td>Internal missiles</td>
<td></td>
<td>Geographical separation of redundant equipment</td>
<td>-</td>
</tr>
<tr>
<td>Dropped Loads</td>
<td></td>
<td>Geographical separation of redundant equipment</td>
<td>-</td>
</tr>
<tr>
<td>Internal explosion</td>
<td></td>
<td>Geographical separation of redundant equipment</td>
<td>-</td>
</tr>
<tr>
<td>Fire</td>
<td></td>
<td>Fire zoning</td>
<td>Fire dampers around the iodine filters (prevent spread of fire)</td>
</tr>
<tr>
<td>Internal flooding</td>
<td></td>
<td>Geographical separation of redundant equipment</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External hazards</th>
<th>Protection required in principle</th>
<th>General protection</th>
<th>Specific protection introduced in the design of the system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>Seismic design</td>
</tr>
<tr>
<td>Aircraft crash</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>-</td>
</tr>
<tr>
<td>External explosion</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>Anti-shock wave check valves</td>
</tr>
<tr>
<td>External flooding</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>Rooms located in the upper levels</td>
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<tr>
<td>Snow and wind</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>-</td>
</tr>
<tr>
<td>Extreme cold</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>Electric heaters allowing the correct operation of the other systems</td>
</tr>
<tr>
<td>Electromagnetic interference</td>
<td>Yes</td>
<td>Installation in the BAS [Safeguard Buildings]</td>
<td>-</td>
</tr>
</tbody>
</table>