

INVAP PROJECT

Ventilation System for the Cyclotron and Radiopharmacy sectors of the Integral Nuclear Medicine and Radiotherapy Centre "INTECNUS" in San Carlos de Bariloche.

1. GENERAL DESCRIPTION OF THE HVAC SYSTEM

Valtria is responsible for the ventilation system of the Integral Centre for Nuclear Medicine and Radiotherapy, which is composed of 7 independent ventilation subsystems, designed to meet different requirements depending on the area of application: ISO 7 / ISO 8 / NC. These subsystems are intended for the ventilation and air conditioning of areas with the potential for surface and/or airborne radiological contamination, and should serve the premises corresponding to the Cyclotron and Radiopharmacy sectors.

The Cyclotron and Radiopharmacy sector has been classified by the ARN as a Class 1 facility, for which reason the regulatory standard AR 6.1.2, which establishes that radioactive effluent discharges to the environment must be by controlled routes through a suitable chimney, is applicable.

In view of the above, the ventilation air from the Cyclotron and Radiopharmacy sector is discharged into the environment by chimney, after filter treatment and emissions monitoring. Likewise, the design of the ventilation of ISO 7 / ISO 8 rooms related to the manufacture of radiopharmaceuticals takes into account the requirements arising from the good manufacturing practices set out in the Argentine Pharmacopoeia and ANMAT Provision 2819/2004.

Once the air extracted from the different rooms, hoods and cells has been filtered by the corresponding ventilation subsystems composed of activated carbon filters, it is discharged into a general extraction collector operating at a constant pressure of approximately - 140 Pa and from there it is discharged into the environment by the chimney extraction subsystem, after monitoring of the emissions.

In general, the ventilation of the Cyclotron and Radiopharmacy sector has the following main functions:

- Satisfy the requirement for outdoor air renewals and the cascade of pressures between rooms.
- Appropriately filter exhaust air prior to stack discharge to minimise the release of radioactive species into the environment.
- Measure all exhaust air flow rates released from the stack to enable emissions to be accounted for.
- Provide premises classified as clean areas with sufficient HEPA filtered airflow to achieve the specified cleanliness class in each case.
- Maintain humidity and ambient temperature conditions in the premises appropriate for the comfort of the operators and the correct functioning of the equipment.

2. GENERAL DESCRIPTION OF THE CONTROL SYSTEM

- a. For the Control Systems of the AHUs, a distributed PLC architecture has been selected, which are installed in the boards of each AHU. All PLCs are capable of executing their own control logic and operating in autonomous mode. They are then linked via a communications bus to a centralised control (BMS, Building Management System) that collects the variables from them and displays them on SCADA.
- b. The SCADA is responsible for collecting information from the AHU PLCs, alarm logging, modification of configuration parameters and data logging. It has the possibility to create different types of access to prioritise users. It also allows the user to create new types of alarms depending on the variables delivered by the PLCs.
- c. For the UTAs, an individual PLC with I/O expansion modules is installed up to all the control signals required by the UTA.
- d. In the event of a power failure the control will revert to the last set configuration.

3. SCOPE OF PROVISION

- a. Executive engineering, manufacture and assembly of ducts that form part of the ventilation systems that supply the Cyclotron and Radiopharmacy areas of the Integral Nuclear Medicine and Radiotherapy Centre of San Carlos de Bariloche, INTECNUS.
- b. Purchase and installation of accessories (grilles, diffusers, flow control louvres, shutters, shutters, non-return louvres, etc.).
- c. Purchase and assembly of equipment by the contractor.
- d. Assembly of equipment supplied by INVAP.
- e. Testing of ducts in the factory (tightness and surface finish) and of the installed ductwork (tightness).
- f. Inclusion of instrument connections.
- g. Seismic-resistant support.
- h. Quality management.

4. STAINLESS STEEL DUCTS

- a. Bubble tight duct with decontaminable inner and outer surfaces.
- b. Section: rectangular / circular
- c. Pressure Class: ± 2500 Pa.
- d. Type of leakage: N/A. Highly watertight duct.
- e. Sealing class: N/A. Conduit of welded construction.
- f. Material: Stainless steel sheet 304 L, 1.5 mm thick.
- g. Transverse connections by means of welded flanges according to ASME-AG1.
- h. High stringency factory and on-site leakage tests and acceptance criteria are established.
- i. A manufacturing procedure is applied, which must be validated through the application of successful tests.

5. GENERAL DESIGN CONSIDERATIONS EARTHQUAKE-RESISTANT SUPPORTS

- a. HVAC duct supports are designed in accordance with ANSI/SMACNA 006-2006 and ANSI/SMACNA 001-2008.
- b. ANSI/SMACNA 001-2008 Seismic Restraint Manual provides the basic theory and outlines a practical method for determining duct supports.
- c. The main objective of the SMACNA manual is to provide a support system that will
 - Neutralise relative pipeline movements in the event of a seismic event.
 - Withstand building movements during an earthquake so that the operation of systems is not compromised.
 - Support to the ducts against seismic ground motions, self-weight of the supports, the supported weight and air pressure of the system.

6. APPLICABLE CODES AND REGULATIONS

- a. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers.
- b. ASME: American Society of Mechanical Engineers
- c. ASTM: American Society for Testing and Materials
- d. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
- e. SMACNA 001-2008. Seismic Restraint Manual. Guidelines for mechanical Systems
- f. SMACNA 006-2006. HVAC Duct Construction Standards. Metal and flexible.
- g. **ISO 16890**: Air filters for general ventilation.
- h. EN 1822 - High efficiency air filters (EPA, HEPA and ULPA). Determining the efficiency of filter elements.
- i. Cyclotron Produced Radionuclides: Guidance on Facility Design and Production of ¹⁸F Fluorodeoxyglucose (FDG) - IAEA, Viena 2012 - STI/PUB/1515.
- j. Cyclotron Produced Radionuclides: Guidelines for Setting Up a Facility– IAEA, Viena 2009 – STI/DOC/010/471.
- k. Farmacopea Argentina 7° Ed. Vol. I- ANMAT
- l. ANMAT Disposition N° 3827/2018.
- m. ARN Regulatory Standard AR 6.1.2 - Limitation of Radioactive Effluents from Class I Radioactive Facilities

7. QUALITY ASSURANCE REQUIREMENTS

- a. The Quality requirements for the adequacy of the Cyclotron and Radiopharmacy Ventilation System are those established for products qualified with Quality Level "C".
- b. The Contractor shall deliver all the documentation (procedures) established in this Tender as Quality Plan, which shall be reviewed and approved by INVAP.
- c. It shall deliver the Data Book including the compilation of procedures, inspection and test records, instrument certificates, welder qualification, and all documentation within the scope of the Quality Plan.
- d. The work carried out by the Contractor in its different stages, or by sub-contractors, shall comply with the quality, safety and environmental plan indicated by INVAP for the project.
- e. The Contractor and Subcontractors shall implement an effective quality management system in the engineering, procurement, manufacture of the ducts and components to

be supplied, and also during assemblies, in order to demonstrate compliance with the requirements of the quality plan.

- f. The work will be framed in the inspection and testing quality plan, including documentation of executive engineering, procurement, manufacturing, assembly and testing.
- g. All instruments used in the inspection and testing stages shall be calibrated in accredited laboratories.
- h. During assembly work, it will be verified that the personnel know, understand and execute the technical and environmental methodology with which the work is to be carried out, providing them with the necessary means.

8. ENVIRONMENTAL REQUIREMENTS

We supply according to the main guidelines of the ISO 14001 standard:

- a. Identification of and compliance with applicable environmental regulations.
- b. Identification and evaluation of environmental aspects - Operational control of these aspects.
- c. Proper management of liquid and solid waste.
- d. Environmental monitoring and measurement (traceable waste management, energy consumption of equipment, use of refrigerants).
- e. Proper storage of substances with spill containment systems, fire protection, adequate ventilation, etc.