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RESEARCH AND DEVELOPMENT

UCHEM Crystal waste project: Fume Cupboard Purchase Specification

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List of Acronyms & Abbreviations

The following acronyms and abbreviations are used in this document:

EPDM	Ethylene Propylene Diene Monomer
ES	Engineering Specification
FAT	Factory Acceptance Test
FDS	Functional Design Specification
GA	General Drawings
SAT	Site Acceptance Test
HEPA	High Efficiency Particulate Air
IQOQ	Installation Qualification Operation Qualification
MOC	Maintenance of Certification
NLM	Nuclear Liability Management
OEM	Original Equipment Manufacturers
Pa	Pascal
PDO	Pre – Disposal Operations
PN	Part Number
R&TD	Research and Technology Development
WAC	Waste Acceptance Criteria

1 INTRODUCTION

UCHEM P-2700 in Bay 1 requires urgent intervention to treat crystal waste that is undergoing physical transformation from solid to liquid. The waste is radioactive and exhibits highly acidic and alkaline characteristics, which are actively corroding existing metal drums within the facility.

To safely manage this waste, it is necessary to neutralise, condition, dry, and stabilise the crystal material so that it complies with Waste Management (WM) Pre-Disposal Operations (PDO) Waste Acceptance Criteria (WAC). Research and Technology Development (R&TD), in collaboration with Engineering Services (ES), has developed and validated the required waste-treatment process. The project has been approved for implementation.

The installation of purpose-designed fume cupboards is a critical safety and containment requirement for executing this process.

2 PURPOSE

The purpose of this purchase specification is to define, in detail, the technical, safety, quality, and delivery requirements for the supply of three (3) fume cupboards for use in the UCHEM Crystal Waste Project at Necsa, Pelindaba.

This specification covers the full lifecycle of the fume cupboards, including:

- Design and sizing
- Materials selection suitable for radioactive and corrosive environments
- Safe handling and containment of radioactive waste
- Procurement of components and accessories
- Fabrication and assembly
- Quality assurance and quality control
- Packaging, transportation, and delivery to site
- Installation

- Factory Acceptance Testing (FAT)
- Site Acceptance Testing (SAT)
- Commissioning and handover

The fume cupboards and all associated accessories shall comply with applicable nuclear safety, occupational health, environmental, and engineering standards, and shall be fit for purpose as primary containment systems for radioactive waste handling.

3 SCOPE OF SUPPLY

The scope of supply includes the design, manufacture, supply, installation, commissioning, and validation of three (3) identical fume cupboards, installed adjacent to one another in a single room at Necsa, Pelindaba.

The scope includes, but is not limited to:

- Detailed engineering design and manufacturing drawings
- Supply of all structural, mechanical, electrical, and control components
- Instrumentation and monitoring systems
- Critical spares and special tools
- Factory Acceptance Testing (FAT)
- Site Acceptance Testing (SAT)
- Installation, commissioning, and validation
- Documentation and training

Any deviation from the requirements of this specification shall be clearly stated in the tender submission. In the absence of such a statement, full compliance with this specification shall be assumed.

4 GENERAL REQUIREMENTS

- The fume cupboards shall provide a safe and controlled working environment for operators handling radioactive and chemically aggressive materials.
- Each fume cupboard shall function as a primary containment system.
- Ventilation shall be integrated with the existing building ventilation system, including blowers and scrubbers.
- Each fume cupboard shall be fitted with a manually operated sash.

Intended Use of Fume Cupboards

1. Fume Cupboard 1: Neutralisation of crystal waste using 5 L containers.
2. Fume Cupboard 2: Blending, mixing, and drying of treated crystal waste.
3. Fume Cupboard 3: Sampling and packaging of conditioned waste.

5 DESIGN

- Design shall follow sound engineering practices and recognised international standards.
- Compliance with **EN 14175** and **ASHRAE 110 (latest revision)** is mandatory.
- The unit shall be **CE-marked or equivalent**.
- Design shall consider safety, ergonomics, maintainability, cleanliness, and decontamination.
- All internal corners shall be coved with a minimum radius of **16 mm**.
- Internal surfaces shall be smooth and non-porous.
- Compliance with **Occupational Health and Safety Act 85 of 1993** is required.

5.1 Shell and Shell Joints

- Shells shall be fabricated from **polypropylene** for corrosion resistance.
- Continuous welding is required.
- Design shall minimise contamination traps.
- Fasteners penetrating the containment boundary shall be avoided.
- Gaskets shall be manufactured from a single, continuous piece.

5.2 Sash

- Sash shall be manufactured from **polycarbonate**.
- Vertical sliding operation (manual or motorised).
- Adequate thickness for radiation and impact safety.
- Automatic closure or alarm if left open beyond a defined time.

5.3 Gaskets Materials

- Acceptable materials include neoprene, EPDM, butyl rubber, or silicone.
- Hardness: 35–45 durometer.
- Thickness: 3–6 mm (1/8" to 1/4").

5.4 Shell Penetrations

- All penetrations (lighting, access panels, and feedthroughs) shall maintain containment integrity.

5.5 Lighting

- LED or fluorescent lighting mounted externally where possible.
- Diffused lighting with anti-glare design.

5.6 Supports and Stands

- Fabricated from structural steel sections.
- Floor-anchored and designed for seismic and operational loads.

5.7 Instrumentation Considerations

- Differential pressure gauges or digital airflow meters.
- Filter pressure drop monitoring.
- Digital display indicating airflow and system status.
- Provide simplistic labels for quick identification and interpretation of any controls and displays on the fume cupboards and accessories thereof.

5.8 User Interface

- Intuitive layout with clear labelling.
- Push-button or touchpad controls.

5.9 Electrical Considerations

- Grounded to prevent static build-up.
- Minimum of two (2) 16 A, 230 V socket outlets per cupboard.
- Compliance with **SANS 10142-1**.

5.10 Airflow

- Face velocity: 0.5 m/s +/- 0.1 m/s (100 fpm +/- 20fpm) at the sash opening.
- Integrated airflow monitoring and alarms system.

5.11 Filtration

- HEPA or equivalent filtration suitable for radioactive particulates.

5.12 Exhaust System

- Connection to existing building ventilation system

5.13 Noise level

- Maximum noise level: **≤ 60 dB(A)** at 1 m during normal operation

5.14 Packaging, Loading & Shipping

- Modular design for ease of transport.
- Lifting lugs provided.
- System must pass through facility access routes.

6 TECHNICAL SPECIFICATION

Parameter	Specification
Overall External Dimension of each fume cupboard.	Length = < 2200 mm or advised by supplier Width = +/- 800 mm Height = < 2500 mm (including the structural support). The height of the fume cupboard must fit inside a 3m high facility, leaving room for the HVAC duct.
Process Chambers (working space)	Length = +/- 1400 mm Width = +/- 800 mm or advised by the supplier Height =1000 mm
Material of construction	Polypropylene in accordance with international standards ASHRAE 110-2016 and EN 14175.
Design Code	The fume cupboard shall be designed and fabricated in accordance international standards ASHRAE 110-2016, EN 14175 and CE certified.
Loading and unloading	Loading will be achieved by manually loading 5L HDPE bottles or beakers into the fume cupboard through the sash.
Process chamber drainage	3 x Manual drainage valve for drainage for each process chamber of the fume cupboard (or suitable method as advised by the supplier).
Surrounding environment	21 to 40 °C, and up to 80 % Relative humidity to protect the operation and control panel.

Equipment operating electrical power	Single phase power supply of 230 V, 50Hz "OR" three phase line to line 400 V, 50Hz as per SANS10142-1.

Note: The purchaser reserves the right to ask for minor modification in specification without affecting the cost of the fume cupboards.

7 FABRICATION AND ASSEMBLY REQUIREMENTS

- The Materials shall be suitable for **corrosive, radioactive, and chemically aggressive environments**.
- All fabrication shall ensure long-term structural and containment integrity.
- Design documents to be approved for fabrication and assembly before fabrication and assembly.

8 QUALIFICATION OF BIDDER

- The Only Original equipment manufacturers (OEMs) or authorised representatives may bid. In case of authorized dealer, a recent and valid authorization certificate from the OEM for the supply of fume cupboard must be attached with the offer.
- Minimum requirements:
    - ISO 9001 certification (OEM certificate will be accepted)
    - Minimum 5 years' experience in fume cupboard design and manufacture
    - Proven reference installations

Required documentation:

- IQ/OQ documentation
- Operating and maintenance manuals (1 x soft copy and 1 x hard copy)
- Design, fabrication and assembly data-pack (with GA drawings, FDS, P&IDs, PFDs, and Isometric drawings)
- Calibration certificates, filter design, and material certificates
- Critical spares list

9 FUME CUPBOARDS TEST

9.1 Factory Acceptance Test (FAT) at vendor's site

- A Verification of documentation (Design, fabrication and assembly documents)
- Material traceability (material certificates with heat numbers)
- Functional and performance testing
- Compliance with EN 14175

9.2 Site Acceptance Test (SAT)

- Installation verification
- Operational performance testing
- Operator training (At least 2 Operators)
- Critical spares to be supplied with fume cupboard (e.g. gloves, gaskets, etc.)
- Final handover and commissioning