

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

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1 INTRODUCTION

UCHEM P-2700 in Bay 1 requires urgent attention to treat crystal waste, as the solid crystals have started changing physical properties from solids to liquids. The waste is radioactive with highly acidic and alkalinity concentration, which is currently corroding metal drums in the facility. In managing these items, there is an urgent need to neutralize and condition crystal waste. The waste needs to be in solid and dry form, and chemically stable to be acceptable by WM PDO. R&TD and ES developed tested the waste treatment processes for the UCHEM special waste to meet the NLM PDO solid waste WAC. The project is approved.

2 PURPOSE

The purpose of this purchase specification is to outline in detail the requirements for three (3) off fume cupboards, sizing, design, safe handling, materials selection and procurement, fabrication, assemble, quality assurance, deliver (at Necsa in Pelindaba), installation, perform functional and site tests (FAT & SAT) and commission of the fume cupboard, along with all its accessories in compliance with nuclear safety standards. This equipment is required for containing radioactive nuclear waste, and this purchase specification shall give details on the scope of supply expected to be met by the suppliers.

3 SCOPE OF SUPPLY

The scope includes the supply, installation, commissioning and validation of three (3) off identical fume cupboard adjacent each other. Quality requirements shall be also applicable such as approving, manufacturing drawings and factory acceptance testing (FAT). The scope also includes the supply of critical spares, and special tools which must be delivered with the fume cupboards on site (at Necsa in Pelindaba).

All the requirements mentioned in this document should satisfy and meet all the requirements highlighted in the fume cupboard ISO standards. Any deviations from the requirements of specification shall be stated in the tender submission. In the absence of such statements, it shall be understood that all requirements of the purchase specification have been fulfilled without exception.

4 GENERAL REQUIREMENTS

The fume cupboards shall create a safe working space for operators to open and handle containment containers during operations. The fume cupboards shall be used as primary containment system, and the ventilation of the fume cupboards shall be dependent on the facility/building ventilation system, which include the blower and the scrubber thereof.

Each fume cupboard shall be fitted with a Sash for manual operation by the operators.

The fume cupboards required for this project are as follows:

- The first fume cupboard shall be used for naturalization of the crystal waste, where 5L bottles with crystal waste inserted through the sash for processing.
- The second fume cupboard shall be used for blending, which mixing and drying of the crystal waste,
- The last fume cupboard shall be used for sampling and packaging of the crystal waste.
- The three (3) fume cupboards shall be in adjacent with each other following the above processes, and located in one room.

5 DESIGN

- The fume cupboards and related items shall be designed to sound engineering and scientific practices and appropriate technical standards to ensure intended performance.
- Utilize the ENS 14175 and ASHRAE 110:2016 or latest revision guidelines, design checklist and applicable Standard of practice for the fume cupboards and the accessories, including datasheet, assembly drawings: shell drawing (weldment), showing windows; and other openings with welded appurtenances; miscellaneous details; dimensioning; tolerance; parts list; and shop drawings.
- The unit shall be CE-marked or equivalent for electrical and safety compliance.
- Safety, human factors, appurtenances, cleanliness, maintenance, and other interfaces must be considered when designing a fume cupboard shell.
- All internal corners shall be coved with a 16mm radius.
- The internal finishes shall be smooth for ease of cleaning and decontamination
- Adhere to Occupational Health and Safety Act 85.

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5.1 Shell and Shell Joints

- Shells shall be fabricated from polypropylene to address all corrosion resistance concerns.
- Design should minimize contamination traps created by sharp corners, cracks and crevices.
- Shell must be continuously welded.
- Avoid fastener and connections that penetrate the containment boundary
- Gaskets to be manufactured from a single piece of material to avoid joints or seams.

5.2 Sash

- Sash provide the primary means of viewing inside the fume cupboard. The sash shall be manufactured from polycarbonate for safe observation during handling.
- The sash shall have an appropriate thickness.
- Work station sash with improved visibility in the fume cupboards to minimize any strain on the operator.
- Maximize size to optimize visibility, with the goal of eliminating blind spots.
- Sash shall slide vertically for operations.
- Sash can be manual or electrically operated, and include detection system, this includes an automatic closure or alarm if left open beyond a specific time.

5.3 Gaskets Materials

- Flat gaskets made of material such as neoprene, EPDM, butyl rubber, and silicone. The gasket hardness should be 35 to 45 durometer. Thickness used shall range from 1/8 inch to 1/4 inch.

5.4 Shell Penetrations

Penetrations like lighting, access and service panels' technical specification, and feedthroughs shall be used to allow access to the fume cupboards for specific purposes while maintaining containment.

5.5 Lighting

- Lighting mounted inside to minimize maintenance inside the fume cupboard. Fluorescent or LED lighting shall be used and locate lights on top where feasible.
- Provide luminaries with baffles to diffuse light, and ensure light tube is not directly visible to a user's eye.

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- Provide flat interior surface for the fume cupboards to reduce glare and avoid glossy finishes, which induce glare.

5.6 Supports and Stands

Fume cupboards supports and stands to be fabricated from standard structural shapes, square or rectangular tubing. Supports shall be made from standard materials or constructed by welding or bolts, and anchored to the floor.

5.7 Instrumentation Considerations

- Differential Pressure Gauge and/or digital airflow meters fitted to monitor the fume cupboards internal airflow.
- Differential Pressure Gauge fitted to monitor supply and exhaust filter pressure drop.
- Provide simplistic labels for quick identification and interpretation of any controls and displays on the fume cupboards and accessories thereof.
- A control system to manage the inside of the fume cupboards, maintaining the required operation state. This includes:
 - Digital display for airflow velocity and system status
 - On/Off controls for lights, exhaust fan and optional motorized sash
 - Audible and visual alarms for low airflow, sash position, or system faults.

5.8 User Interface

- Intuitive, with clear labelling and touchpad or push-button controls.

5.9 Electrical Considerations

- The electrical components of fume cupboards shall be grounded to prevent static build-up.
- The fume cupboards should have at least two (2) 16A switched socket outlets, single phase, 230 V, 50 Hz power and main switch.

5.10 Airflow

- Minimum face velocity: 0.5 m/s +/- 0.1 m/s (100 fpm +/- 20fpm) at the sash opening to ensure contaminated particulates do not escape to the surroundings.
- Integrated digital airflow monitor with visual and audible alarms to alert users if face-velocity falls below safe levels.

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5.11 Filtration

- Equipment with high-efficiency particulate air (HEPA or applicable) filters capable of capturing radioactive and contaminated particulates.

5.12 Exhaust System

- The fume cupboard will be connected to the existing building ventilation system

5.13 Noise level

- The fume cupboards noise level not exceeding 60 dB(A) at 1 meter from the unit during normal operations.

5.14 Packaging, Loading & Shipping

- Design the fume cupboards system to disassemble into smaller sections to ease handling, crating, and shipping.
- Designs should include lifting lugs on large tanks, fume cupboards, and equipment to facilitate handling.
- Verify that the system can pass through the doorways and hallways required to reach the installation site.

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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 following information needs to be taken into account during fabrication and assembly of the fume cupboards.

7.1 Corrosive & Degrading Atmospheres

Care should be taken when selecting assemble material such as polypropylene for use in a contaminated and corrosive environment. In such circumstances, the component materials need to be able to withstand chemical, contaminated, toxicity and corrosion product attack when selected and used.

8 QUALIFICATION OF BIDDER

The original equipment manufacturers (OEM) and their authorized representatives are eligible to participate in the 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. Essential qualification criteria for the bidder are as following:

- It is desirable that the OEM to be ISO 9001: 2008 / ISO 9001: 2015 quality management system certified, CE certification or its equivalent for design and manufacture of fume cupboards.
- The OEM shall have at least five years of experience in design and manufacturing of fume cupboards.
- The bidder shall also submit the list of names of organizations where the OEM has supplied the fume cupboards. Offers not meeting these requirements will be treated as technically incomplete and may be rejected.
- Installation and Operational qualification (IQOQ) Documentation
- Operating Manual AND Maintenance (1 x soft copy and 1 x hard copy)
- GA/FDS/P&IDs/PN/ES Documents
- Calibration/ MOC/filter Certificates.

9 FUME CUPBOARDS TEST

9.1 FAT and SAT at vendor's site

A pre dispatch factory acceptance test will be carried out in the presence of purchaser's engineers as follows:

- Verification of all the documents as listed in article of this specification on information management; full technical manual, including maintenance schedules and safety protocols.
- Verification of traceability of raw materials and components used for the fume cupboards.
- The manufacturer shall perform all the above checks / testing / verification on their own and send the test report to Necsa Engineering Services prior to calling Engineers for pre-dispatch factory acceptance test as per BS EN 14175.