Republic of the Philippines
PHILIPPINE NUCLEAR RESEARCH INSTITUTE
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NRLSD BULLETIN NO. 89-3 USE OF FUME HOOD IN NUCLEAR MEDICINE FACILITIES

A. ADDRESSEES

All licensees using radioactive material in medical application particularly I-131, radioactive gases and aerosols for use in nuclear medicine.

B. PURPOSE

This bulletin is issued to keep the licensees aware of the need for fume hoods and their proper design, installation and efficient operation in a nuclear medicine laboratory.

C. DESCRIPTION OF CIRCUMSTANCES

Personnel in nuclear medicine laboratories are faced with the problem of additional radiation exposure through inhalation or ingestion of radioactive material from contaminated air. Buildup of concentrations of radioactive materials in the air inside the laboratory may be attributed to accidental spillage of radiopharmaceutical and release of gaseous or airborne radioactive substances during dispensing, handling, administering, or storing of radionuclides.

For example, in the dispensing, administration to patients and storage of I-131, a substantial quantity of radioactive material is released to the environment due to its volatile property. Mixed with the air, it is inhaled thereby causing internal as well as external radiation exposure of laboratory personnel.

To ensure the dilution and removal of undesirable air contamination, installation of a fume hood may be necessary. The hood has mechanical means of causing air to flow toward the hood with a velocity sufficient both to prevent dispersal of radioactive substances from inside the hood and to exhaust the contaminated air to the outside through appropriate filters.

The more activity of I-131 being handled, the greater is the extent of contamination of the laboratory air. The radioactivity range which requires the use of fume hoods varies with the radioisotopes used. In handling I-131, the suggested radioactivity range is **1 mCi-100 mCi**. However, the range values may be modified depending on the type of operation being conducted* thus:

Type of Operation	Modifying Factor
Simple storage	X 100
Very simple wet operations (e.g. preparation of aliquots of stock solutions)	X 10
Normal chemistry (e.g. analysis, simple chemical preparations)	X 1
Complex wet operations (e.g. multiple operations or operations with complex glass apparatus) with risk of spills	X 0.1
Simple dry operations (e.g. manipulation of powders)	X 0.1
Dry and dusty operations (e.g. grinding, sieving)	X 0.01

For example, in simple storage of I-131, the radioactivity range is 100 mCi-10 Ci; but for dry and dusty operations, only 1 mCi maximum.

D. DISCUSSION

Optimum performance from a hood can be obtained by proper design, proper installation, and efficient operation and maintenance.

D.1 **Hood Design**

Proper design of exhaust hoods is necessary if a local exhaust system is to effectively control atmospheric contamination at its source with a minimum air flow and power consumption. Effective control of a contamination producing process is brought about by capturing the contaminated air and causing it to flow into the exhaust. Flow toward the suction opening must be sufficiently high to maintain the necessary capture velocity and to overcome opposing air currents.

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* Reference: Table 2, ICRP Publication 5, Handling and Disposal of Radioactive Materials in Hospitals and Medical Research Establishments, Pergamon Press, London (1964)

Some design and installation considerations for fume hoods are the following:

1. Locate the hood away from heavy traffic aisles, doorways and air supply grilles;

2. The exhaust stack should proceed as directly as possible to the roof of the building, it should not be connected with any nonradioactive system. The stack should be 12 feet or more above the building and ensure that the contaminated air will not enter any adjacent building;

3. An average face velocity of 125-200 fpm and a minimum face velocity of 100 fpm would be necessary to insure that no contaminant would escape from the hood into the room;

4. The hood should be isolated by means of dampers to prevent back flow when the hood is not in service;

5. The hood should have appropriate filters** in its exhaust duct installed in a location where these may be easily changed. The licensee's written procedure for determining the activity of the filter should include its frequency of determination;

6. Locate the fan after the filters in the exhaust system;

7. By-pass opening in the hood is desirable to avoid excessive in draft under partially-closed sash and to simplify laboratory air flow balance;

8. Easy decontamination of the inside surface of the hood must be made possible; frequently, stainless steel is used for the metal parts of the hood for this reason;

9. Provisions for gas, air, water and electrical outlets should be controlled from outside the hood. Illumination inside the hood should be provided by a 50-100 watts bulb located outside with the light passing through a transparent sealed window;

10. If gamma-emitting nuclides are to be used in the hood, provision should be made for supporting the weight of the shielding.

** Filter arrangement: Refilter for removing larger particles from gas-stream, High Efficiency Particulate Air (HEPA) filter to remove aerosol which adsorb radioiodine, activated charcoal filter to remove the gaseous radioiodine, and end filter to remove any charcoal powder containing radioiodine

D.2 Hood Operation and Maintenance

Proper use and maintenance will increase hood life and its efficient operation:

1. Handling and dispensing operations should be conducted inside the hood as much as possible;

2. If the fume hood is being used for storage of I-131, the fan motor should be "ON" during working time to assure that the I-131 which escapes from the container is vented to the exhaust outside the facility thereby maintaining the room air contamination below Derived Air Concentration (DAC);

3. A hood should not be used for storing other laboratory items. Piles of extraneous material in the hood particularly at exhaust openings at the back interfere with hood performance. Poor performance can often be traced to blocking of exhaust openings by bottles, flasks, etc;

4. Poor operation can sometimes be traced to blockage in the blower systems. Old rags, paper, etc. sucked in or inadvertently left in the ducts will reduce blower capacity;

5. Always close the front door or sash of the fume hood when not in use. It should be opened only to the minimum extent necessary for operations to maintain sufficient inward velocity of air through the opening;

6. The opening and closing of the front door of the hood should be as smooth as possible;

7. Inspect the hood periodically; monthly for new or critical installations, quarterly or semi-annually for others;

8. Measure air changes in the room where the hood is installed every 6 months using a calibrated velometer. There should be 3 to 5 room air changes per hour;

9. After repairs, blower operation should be observed to make certain that the direction of rotation is correct.

E. REQUIRED LICENSEE ACTIONS

In response to this bulletin, licensees who handle 1 mCi or more*** of I-131 should install a fume hood in the laboratory or facility to ensure the safety of the working personnel from radioactive air contamination.

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*** depending on the type of operation

However, a licensee may seek a relaxation or exemption from this requirement if he can show that he can safely handle the radioactive materials such that radioactive contamination of the air in the facility or laboratory is below the Derived Air Concentration (DAC) limits (i.e., for I-131, 700 Bq/cu.m.). He should make an assessment of the radiation situation in the working environment to assure safe working conditions. Such evaluation should consider the nature of work, the types and quantities of radionuclides handled and their inventories, the type of facility, the possible routes and rates of release of radioactivity into the environment and the safety precautions taken to prevent undue release of radioactivity to both the working area and outside the facility. Licensees shall submit the said evaluation to PNRI for review and approval.

Should a fume hood be found necessary in his facility, the licensee should submit his construction plans and operating and maintenance procedures. The licensee should make a commitment to observe its proper use and maintenance to obtain optimum hood performance, including air flow rate measurements at least twice per year, records of which shall be kept and made available during PNRI inspection and audit.

Licensees with existing fume hood should make an evaluation of their hoods and submit to PNRI their operating and maintenance procedures and make commitment to observe proper use and maintenance of their hoods.

F. COMPLIANCE SCHEDULE

Licensees shall inform the Institute of the actions taken to comply with this Bulletin within 60 calendar days after receipt hereof.

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