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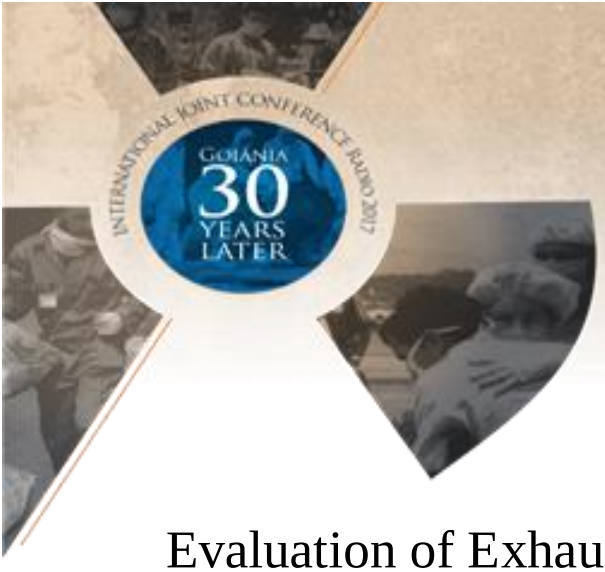

Evaluation of Exhaust System for Gaseous Waste from the Source Production Laboratory for Radiotherapy – IPEN

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ABSTRACT

Exhaust systems in fume hood for chemicals and hazardous materials as radioactive substances are of great importance for the protection of the Occupationally Exposed Individual and the environment. They protect against external contaminations by particulate matter, volatile and against inhalation of radioactive gases. This work intends to evaluate the exhaustion system of the Laboratory of Production of Radioactive Sources at the Nuclear and Energy Research Institute (IPEN).

Keywords: Radioactive waste; Gaseous waste; Filter System; Radioactive Exhaust; Iodine-125.

1. INTRODUCTION

The production of sources for medical applications, such as Iodine-125 for brachytherapy, involves several steps: fixation of the Iodine-125 on silver substrate, welding of the titanium tube used as a seed casing and quality control of the produced sources. In each of these stages the volatilization of Iodine-125 can occur and in case of failures in the ventilation systems: the radioactive contamination of the air. The main purpose of the different types of fume hood of radioisotopes is to avoid unnecessary exposure to radiation. This is by creating a depression inside the fume hood by means of an extractor, which results in an inlet air flow from the laboratory and prevents the escape of contaminated material to protect the worker. Finally, the contaminated air is eliminated through a filtration system with thick filters and activated carbon that captures these agents, thus preventing their escape into the environment [1, 2]. The exhaust hood used in the LPFRT is cuapboard type. (Fig. 1).

These systems rely on several types of filters: thin and thick filters, high efficiency particulate air (HEPA) and activated carbon. All of these filters have different efficiencies in the removal of

radioactive or non-radioactive contaminants and should be periodically replaced to ensure adequate removal of contaminants. Thus, laboratories that produce, manipulate and store radioactive materials must have such systems in place to meet the demands of the installation, guaranteeing the radiological safety of all involved and the environment. Exhaustion capacity is one of the most important items to be checked periodically by face velocity, made by means of an anemometer and expressed in meters per second (m / s) and validated by the smoke visualization test [3 - 5].

The objective of this study was to evaluate the exhaustion capacity of one of the laboratories of the Laboratory of Production of Radioactive Sources at the Nuclear and Energy Research Institute (LPFRT - IPEN) based on the ASHRAE 110 - "Method of Testing Perfomance of Laboratory Fume Hood ". The laboratory is in the phase of implantation for the developed sealed sources of Iodine-125 for brachytherapy [3].

2. MATERIALS AND METHODS

The methodology used in this study consisted of the general inspection of the system (occupation of internal space, opening of windows and filters used); evaluation of the exhaustion capacity of the system through the quantitative evaluation - face velocity using an analogical anemometer and qualitative evaluation, through the smoke visualization test. For the face velocity test, nine measurements were made with 100% opening of the chapel window; Six measurements with 50% aperture and three measurements with 25% aperture. After the measurements, the mean values were calculated for each aperture (Table 1). For the smoke visualization test two beakers with concentrated ammonium hydroxide and concentrated hydrochloric acid were used and evaluation based on the recommendation in the literature [2, 3].

Figure 1: Left: Anemometer used in the face velocity test. Center: face velocity test with full opening windows. Right: smoke visualization test.

3. RESULTS AND DISCUSSION

The average face velocity for the analyzed fume hood was 0.59 m /s, value within the International recommendations (Table 1.) [6]. The smoke visualization indicated that the flow of the hood is working properly (Fig. 1) allowing to validate the efficiency of the hood exhaust system. The visual inspection also presented satisfactory results in relation to the general conditions of the fume hood.

Table 1: Results of the face velocity test and reference values.

Window opening	Face velocity (m/s)	Average face velocity (m/s)	Velocity recommended in standard NIOSH*
25%	1.18		
50%	0.46	0,59	0,51 a 0,63
100%	0.13		

* (National Institute for Occupational Safety and Health – EUA, 2011)

4. CONCLUSION

The main results show that the system has satisfactory efficiency since it is changed periodically. The analysis of the current system available is of paramount importance for the installation in order to certify the efficiency of the already installed system. General recommendations have also been suggested to suit the current system standards.

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