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RADIOLOGICAL PRACTICES USING DOSIMETRIC FILMS AND ELECTRONIC DOSIMETERS IN F-18 PRODUCTION AT CYCLOTRON COMPLEX CENTER AT IEN/CNEN

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ABSTRACT

The aim of this work is to evaluate, guide and correct radiological practices based on dose rate values obtained from dosimetric films and electronic dosimeters used by technicians involved in Fluorine-18 production facilities at IEN/CNEN. Standard statistical methods have been used to analyze and to evaluate these results. The comparison between these results is the first step to orient decisions concerning radiological practices. Besides, radiometric routine surveys are under evaluation in order to improve radiological control in these facility areas. The electronic dosimeters provide the technicians immediate reading and this help them take protective action immediately. So the comparison between dosimetric film and electronic dosimeters data will provide information about how the recently employed electronic dosimeters are being used and what corrections in their practical use are necessary in order to achieve correct practices. In addition the results and observations obtained will be very important to implement possible changes in radiological routine practices in order to optimize them and keep occupationally exposed individuals radiological dose rates, as low as reasonably achievable, according to ALARA principle.

1. INTRODUCTION

Due to an increase ^{18}F production, improvements on facility radiation monitoring practices have beenestablished [1]. Recently, electronic dosimeters have been used to monitor gamma dose rates during ^{18}F processin, especially near ^{18}F cell. There are two particle accelerators at IEN: CV-28 and RDS-111 cyclotrons. The CV-28 accelerates protons with energy of 24 MeV and it hits two targets: 124Xe target, for ^{123}I production, used in the radiodiagnostic of thyroid and 18F used in many different types of radiodiagnostics. CV-28 of the IEN possesses capacity to accelerate different particles presented in Table 1 [2].

Table 1. Operations of the CV-28 of the IEN

Particles	**Energy (MeV)**	***Maximum external current (μA)***
Protons	2-24	*70*
Deuterons	3-14	*100*
$^{3}He^{++}$	5-38	*70*
$^{4}He^{++}$	*6-28*	*50*

In 2003, RDS – 111 was installed at IEN for 18F production. It accelerates 11 MeV protons in H_2 ^{18}O target according to nuclear reaction: **^{18}O (p, n) ^{18}F**, and 50 μA average proton current. The ^{18}F is used at IEN for the synthesis of radiopharmaceutical FDG (Fludeoxyglucose). FDG is used in PET equipment (Positron Emission Tomography) image or SPECT (Single Photon Emission Computer Tomography), and it is responsible for a revolution in the diagnostic examinations in cardiology, oncology, neurology and neuropsychiatry.

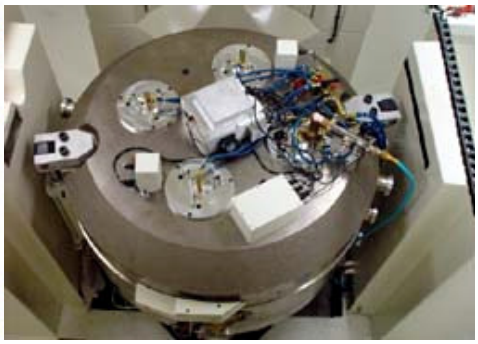

Fig. 1 ciclotron-CV-28 **Fig. 2 ciclotron –RDS-111**

2. MATERIALS AND METHOD

The Cyclotron Complex and Radiopharmaceutical Processing Center workers were advised to use standard dosimetric films at the time as the recently acquired calibrated PM1621M portable electronic dosimeters. Both dosimeters are sensible to gamma and X-ray radiation. The goal consists on the analysis and comparison of the results obtained in the electronics osimeters and dosimetric films used by the workers A, B and C. The use of electronic osimeters provide means to take immediate actions in order to minimize dose rates received by workers.

3. RESULTS

The values obtained during practices are listed in Table 2 [3,4]. Observing these data it can be een significant discrepancies. So a investigation was carried out in order to clarify what has NAC 2009, Rio de Janeiro, RJ, Brazil. really happened. After investigation on the causes for discrepancies between dosimetric film nd electronic dosimeter data it was observed that the workers were using electroni dosimeters under lead apron and the dosimetric films over it, characterizing wrong practice. Both dosimeters should have been placed on the same position in order to provide conditionsto compare results.

Table 2. Average of dose rates obtained in ^{18}F processing area

WORKERS	FILME BADGE DATA (AVERAGE) (μSvh^{-1})	PERIOD	ELETRONIC DOSIMETERS DATA (AVERAGE) (μSvh^{-1})
A	5600 ± 74.83	01/02/2008 to 04/12/2008	25.06 ± 5.08
B	850.00 ± 31.90	01/02/2008 to 04/12/2008	37.44 ± 6.12
C	850.00 ± 29.15	01/02/2008 to 04/12/2008	32.55 ± 5.70

4. CONCLUSIONS

After interviewing workers on the causes for wrong practice, they informed that it was morepractical using electronic dosimeters inside smocks pocket (under lead apron) and the dosimetric film could be placed in a small pocket over lead apron. Although both types of dosimeters have been placed on chest, electronic dosimeters were shielded by lead apron, but the dosimetric films were not. Discrepancies between dosimetric film and electronic dosemeters revealed wrong practice and its cause. This wrong use was detected and making it possible to guide for correcting procedure. This data acquisition was the first step to go on acquiring new data and observing and correcting wrong practices [5] in order to keep dose rates as low as reasonably achievable, ALARA [6].

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