Radioactive Waste Management Goiânia - São Paulo: 30 Years Later

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ABSTRACT

Considered the largest urban radiological accident in the world, the accident in Goiânia with Cesium-137 resulted in the death of four people and injuries in another 49, besides measurable levels of internal or external contamination in 129. The accident generated also environmental contamination and thousands of tons of radioactive waste that resulted from the response activities. The accident occurred as a result of the dismantling of an equipment of radiotherapy by employees of a junkyard. Before the accident was identified, contaminated materials were sent to recycling companies in the state of São Paulo. The objective of this work was to report the existence of waste from Goiânia accident in the state of São Paulo and to check the estimated activities at the time of the waste conditioning by measuring the current dose rates in waste packages, allowing a refinement of previously applied calculations.

Keywords: Radioactive waste; Radiological accident Goiânia; Cesium-137; Waste management.

1. INTRODUCTION

The accident in Goiânia occurred as a result of the dismantling of an equipment of radiotherapy by employees of a junkyard who also collected scrap paper for recycling. Most of the waste generated by the accident response team was managed locally and disposed of in the nearby town of Abadia de Goiás. However during the screening of contaminated scrap paper in recycling companies of Goiânia, team members learnt that before the accident was recognized, contaminated paper bales and scrap metal were sent to recycling companies in the state of São Paulo., Contaminated material was eventually located in four cities (Araras, São Carlos, Osasco and São Paulo) [1, 2], collected and transferred to Radioactive Waste Management Facility (RWMF) at the Nuclear and Energy Research Institute (IPEN). Approximately 39 tons of contaminated paper and scrap metal were collected by IPEN. Patient excreta and other waste from patients treated in the Marcílio Dias Hospital in Rio de Janeiro were also transferred to this storage [3].

In August 1988, the collected paper bales were conditioned in 1.6 m^3 -stainless steel boxes and stored together with the other accident waste 200 L- drums. Table 1 shows stored waste data and Figure 1 shows the paper bales conditioning operation in 1988 and the present day appearance of the storage room.

Table 1: Data about the waste coming from the Goiania accident, stored in the RWMF, in São Paulo.

Waste type	Papel bales	Metal scrap	Compacted waste	Cemented excreta
No. of packages	50 boxes	43 drums	43 drums	17 drums
Total mass (tons)	39.028	8,0	4.4	2.3
Total volume (m^3)	86.4	8.9	8.9	3.6
Contact dose rate (mSv/h)	1.5	0.10	1.0	0.10
Estimated Activity (GBq)	165	50	3.3	0.86

Figure 1: Waste collected in the state of São Paulo was conditioned in stainless steel boxes (left) and are presently stored at the RWMF, at IPEN (right).

The reported activities are the result of an estimate based on dose rate measurements at 1 meter from the surface of the waste packages. A review of the activities present in the packages are the objective of this paper.

2. MATERIALS AND METHODS

The data collected in this retrospective study were: volume, activity, dose rate at 0.50 cm, 100 cm and 150 cm of each waste package. For data of total volume of storage, height, width and depth measurements of the storage boxes were obtained and later used for usual calculation of volume and total volume. Dose rate measurements were compared with recalculated dose rates using Micro-Shield®.

For validation of the MicroShield® calculations the dose rates were measured in the boxes at the same distances with portable detector model FAG FH 40F2. Results of the dose rates of only two boxes are presented here.

3. RESULTS AND DISCUSSION

The relationship between measured and calculated dose rates (Fig. 2) indicates that box activities were overestimated at the time of storage in August 1988. The working conditions in the middle of an accident response may have interfered and made it difficult to correctly measure these activities (Table 2).

Figure 2: Graph of the relationship between dose rates measured at distances of 0.5 m, 1.0 m and 1.5 m and calculated with the MicroShield® 9.03 program.

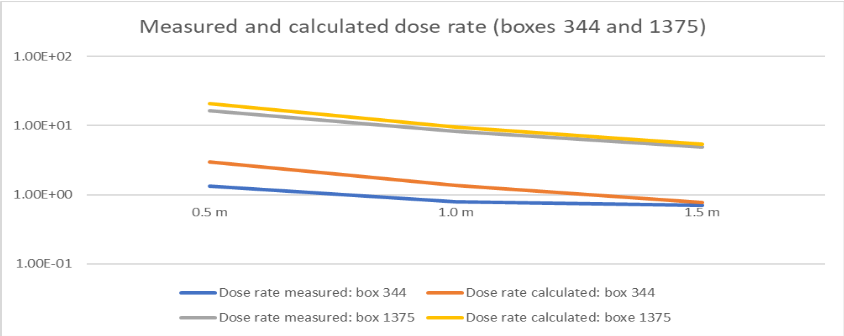

Table 1: Correction of current activities and exposure rates.

		Old	Current	Old	Old	Current		
Box	Packaging date	activity (MBq)	activity (MBq)	Exposure rate (µSv/h)	Exposure rate 1m (µSv/h)	Exposure rate 0,5 m (µSv/h)	Exposure rate 1m (µSv/h)	Exposure rate 1,5 m (µSv/h)
241	01/03/1988	97	49	6	0,3	1,17E+00	5,42E-01	3,04E-01
246	02/03/1988	9731	4901	600	38	1,08E+02	4,97E+01	2,77E+01
247	01/03/1988	24346	12261	1500	94	3,02E+02	1,40E+02	7,88E+01
251	03/03/1988	130	65	8	1	1,52E+00	7,05E-01	3,95E-01
260	03/03/1988	130	65	8	1	1,45E+00	6,69E-01	3,74E-01

4. CONCLUSION

Despite the catastrophic dimensions, the accident leaves us with an important legacy: the recognition of the constant need to improve the safety of radiological equipment and facilities. The aim of this paper is, however, to report to the broader audience of the Joint Conference Radio 2017, facts that may have passed unnoticed, that the Goiânia Accident had impacted much farther than was usually reported in scientific papers and by the media.

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