RESEARCH WASTE MANAGEMENT PROGRAM - AN ACTION PROPOSAL

COSTA RAMOS, A; ESPÓSITO, I
Radioactive Waste Management Coordination
Superintendence of Licensing and Control
Brazilian Nuclear Energy Commission

XA9745659

Abstract

The Brazilian Nuclear Energy Commission planned, prepared and established a Research Waste Management Program, started in 1996, in order to map, to analyze and to solve the common problems in the research field. The specific study done included a large number of academic institutions. The procedures, results and operational methodology used by the Team linked to the Program , in one of the research institutions studied where corrective actions were implemented to avoid unnecessary dose to the public, will be discussed in this article.

1. INTRODUCTION

In Brazil, scientific researches with radioactive material, are developed, mainly in as public and private universities as well as public research establishments and private enterprises and are related to medical and biological field[1].

To ensure protection of human health and environment, now and in the future, the Brazilian Nuclear Energy Commission(CNEN) established a program named "Research Waste Management Program(PROGER)" , in order to control and to optimize the management of the wastes generated by the radiological research labs and avoid dissemination of radioactive material into the environment and the public.

2. PROCEDURES

The starting action for the Program consisted of preparation of specific questionnaires about waste management, and its distribution by mail, among academic institutions of all country.

The questionnaires distributed broached questions about: trends of researches; description of the use of radionuclides; radionuclides more frequently in use; types of radioactive waste generated; amount of radioactive waste generated; radioactive waste management executed; the current disposal of the radioactive waste; provisory deposit for radioactive waste; radiological experience of the personnel and the on-going Radioprotection Service.

An Operational Team was selected in CNEN's staff to plan and prepare corrective actions in the cases when it might be necessary.

3. RESULTS

A number of 123 questionnaires were distributed, covering 48 scientific and academic institutions. A total number of 174 researches labs answered and sent back the questionnaires to CNEN.

The Operational Team started its functions, at the end of 1996, by a cooperation agreement with a research institution located in Rio de Janeiro Federal University. This institution was selected and contacted taken into account their location, nearby of CNEN's headquarters, and the possibility to train all the personnel of CNEN's team at the same time in the tasks of this special case of radioactive waste management, and to train the personnel of the Radioprotection Service of the University in waste management too.

The selected institute had 13 labs. developing researches with radioactive materials and one radioactive waste storage room. An overview of the 13 labs condition linked to radiological waste generation might be seen in Table 1.

After a analysis of the lab conditions and in the storage room, the CNEN's Team established the goals to be accomplished with the implementation of the PROGER in the institution:

01) **Inspection and technical visit :**

A interaction between the generator and the inspection service is strongly recommended, to carry out the identification and documentation of principal duties, tasks and difficulties to implement the correct waste management.

02) **Radioprotection Service:**

A Radioprotection Service, according a CNEN's specific regulation[2], is a service in charge of the execution and maintenance of a radioprotection plan, include a radioactive waste management plan. In fact, the development and improvement of a Radioprotection Service in the institutions is important to ensure continuity in the work developed after a corrective action.

03) **Storage and segregation of radioactive waste:**

Storage for decay is the best method to be used in the research waste case, due the low level of activity and the short half-life of the majority of radionuclides used. Therefore after the storage the waste can be released on urban garbage system and sanitary sewerage system within the specific clearance limits.

Segregation is a fundamental action for waste management and allows for a correct inventory of the waste[3].

04) **Biological and organic radioactive wastes:**

Radioactive waste of biological materials must be managed with particular care due their potential hazards. A special strategy for the correct management of this waste is necessary in order to carry out a safe handling, processing, storage and disposal.

Organic radioactive wastes require special management that take into account both their radioactivity and their chemical content, because the organic radioactive waste can have besides its radioactivity detriment a chemical detrimental effects[4].

05) **Removal of wastes which needs to be disposal:**

A safety and correct handling and packing of the wastes which needs disposal or special care, as Carbon-14(C-14), tritium(H-3), Cesium-137(Cs-137) or Cobalt-60(Co-60)[5] should be provide by the Team.

06) **Safety culture of each lab with the non radiological aspects of safety:**

In several research labs investigated , the principal problem is not due to the radiological risk, but due the chemical hazard and the absence of personnel training in this field[6].

07) **Educational Program:**

It is strongly necessary to provide specific education to researches, in order to homogenize the actions and procedures[7].

08) **Environmental monitoring:**

It's recommended the establishment of a environmental monitoring program when we have quantities of radionuclides released into the environment like in this case.

4. OPERATIONAL METHODOLOGY

The main problem founded on the institution was related to the radioactive waste storage room, where, during 6 years, all types of waste was storage without the necessary care.

To solve this problem a control point and a segregate area was prepared: the floor was covered with a plastic film; the area around was monitored, signalized and isolated; steel drums of 200 litters were lined with plastic bags to put the segregate wastes inside; the access was restricted; the Security Service of the University was advised and the public (students, employees and professors) too.

The categorization of the solid waste in accordance with practical experience took into account the fact that the waste were a combining of gamma and beta emitters, and so it was possible to use the radiation count rate of the waste to classify it[8]. The categories selected was showed in Table 2.

The waste were segregate slowly once that part of it didn't have any tag to identify the activity of the contents. Most part of the waste were pure beta emitters, including soft beta like Sulfur 35(S-35) and Tritium (H-3) and in order to avoid mistakes in the segregation works, all soft beta emitters were include in the category of radioactive waste to be analyzed better in the future. All the waste of C-14 and H-3 were storage separately to be removed to a temporally deposit of CNEN.

The corrective actions spent 72 working hours to segregate the waste, to remove it, to clean up and prepared the new storage room. The CNEN's Team used the same procedures of the segregate actions in the Goiânia's Accident[9]. The amount of waste put out like common garbage; storage for decay and collected for a CNEN's institute is shown in Table 3. The quantities of personnel protection material, dump steel drums, plastic bags, and other materials used in the operational actions is shown in Table 4.

The liquid waste management applied in the institution nowadays is under investigation, because although the volume of soluble liquid waste released by each lab individually into the sewerage system be in accordance with the Brazilian specific regulation[10], it's necessary more data about the total volume of the sewerage system and the total volume of aqueous waste released by all labs of the institution, to make a more refined evaluation of the on-going situation concerning the Brazilian regulation.

The volume of organic liquid waste is small when compared with aqueous radioactive waste. Most part of the organic waste is composed of scintillation liquids from radiochemical analysis such as toluene, and were storage for future treatment like, for instance, fractionation to recover the toluene.

5. CONCLUSION

Most part of the established goals for the actions on this institution were reached:

1) The interaction with the researches were positive and promising;
2) The training of the Radioprotection Service was very good and the exchange of experiences very useful;
3) The necessary actions to segregate the waste were and improved. The levels of the radiation measures(cps) inside the storage room decrease twice, and nowadays is the same of the currently background in the surrounding area;
4) The main problem of the actions were related to the biological and organic wastes. The researches of the institution are trying together with the CNEN's staff, to find the better solution for this specific problem;
5) The removed wastes were composed mainly of C-14 and H-3, due to there half-life and the difficult of detection;
6) Instructions for safety behavior inside a chemical lab were distributed;
7) The educational program to researches is being implemented by seminaries given by the CNEN's staff.
8) A environmental monitoring program might be established in order to ensure the radiological safety around the installation.

The main results of this Radioactive Waste Management Program - PROGER is master by practice of segregation, storage, monitoring and others actions, the correct and applicable radioactive waste management in scientific researches institutions in Brazil.

It is clearly necessary to improve and to expand the PROGER to all country, to avoid unnecessary exposure, and to reduce the probability of the so called stochastic effects of low doses[11] in the academic institutions.

TABLES

BIOCHEMISTRY LABORATORYS	RADIONUCLIDES IN USE	WASTE TYPES*
Nº 01	S-35; C-14; H-3	SW, LW
Nº 02	Ca-45; C-14; S-35; Fe-55; Fe-59; H-3; I-125; P-32	SW, LW
Nº 03	H-3; C-14; S-35; P-32	SW,LW
Nº 04	Cr-51; H-3	SW,LW
Nº 05	P-32; Ca-45; Sr-90	SW,LW
Nº 06	P-32; Ca-45; C-14; H-3	SW,LW
Nº 07	H-3	SW,LW
Nº 08	P-32	SW,LW
Nº 09	P-32	SW,LW
Nº 10	H-3; C-14; S-35; P-32	SW,LW
Nº 11	P-32; I-125; S-35	SW,LW
Nº 12	P-32; Ca-45; H-3	SW,LW
Nº 13	H-3; P-32	SW,LW
TOTAL 13 Labs	H-3; C-14; P-32; S-35; I-125; Cr-51; Ca-45; Fe-55; Fe-59	

TABLE 1

INSTITUTION LABS., WASTE OVERVIEW

* SW - solid waste / LW - liquid waste

CATEGORY	RADIATION MEASUREMENT(RM) ON THE SURFACE OF WASTES (CPS)	REMARKS
Common Garbage	R.M.= Background*	β, γ emitters
Waste to decay more	R.M >Background	β, γ emitters
Waste to storage	R.M.>>3xBackground	β, γ emitters

TABLE 2
ADOPTED CATEGORIES OF SOLID WASTE

*200 cps = background counting rate

CLASSIFICATION	QUANTITY (V=liter)•	REMARKS
Common Garbage	20000	
Waste Storage	1000	For decay
Waste Removed	1200	C-14; H-3 and Sr-90

TABLE 3
TOTAL QUANTITY OF WASTE

•The waste were evaluated in liters due the total volume used of plastic bags with wastes after segregation

PROTECTION EQUIPMENT	QUANTITY
Disposable overall	20
Disposable masks anti-dust	20
Disposable overshoe (pair)	20
Steel dump drums 200 liters	10
Rubber gloves (pair)	20
Plastic bags 200 liters	100
Plastic sheet (m^2)	30

TABLE 4
PROTECTION EQUIPMENT

REFERENCES

Thesis

[1] CABALLERO,K.C., Radiation Protection in Brazilian Universities, M.sC. Thesis, Federal University of Rio de Janeiro, Rio de Janeiro(1993).

CNEN 's Regulation

[2] Radioprotection Service Regulation - CNEN-NE- 3.02, 1 vol., CNEN, Rio de Janeiro(1988)

Report

[3] INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, Principles for the Disposal of Solid Radioactive Waste, Report of Committee 4, Pergamon Press(1988) 2-3.

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Handling and Treatment of Radioactive Aqueous Waste, IAEA - TecDoc 654, Vienna (1992), 21.

Journal Article

[5] MOURAO, R. P., Packing For The Transport And Storage Of Spent Sealed Sources In Brazil, RAMTRANS, Vol. 7,Nos 2/3, Nuclear Technology Publishing(1996), 163-167.

[6] SOUZA PORTO, M.F., FREITAS, C.M., Major Chemical Accidents in Industrializing Countries:The Socio-Political Amplification of Risk, Risk Analysis,Vol.16, No.1(1996),19-29

Report

[7] IBID [4], 19

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Standardization of Radioactive Waste Categories, Technical Reports Series No. 101(1970), 12-14.

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, The Radiological Accident of Goiânia, IAEA Report, Vienna(1988), 82-84.

CNEN 's Regulation

[10] Radioactive Waste Management in Radioactive Installation - CNEN-NE- 6.05, 1 vol., CNEN, Rio de Janeiro(1985).

Paper

[11] FRY, R. J. M., Effects of Low Doses of Radiation, Health Physics 70, vol.6(1996)823-827.