Exemption and Clearance Progress in the Argentine Regulatory System

Bossio, M.C.

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Bossio, M.C.[1]

Nuclear Regulatory Authority
Argentina

Abstract

Generic Exemption Levels and Generic Clearance Levels were adopted by the Nuclear Regulatory Authority (ARN), which recommended the Radioactive Waste Department of such institution the development of regulatory implementation guides, which are currently available in the ARN's website.
The progress made in Argentina related to exemption and clearance of practices or materials containing radionuclides is addressed in this paper. In this context, examples of some clearance and exemptions requests are presented.
As consequence of the implementation of the exemption and clearance generic levels, the ARN expects to optimize the regulatory registration system and the radioactive waste management system, taking into account that there is no need to control radioactive materials that produce trivial doses to the public and to the environment. As a result, the ARN will develop a graded approach when allocating its resources, stressing out those activities that present a significant radiation risk, fulfilling with the IAEA's international recommendations.

Introduction

With the aim of optimizing the regulatory system in Argentina, the Nuclear Regulatory Authority (ARN) evaluated two worldwide concepts used in the radioactive waste management field: "Generic Exemption Levels" (NGE) and "Generic Clearance Levels" (GCL). The analysis covered the study of international references, especially, the Document from the Commission of the European Communities "Radiation Protection 65" and the "Safety Reports Series 44", from the International Atomic Energy Agency, in which the scenarios used to derive these levels are established [1][2]. The parameters used in each scenario and its corresponding degree of conservatism were thoroughly evaluated, and based on this assessment, the possible adoption of such levels in the Argentinean Regulations was considered.

In 2007, the ARN Director's board approved the adoption of the Generic Exemption Levels recommending the development of a regulatory implementation guide. From that date an important progress has been done concerning exemption of radioactive material. This paper addresses the results and conclusions of evaluations from some requests received by the ARN, such as, the exemption of the distribution, use and final disposal of lighting products with radioactive material (^{85}Kr and ^{232}Th), the exemption for the trade, installation, use and decommissioning of welding TIGs (plasma spraying) containing ^{232}Th, and the release of Ionization Chamber Smoke Detectors (ICSDs) containing ^{241}Am.

In 2009, the ARN Director's board approved the adoption of the Generic Clearance Levels, recommending also the development of a regulatory implementation guide. Since that year, nuclear fuel cycle facilities have been very interested in the possibility of releasing materials with radioactive content from their installations, however, as the demonstration for compliance with the generic values is not an easy task, the ARN did not receive any formal request yet from these facilities. In the meantime, the ARN has organized a symposium for the "National Radioactive Waste Management Program" with the aim of providing guidance on clearance procedures. As a result, in the next years, the ARN expects to receive more clearance requests including the release of silica gel, metals components, compactable waste from nuclear power plants and other facilities within nuclear fuel cycle.

However, progress has been made related to conditional clearance. Conditional clearance is based on a case by case study, and it consists on releasing radioactive material if the trivial dose criterion is met (10-

[1] mbossio@arn.gob.ar

100μSv/y) [5]. This paper addresses the result of the evaluation of a conditional clearance concerning liquid waste with ^{3}H from a laboratory.

The regulatory implementation guides for exemption and clearance are currently available in the ARN's website (AR Guide 06 and AR Guide 08) [3] [4].

Evaluations Regarding Exemption

1. Luminous Lamps Containing ^{85}Kr and ^{232}Th

The ARN received a request for granting the exemption for the import, export, use and storage of luminous lamps containing ^{85}Kr and ^{232}Th.

In Argentina the international trade of any radioactive material is subject to control regardless the total activity or the activity concentration. Therefore, the import or export of these luminous lamps should be notified to the ARN.

In order to determine if the use and storage of these products were exempted the following assessment was carried out.
The total activity for each model of the luminous lamp declared by the petitioner was compared to the NGE of ^{85}Kr (10000 Bq) and ^{232}Th (1000Bq) established in the regulatory guide AR 6. In all the analyzed cases the total activity was smaller than the NGE, therefore the use of these lamps would not represent any radiological risk to the public considering them exempted form regulatory control. However, if the petitioner changes any of the conditions declared in its request, it should be notified to the ARN in order to determine if the exemption is still valid. The associated final disposal of these is also exempted form regulatory control.

In order to evaluate if the storage of these products represent a risk to the public or if the practice could be exempted, the maximum activity to be stored was needed. The petitioner declared that no more than 14,3 MBq of ^{85}Kr y 6,3 KBq of ^{232}Th would be stored at any moment.

The exposure scenarios considered for this assessment were external irradiation and inhalation of combustion products as a result of an accidental fire.[1] First, the scenarios were calculated for the lamps containing ^{85}Kr and then for lamps with ^{232}Th. Finally the doses were summed up.
The first exposure pathway considers a person working in an office at 5meters from the deposit according to the lay out provided by the petitioner. The radioactive lamps were represented as a punctual source of 1m3. For the external exposure from lamps with ^{85}Kr, the beta radiation was not taken into account and for ^{232}Th alpha radiation was not considered. The resultant dose for this scenario was 0,48μSv/a. Therefore, the external dose received from the storage of these lamps is below the trivial dose range [5].

The second scenario considered a person inhaling the combustion products that fill the volume of the storeroom as a result of an accidental fire during 10 minutes. All the activity is assumed to get on fire. It was also assumed that the airborne concentration remains constant during 10 minutes. The inhalation dosimetric factor for ^{85}Kr is negligible. Therefore the relevant radionuclide in this case was ^{232}Th. The resultant dose for this scenario was 0,00132 μSv/y.

In order to complete the evaluation and assess the doses received by the public living near the deposit in case of an accidental fire, the HOT SPOT model was run considering different atmospheric conditions. The worst scenario considered (Hf[2] = 0 m y Hp[3] = 4 m, y F stability class F (0,1 m/s)) originates a dose of 0,00315μSv/y for ^{232}Th and 0,000138 μSv/y for ^{85}Kr. [7]

As consequence, the storage of luminous lamps does not represent any radiological risk to the workers or public, and the exemption of this practice has been granted by the ARN. However, if the total activity stored exceeds in one order of magnitude from the one declared by the petitioner, a new assessment should be carried out in order to guarantee radiological safety.

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[2] Hf: Height of fire
[3] Hp: Height of plume

2. Welding TIGs (Plasma Spraying) Containing ^{232}Th.

In December 2012 the ARN received a request for the exemption of the practice of importation, sale, installation and dismantling of 10 (ten) Welding TIGs (plasma spraying) containing ^{232}Th.

As mentioned before, in Argentina the international trade of any radioactive material is subject to control regardless the total activity or the activity concentration. Consequently, the import or export of these welding TIG´s should be notified to the ARN.

According to the petitioner, the total activity for each electrode was 1232 Bq. This activity exceeds the NGE established in the AR Guide 06 of 1000 Bq[3]. However, a series of exposure scenarios were evaluated in order to analyze if the trivial dose criteria was still met, allowing the exemption of the practice.[8]

The exposure pathways considered were [1]:

1) External irradiation due to storage of 10 TIG´s
2) External dose from handling a TIG
3) Final disposal in landfill site
4) Accidental fire in storage

The doses that arise from these scenarios were, in the first case E = 0,22 μSv/y, in the second case E = 0,0262 μSv/y and in the third case E = 0,54 μSv/y. In the last exposure pathway the dose was of the order of 27μSv/y, but the comparison dose criteria established in [1] for low probability scenarios is 1mSv/y. As it can be noticed, the doses are trivial, thus they do not represent a significant risk to the public.

In order to complete the evaluation, the professional use was also considered. As these electrodes would be handled in a remote way and the user would be isolated in a metallization cabin, the doses would result trivial as well. As consequence, the exemption of the practice was granted by the ARN. However, if the petitioner changes the conditions declared in the request, such as for example, the amount of electrodes in stock, it should be verified that the doses are still trivial.

3. Final Disposal of Smoke Detectors

In May 2013 the ARN received an enquiry on how to manage the final disposal of 2 smoke detectors containing Am 241. The information about the activity, brand, model and photo of the smoke detector was requested in order to proceed with the evaluation. Due to confidential agreements, the brands will be named as "A" and "B". The total activity for the "A" smoke detector was 0,9μCi and for the "B" detector was 1μC.

As it can be observed, the activities for these smoke detectors exceed the NGE for ^{241} Am (10000Bq) established in the AR Guide 6 [3], however, a series of exposure scenarios were analyzed in order to determine the possibility of granting a conditional exemption and allowing a conventional final disposal.

The scenarios considered were [1]:

- External exposure considering the smokes detectors as a point source
- External exposure from a landfill site.
- External exposure to skin from handling the smokes detectors found at a landfill site
- Ingestion of the ^{241}Am source at a landfill site.

For the analysis it was conservatively assumed that the activity of both smoke detectors was 1 μCi (37000Bq).

The first scenario considers that a child could be exposed to both smoke detectors left in a room of a house for a total of 5000 hrs. For the second scenario, the total exposure time considered was 300hrs. For

the third scenario it was considered that a child could play 10 minutes per day during a year with the source. None of these scenarios represented a significant dose.

The critical exposure pathway for this assessment corresponds to the last scenario: "ingestion of the ^{241} Am source at a landfill site", which assumes that a child inadvertently ingests a small fraction (1.10^{-3}) of the radioactive source.

The scenario is represented by the following calculation:

E = A * R9 * f * DECAY

Where R9 = Ingestion dose coefficient factor for child [6]

E = 37000 Bq * $3{,}7.10^{-7}$ Sv / Bq * 1.10^{-3} * 0,99

E = 13,5 μSv/ año

As it can be observed, the dose arising from for the critical exposure pathway is greater than 10μSv/y, but still lies between the trivial dose range. [5]

The ARN allowed the final disposal of the 2 smoke detectors in a landfill site considering that the doses arising from the scenarios would be trivial to the public, and that the radioactive material is securely bound in a metal foil which makes the source inherently safe.

Evaluations regarding Clearance

1. Clearance of Radioactive Waste from a Laboratory

In September 2012 the ARN received a request for conditional clearance of liquid radioactive waste generated in laboratory of food contaminant analysis.

The petitioner establishes that 3 batches of analysis are carried out per week in the laboratory. In each batch 50 tubes with organic substances and ^{3}H are used. Each tube contains 7ml and a total activity of 0,014 μCi. The radioactive liquid wastes are discarded in 20lts plastic drum. The maximum storage period of these wastes is 6 weeks; hence 18 batches of 50 tubes will be generated in this period. This means that the total volume and the total activity that would be stored is 12, 6 μCi. Conservatively assuming that the density of the solution is equal to the density of water (1g/cm3), the mass of waste would be 6,3 kg. Due to the fact that it is a homogeneous waste, the resultant activity would be 74 Bq/g.

As it can be observed, the activity concentration of the waste is significantly smaller than the NGE (in activity concentration) established in the AR Guide 6 of 1.106 Bq/g[1] and is less that the GCL established in the AR Guide 8 of 100 Bq/g [4].

As consequence, the ARN granted the conditional clearance for these wastes. Nonetheless, it should be noticed that these waste should be treated as hazard wastes and be incinerated in order to avoid any other kind of risk. If the petitioner wishes to change the storage procedure, or decides to mix these wastes with other wastes, he must notify the ARN in order to assess the conditional clearance under the new conditions.

Conclusions

As a result form the adoption and implementation of exemption and clearance levels, the ARN expects to optimize the regulatory registration system and the radioactive waste management system, taking into account that there is no need to control radioactive materials that produce trivial doses to the public and to the environment. As a result, the ARN will develop a graded approach when allocating its resources, stressing out those activities that present a significant radiation risk, fulfilling with the IAEA's international recommendations.

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