National Campaign for the Search and Recovery of Orphan Radioactive Sources
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Abstract. This paper aims to describe the main initial approaches of the campaign for the “Recovery of Orphan Radioactive Sources” undertaken in Spain, in addition to the steps taken, the experience gained and the partial results obtained. The campaign began on 19\textsuperscript{th} February 2007 and this paper reports the findings until 31\textsuperscript{st} December 2007. The paper aims to share the experience gained with others who are considering or are already involved in similar campaigns and to enable opinions to be exchanged with those responsible for such campaigns in other countries. The campaign was initiated by the Spanish Ministry of Industry, Tourism and Trade with the expert assistance of the Nuclear Security Council. The initiative came about as a result of national legislation currently in force regarding the control of highly active and orphan radioactive source, which implements a European Directive. The campaign was commissioned to ENRESA (the Spanish National Company for Radioactive Waste Management) and the work, which began in 2007, will continue into 2008. The campaign aims to seek and recover the largest possible number of orphan radioactive sources (an orphan radioactive source is understood to be one which is detected outside the standard control system and which, when detected, has an activity level higher than the exemption levels established in national and European regulations) and involves the collaboration of various different agents and organisations where such sources are or may be found. Finally, the paper provides details regarding the number and radiological characteristics of the sources which have already been recovered in Spain during the 2007 campaign.

KEYWORDS: orphan; sources; campaign; Spain.

1- Introduction

The purpose of this study is to describe the initial basic approaches, the steps followed and the experience and partial results obtained in the campaign for "The Search and Recovery of Orphan Radioactive Sources", organised in Spain, from its start on the 19\textsuperscript{th} of February until 31\textsuperscript{st} December 2007. The intention is to share this experience with those who wish to start or have already begun similar campaigns, enabling the exchange of opinions with those responsible in other countries.

2- Approach

The campaign was launched on the initiative of the Ministry of Industry, Tourism and Trade (MITYCYC), with the advice of the Nuclear Safety Council (CSN). The initiative came about as a result of national legislation currently in force regarding the control of high activity and "orphan" radioactive sources, as incorporated in a European Directive. The implementation was entrusted to ENRESA (the Spanish National Company for Radioactive Waste Management SA), who will carry it out between 2007 and 2008.

This initiative gives continuity to others driven by the authorities in our country over three decades, such as the withdrawal of radium sources from medical use, the withdrawal of sources from any application in disuse, including radiotherapy and radioactive heads of lightning rods. It also covers the development of the Collaborative Protocol for the Radiological Surveillance of Metallic Materials, in progress since 1999.
In addition in Spain a specific administrative mechanism has existed for many years, by which any holder of an “unregulated” radioactive source could request the Authorities for its official disposal, managed by an authorised national agent (ENRESA from 1986). This is referred to as a “Transfer Licence”.

3- Objectives

The aim of the campaign is the search and recovery of the largest possible number of orphan radioactive sources. "Orphan radioactive sources” include those sources that are detected outside the established system of regulation, and which, at the time of detection, have an activity level higher than the levels of exemption as defined in national and European law. The campaign is based on the voluntary cooperation of diverse agents and organizations, where the sources are or may be found.

4- Methodology

Since its starting date, 17th February, until the end of 2007, the following core activities, as described below, have been carried out following a basic initial publicity, provided by the MITYC (Ministry of Industry, Tourism and Trade):

- The Creation of an Advisory Committee to support the task of ENRESA, formed by members selected for their experience. With their aid, the Committee proceeded to identify the sectors of activity likely to possess these types of sources, and to define the ideas and basic parameters for actions to be undertaken.

- The activation of electronic Web pages for MITYC, CSN and ENRESA, with the related campaign information. These pages include a document on “graphical information on sources and equipment”, drawn up especially to help identification and location of possible possessors of sources.

- The identification of other historical or current interest sector, through telephone contacts and interviews with individuals identified as key, both active and retired.

- Bibliographical search, Internet search and the consultation of international publications related to the campaign.

- Contacts with international agencies with experience of similar situations.

- Study of historical resolutions of transfer, detections of national origin carried out in the application of the collaboration protocol on the radiological monitoring of metallic materials and other historic documents of interest.

- The preparation of an official "card", with text agreed between the different agencies, to promote the campaign, with accompanying letters depending on the type of receiver.

- The development of a "contacts" database and mass mailing letters with information on the campaign sent to all contacts in it, namely:

  - The older universities in Spain.
  - Hospitals and clinics with activities related to the use of ionising radiations.
  - Official investigation Centres.
  - Official Schools related to medical, sanitary, scientific and technological activities.
  - Business Associations in the most representative sectors of the industry.
• Suppliers of radioactive material or equipment, detectors and laboratory equipment. Companies supplying electro medicine equipments and businesses related to radiation protection.

• Information about the campaign sent to medical, scientific professionals and industrial associations and societies, in order to achieve a "multiplier" effect through the re-transmission to its members and its dissemination via their own regular media (electronic pages, magazines, publications, etc).

• Additional promotion of the campaign in forums for the Radiological Protection and in courses related to the topic of the campaign.

The promotional activities began to be effective in the summer; four or five months after the beginning of the project.

5- Results

• In the period covered by this report, 21 organisations declared the possession of the first orphaned radioactive sources found. They are classified by sector of activity as follows:
  
  o Medical Facilities (5)
  o Teaching and Investigation Facilities (5)
  o Industrial Installations (9)
  o Institutions and Official Organisations (2)

• In the project, attention has been paid to all communications and responses received, whether or not related to genuine orphan radioactive sources. In some cases, the matter was re directed to ENRESA’s normal answering system for the ordinary course radioactive waste or other alternative routes, according to the characteristics of the declared material.

• In the month of October the MITYC’s Official Resolution, necessary, according to the national norm, to start withdrawing the sources, was received. After this, it was possible to proceed to the first collections.

• Each collection operation included the following actions:
  
  o Analysis of available information and a complete description of the radioactive sources declared.
  o Acquisition of graphical images of the sources and equipments.
  o Preparation of the sources for its temporary storage and transport.
  o Withdrawal of radioactive sources from the declaring premises and transport to ENRESA’s facilities in El Cabril (Cordoba)

Figure 1: Preparation of sources by ENRESA technicians
By December 31st 2007, the first 26 sources had been withdrawn. They are classified by radionuclide and activity in Table 1.

**Table 1**: Orphan sources withdrawn by December 31st 2007

<table>
<thead>
<tr>
<th>quantity</th>
<th>radionuclide</th>
<th>maximum activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Cs-137</td>
<td>185 GBq</td>
</tr>
<tr>
<td>5</td>
<td>Sr-90/Y-90</td>
<td>7.4 GBq</td>
</tr>
<tr>
<td>1</td>
<td>Am-241/Be</td>
<td>740 MBq</td>
</tr>
<tr>
<td>1</td>
<td>Ni-63</td>
<td>370 MBq</td>
</tr>
<tr>
<td>3</td>
<td>Ba-137m/Cs-137</td>
<td>220 MBq</td>
</tr>
<tr>
<td>3</td>
<td>Ra-226/Be</td>
<td>185 MBq</td>
</tr>
<tr>
<td>1</td>
<td>Cm-244</td>
<td>37 MBq</td>
</tr>
<tr>
<td>1</td>
<td>Ra-226</td>
<td>16.2 MBq</td>
</tr>
<tr>
<td>3</td>
<td>Tl-204</td>
<td>1.85 MBq</td>
</tr>
<tr>
<td>1</td>
<td>Co-60</td>
<td>0.4 MBq</td>
</tr>
<tr>
<td>1</td>
<td>Ba-133</td>
<td>0.4 MBq</td>
</tr>
</tbody>
</table>

In addition to these sources, 6 other pieces or equipments, containing depleted uranium in their shielding, with a total weight of 74.5 kg, were also withdrawn. Some other uncapsulated sources, liquid products of lower activity containing C-14, Bi-210 and Pb-210, among other isotopes, were also withdrawn.

6- Conclusions

International and Spanish experience equally show that, even though a suitable regulatory framework exists and though it is implemented efficiently by the supervisory authorities, as is the case in our country, orphan radioactive sources may still exist for various reasons. Among these, sources are found in activities carried out in the past, although this is not the only reason.

The proceedings in Spain previous to this campaign that have been mentioned, were and continue to be very positive as regard the recovery of control of the majority of radioactive sources existing in the country. During the present campaign, consequently, it is not expected to find very appreciable amounts of orphan sources; however, the experience accumulated in the first ten months of its development is very interesting and everything indicates that the campaign will be able to effectively achieve its objective.

7- Bibliographic References

The following publications have been useful in the establishment of the approach of the campaign:

[1] INTERNATIONAL ATOMIC ENERGY AGENCY Strengthening control over radioactive sources in authorized use and regaining control over orphan sources IAEA-TECDOC-1388
[3] INTERNATIONAL ATOMIC ENERGY AGENCY Arrangements for dealing with orphan radioactive sources in the metal recycling industry, IAEA safety guide DS 411
[4] INTERNATIONAL ATOMIC ENERGY AGENCY Development of a National Strategy for regaining control over orphan sources and improving control over vulnerable radioactive sources. IAEA safety guide DS410
[5] Informe Monterrey “Commercial Radioactive Sources”
[6] INTERNATIONAL ATOMIC ENERGY AGENCY Categorization of radioactive sources IAEA TECDOC 1344
[7] INTERNATIONAL ATOMIC ENERGY AGENCY Management of disused long lived sealed radioactive sources IAEA TECDOC 1357
[8] INTERNATIONAL ATOMIC ENERGY AGENCY Management of spent high activity radioactive sources IAEA TECDOC 1301
[9] INTERNATIONAL ATOMIC ENERGY AGENCY Management for the prevention of accidents from disused sealed radioactive sources IAEA TEC DOC 1205
[10] INTERNATIONAL ATOMIC ENERGY AGENCY Métodos para la identificación y localización de fuentes radiactivas gastadas. IAEA TEC DOC 804