

Belgian Global Approach on the Radiological Surveillance of Radioactive Orphan Sources and Radioactive Substances in Metal Scrap and Non-Radioactive Waste – 14126

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ABSTRACT

In order to enhance the control on radioactive sources, the Belgian Federal Agency for Nuclear Control (FANC) has created a global approach on the surveillance of radioactive orphan sources and radioactive substances in the non-nuclear industry.

As one of the European leaders, Belgium has since late 2011 a strong legal basis to organize the effective monitoring of possible presence of radioactive material in conventional waste. The legal framework is described and uses the following basic principles:

- Preventing radioactive sources from ending up in non-nuclear sectors;
- Defining the “orphan source-sensitive flows” in non-nuclear facilities;
- Identifying the “Orphan sources-sensitive facilities”;
- Imposing appropriate monitoring of the “Orphan sources-sensitive facilities”;

An important aspect includes the financial solution related to the orphan source problem. Again, a legal basis and a workable system have been put in place.

The financial solution resulted from the concern that the protection of the population and the environment should not depend on the liability of the finder of an orphan source. The costs associated with the management of the orphan sources will be borne by the insolvency fund, set up by the National Agency for Radioactive Waste and Enriched Fissile Materials (NIRAS/ONDRAF).

The monitoring results of 2012 are illustrated in detail; the mandatory reporting's of alarms are analysed by sector, origin, type of material and seriousness. The figures, statistics and conclusions that can be drawn are discussed extensively.

Finally, the challenges and difficulties of this system are discussed. Past and future challenges get the necessary attention.

INTRODUCTION

In recent years, maintaining the control over radioactive sources has undoubtedly been a subject that is globally gaining in importance. After several accidents (eg. Algeciras-Spain, Goiânia-Brazil, Juarez-Mexico, Istanbul-Turkey, Bangkok-Thailand, ...), the Belgian government elaborated a global approach on the radiological surveillance of radioactive orphan sources and radioactive substances.

Firstly, it must be avoided at all cost that a radioactive source appears in an uncontrolled circuit. Therefore a strict system for the use of radioactive sources based on licences, periodical controls and inspection was set up.

Additionally, it is also important to have the possibility to detect uncontrolled sources and to react

appropriately when an orphan source is found. At the same time, the feasibility and economic impact of the measurements should be considered. In 2006, a specific guideline (ref. [1]) and technical annex (ref. [2]) were published in the Belgian legislation for establishments equipped with a portal monitor in operation.

However, there was no legal ground to impose the installation of a portal monitoring system. On September 13th, 2011, the Belgian Federal Agency of Nuclear Control (FANC) was confronted with a serious incident i.e. the contamination of an industrial blast furnace at La-Louvière (BE). This incident caused enormous financial damage to the company and poses, now and in the future, enormous challenges in terms of technical and organisational solutions.

At the end of 2011, an official legal base in the form of a Royal Decree (ref. [3]) was published in which the obligations for the different orphan source sensitive establishments are described together with a corresponding guideline (ref. [4]) to use when an orphan source is detected. The follow-up, the announcement and the practical elaboration of the Royal Decree and guideline were coordinated by FANC. ONDRAF/NIRAS has set up a financing system which can be used when an orphan source is detected. The costs related to the further management can be financed by the insolvency fund instead of by the finder. This system is developed in order to stimulate the use of the guidelines concerning the detection and the reporting of orphan sources (ref. [5]).

The principles of the legal base and the financing system of orphan sources will be explained further, as well as the challenges for the future. The results achieved in 2012 will also be discussed. To ensure a workable, feasible and high-quality follow up, the Agency is facing numerous challenges.

BELGIAN GLOBAL APPROACH

The Belgian approach developed by FANC, ONDRAF/NIRAS and its partners includes several aspects:

Preventing Radioactive Sources From Ending Up In Non-nuclear Sectors

Beyond the control of ionizing radiation that already exists in Belgium (see Royal Decree of 20/07/2001: ref. [6]), FANC has strengthened the professional and regulatory monitoring of high-activity sealed sources in order to prevent any disappearance or misuse of high risk orphan sources and to avoid its outbreak. The Council Directive 2003/122/Euratom of December 22nd, 2003 on the control of high-activity sealed radioactive sources and orphan sources, was transposed into Belgian legislation on May 23rd, 2006. As a result, it is now necessary to provide individual records of each high-activity sealed source (HASS) containing information about the unique identification, marking, specific testing, Moreover, targeted inspections and complementary technical controls have also been made compulsory.

Defining The « Orphan Sources-Sensitive Flows »

In cooperation with the stakeholders and the environmental administrations of the three Belgian Regions, and relying on the national and international experience that it has acquired, FANC has identified which flows run a risk of containing orphan sources amongst material flows treated by the waste recycling and processing industries. These flows are identified in accordance with the waste classification codes set up by the European Commission and are declared « orphan sources-sensitive flows ». The complete list of codes is listed in appendix 1 of the Royal Decree of 14 October 2011 (ref. [3]).

Identifying The « Orphan Sources-Sensitive Facilities »

Non-nuclear industrial sites processing one or several of those supply flows with a risk of containing orphan sources are de facto listed as « orphan sources-sensitive facilities (OSSF) ». All these facilities have to meet a minimum of requirements regarding staff training, vigilance measures and action plan if a source is detected. A procedure must be put in place in case a radioactive source is detected.

Imposing appropriate monitoring in non-nuclear facilities

Amongst the orphan sources-sensitive facilities, some have a higher probability of being confronted with an orphan source than others. In order to avoid a contamination of their installations, those facilities have to comply with the obligation of screening systematically and automatically every incoming orphan sources-sensitive flow - in particular by installing a portal monitor.

The complete list of facilities for which a compulsory radioactivity monitoring is necessary, is published in appendix 2 of the Royal Decree of 14 October 2011 (summary in TABLE I). This list has been established with the stakeholders and the environmental administrations of the three Belgian Regions. To this end, a careful study of the scrap and waste flows has been carried out in order to identify the nodal points in the scrap recycling network where a monitoring system would be the most appropriate choice. The goal is to keep a balance between the need to monitor as many scrap metal flows as possible without imposing heavy regulations and heavy financial investment costs on small facilities. For example, in this optimization approach, Belgium is considering a threshold limit value of 25,000 ton/year of scrap metal entering a facility for imposing the use of an automatic screening system for radioactive materials.

TABLE I. Facilities with active monitoring

Types Of Facilities
Incineration and co-incineration plants
Dumping sites
Facilities for the mechanical handling of scrap with an annual intake of more than 25,000 tons of scrap
Facilities for the smelting of ferrous metals and waste materials containing iron with an annual intake of more than 25,000 tons of waste materials containing ferrous metal.
Facilities for the production and smelting of non-ferrous metals, including alloys and waste materials containing non-ferrous metals, with an annual intake of more than 25,000 tons of waste material containing non-ferrous metals
Plants for the mechanical-biological treatment of household waste matter and comparable waste material.

FANC considered that the radiological protection aspect and the achievement of uniform practices should be guaranteed. Therefore, the directive of November 3rd, 2011 (ref. [4]) for the follow up of detections or discoveries of an orphan source in orphan sources-sensitive facilities has been published. The orphan sources-sensitive facilities which do not have to comply with the compulsory systematic and automatic screening through radiation portal monitor have to meet a minimum of requirements regarding staff training, vigilance measures and action plan in case a radioactive source is detected.

On the other hand, the orphan sources-sensitive facilities which have to comply with automatic screening through radiation portal monitors have to follow the procedure as described in the directive when a portal monitor alarm is triggered. It describes the radiological protection measures to be taken by the staff as well as the information to be provided by the operator to FANC.

The operator is only allowed to intervene without the assistance of a radiation expert when the radioactivity does not exceed specific levels. Beyond certain levels, an expert in radiological protection must be present during the recovery of the source from the shipment. For shipments with naturally occurring radioactive materials (NORM), where the radioactivity is generally homogeneously spread over the whole shipment, an additional action level is defined (about twice the natural background) below which no intervention is necessary. The definition of these action levels considerably simplifies the management of radiation related alarms by the operators. This directive has been written in collaboration with the various stakeholders.

FINANCING ORPHAN SOURCES

With the gradual introduction of portal monitors, the different industrial sectors became increasingly reticent regarding the financial responsibility for waste treatment associated with radioactive sources discovered in their installations. In the past, when a radioactive source was found and its owner could not be identified, the characterization, management and treatment costs for this radioactive material called 'orphan source' had to be paid by the finder.

In order not to compromise the already achieved success, but instead, to stimulate the further introduction of such portal monitors, FANC and the Belgian National Agency for Radioactive Waste and Enriched Fissile Materials (NIRAS/ONDRAF) became aware that it was necessary to develop a structural mechanism that was able to cover all the costs associated with the management of these radioactive by-products, once they had been declared "orphan sources".

In March 2007, the Belgian Council of Ministers adopted a financial solution for the costs associated with the waste management of recovered orphan sources, within the framework of the transposition of the European Directive 2003/122/Euratom of December 22nd, 2003 concerning the monitoring of high-activity sealed radioactive sources and orphan sources. This financial solution, set up by FANC and NIRAS/ONDRAF, resulted from the concern that the protection of the population and the environment should not depend on the liability of the finder of an orphan source. When a radioactive source is found, the "polluter pays" principle is now applied by FANC that first tries to identify the polluter and then brings proceedings against him. If the polluter cannot be identified or if the efforts made to identify him are out of proportion with the cost involved, the source is considered as an orphan source and the financial costs are borne by NIRAS/ONDRAF's Insolvency Fund.

The scope of the intended financial arrangement was not easy to determine. It depended on the definition given to an "orphan source" and on the degree in which a person, for example the previous holder of the source, could still be held financially responsible for its management and for the damage that might have resulted from its mismanagement. The main objectives of the financial arrangement can be summarized as follows:

- preventing the indiscriminate dumping of orphan sources;
- promoting the recuperation of discovered orphan sources;

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- compelling the involved industrial sectors to take their responsibilities;
- fairness towards the finders of orphan sources;
- being fraud-proof;
- introducing a minimum of new administrative burdens.

Operators from orphan sources-sensitive facilities (OSSF), who wish to take advantage of the financial arrangements for orphan sources, need to contact FANC and register their facilities. They are compelled to take measures to prevent orphan sources from ending up on their sites, in their installations or in the supply of goods and bulk materials. Should such a source be detected, the operator has to follow the guidelines of the Agency and accept its investigation to verify if its guidelines are complied with and to determine possible responsibilities in order to enhance the identification of the party legally responsible for the presence of the source. The role of ONDRAF/NIRAS is to check the characterisation of the orphan source and to regulate the collection after which the waste is processed and conditioned in expectation of final depository.

A special fund, called Insolvency Fund, was set up by ONDRAF/NIRAS to the bankruptcy or insolvency of waste producers. It is financed by the radioactive waste producers by means of a contribution (5%) in the tariffs for processing radioactive waste. The amount of the contribution to the Insolvency Fond is suspended when the amount of the Fund has reached an upper limit. There is also a lower limit of the amount in the Fund. Every five years both limits are determined on the basis of the inventory of all nuclear installations. Originally, this fund aimed at protecting NIRAS/ONDRAF against the risk of insolvency of a radioactive waste producer. Following costs are associated with the management of orphan sources and are covered by the Insolvency Fund (ref. [7]):

- Costs due to NIRAS/ONDRAF performances
- Costs for the radiological and chemical characterisation
- Costs for the packaging of an orphan source by an official expert before transportation
- Transportation costs
- Costs for the temporary storage, the treatment, the conditioning and the final depository
- Costs for the management of secondary waste that could be produced due to the intervention concerning orphan sources.

The costs associated with orphan sources can be covered by the Insolvency Fund when the following conditions are found to be satisfied (ref. [7]):

- The establishment where the orphan source is found is officially registered;
- The orphan source is not from foreign origin;
- The owner of the establishment where the orphan source is found has announced the detection to FANC following the directives;
- The activity of the orphan source exceeds the limit value for the use of a measuring port;
- FANC confirms that the found source is an orphan source;

However, some restrictions have been introduced and a number of categories of orphan sources are not covered by this mechanism, such as:

- Sources that do not fit the definition of orphan source are at the expense of the finder;
- Orphan sources from identifiable practices, work activities involving NORM and TE NORM and interventions are at the expense of the identified operator;
- Orphan sources forming an integral part of immovable property are at the expense of the owner of that property. (e.g. radioactive lightning rods);

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- Radioactive sources and materials found in contractual supplies originating from foreign suppliers will not be compensated;
- Orphan sources causing a contamination because of failure of detection; the extra costs due to this failure won't be covered either.

The following table shows the number of demands processed by NIRAS/ONDRAF per year and the costs covered by the Insolvability Fund per year starting from 2006. It shows the total costs of treatment and conditioning, the total cost of the transport and the grand total cost per year.

TABLE II. Cost Insolvability Fund per year

Year	# Demands	Costs T&C ONDRAF/NIRAS	Transport	Total	Means Cost Per Demand
2006/2007	7	10 030.91 €	848.00 €	10 878.91 €	1 554.13 €
2008	14	35 206.93 €	4 221.95 €	39 428.88 €	2 816.35 €
2009	33	50 214.59 €	8 282.43 €	58 497.02 €	1 772.64 €
2010	13	28 581.51 €	3 690.74 €	32 272.25 €	2 482.48 €
2011	28	97 424.62 €	6 511.66 €	103 936.28 €	3 712.01 €
2012	28	91 444.41 €	10 809.18 €	102 253.59 €	3 651.91 €
Total	123	312 902.97 €	34 363.96 €	347 266.93 €	

Following graph shows the costs covered by the Insolvability Fund per year.

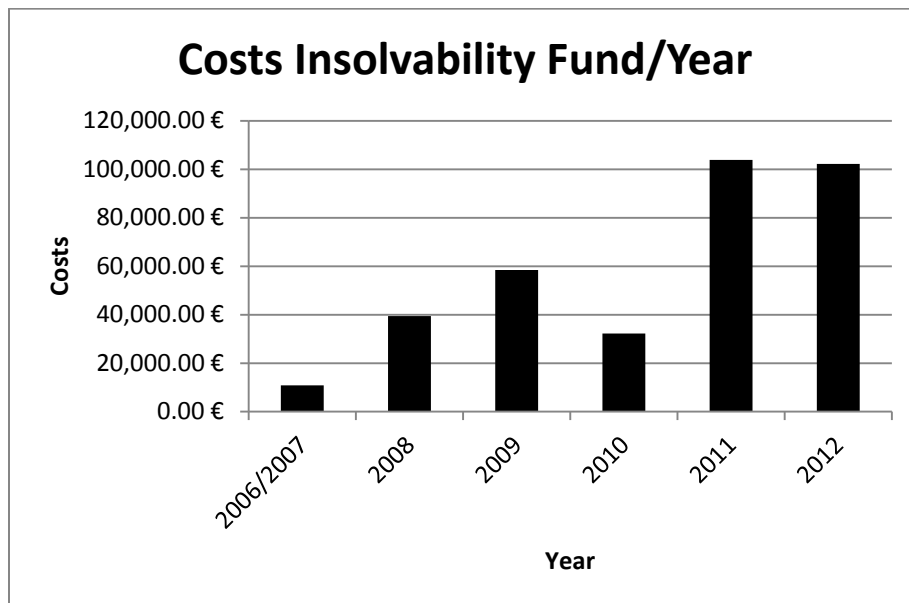


Fig. 1. Costs Insolvability Fund/Year

Graph 1 shows an increase of the costs covered by the Insolvability Fund over the years starting

from 2006. The increase is due to an increase of processed demands. In 2010 there was a decrease because of a decrease of processed demands at NIRAS/ONDRAF. It can be concluded that the introduction of the whole system of managing orphan sources (guidelines, royal decrees, etc.) results in a better detection and treatment of these sources leading to a better protection of the people and the environment.

MONITORING RESULTS

Collecting information and providing feedback

FANC is in charge of registering radiation portal monitors and orphan sources-sensitive facilities. Each detected radioactive source and each triggered portal monitor alarm must be reported to FANC.

The actions taken by each party (portal monitor operators, hauliers, FANC inspectors, radiation experts, ...) and the characterization information for each source are recorded in a database in order to provide further feedback and to make it possible to continuously assess and enhance the Belgian authorities' approach.

Registrations

On December 31st, 2012 there were 524 Belgian firms officially registered as an "Orphan Sources-Sensitive Facility (OSSF)". 429 (82%) of these establishments are categorised under "OSSF without a portal monitor". The other 18% or 95 establishments dispose of one or multiple portal monitors for the active screening of incoming and outgoing orphan source sensitive flows. An overview of the 'OSSF' in Belgium can be found in TABLE III.

TABLE III. Orphan Source Sensitive Facilities (OSSF) registered

Type OSSF	n°	%
Recycling Park (NoPM)	387	74%
Scrap (PM)	59	11%
Scrap (NoPM)	25	5%
Country Borders (PM)	13	2%
Incinerator (PM)	12	2%
Sort Centres (NoPM)	11	2%
Melting Ferro- and Nonferro (PM)	8	2%
Unknown	3	1%
Melting ferro-en nonferro (NoPM)	3	1%
Landfill (PM)	2	0%
Mechanical-biological treatment (PM)	1	0%
Total	524	100%
OSSF without portal monitor (NoPM)	429	82%
OSSF with portal monitor (PM)	95	18%

In total, there are 201 active portal monitors on the Belgian territory. The majority (48%) can be found in the scrap business. Another big part of portal monitors (26%) are installed on strategic in- and export locations like ports or customs. An overview of the distribution of portal monitors over the different sectors can be found in Table IV.

TABLE IV: Portal Monitors on 31/12/2012

Portal Monitors (PM) registered	N°	%
Scrap (PM)	97	48%
Country borders (PM)	52	26%
Melting ferro- and nonferro (PM)	32	16%
Incinerator (PM)	7	3%
Landfill (PM)	6	3%
Unknown	5	2%
Hospital (PM)	2	1%
Total	201	100%

Alarms

A total of 170 alarms were registered by FANC in 2012. This equates to an average of around 14 alarms per month, or one alarm every 2 days. These alarms were mainly detected at facilities with a portal monitor (PM - 89%), and occurring mostly in incinerators (36%). These are predominantly due to short-life medical waste. Another large number of alarms is caused by scrap processing (34%). This mainly concerns contaminated metals.

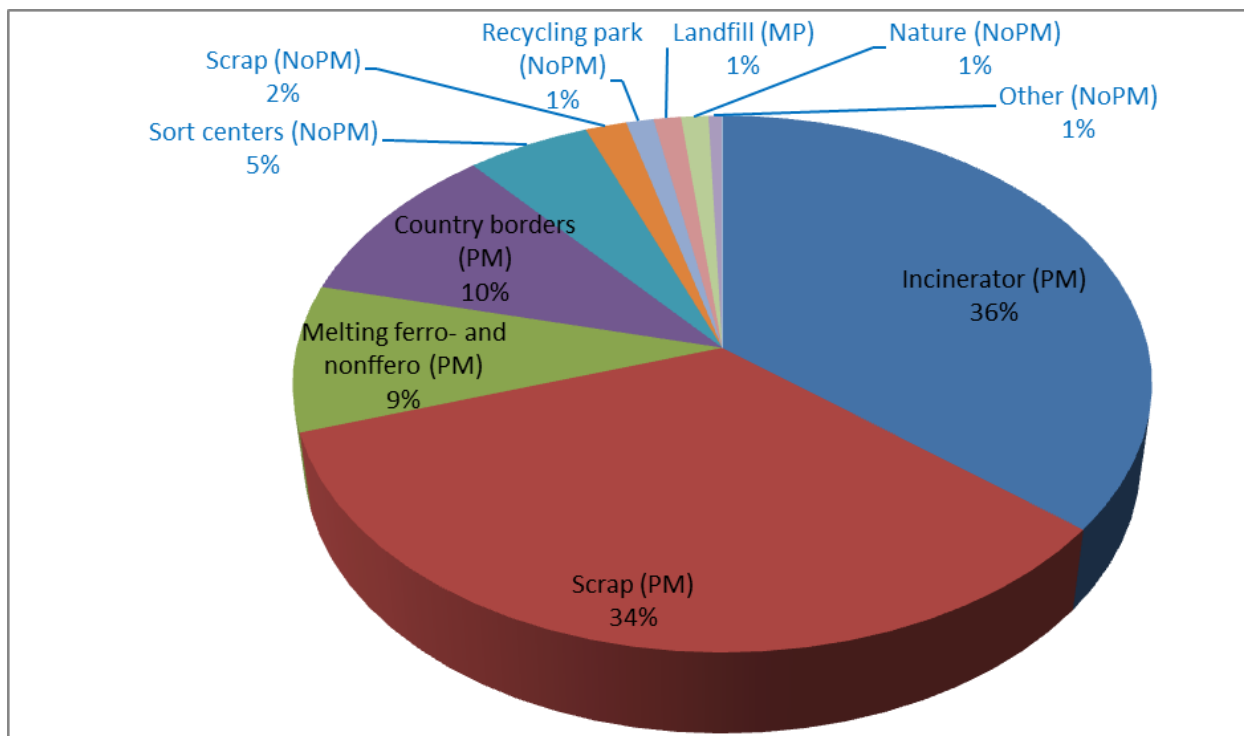


Fig. 2. Alarms 2012 per Sector

In essence, most alarms (89%) are registered by operators of a portal monitor, which is normal given the routine screening. The chart above shows in which sectors the other alarms are detected.

It is interesting to note that the number of detection portals at incinerators only amounts to 3% (see IV). They are however responsible for 36% of the alarms. This is a specific problem of radioactive medical waste, which requires a specific approach. After analysis of the alarms registered at incinerators we can conclude that 87% of the alarms at incinerators are caused by medical waste (see Fig. 3).

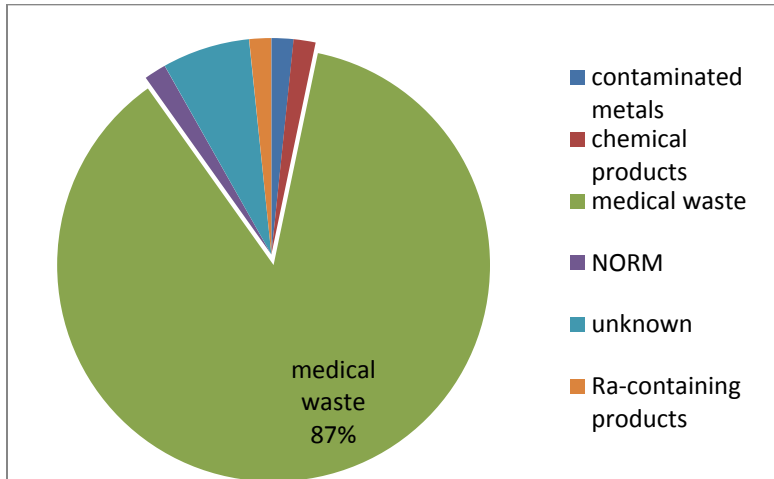


Fig. 3. Type of material at incinerators

Origins

An overview of the origin of cargoes generating alarms is given in Fig. 4. Most detected alarms (41%), come from intermediaries, ‘traders’ such as smaller scrap dealers, sorting centres that do not have a detection portal, etc. In addition, 18% come from foreign cargoes. These are mostly detected at the border (ports, customs, etc.) or in scrap-processing operations. A relatively large number of alarms originates from known medical institutions (e.g. known hospitals). In these cases, FANC takes action to prevent (still) radioactive medical waste from leaving the premises. A FANC inspector contacts the medical institution and requests an action plan in order to avoid that still radioactive waste leaves the site in the future. If a series of alarms are triggered by a single medical institution, an on-site inspection is conducted by a FANC inspector.

A small part of the alarms (9%) can be attributed to individuals (e.g. delivery of minerals, chemical radioactive products, lightning rods). “Industrial establishments” (1%) are facilities that are known to FANC and have a permit to use radioactive substances under strict conditions and controls. ‘Firms’ on the other hand are facilities that do not have a permit but still generate alarms (e.g. NORM materials).

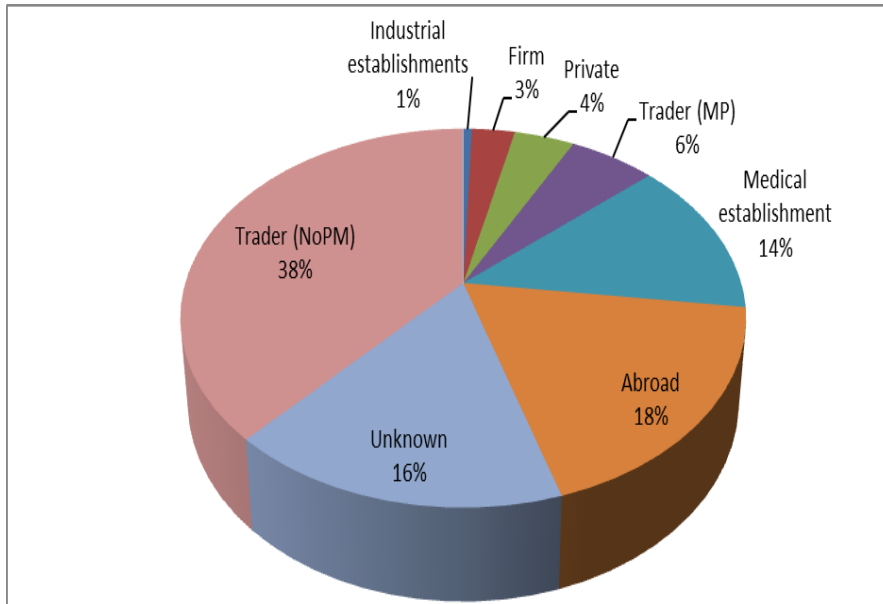


Fig. 4. Origin Of The Cargo

FANC is also interested in what comes from abroad (18%) (See Fig. 5). It can clearly be stated that “contaminated metals” constitute the largest proportion (58%) of this percentage. These are metals for which, for example, a radioactive source has been melted during the production process. We also find lightning rods from abroad (7%), as well as NORM material (3%) and products containing radium (3%). Since the origin of the radioactivity is from abroad these cargoes are, in most cases, returned under supervision to the country of origin after contact with the foreign authorities.

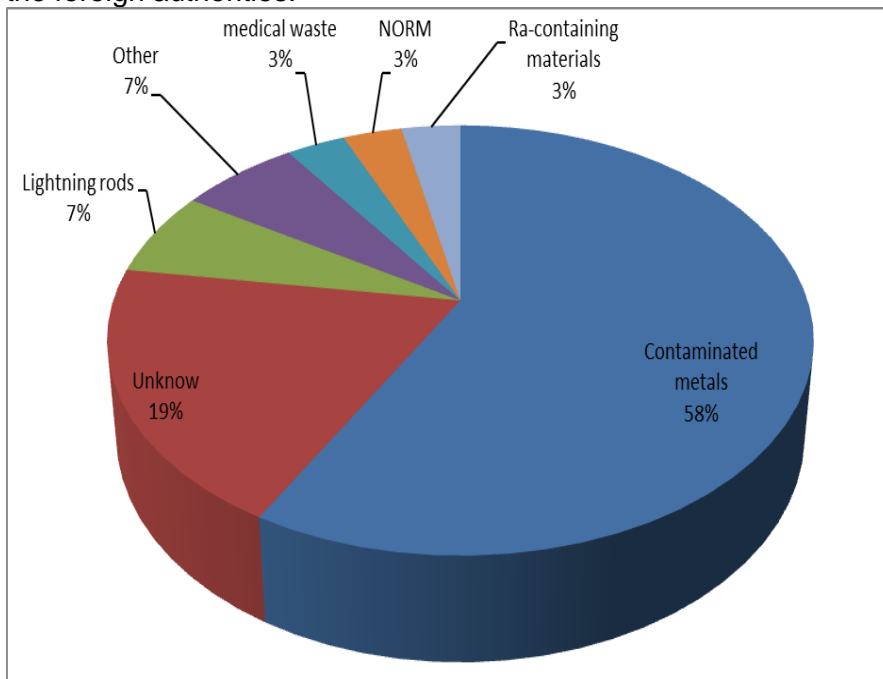


Fig. 5. Types of material from abroad

Interventions by expert

If a risk of exceeding certain radiation doses exist, a recognised expert must be involved in the further handling of the alarm. These are thus considered as the ‘more dangerous’ alarms. This was the case 17 times in 2012, which corresponds to approximately 10% of the alarms. Obviously, these cases has only occurred in facilities where a portal monitor is installed (PM) (see Fig. 6).

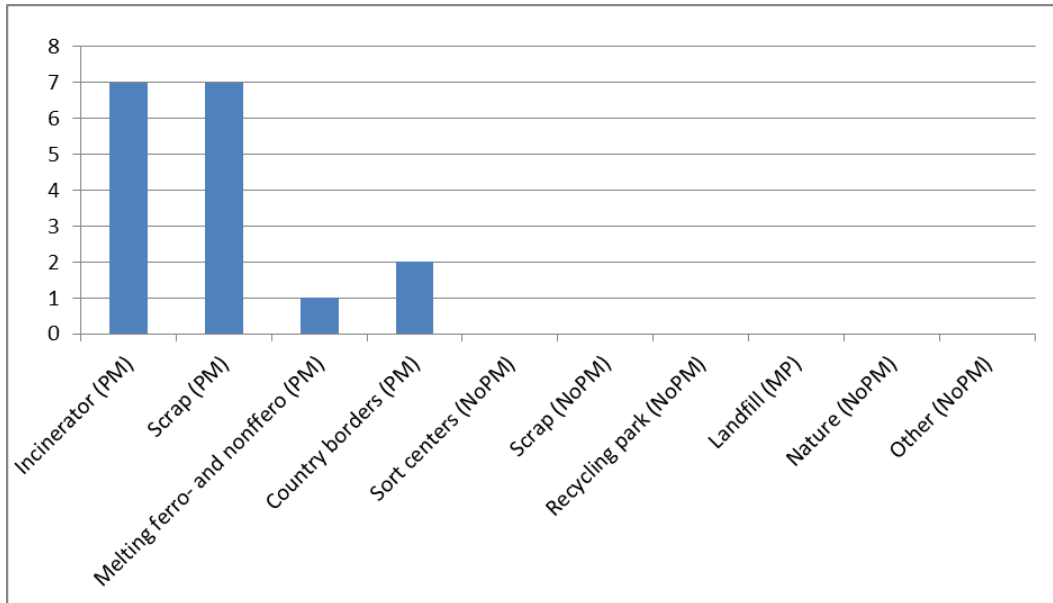


Fig. 6. Intervention by expert

Declarations of orphan sources

FANC decides when a detected source is to be regarded as an orphan source. This generally means that the owner cannot be traced, that the facility has met all the requirements of FANC and that the guidelines have been followed properly. The costs are then borne by the insolvency fund. Only 24% of the alarms result in the drawing up of an orphan source certificate for the objects detected (See Fig. 7.) as alarms caused by medical waste, foreign waste and NORM waste do not follow the same treatment. As mentioned above, there were a total of 170 alarms registered in 2012, only 56 of them resulted in the drawing up of an orphan source certificate.

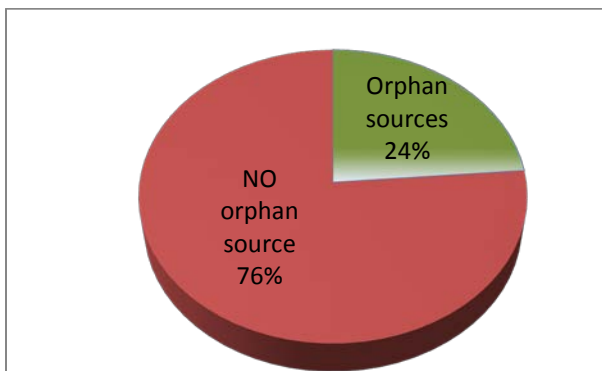


Fig. 7. Orphan Sources

CHALLENGES AND CONCLUSIONS

The implementation of the legislation on the field, the uniform approach, preserving radioprotection and preventing any abuse, are key-factors in the success of the Belgian approach. These and other aspects create a huge challenge for the future.

Therefore, a few subjects that have a huge impact are highlighted. An overview of the different initiatives is briefly discussed, but need a continuous follow-up and improvements for the future.

Information

The global approach has been developed in collaboration with most of the professional federations from the metal works, the waste treatment and the recycling sector during several stakeholder-meetings. In the future, it is important to inform the different sectors in both an active and a passive way.

FANC uses the following means of communication to inform the stakeholders:

- Website FANC (ref. [8]): a specific webpage with all the necessary information is available. The website can serve as an information platform for various documents and texts and as a means of distribution to the general public.

The following sections can be found on this webpage:

- Introduction: framework of the orphan source problem;
- Global approach;
- The regulatory system;
- Financial solution for orphan sources;
- Training and information: training material from FANC for the concerned sectors/employees;
- Frequently Asked Questions: FAQ;
- Monitoring portal-wizard : online tool that can be used when a portal monitor gives an alarm to determine the various steps and actions in accordance with the guidelines;
- Experience and feedback;
- Photo book of radioactive substances that can be found with or without a portal monitor;
- Posters in digital versions;
- Press Release concerning the publication of the Royal decree on the tracing of radioactive substances in certain material and waste flows and concerning the management of facilities sensitive to orphan sources;
- Stakeholders' meeting: the reports and presentations of the meeting are online and available for consultation by the stakeholders.
- Suggestions;
- Posters: FANC has created posters (available in Dutch and French) summarizing the most important messages for the employees on the field. These posters are distributed to all orphan source sensitive facilities. Two versions are available:
 - Poster for the Orphan Source Sensitive Facilities without a portal monitor.
 - Poster for the Orphan Source Sensitive Facilities with a portal monitor. This poster is slightly different because the main "hold" points during the intervention are also repeated.
- Movie: a movie to explain and visualize the intervention and directives is available. This movie is also used in training courses.
- Newsletter: on a regular basis, FANC informs the different stakeholders by means of a

newsletter sent by mail. The newsletter contains several current topics such as international accidents, new initiatives,

- Press releases: Press releases are distributed to highlight the new legislation. FANC also participates in press conferences to communicate openly to the general public about the orphan source issues.
- Official letter to the companies that are involved to inform them about the new legislation and obligations.

Training

A key-factor for the success of the Belgian approach is the education and training of the workers and staff of the involved sectors. This training obligation is published in article 6 of the Royal Decree of October 14th, 2011. Therefore FANC has taken initiatives to provide all the necessary information and training. The specific needs of the workers and the level of training will always be taken into account. FANC annually organizes a centralised training day for interveners of orphan source sensitive establishments with a portal monitor. Additionally, the following courses are offered if requested by various establishments or associations:

- Education for the supervisors or managers of a site: focussed on the management responsibilities, the commitments and obligations, the risks for the personnel, the financial aspects and the limitations of a measuring instrument or portal monitor;
- Education for interveners *with a portal monitor*: all the different necessary subjects as described in article 6 of the Royal Decree, the guidelines in practice;
- Education for interveners *without a portal monitor*: all the different necessary subjects as described in article 6 of the Royal Decree, the guidelines in practice, taken into account that there is no portal monitor installed;

Training for the site personnel: all the different necessary subjects as described in article 6 of the Royal Decree, with an emphasis on the vigilance procedure.

Agreements

Because the orphan source issues are cross boundary, FANC has to deal with international aspects. Typical examples are the detections of radioactivity in Belgium in shipments from abroad and vice versa. Therefore, Belgium has already had extensive contacts with two neighbouring countries, France and The Netherlands, regarding the return of the cargo and the information to the government. These contacts should finally result in a cooperation agreement. Contacts with other foreign governments seem more difficult and this is certainly a major challenge for the future.

Awareness and control

Ensuring the implementation on the field is one of the tasks of FANC. To achieve this goal a multi-phase approach is developed:

- Phase 1: Identification of the different facilities in Belgium because of the application of the new legal framework;
- Phase 2: Informing and raising the awareness of the identified facilities about the new legislation and its consequences and obligations;
- Phase 3: Administrative controls (for instance: registration as OSSF, registration of portal monitors, ...);
- Phase 4: Inspections on the field based on samples, complaints, errors in declaration forms.

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