Regulatory Inspection: A Powerful Tool to Control Industrial Radioactive Sources

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Abstract. An important contribution for Brazilian development, especially for the quality control of products, is the use of radiation sources by conventional industries. There are in Brazil roughly 3,000 radioactive sources spread out among 950 industries. The main industrial practices involved are: industrial radiography, industrial irradiators, industrial accelerators, well logging petroleum and nuclear gauges. More than 1,800 Radiation Protection Officers (RPOs) were qualified to work in these practices. The present work presents a brief description of the safety control over industrial radioactive installations performed by the Brazilian Regulatory Authority, i.e. the National Commission of Nuclear Energy (CNEN). This paper also describes the national system for radiation safety inspections, the regulation infrastructure and the national inventory of industrial installations. The inspections are based on specific indicators, and their periodicity depends on the risk and type of installation. The present work discusses some relevant aspects that must be considered during the inspections, in order to make the inspections more efficient in controlling the sources. One of these aspects regards the evaluation of the storage place for the sources, a very important parameter for preventing future risky situations.

KEYWORDS: Radiation safety inspections; source control, industrial installation.

1. General aspects

The Brazilian Regulatory Authority is the National Commission of Nuclear Energy (CNEN), which is responsible for all activities related to nuclear or radioactive materials. CNEN has an infrastructure for controlling industrial radioactive installations, composed by a Director of Radiation Protection and Nuclear Safety and two General Coordinators. One is the General Coordination of Medical and Industry Installations – CGIMI, responsible for the national system of authorization and control over radioactive practices. The other is the Institute of Radioprotection and Dosimetry (IRD/CNEN), responsible for the national programme of radiation safety inspections.

Every installation that uses radiation sources in Brazil must be authorized by CNEN and may be subjected to the regulatory process of licensing: authorization, inspection, control and personnel certification. CNEN has a data base programme with the Brazilian inventory of sources and installations. Nowadays there are approximately 3,070 radioactive installations: 41% in medical field; 31% in industrial area; 22% in research; 4% in commerce and 2% in services area.

CNEN is also responsible for the Brazilian regulation related to industrial radioactive installations.

The CNEN's regulation comprehends a general regulation and six specific guidelines, as follows:

a) General Regulation: *Basic guideline for radiation protection*, NE 3.01-CNEN [1], based on IAEA recommendations of BSS 115 [2];

b) Specific Guidelines: *Radiation protection services* CNEN-NE-3.02 [3]; *Licensing of radioactive installations*, CNEN-NE-6.02 [4]; *Operation of industrial radiography services*, CNEN-NE-6.04 [5]; *Certification of qualification for radiation protection officers*, CNEN-NE-3.03 [6]; *Management of radioactive waste in radioactive facilities*, CNEN-NE-6.05 [7]; *Transport of radioactive materials*, CNEN-NE-5.01 [8].

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The 950 installations that use radioactive sources for industrial applications are classified into the following practices: industrial radiography (162 installations), industrial irradiators (8 installations), industrial accelerators (14 installations), well logging petroleum (23 installations), nuclear gauges (612 installations) and others (130 installations).

Additionally to the number of fixed industrial radiography installations, usually each year more than 200 on-site radiation jobs are carried out throughout the country. These installations are responsible for the movement of a high number of industrial gamma radiography apparatus and workers. The same situation happens in well logging petroleum practice, with their offshore and onshore installations.

For the last 25 years the Institute of Radioprotection and Dosimetry (IRD) has been responsible for performing the national program of inspections in order to control the safe use of radioactive sources at industry activities. Since then, more than 2,000 radioactive industrial facilities were inspected.

Based on CNEN's regulations, it is required that each industrial installation that deals with radiation sources must have at least one Radiation Protection Officer (RPO), responsible for the radiation protection service. However, for practices classified as IAEA categories 1 and 2 (industrial irradiators and industrial radiography) [9] at least two RPOs are required. During almost 30 years more than 1,800 RPOs were qualified by CNEN to work in the industry practices.

The IRD's planning for the periodicity of inspections depends on the type of application, on the installation's past performance and on the risks presented by the radioactive sources. Usually the regulatory inspections are performed without previous announcement, i.e. they are unannounced.

The frequencies for routine regulatory inspections scheduled by IRD/CNEN are:
- Industrial radiography practices:
    - On-site installations: once a year;
    - Fixed installations with gamma rays: once every two years;
    - Fixed installations with X rays: once every three years.
- Well logging petroleum practices: once every two years;
- Industrial irradiator practices: once every two years;
- Nuclear gauges practices: Manufacturers: once a year;
    Installations are subgrouped according to the number of radioactive sources:
    - Up to 10: once every five years; if neutron sources are present, once every four years;
    - From 11 to 40: once every four years; if neutron sources are present, once every three years;
    - Forty-one or more: once every three years; if neutron sources are present, once every two years.

2. Main recommendations for inspecting the security of sources

The existence of an efficient system for regulatory control is the most important factor for the safety of radiation sources. In such systems, regulatory inspections deserve especial attention. In order to make the inspections more efficient in controlling radiation sources, priority must be assigned to the inspections according to the categorization of practices and sources [9]. In this way, regulatory authorities must give priority in some aspects to categories 1 (industrial irradiators), 2 (industrial radiography) and 3 (nuclear gauges and well logging petroleum).

While planning inspections to large-scale industrial irradiators, the most relevant aspect is the transport of sources. During transportation those sources are carried in a Type B(U) container. To avoid malevolent motives such as terrorism or individual's intent to harm the population, the transport must be more surveilled and protected than others, using an intensive vigilance during the route of transportation. The other safety aspects at industrial irradiators are easier to control, as the design of these facilities provides that persons cannot have access to the radiation room while the source is in the exposed position. Such control of access relies heavily on the use of interlocked systems. Another

point is that as these sources have very large activities, they are installed in large water filled storage pools.

On planning on-site industrial radiography inspections, it is recommended that one should:

- Increase the frequency of unannounced inspections, because the surprising factor helps to reveal how the service is really being performed and whether the sources are kept in safety;
- Perform the highest number as possible of on-site inspections, because the probability of loosing control over a source is higher at those services;
- Keep a record with all scheduled on-site jobs, including localization, date, time, staff, equipments and apparatus.

During on-site industrial radiography inspections, it is advisable to check:

- The conditions in which the exposure containers are temporarily stored, to prevent the risk of them being stolen;
- The localization of the place for temporary storage, emphasizing that it must be under the responsibility of the hiring company;
- The transport conditions, with emphasis on the safety of exposure containers;
- Conditions of surveillance of the exposure containers, counting the number of persons appointed to take care of them, including operators and guards, especially when the jobs are being performed in remote locations;
- The use of physical safety equipments, suitable and necessary for performing on-site jobs at night;
- The high-risk operations that may cause the source to be dettached and lost;
- The conditions of control over the exposure containers' keys.

On performing inspections at the headquarters of the radiography organizations, one should check:

- Whether the records of on-site jobs are updated, in order to confirm the exact localization of the radiation sources;
- The conditions of storage of the exposure containers, with emphasis on access control (keys, cameras, physical barriers) and on suitable warnings, to decrease the chance of stealing;
- The maintenance status of the exposure containers, in order to prevent that some of them, not in a good condition be taken to on-site jobs, increasing the probability of an accident;
- That exposure containers are transported just with specific suitable equipments;
- The conditions of storage of exposure containers without radiation source or out of use;
- The conditions of physical safety at the headquarters.

On planning inspections at nuclear gauges facilities, it is advisable to check:

- The physical condition of the place where the nuclear gauge is installed;
- The safety conditions of the storage place, with emphasis on access control (keys, cameras, physical barriers) and on suitable warnings, to decrease the chance of stealing;
- The access control to the nuclear gauge;
- The conditions of surveillance during on-site jobs;
- The conditions of transport, especially in relation to the safety of the gauges.

On planning inspections at well logging petroleum, it is advisable to check:

- The safety conditions of the storage place, with emphasis on access control (keys, cameras, physical barriers) and on suitable warnings, to decrease the chance of stealing;
- The conditions of surveillance during on-site jobs;
- The conditions of transport, especially in relation to the safety of the gauges.

3. Conclusions

Brazilian experience, acquired mainly with the Goiânia accident which occurred in 1987 [10], as well as with other accidents in industrial area, headed us to a more proactive attitude regarding the control

over radiation sources in Brazil. In order to improve this control, the concepts and recommendations of the standard ISO-IEC-17020 [11] were introduced in our programme of inspections. This implementation, together with the experience acquired along 25 years performing regulatory inspections, helps us in keeping under effective control the radioactive sources in use in our country.

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