



Analysis of the regulatory framework in Brazil for the management of NORM waste from oil and gas industry

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1. Introduction

NORM (Naturally occurring radioactive material) usually contains radionuclides from the uranium and thorium decay chains, and it is generated in very large volumes. NORM waste from oil and gas (O&G) industry typically contains ²²⁶Ra, ²²⁸Ra and daughters, and also other toxic substances, such as metals or hydrocarbons. Therefore, both radiological and non-radiological aspects must be considered for its management.

These wastes need specific management, with a pragmatic graded approach. Managing NORM implies an initial risk-based characterization, followed by a more detailed characterization that allows its safe management, using methods like volume reduction, packaging, and inertization. Scales and sludges, the main NORM waste originated by the oil and gas industry, are generally kept in storage until disposal in suitable facilities.

The oil companies operating in Brazil have been looking for solutions for the disposal of such material. This work is an analysis of the Brazilian regulation regarding this kind of waste, as well as a brief summary of the legal framework in some other countries, that have been dealing with this issue, for a comparative approach. The ultimate goal of this compilation is to suggest possible improvements in the Brazilian regulation, taking into account safety and economical aspects.

2. Methodology

The methodology used was a study on the national and international legislation applicable to NORM O&G waste management, as well as the recommendations issued by the International Atomic Energy Agency - IAEA. The authors also held virtual meetings with regulators and operators from different countries. At the international level, the applicable regulations from USA, Canada, United Kingdom, Norway, Malaysia, France and the European Union regulation were analyzed.

3. Results and Discussion

In the Brazilian scenario, two federal organizations are involved in the regulation of activities related to the management of NORM waste. IBAMA is responsible for the environmental licensing [1], while CNEN's Directorate of Safety and Security is the nuclear regulator nowadays, with a new nuclear

regulatory agency being created. The latter is preponderant when the NORM content of radionuclides are above the limits set in the regulation [2], being classed and managed as radioactive waste class 2.2. Below such level, NORM O&G waste is classified as hazardous waste - Class I due to its toxicity [3], especially in the case of sludges. Nevertheless, the disposal of large volumes must be authorized by the nuclear regulator.

Within the Law 10308/01, CNEN (Nuclear Energy National Commission) has the attributions to design, build, install, and operate intermediate and final deposits of radioactive waste. For intermediate and final deposits of radioactive waste, Law 10308/01 opened up the possibility of the delegation to third parties the services of designing, building, installing, managing, operating and removing wastes from one deposit to another [4].

The nuclear regulation does not have specific standards about NORM from the petroleum industry, they are cited in the normative for radioactive waste [1],[5], but without delving into details. The licensing requirements for final deposits for NORM waste in the nuclear standards are absent and requirements and case scenarios for the safety assessment of the final deposits should also be defined. Generic safety assessments could be the basis to set categories for a graded approach for NORM waste management, similarly to CNEN N.N. 4.01 [5]. The graded approach may allow part of the waste to be managed as hazardous waste if the dose constraints set by the regulation are met.

If the issuance of new regulation is aimed to clarify the cited aspects, like changes in Law 10308/01 or creating specific standards for NORM, this may require a long time. On the other hand, it may be quicker to create a regulatory position (PR) that explains the CNEN NN 8.02:2014 [6] standard, in order to guide and establish requirements to deal with the NORM from O&G. However, this proposition may not be essential for the regulatory body to proceed with the definitions about solutions for this waste.

On the international scenario, the waste generated from the technological concentration of NORM, including uranium mining and processing waste, as well as waste generated from oil and gas exploration, and others, are differently classified and managed, depending on the generating country. In some countries, they are considered conventional industrial wastes while in others, depending on their activity, as radioactive wastes [7].

Due to the existence of significant and highly variable levels of background exposure to naturally occurring radionuclides, exemption is probably the ideal option in a much wider range of doses, usually doses of the order of 1 mSv or less in a year [7].

In the United States different federal and state agencies share the responsibility for specific aspects of the radioactive waste management process, which includes NORM wastes. The case studied – injection in geological formations in Texas – is an example of a situation where NORM-specific regulation was issued. Besides injection, also the spread of NORM waste on land surface – landfarming - is allowed [8], [9].

In Canada the federal nuclear authority regulates over the nuclear fuel cycle and the transport of radioactive materials, whereas the NORM-related industrial activities are regulated by provincial legislation. Specifically, for NORM wastes, guidelines were developed jointly by federal, provincial, and territorial regulators, and contains generic guidance and basis for specific regulations on the management of this type of waste [10], [11].

Malaysia is another example of country with NORM-specific regulation. The Atomic Energy and Licensing Board developed a Code of Practice that provides guidance and sets requirements for the operation of oil and gas facilities and waste disposal activities [12], [13].

Examples of countries where no NORM-specific regulations exist are the United Kingdom, Norway, and France. Instead, in these countries the NORM waste management is regulated according to legal instruments applicable to hazardous or radioactive wastes [14], [15], [16], [17].

4. Conclusions

In general, the nuclear regulatory requirements, developed for the peaceful uses of nuclear energy, do not contemplate the monitoring of non-radioactive pollution sources in their entirety, reinforcing the need for environmental and nuclear licensing of the installations and the interaction between the two agencies.

The licensing requirements for final deposits for NORM waste in the nuclear standards are absent. Requirements and case scenarios for the safety assessment of the final deposits should also be defined. Generic safety assessments could be the basis to set categories for a graded approach for NORM waste management. The graded approach may allow part of the waste to be managed as hazardous waste if the dose constraints are fulfilled.

The delegation to other parties (generators or contractors) to design, manage and operate final deposits for NORM waste is foreseen in the Law 10308/2001 and should be evaluated by CNEN and the nuclear regulatory body. It is important to point out that this Law was issued before the NORM waste got attention and thus, it inadvertently sets the responsibility for CNEN to dispose large volumes of waste generated by private companies.

Besides some countries have specific regulation for NORM waste, like Malaysia, Canada and USA, the suggestions above would be the simplest way to assure safety for the management of NORM from oil and gas industry and would be in accordance to the regulatory framework in some countries, like UK, France and Norway, that apply the same legal instruments used for radioactive wastes.

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