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Assessing the management system to demonstrate the safe of transport of radioactive material

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ABSTRACT

Radioactive materials are used for medical purposes, to avoid greenhouse gas effect in energy production plants, food and other products sterilization, research and sophisticated measurement technologies. Transport of radioactive material involves a range of actors each one having specific responsibilities for safety. Through Management System, consignors and carriers fulfil objective evidences that safety requirements are met in practice, while compliance assurance programs allow regulatory bodies and/or competent authorities to demonstrate to society that public, workers and environment are protected. According to the International Atomic Energy Agency (IAEA), safety has to be achieved and maintained through an effective management system. This system should integrate all elements of management so that requirements for safety are established and applied consistently with other requirements, including those related to human performance, quality and security, and so that safety is not committed by other requirements or demands. National Nuclear Energy Commission (CNEN), the Brazilian Regulatory Body for the safe transport of radioactive materials, adopt international standards to establish safety requirements deemed relevant for protection of health and minimization of danger to life and property, and to provide for the application of these standards. Seeking for continuous improvement, the adherence of the practices adopted by Transport Safety Unit (TSU) against the recommendations from the IAEA was assessed. This assessment led to the elaboration of proposals for improvement as well as the identification of good practices. The methodology used to perform this assessment was the Self-Assessment of Regulatory Infrastructure for Safety (SARIS) methodology, developed by the IAEA. This paper will describe the most relevant findings of this study.

Keywords: transport of radioactive material, management system, self-assessment.

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RESUMO

Os materiais radioativos são utilizados para fins médicos, para evitar as adversidades de gases de efeito estufa em usinas de geração de energia, para a esterilização de alimentos e outros produtos, para pesquisas e tecnologias de medição sofisticadas. O transporte de material radioativo envolve uma série de atores, cada um com responsabilidades específicas de segurança. Por meio do Sistema de Gestão, os expedidores e os transportadores demonstram objetivamente que requisitos de segurança são atendidos na prática, enquanto os programas de garantia de conformidade permitem que órgãos reguladores e/ou autoridades competentes demonstrem para a sociedade que o público, os trabalhadores e o meio ambiente estão protegidos. De acordo com a Agência Internacional de Energia Atômica (AIEA), a segurança deve ser alcançada e mantida por meio de um sistema de gestão eficaz. Este sistema deve integrar todos os elementos da gestão, de modo que os requisitos de segurança sejam estabelecidos e aplicados de forma consistente com outros requisitos, incluindo aqueles relacionados ao desempenho humano, à qualidade e à segurança, e para que a segurança não seja comprometida por outros requisitos ou demandas. A Comissão Nacional de Energia Nuclear (CNEN), órgão regulador brasileiro para o transporte seguro de materiais radioativos, adota padrões internacionais para estabelecer requisitos de segurança considerados relevantes para a proteção da saúde, minimização do perigo para a vida e a propriedade e para a aplicação dessas normas. Buscando a melhoria contínua, foi avaliada a aderência das práticas adotadas pela Unidade de Segurança do Transporte (TSU, na sigla em inglês) às recomendações da AIEA. Esta avaliação levou à elaboração de propostas de melhoria, bem como à identificação de boas práticas. A metodologia utilizada para realizar essa avaliação foi a metodologia SARIS (Autoavaliação da Infraestrutura Regulatória para Segurança), desenvolvida pela AIEA. Este artigo descreverá os achados mais relevantes deste estudo.

Palavras-chave: transporte de material radioativo, sistema de gestão, autoavaliação.

1. INTRODUCTION

Radioactive materials are used for a wide range of purposes, including the power generation, research, manufacturing, industrial processes, medical diagnosis and therapy. Industrial applications of radioactive material include inspection and gauging operations such as examining the integrity of welded joints or measuring the thickness of paper as it is produced. Sealed radioactive sources are also used extensively in oil and gas exploration, drilling operations and to check the compactness of roadbeds during paving operations. Radionuclides are used to diagnose and treat a wide variety of diseases [1].

The transport of radioactive materials involves potential radiological risk and - like any other activity concerning the use and application of ionizing radiations - needs to be regulated, standardized, licensed and controlled.

Transport operations - domestic or international - involve at least three actors: a Consignor, a Consignee and a Carrier. Other actors as packaging designers, test facility operators', maintenance & servicing personnel, dispatchers and cargo handlers also take part.

Transport operations also encompasses a Regulatory Body and, in some countries, a Competent Authority is in charge of applying the regulations as well as Environmental Protection Agencies. Local, regional or national level authorities may be requested to take part, should it be required in the legislation or regulations. All these actors have clear responsibilities and are expected to demonstrate that their actions are performed in accordance with safety requirements.

Finally, relevant portions of transport operations are across borders and this may impose the need for a global approach. The IAEA is the body of the United Nations tasked with promoting international cooperation with a view to enhancing safety globally by exchanging experience and improving capabilities to (a) control hazards, (b) prevent accidents, (c) respond to nuclear or radiological emergencies and (e) mitigate any harmful consequences.

One of the Agency's strongest recommendations is that the competent authority should establish, implement, evaluate and improve a management system that is aligned with and contributing to safety goals. The system must be continually evaluated and improved and its processes must be open and transparent [2].

CNEN, the Brazilian Regulatory Body and Competent Authority for the safe transport of radioactive materials, adopts international standards to establish safety requirements deemed relevant for protection of health and minimization of danger to life and property. Brazilian regulations are mostly based on the IAEA recommendations. Accordingly, the domestic regulations for transport safety establish that a Quality Assurance Program shall be submitted to CNEN for approval.

The present study focuses the fiscal years 2012-2015 and describes the practices of the CNEN's Transport Safety Unit. It intends to contribute to the understanding and strengthening of the safety management system in the transportation of radioactive material through an assessment of the activities carried out by the Safety Transport Unit. Taking into account the findings of this analysis, this

paper presents a set of proposals for improvements of the management practices of the Unit. Good practices, as identified during the assessment, are also presented as a result.

2. METHOD

In order for society to take advantage of the technology that radioactive materials provide, transportation must be safe and efficient and, for this to happen, there is a set of national and international standards and regulations to be complied with.

With the ever increase in the volume of transport of radioactive material the need for ensuring safety of transport of the material cannot be overemphasized [3].

According to the Agency, "The requirements established in the Transport Regulations, when complied with by the package designer, consignor, carrier and consignee, ensure a high level of safety for the transport of radioactive material" [4].

The publications by means of which the IAEA establishes standards are issued in the IAEA Safety Standards Series. This series covers nuclear safety, radiation safety, transport safety and waste safety. The publication categories in the series are Safety Fundamentals, Safety Requirements and Safety Guides. The principal users of safety standards in IAEA Member States are regulatory bodies and other relevant national authorities [5].

2.1. IAEA Safety Standards Series (Fundamentals, Requirements and Guides)

The IAEA standards published in the Safety Standards Series set out fundamental principles of safety (Safety Fundamentals) to ensure the protection of people and the environment from the harmful effects of ionizing radiation. The fundamental Principles lay the foundation for the requirements (Safety Requirements), which must be fulfilled to ensure the protection of people and the environment, both now and in the future. The Agency has also developed Safety Guides, which provide recommendations and guidance on how to meet safety requirements, reflecting international best practices, to help users achieve high levels of safety.

Safety requirements are expressed in terms of “shall” statements. The guidance provided in these documents are expressed as “should” statements [5].

2.1.1. IAEA Safety Services – Appraisals

Safety requirements are only effective if put into practice properly and the responsibility for safety lies with each country. To help Member States the IAEA offers several review services to support in this task. Integrated Regulatory Review Service (IRRS), one of the services developed by the IAEA, is intended to provide Members States with peer review to strengthen and enhance the effectiveness of the national regulatory infrastructure of Member States. Preparation for an IRRS mission includes a self-assessment conducted by the requesting State in accordance with the IAEA's self-assessment methodology.

The results of an appraisal service are normally expressed in terms of Recommendations, Suggestions and Identified Good Practices.

2.1.2. Management System and Compliance Assurance Program

Confidence in safety is achieved through management systems and compliance assurance programs defined, according to the IAEA Transport Regulations [6], respectively as:

a) A set of interrelated or interacting elements to establish policies and objectives and allow the objectives to be achieved in an efficient and effective manner; and

b) A systematic program of measures implemented by a competent authority to ensure that the provisions of the IAEA Transport Regulations, or its own regulation, which are aligned with that of the IAEA, are complied with in practice.

The 2012 Edition of IAEA Transport Regulations requires in its Paragraph 306 that "A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations to ensure compliance with the relevant provisions of these Regulations" [6].

Organizations that design, manufacture, test, assess, service, maintain, handle, consign, carry or otherwise uses a package in connection with the transport of radioactive material need to comply with the requirements on quality assurance programs and with the requirements on the management system. However, a regulatory body also needs to implement its own management system in order to discharge its mandate and perform its functions in an effective and efficient way.

2.1.2.1. Assessing the Management System

According to the IAEA, the management system should be designed in such a way that whenever an assessment of any kind is performed, the results demonstrate that it is under control and also that all the procedures under its control are producing results that satisfy the specified requirements[5].

Assessment of the regulatory framework for safety with respect to the IAEA safety standards may be carried out either through an external review or through self-assessment. Self-assessment provides a mechanism by which an organization can assess its performance against established standards and models and thus identify areas for improvement. Rather than independent assessments, self-assessments are the primary method of assessing and verifying performance. Self-assessment is a learning process that reveals the current situation as it truly is, relative to how it may have been perceived to be.

The Self-assessment of the Regulatory Infrastructure for Safety (SARIS) is the methodology and tool developed by the IAEA to assist Members States in undertaking self-assessment of their national safety framework in accordance with the requirements and recommendations of the IAEA safety standards, and to develop an action plan for improvement [7].

2.2. Applying SARIS Methodology

In the SARIS methodology, a modular approach allows the Regulatory Body to focus on selected topics. The topic adopted for the present study was the "transport of radioactive material" and, consequently, the SARIS Question Set 006 - Regulation of Transport of Radioactive Material.

The YES or NO answers given to the SARIS Question Set questions were unable to meet the purpose of the study. In this connection, two complementary questions, common to all primary SARIS questions, have been added: (a) is the competent authority satisfied with the consistency, regularity, completeness, accuracy and comprehensiveness with which its actions are implemented? and (b) what measures could be taken (tools, resources) to improve the level of satisfaction (greater adherence to requirements)?

From the analysis of the answers given, the strengths and weaknesses of the regulatory body were then identified, as well as opportunities for improvement and threats. In addition to the Question Set, other elements were used in order to complement and deepen the self-assessment.

The first self-assessment process was started at CNEN in 2013 and has not been concluded to date. However, still in 2013, a diagnosis and a process mapping of the Regulatory Body took place. The outputs from this process were taken into account in this study. To better understand their view of

the TSU, Stakeholders were requested to provide feedback. The IAEA carried out a Transport Safety Appraisal Service (TranSAS) mission to assess the safety of radioactive material transportation. The outcomes and results were also noted in this study.

2.3. Results of the assessment

2.3.1. Diagnosis

Relevant aspects of the diagnosis are presented in the following table.

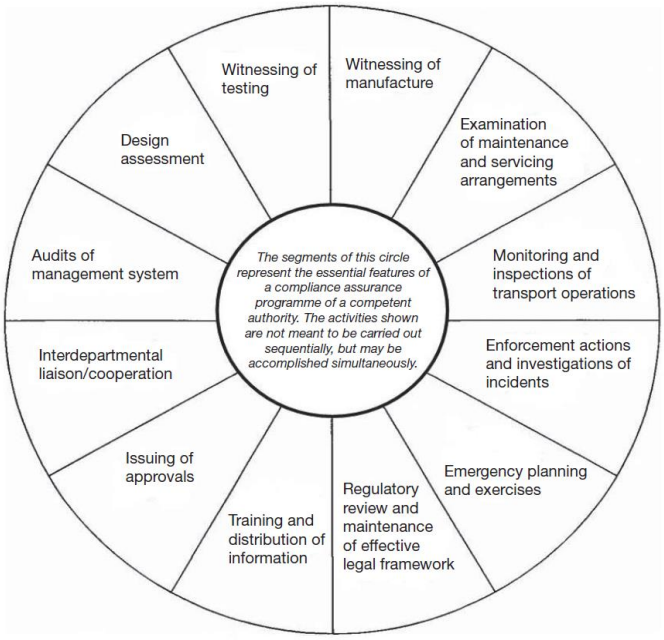
Table 1: Diagnosis: most relevant aspects

Notes
The regulatory structure defined by CNEN is not strong enough to provide the expected autonomy and independence the transport area should have in order to discharge its activities.
The TSU's should have from 6 to 8 experts. Currently it has 3.
Issues related to network security and infrastructure hinder the flow of information through electronic means.
There is a delay in updating the rules. The main one, NE 5.01, is dated 1988. Updates should occur at least every five years.
There are no (financial) punishment mechanisms for non-compliance, but the license suspension or revocation can be applied as a form of fine.
There are only performance indicators for accounting inspections and reports made during the year and they don’t reflect the TSU's performance.

2.3.2. Process Mapping

In Process Mapping were detailed organizational structure and processes that make up the TSU value chain, namely: issuing of approvals (divided into witnessing of testing and design assessment); issuing transport authorization; monitoring and inspections of transport operations and management systems audits. In addition to these mapped processes, the TSU performs the other processes that make up the Compliance Assurance Circle (Figure 1), except for the item "witnessing of manufacture". Failure to carry out this process is compensated by the witnessing of testing required by the regulations, in addition to inspections and audits, to obtain objective evidence that the requirements are being met.

Figure 1: Compliance Assurance Circle



Source: TS-G-1.5 [8]

In the year of 2012, the Director of Nuclear Safety and Security started consultations and preparatory steps in order to submit to the IAEA a request for an IRRS Mission in Brazil. In the same year, the TSU was created to address all safety aspects of radioactive material transport.

At the time, the co-author of this paper proposed - and got the agreement from the Director of Nuclear Safety - to structure TSU fully based on the IAEA Safety Guide on Compliance Assurance. Basically, the TSU was structured and organized to respond and fulfill the 12 activities presented in Figure 1.

2.3.3. Answering the SARIS Question Set

The questionnaire is the very first step in the preparatory work for an IRRS Mission and, in parallel, it is one of the required steps on the self-assessment methodology.

Table 2 presents the Primary Questions (QP) and Subsidiary Questions (QS) of the Questionnaire and their answers. Item **2.3.4** brings the outcomes of the answers to the Complementary Questions.

Table 2: SARIS Question Set

006 Regulation of Transport of Radioactive Material

Primary Module: Safety Requirements for Transport of Radioactive Material

QID	Question	Answer
1	In the context of paragraph 802 of SSR-6, does the Competent Authority for transport issue the necessary approval or validation certificates as appropriate?	Yes
1.1	In the context of SSR-6 paragraph 802, which of them relate to your country and for which of them the Competent Authority of transport currently does not approve or validate as appropriate?	Not Applicable
2	Does the competent authority for transport register serial numbers of transport packaging manufactured to an approved design?	Yes
2.1	What measures are planned to improve compliance with these requirements?	Not Applicable
3	Does the competent authority for transport perform review and assessment of relevant information for determining whether the applicant for authorization or the authorized party complies with applicable regulatory requirements?	Yes
3.1	Does the competent authority for transport continue to review and assess as necessary, relevant information associated with the transport approvals during the validity period of the transport approvals?	Yes
3.2	What measures are planned to improve compliance with these requirements?	Not Applicable
4	Prior to issuance of approval of special arrangement shipments, is it required that the competent authority for transport is satisfied that conformity with some of the provisions of the regulations is impracticable and that the requisite standards of safety established by the regulations have been demonstrated?	Yes
4.1	What measures are planned to improve compli-	Not Applicable

	ance with these requirements?	
5	Does the competent authority for transport carry out inspections of facilities and activities related to transport of radioactive materials to verify compliance with regulatory requirements and the conditions specified in any approvals?	Yes
5.1	What measures are planned to improve compliance with these requirements?	Not Applicable
6	Does the competent authority for transport make arrangements for assessments of radiation doses to persons due to transport of radioactive material, to ensure the system of protection and safety for transport complies with GSR Part 3?	Yes
6.1	What measures are planned to improve compliance with these requirements?	Not Applicable
7	Does the competent authority for transport require appropriate action to be taken on discovery of a non-compliance?	Yes
7.1	What measures are planned to improve compliance with these requirements?	Not Applicable
8	Has the competent authority for transport established or adopted regulations and guides to specify the principles, requirements and associated criteria for safety upon which its regulatory judgements, decisions and actions are based?	Sim
8.1	How does the competent authority for transport establish or adopt transport regulations and guides?	The CNEN transcribes, in its own transport regulations, the requirements offered by the IAEA. The CNEN Transport Guide (based on IAEA publication TS-G-1.1) contains guidelines developed from US guides, IAEA requirements and CNEN's own experience.
8.2	What measures are planned by the competent authority for transport to improve compliance with these requirements?	Not Applicable
9	Does the competent authority for transport re-	Yes

	quire that persons engaged in transport receive adequate training?	
9.1	What measures are planned by the competent authority for transport to improve compliance with these requirements?	Not Applicable
10	Are adequate emergency arrangements in place for the transport of radioactive material?	Yes
10.1	What measures are planned by the competent authority for transport to improve compliance with these requirements?	Not Applicable

2.3.4. Analyzing the responses (SWOT Analysis)

According to the SARIS methodology, it is expected that during the analysis phase the strengths and weaknesses of the regulatory body will be identified, together with the opportunities for improvement and the threats that may arise if nothing is done. Table 3 to 6 present the most relevant items of each group.

Table 3: Strengths

Specialists and laboratories unique in Brazil, relevant to the transport of radioactive materials, are allocated to CNEN.
Brazil has a centralized system to respond to any radiological emergency. Such system has been recognized by the IAEA as reference for the Latin America region.
Adequate guidance is provided by CNEN through adoption of IAEA safety publication i.e. advisory and complementary technical documents. The availability of an Explanatory Manual has proved to be efficient.
CNEN's TSU delivered training modules. The first addressing transport operations and the other aimed at the preparation and improvement of management systems for transport safety.
There are no reports of incidents or even accidents re. transport of radioactive material from which exposure of persons or environment has exceeded the limits established by the Regulations.

Table 4: Weaknesses

To adequately discharge its activities, TSU would need 6 to 8 staff. Currently it has only 3.
The TSU basically depends on the personal expertise and experience of its Coordinator, which is not a recommended practice.
Due to budget restrictions, the perspective of hiring new staff in the short and medium term is scarce.
The TSU highly depends on the expertise available in other technical areas. Nevertheless, such expertise is not always available to contribute, or are not enough.
The Explanatory Manual on Transport is not yet approved by the Radioprotection and Safety Directorate (DRS).
A formal standardized process to approve guidance material does exist. On the other hand, guidance material available on the CNEN's website sounds inconsistent with the formal process.
The collaborative work between CNEN's experts, laboratories and TSU could be optimized under a clear and formal process, and associated discipline.
Although the regulations require a Management System for transport safety, no detail is provided on how to comply with the requirement.
The Inspection Manual - a basic reference for the regulatory enforcement, regulatory inspections and audits - is not available for use, since it is still in the line for approval by the higher-level administration.
To allow the enhancement of the management system adopted by the TSU it would be necessary that the DRS itself improve its own management program. This approach is highly recommended in the IAEA document "The Management System for Facilities and Activities" GS-R-3.
Due to the lack of financial resources, prioritization criteria for conducting inspections should be clearly defined.
The TSU has difficulty in expanding its assessments to embrace, for instance, requirements for keeping as low as reasonably possible the level of radiation received by drivers during transport operations.
Changes in key positions in the organization (CNEN) have prevented the implementation by TSU the full scope initiatives like training modules, seminars and workshops activities.
No institutional programs have been identified for knowledge management, recognition and dissemination of talent, as well as for encouraging participation in partnerships.
CNEN laboratories specializing in nondestructive testing and analysis receive external requests that compete with those of the TSU. The former is, as a rule, prioritized.

In recent years, TSU has been unable to perform all planned regulatory inspections. Some of relevant activities like those involving incidental transport was not covered by the inspection program. The qualified companies (e.g.: service providers in transport) are still to be covered.
There is a need to identify and adopt performance indicators to provide a real view of the TSU's performance.

Table 5: Opportunities

The IAEA provides programs to support Member States to achieve effective regulatory independence, providing education and training, and sharing information, analysis, results and lessons learned.
Training opportunities are also identified in the Institut de Radioprotection et de Sûreté Nucléaire (RSN) in France and in the US Department of Energy (DOE).
At CNEN, there is the training carried out at the Institute of Radioprotection and Dosimetry (IRD), through the IAEA postgraduate program on safety of radioactive sources.
The IAEA provides expert support (Use of External Experts by the Regulatory Body, Safety Guide GSG-4).
A Cooperation Protocol is being agreed by DRS and Research and Development Directorate (DPD) which will enable partnerships in cases requiring the collaborative work of experts and the use of laboratories.
The increased use of radioactive material is creating additional demands for transport within and across national borders. Up to 400 medical facilities respond to approximately 2 million procedures per fiscal year.

Table 6: Threats

Seniors experts, from which most of experiences could be transferred to newcomers, have been motivated to retire.
The process of hiring new staff is excessively time-consuming, bureaucratic and subject to the policies from government.
The CNEN as a whole is threatened by the discontinuation of investments.
Budgetary constraints threaten the execution of an inspection plan.
Institutes tend to prioritize external requests over internal demand for services.

Training conditions as well as the application of penalties are not culturally strengthened aspects in the country, requiring greater attention of the TSU seeking for assurances regarding the compliance with the regulations.

2.3.5. Interviews

It is part of the scope of the self-assessment to complement the information obtained within the organization with stakeholder feedback. Carriers represent a significant part of the stakeholders in the transport of radioactive materials. Three of them were chosen to respond to a semi-structured interview. From the evaluation of these interviews, it was observed that:

a) They are all satisfied with the documentation available on the internet (regulation and guides);
b) Two of them has used special arrangement. Both stated that would keep using it, as they see no solution to minimize its use. The third one does not need it yet;
c) They are all satisfied with their participation in the regulatory process;
d) To keep doses (to the drivers) under required limits, carriers take some measures such as shielding vehicle, driver caster, monitoring and recycling;
e) With respect to training, the first one does not present demand; the second one would like CNEN to provide training for both agencies and companies, addressing relevant topics and overview; and the third one mentioned that there is a lack of knowledge on the part of the various agencies responsible for the inspections, so it would be great if all of them participate in a unique training; and
f) Finally, they were invited to make suggestions. They were unanimous in stating that they were satisfied with the relationship with TSU. One of the carriers mentioned that inspection is scarce favoring unfair competition. The second one would like CNEN to make the list of authorized carriers available on the website again. The last one would like the form to special arrangements had the same treatment as the other requirements (electronic form).

2.3.6. IAEA TranSAS Mission to Brazil – Summary

Transport Safety Appraisal Service (TranSAS) is a service provided by the IAEA aiming to assist any requesting State with ensuring a high level of safety during the transport of radioactive material by reviewing its implementation of the IAEA Transport Regulations and by making recommendations and suggestions for improvement where appropriate.

The general scope for any TranSAS includes an appraisal of the State's regulatory practices for transport safety with respect to the requirements of the IAEA Transport Regulations and related international standards and guidelines, covering all modes of transport (i.e. road, rail, maritime and air). The specific scope for a TranSAS may include particular emphasis on any aspect of the appraisal as requested by the State. In 2002, the IAEA performed a TranSAS Mission to Brazil.

In general, the appraisal to Brazil concluded that, although some improvements are recommended, all areas of transport safety are well addressed in Brazil and some good practices are valuable for the safe transport of radioactive material.

There is some potential for improvement for harmonizing revision to the national transport regulations with revisions to the regulations from the international modal organizations.

It would also be useful to develop formal agreements between ministries in areas of overlapping responsibilities. The responsibilities for regulating, licensing and inspection should be more clearly separated from the operational and promotional functions. More formality in procedures could be used to enhance compliance assurance aspects of regulating the transport of radioactive material.

Good practices were noted in particular in the area of emergency response.

The capabilities for responding to an emergency and the very practical guidelines would be very worthwhile for other competent authorities to consider. Another good practice involves the emphasis on preparing and evaluating transport plans and the practical application of these plans for assuring compliance [9].

3. RESULTS AND DISCUSSION

3.1. Good Practices

Identifying good practices is a healthy way to achieve more efficiency, effectiveness and value recognition. It is intended to draw attention, in this item, to practices of the TSU that somehow stood out during the study, especially considering the lack of resources (human, financial, infrastructure, etc.).

Table 7: Good Practices

The deadlines for meeting external requests are negotiated by the group with the applicants and are fulfilled.
The TSU has efficient mechanisms to monitor the processes of applicants.
Advisory material on transport safety issues and guidance are consistent with IAEA publications.
E-learning training and education material related to mgmt. system are under development.
Stakeholders are kept in close connection in relation to development of regulations.
Cooperation with relevant domestic agencies avoids lack of action and/or overlapping of responsibilities.

3.2. Proposals

After identifying the strengths, weaknesses, opportunities and threats, in the analysis phase of the SARIS methodology, the proposals are formulated so that senior managers can prepare an action plan for improvements. The proposals from this study are presented in the form of recommendations and suggestions, following the standard adopted by the IAEA in its evaluations. The recommendations and suggestions presented here may also serve in establishing an Action Plan. The following set of proposals should be taken as a living document, which in turn unfold in a more comprehensive in the extent that actions are implemented.

Table 8: Proposals

The authors recommend the establishment of measures to assessment and improvement of the DRS's Management System, including but not limited to: (a) finalize the self-assessment exercise as a previous phase for the IAEA IRRS Mission, (b) Identify, through self-assessment, weaknesses and propose actions seeking for improvements.
To consider the development and use of an IRRS pre-mission in order to accumulate experience before the Mission itself. Former DRS staff and national professional with international experience could/would carry the pre-Mission.
The authors strongly recommend to effectively and continuously assessing managerial actions to focus on adopting a clear/well defined vision and policy regarding allowing tangible objectives and

consequent deliverables.

The authors recommend: a) To encourage and enhance the interdepartmental liaison and cooperation, notably DPD-DRS, by the adoption of Cooperation protocol drafted by DPD (OI-CGPA-No0003, May 2014). b) To establish review and revise process and procedures in order to keep such documents up to date and in line with international trends, needs and accumulated experience.
The authors recommend submitting to the 5 Commissioners (CD) to approve the use of Regulatory Guides and to grant the Director of Nuclear Safety the autonomy to approve such guides.
The authors recommend due effort to publish the new version of domestic regulations for the safe transport of radioactive material.
Review and revise the domestic advisory material to be consistent with the new edition of the national transport regulations and to integrate it to the structure of the Regulatory Guides.
To ensure that education and training, as developed by the TSU, be carried out timely and fulfills the need and expectation from the Regulatory body itself and industry.
To discipline the use of existing human and material resources DRS may take advantage of the expertise from the Nuclear and Energy Research Institute (IPEN), the Nuclear Engineering Institute (IEN) and the Nuclear Technology Development Center (CDTN). Care should be taken in order to avoid the use of experts for both Regulatory Body and the industry side. The independence of each institute (TSO) is to be kept at all cost.
To ensure financial and human resources are available to allow TSU in discharging its responsibilities regarding to Transport Safety Unit.

4. CONCLUSION

By the application of IAEA's SARIS Methodology, a self-assessment exercise was conducted at the Transport Safety Unit (SASTR, in Portuguese), a cell of the Brazilian Nuclear Regulatory Body and Competent Authority in charge of control and safety of operations involving the transport of radio-

active material. The aim was to produce - and make it available - objective evidences that the transport of nuclear and other radioactive materials in Brazil is carried out in a structured, reliable and safe manner. It was concluded that the practices of the SASTR - when evaluated against SARIS Question Set 006 - indicates about a hundred percent adherence in relation to the IAEA recommended best practices in transport safety.

For further improvement, the research effort was extended and an extensive survey was carried out, which allowed deepening the evaluation. This effort included the evaluation of Diagnosis and Process Mapping documents; the responses and respective analyses of the complementary questions; stakeholder feedback and evaluation of TranSAS results.

This broader approach allowed the identification of 10 (ten) improvement proposals and to 6 (six) good practices. The findings of the study provide a sound basis for the outline of an action plan by means of which DRS would improve its performance, ensure regulatory stability and strengthen both its management system and safety culture.

Should Brazil decide to submit to the IAEA a request for an IRRS Mission, the Transport Safety Unit is ready to provide clear, complete and reliable self-assessment results.

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