

INTRODUCTION

Brazilian legislation requires that all nuclear facilities establish and maintain arrangements for on-site preparedness and response for a nuclear or radiological emergency [1]. Those arrangements must obey IAEA guidelines and the Brazilian Nuclear Program Protection System (SIPRON) procedures.

Currently, the Brazilian regulatory authority is dealing with 6 licensing processes of research and test reactors, with power from few hundred watts to close to 50 MW_{th} (table 1). Although CNEN normative states generic requirements which these plans must comply, there is not a well-defined national guideline regarding the details on how the emergency plans must be developed.

Table 1. Brazilian Research and Test Reactors Information

Facility name	Application	Type	Power	Status
IPEN/MB-01	Research	POOL	100 W	Operational (1988)
Argonauta	Research/Education	ARGONAUT	500 W	Operational (1965)
IPR-R1	Research	TRIGA MARK I	100 kW	Operational (1960)
IEA-R1	Research/Isotope production	POOL	5 MW	Operational (1957)
RMB	Research/Isotope production	POOL	30 MW	Planned
LABGENE	Propulsion model	PWR	48 MW _{th}	Planned

The lack of standardization became a challenge during the assessment of licensing documents of the Research Reactors (RR). Furthermore, while elaborating the Research Reactors Emergency Plans (RREP) the operators are not following the same guidelines, thus submitting documents that are not, necessarily, coherent with CNEN's Emergency Response Plans. This poses as a problem for the assessment of the documentation and the implementation of the plans.

As a training exercise, it was applied the 5W1H methodology on CNEN's regulatory approach to understand if it was clear, to RR licensees, how a RREP would be analyzed by the regulatory body.

ANALYSIS OF THE BRAZILIAN LEGISLATION TO EVALUATE RREP

The 5W1H methodology consists of a series of questions – Why, Where, Who, When, What and How – where each question must have a factual answer and, with them, it should be possible to outline the subject in question. The results obtained with this methodology on CNEN's regulatory approach could lead its further development, or update.

At first look, CNEN's requirements seemed to cover all the mandatory information for emergency plans (the What). Table 2, which summarizes the obtained answers, shows that there is not a clear definition on “How” to prepare the documentation available to the licensees. This lack of details (the How) leads to an operator's misunderstanding, and they tend to submit non-acceptable documents for CNEN

Question	Answer	Document
Why?	Compliance with IAEA SF-1 [2]	
Where?	Nuclear Facilities – Research Reactors	CNEN NE 1.04
Who?	Licensee	CNEN NE 1.04 (4)
When?	Safety Analysis Report (Preliminary and Final)	CNEN NE 1.04 (6.4; 8.4)
What?	Preliminary SAR: 7 Requirements Final SAR: 12 Requirements	CNEN NE 1.04 (6.4.11) CNEN NE 1.04 (8.5)
How?	There is not a factual answer to that question	

Without a well defined “How” definition even CNEN's evaluation itself becomes a challenge, as there is no parameters to be followed by the different operators. Moreover, as pointed out in table 1, we deal with installations from 100 W to 48 MW_{th}, therefore it is clear that it can not be used the same approach for all of them.

Then, how to “HOW”?

CNEN has a policy to adopt IAEA guides, or other international regulation, when there is not a specific Brazilian regulation about the topic. Considering this policy the result from the 5W1H method is not totally unexpected. However, to avoid misinterpretation of the requirements, it should be made clear which guidelines will be accepted.

The results from 5W1H questionnaire led to further investigation on how the “how” questions should be addressed and, thus, some questions have arisen. The main question that will be considered are:

- ✓ How to evaluate, specifically, RREP?
- ✓ Should it be just a graded approach of the NPP Emergency Plans? How to define parameters for graded approach? Should the graded approach be based only in operational power?
- ✓ How to standardize and harmonize the requirements between reactors already in operation and planned reactors?
- ✓ How to standardize and harmonize the emergency classification system in order to optimize the response and communication during an actual emergency?
- ✓ How to establish a criteria for emergency planning zones definitions?
- ✓ How should be presented the emergency action levels? How to assess their consistency?
- ✓ How should be presented their proposed protective actions? How to assess their consistency?
- ✓ Should the structure of emergency response, from the regulator, drive, somehow, this process?
- ✓ How to present this requirements to the operators, considering the Brazilian licensing system? Should we maintain the actual policy? Should there be a law? Or a guideline?

FURTHER DEVELOPMENT

Considering the documentation shown in Table 3, deeper studies on their content shall be conducted in future works. It is known that this list is not complete and other available documentation, as the European directives and other available national guides, must be considered to evaluation.

Table 3. Main documents selected to future study and development of a guide

Document	Year	Importance (Question)
GSR Part 7 - Preparedness and Response for a Nuclear or Radiological Emergency	2015	WHAT / General
SSR-3 - Safety of Research Reactors ¹	2016	Support document
GSG-11 - Arrangements for the Termination of a Nuclear or Radiological Emergency	2018	Partial HOW
GS-G-2.1 - Arrangements for Preparedness for a Nuclear or Radiological Emergency	2007	Partial HOW
GSG-2 - Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency	2011	Partial HOW
EPR-Research Reactor 2011 - Generic Procedures for Response to a Nuclear or Radiological Emergency at Research Reactors ¹	2011	Partial HOW
EPR-Method 2003 - Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency	2003	General HOW
EPR-Harmonized Assistance Capabilities - Guidelines on the Harmonization of Response and Assistance Capabilities for a Nuclear or Radiological Emergency	2017	Partial HOW
ANSI/ANS-15.16-2015 - Emergency Planning for Research Reactors ¹	2015	HOW
10 CFR Part 50 - Appendix E - Emergency Planning and Preparedness for Production and utilization Facilities	2017	WHAT AND HOW / General
US Reg Guide 2.6 - Emergency Planning for Research and Test Reactors and other non-power production and utilization facilities ²	2017	Support document
NUREG-0849 - Standard Review Plan for the Review and Evaluation of emergency plans for Research and Test Reactors ¹	1983	HOW TO EVALUATE

¹ Specific to RR

² Evolved from a document specific to RR

The next steps of this work intends to lead to a review of internal documentation on Emergency Preparedness, either generic or specific to research and test reactors, and the development of a Brazilian guide on how to submit an emergency plan specific to research and test reactors.

REFERENCES

1. CNEN; Norma CNEN NE 1.04 – Licenciamento de instalações nucleares; 2002.
2. IAEA; Fundamental Safety Principles – Safety Fundamentals No.SF-1; 2006.