

A Self-Assessment of the Effectiveness to Control Radiation Sources in Sierra Leone

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1. Introduction

Recently, there has been an exponential increase in the use of ionizing radiation sources in Sierra Leone [1]. There is an urgent need to effectively control sources of ionizing radiation. Sources of ionizing radiation pose serious occupational, public health, and environmental consequences, if not properly controlled.

The government of Sierra Leone knows the importance of controlling these sources of ionizing radiation and of establishing an independent Nuclear Safety Infrastructure. Therefore, the government established the Board Secretariat as the regulatory body for ionizing radiation through the Protection from Radiation Board Act in 2001 (RPBA, 2001). Sierra Leone has no nuclear facilities but, it is rapidly developing its infrastructure in order to obtain nuclear technology. However, the regulatory effectiveness in controlling radiation risk is essential for the International Atomic Energy Agency to allow the transfer of nuclear technology. For this reason, this study will evaluate the status of the regulatory authority in Sierra Leone to control radiation risk.

The International Atomic Energy Agency (IAEA) review mission to Sierra Leone found that the RPBA did not give sufficient enforcement powers to the Board Secretariat [4]. Hence, the RPBA was repealed and replaced by the Nuclear Safety and Radiation Protection Act, 2012 (NSRPA, 2012), which has now established the Nuclear Safety and Radiation Protection Authority (NSRPA) with sufficient enforcement powers in line with all relevant international standards of the IAEA including the IAEA's General Safety Requirements Part 3.

According to IAEA to sustain and maintain high levels of safety in nuclear and radiation installations depends on an effective legal instrument and government support, including a national regulatory body with appropriate finances, well-trained staff, and well-defined responsibilities and functions. The regulatory body should have access to adequate resources [2]. However, though the NSRPA was also given power by the NSRPA, 2012 to conduct research on nuclear and radiation issues, none have yet been conducted using Sierra Leone as a case study. This research will analyze the regulatory infrastructure in Sierra Leone and make any necessary

recommendations for improvement of the regulatory infrastructure in Sierra Leone to effectively control radiation sources.

2. Methods

The effectiveness of the regulatory authority to control radiation sources was evaluated. An International Atomic Energy Agency questionnaire [3], known as the self-assessment for regulatory infrastructure, was used. The questionnaire consists of over 150 questions. The questions evaluated were then divided into management systems, regulatory processes, authorization, inspections and enforcement. categories Table 1 shows some of the questions used.

Table 1 Some questions of the IAEA's, SARIS

Management systems	
1	Explain how the regulatory body continuously improves its management system.
2	Explain how the regulatory body ensures that processes within its management system are open and transparent.
3	Explain how the regulatory body assesses the effectiveness of its management system in fostering and supporting a safety culture.
4	Explain how the regulatory body management system ensures that safety is given due priority in all regulatory activities and decisions.
5	Explain the extent to which the management system sets out the planned and systematic actions necessary to demonstrate that regulatory body obligations are being fulfilled.
Regulatory Processes	
1	Does the regulatory body's organizational structure enable it to discharge its responsibilities? and perform its functions effectively in a manner commensurate with the radiation risk associated with facilities and activities?
2	Explain how the current structure of the regulatory body has been determine?
3	Describe the process and explain how the regulatory body ensures that allocation of resources within its organisation is commensurate with the radiation risks associated with facilities and activities in accordance with a graded approach.

4	Does the regulatory body perform its functions in a manner that does not compromise its effective independence?
5	Explain how the regulatory body ensures its responsibilities are discharged in such a way as to preserve its effective independence.
	Authorization
1	Is authorization by the regulatory body, including specification of conditions necessary for safety, a prerequisite for facilities and activities not either explicitly exempted or approved by a notification process?
2	List the facilities and activities explicitly subject to authorization by the regulatory body.
3	Is the applicant required to submit an adequate demonstration of safety in support of the application for authorization of a facility or an activity?
4	Explain how the regulatory body verifies the competence of individuals with assigned responsibility for safety of authorized facilities and activities.
5	In the granting of an authorization, explain the mechanisms by which the regulatory body may impose limits, conditions and controls on the authorized party's subsequent activities.
	Inspection
1	Does the regulatory body carry out inspections of facilities and activities to verify that the authorized party is in compliance with regulatory requirements and the conditions upon which authorization is granted?
2	Explain how the regulatory body establishes and maintains the principle that regulatory inspections do not diminish the authorized party's prime responsibility for safety and do not substitute for the control, supervision and verification activities conducted under their responsibility.
3	List and explain any other aspects tailored into the regulatory body's graded approach, in addition to the radiation risks associated with the facility or activity under review.
4	Explain how the regulatory body records the results of inspection activities (including actions taken or the basis thereof) and the extent to which such records are used to provide feedback to authorized parties on the regulatory process.
5	Do regulatory inspections cover all areas under the regulatory body's responsibility? If not, list and explain the gaps.
	Enforcement
1	Describe the types of regulatory enforcement actions taken.
2	List and explain the types of non-compliance for which only notifications are issued by the

	regulatory body.
3	List and explain the types of non-compliance for which additional conditions and requirements are imposed by the regulatory body.
4	List and explain the types of non-compliance for which written warnings and penalties are issued by the regulatory body.
5	List and explain the types of non-compliance for which the regulatory body would revoke an authorization

The study covered management responsibilities, inspections, authorization, and enforcement. The study was conducted in Sierra Leone on the activities of the Nuclear Safety and Radiation Protection Authority, under the Ministry of Energy. The questions were answered by only management staff because the questions were based on information that only the management staff would provide the appropriate answers. The questionnaire was administered from June to November, 2013, to allow sufficient time for responses.

Each manager responded to a module different from the module they analyzed. The answers were based on the Nuclear Safety and Radiation Protection Act, 2012, [4], procedures for authorization, inspection, and other relevant procedures and practical implementation of those procedures. The structure of the regulatory infrastructure for effective implementation was practically evaluated. In addition, strengths and weakness analysis was conducted.

3. Data and Results

The results compared the strengths and weaknesses of the following: management systems, regulatory processes, authorization, inspection, enforcement, and control of records. The result also compared the overall strength and weakness of the authority. These comparisons provide a strong insight into the effectiveness of the regulatory authority in Sierra Leone to control sources of ionizing radiation.

The study results were obtained using the questionnaire and database of Self-Assessment for Regulatory Infrastructure developed by the International Atomic Energy Agency (IAEA) [3]. The database compared the responses to IAEA's best practices. Our study found that there have been improvements in the legal provisions as opposed to the 2008 study by the IAEA. It was also found that full implementation of the legal provisions was a challenge just as in the previous study. Regulations to be implemented with the act remained in the draft form.

Table 2 shows some major strengths of the regulatory authority while Table 3 shows some of their weaknesses. In the analysis each strength was scored one and each weakness was zero for proper analysis of the data.

Table 2. Some of the strength of the regulatory authority

Strength	Ranking
Regulations and guides have been established by the regulatory body to specify the principles, requirements and associated criteria for safety. Though some are in the draft form.	1
The procedures for authorization makes it relevant for the update of the database in the regulatory body.	1
The management system of the Authority promotes and supports a strong safety culture through education and training.	1
The law emphasizes safety and security of sources including categorization of sources.	1
The Senior Management has developed some goals, strategies, plans and objectives that are supportive with the policies of the Authority.	1
The Executive Secretary of NSPA has the overall responsibility for the management system of the regulatory body.	1
The law gives sufficient enforcement powers to the Authority.	1
The law make it clear for the authority to adherence to the yearly work plan of inspection and renewal of authorization. The authority annually develops work plan.	1

Table 3. Some weakness of the regulatory authority

weakness	Ranking
The Authority is yet to develop a human resource plan that states the number of staff necessary and the essential knowledge, skills and abilities needed to perform all necessary regulatory functions.	0
There is no strategy in place to compensate for the departure of qualified staff.	0
The authority does not have a central storage system of information. Thus the source registry is incomplete.	0
There is an inspector manual, procedures and guides to ensure that the infrastructure and the working environment necessary for regulatory work are maintained and re-evaluated but these manuals are not fully implemented.	0

Senior management and management at all other levels are yet to carry out self-assessment to evaluate the performance of its works.	0
The Authority does not have a central waste storage facility.	0
Important regulations to compliment the law are still in the draft form.	0

Figure 1 is a pie chart showing the strength to weakness ratio of the authority. Figure 2 shows an analysis of four broad categories of regulatory activities important to the effectiveness of the regulatory authority in Sierra Leone.



Figure 1. Overall strength vs. weakness

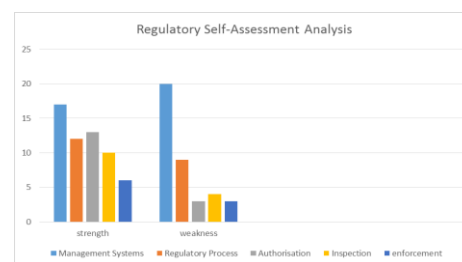


Figure 2. Comparison of the strength and weaknesses for different evaluated parameters

Previous data obtained by the IAEA Integrated Regulatory Review Service (IRRS) on the effectiveness of the regulatory infrastructure in Sierra Leone were not encouraging [5]. Some of the IRRS recommendations includes; the Protection from Radiation Act, 2001 of Sierra Leone must be reviewed and revised with emphasis on safety and security of radioactive sources, categorization of sources and enforcement, the radiation protection board should develop and enact practice specific regulations, the national registry of radiation sources must be completed, the authority should have a central waste storage facility [5]. The IRRS findings led the government to repeal and replace the Protection from Radiation Act 2001 to the Nuclear Safety and Radiation Protection Act 2012 [5].

The result modeled from the self-assessment for the regulatory infrastructure database is similar to that obtained by the model used by the IRRS mission to

Sierra Leone. Some of the findings are almost the same while others show an improvement trend as seen in Tables 2 and 3. The result does not show the overall status of the regulatory infrastructure, but covers in detail some important aspects related to the effective functioning of the regulatory authority in protection and safety. The result obtained can be used to improve the management systems, regulatory processes, authorization, inspection, enforcement, and control of records.

4. Discussion and Conclusions

The research evaluated the status of the regulatory authority of Sierra Leone. The status of the regulatory authority was evaluated against several parameters including management systems, regulatory processes, authorization, inspection, and enforcement. The ability to effectively control ionizing radiation sources depends on the status of the regulatory body. The Integrated Regulatory Review Service Report on Sierra Leone led us to infer that there is a need for the regulatory authority to rapidly improve its ability to control ionizing radiation sources in the country.

The findings however, revealed that the overall strengths of the regulatory body in Sierra Leone slightly outnumber the weaknesses. Management systems have a ratio of 0.85:1 of strengths to weaknesses. This ratio makes management systems the weakest parameter evaluated. Thus there is need for stronger collaboration between management staff. The Regulatory processes have a ratio of 1.3:1, authorizations have a ratio of 4.3:1, inspections have ratio of 2.5:1, enforcement has ratio of 2:1. A gradual improvement is needed in other categories evaluated.

The findings revealed some similar results to that of the Integrated Regulatory Review Service Report on the regulatory authority in Sierra Leone. However, it showed improvements in other areas when compared to the Integrated Regulatory Review Service Report. The results could be used to help improve the overall regulatory infrastructure in Sierra Leone. This may lead to the international community having more confidence in the nuclear regulatory infrastructure of Sierra Leone, leading to transfer of more complex nuclear technology, including nuclear power reactors.

The research did not cover all topics concerning regulatory infrastructure. It is limited to only the responsibilities and functions of the regulatory authority. Therefore, future research into other areas such as government responsibility for safety, global safety regime is recommended.

5. Acknowledgement

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6. References

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