

**INTEGRATED  
REGULATORY  
REVIEW SERVICE (IRRS)  
MISSION  
TO  
NIGERIA**

Abuja, Nigeria

*2-12 July 2017*

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY



Integrated  
Regulatory  
Review Service

**IRRS**



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**REPORT OF THE  
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NIGERIA**





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NIGERIA**

**Mission dates:** *2-12 July 2017*  
**Regulatory body visited:** *Nigerian Nuclear Regulatory Authority (NNRA)*  
**Location:** *Abuja, Nigeria*  
**Regulated facilities and activities in the mission scope:** *Radiation Sources in Industrial and Medical Facilities, Research Reactors, Transport, Emergency Preparedness and Response, Medical Exposure, Occupational Exposure, Public and Environmental Monitoring*  
**Organized by:** *IAEA*

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**The number of recommendations, suggestions and good practices is in no way a measure of the status of the national infrastructure for nuclear and radiation safety. Comparisons of such numbers between IRRS reports from different countries should not be attempted.**

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## EXECUTIVE SUMMARY

At the request of the Government of Federal Republic of Nigeria, an international team of senior safety experts met representatives of the Nigerian Nuclear Regulatory Body (NNRA) from 3 to 12 July 2017 to conduct an Integrated Regulatory Review Service (IRRS) mission. The purpose of this peer review was to review Nigeria's regulatory framework for nuclear and radiation safety.

The mission took place at the NNRA Headquarters in Abuja. The IRRS mission covered all civilian facilities and activities in Nigeria. The review compared the Nigerian regulatory framework for nuclear and radiation safety against IAEA safety standards as an international benchmark for safety. The mission was also used to exchange information and experience between the IRRS team members and the Nigerian counterparts in the areas covered by the IRRS.

The IRRS team consisted of twelve senior regulatory experts from eleven IAEA Member States, two IAEA staff member, one IAEA administrative assistant. The IRRS team conducted a review of the following areas: responsibilities and functions of the government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body including the authorization, review and assessment, inspection and enforcement processes; development and content of regulations and guides; emergency preparedness and response; occupational radiation protection, control of medical exposure, public and environmental exposure control, transport of radioactive material, waste management and decommissioning, the interface between nuclear safety and security and the tailored module for countries embarking on nuclear power.

The IRRS mission included discussions on three policy issues discussions: independence of NNRA; Openness, transparency and stakeholders involvement (including public communications); Enhancing NNRA effectiveness and competence.

The mission included observations of regulatory activities, interviews and discussions with management and staff of the NNRA, as well as the high level management of NNRA and a member of the NNRA Board. Activities included visits to the National Hospital Abuja, Gamma Irradiation Facility, Abuja, and Center for Energy Research and Trainings, Zaria. The IRRS team members observed regulated activities and performance of inspection activities, including discussions with the licensee personnel and management.

In preparation for the IRRS mission, Nigeria conducted a self-assessment and prepared a preliminary action plan to address weaknesses that were identified. The results of the self-assessment and supporting documentation were provided to the team as advance reference material for the mission. During the mission, the IRRS team performed a systematic review of all topics presented in the advance reference material. Throughout the mission, the IRRS review team was extended full cooperation in the regulatory, technical, and policy issues by all parties in a very open and transparent manner.

NNRA is the regulatory authority for oversight of nuclear and radiation safety of facilities and activities in Nigeria. NNRA has developed regulations and requirements to carry out its regulatory responsibilities and for compliance with the IAEA safety standards and international best practices. The IRRS team recognized that NNRA continues to update its regulatory requirements and encouraged NNRA to further enhance its regulatory framework.

The IRRS team recognized that Nigeria has a committed regulatory body for the protection of people and the environment, and for continuous improvement of safety, which has also been demonstrated by inviting the IRRS mission. The main challenges of NNRA are ensuring its effective independence to adequately

implement its regulatory decisions, and developing the necessary skills and competences to effectively conduct regulatory activities, also in view of the planned embarking on a nuclear power programme

The IRRS team identified a good practice and made recommendations and suggestions where improvements are necessary to enhance NNRA's regulatory framework in line with the IAEA safety standards.

The identified good practice is that NNRA conducts routine workshops and training for the news media to inform them about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body.

The IRRS team also identified issues in need of improvement and believes that consideration of these will enhance the overall performance of the regulatory system. The team also recognized that some of the issues have been identified by NNRA's action plan for improving the national regulatory infrastructure as a result of the self-assessment.

In particular, the Government should:

- establish a national policy on safety to fully incorporate the fundamental safety objective, fundamental safety principles and long-term commitment to safety;
- ensure that the legal framework is kept up to date and corresponds to the current IAEA Safety Requirements;
- ensure that the NNRA is effectively independent and has functional separation from entities having responsibilities or interests that could unduly influence its decision-making;

NNRA should:

- carry out a competence and skills needs analysis for all its regulatory responsibilities, and develop and implement a human resources plan to address the existing gaps;
- develop formal processes and procedures for authorization, review and assessment, inspection and enforcement as necessary, that are based on specified policies, principles and associated criteria;
- establish a documented management system in line with IAEA safety standards;
- ensure that all facilities and activities that are not either explicitly exempted or approved by means of a notification process have a valid authorization;
- establish and implement an enforcement policy within the legal framework for responding to non-compliance by authorized parties with regulatory requirements or with any conditions specified in the authorization.

The IRRS review team findings are summarized in Appendix VI.

An IAEA press release was issued at the end of the IRRS Mission and a joint IAEA and NNRA press conference took place.

## I. INTRODUCTION

At the request of the Government of Nigeria, an international team of senior safety experts met representatives of the Nigerian Nuclear Regulatory Authority (NNRA) from 3 to 12 July 2017 to conduct an Integrated Regulatory Review Service (IRRS) mission. The purpose of this peer review mission was to review Nigeria's regulatory framework for nuclear and radiation safety. The review mission was formally requested by the Government of Nigeria on 23 September 2015. A preparatory meeting was conducted 27-28 June 2016 in Abuja to discuss the purpose, objectives and detailed preparations of the review mission in connection with regulated facilities and activities in Nigeria and their related safety aspects and to agree on the scope of the IRRS mission.

The IRRS review team consisted of 12 senior regulatory experts from 11 IAEA Member States, 2 IAEA staff and 1 IAEA administrative assistant. The IRRS review team carried out the review in the following areas: responsibilities and functions of the government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body including the authorization, review and assessment, inspection and enforcement processes; development and content of regulations and guides; emergency preparedness and response; occupational radiation protection, control of medical exposure, public and environmental exposure control, transport of radioactive material, waste management and decommissioning, the interface between nuclear safety and security and the tailored module for countries embarking on nuclear power.

In addition, policy issues were discussed, including: independence of NNRA; Openness, transparency and stakeholders involvement (including public communications); Enhancing NNRA effectiveness and competence.

NNRA conducted a self-assessment in preparation for the mission and prepared a preliminary action plan. The results of NNRA's self-assessment and supporting documentation were provided to the IRRS review team as advance reference material for the mission. During the mission the IRRS review team performed a systematic review of all topics within the agreed scope through review of NNRA's advance reference material, conduct of interviews with management and staff from NNRA and direct observation of regulatory activities at regulated facilities - the National Hospital Abuja, Gamma Irradiation Facility, Abuja, and Centre for Energy Research and Training, Zaria. Meetings with the Minister of State, Petroleum Resources and the Acting President of Nigeria were also organized.

All through the mission the IRRS team received excellent support and cooperation from NNRA.

## II. OBJECTIVE AND SCOPE

The purpose of this IRRS mission was to review Nigeria's radiation and nuclear safety regulatory framework and activities against the relevant IAEA safety standards to report on regulatory effectiveness and to exchange information and experience in the areas covered by the IRRS. The agreed scope of this IRRS review included all facilities and activities regulated in Nigeria. It is expected that this IRRS mission will facilitate regulatory improvements in Nigeria and other Member States, utilising the knowledge gained and experiences shared between NNRA and IRRS reviewers and the evaluation of Nigeria's regulatory framework for nuclear and radiation safety, including its good practices.

The key objectives of this mission were to enhance the national legal, governmental and regulatory framework for nuclear and radiation safety, and national arrangements for emergency preparedness and response through:

- a) providing an opportunity for continuous improvement of the national regulatory body through an integrated process of self-assessment and review;
- b) providing the host country (regulatory body and governmental authorities) with a review of its regulatory technical and policy issues;
- c) providing the host country (regulatory body and governmental authorities) with an objective evaluation of its regulatory infrastructure with respect to IAEA safety standards;
- d) promoting the sharing of experience and exchange of lessons learned among senior regulators;
- e) providing key staff in the host country with an opportunity to discuss regulatory practices with IRRS Review Team members who have experience of other regulatory practices in the same field;
- f) providing the host country with recommendations and suggestions for improvement;
- g) providing other states with information regarding good practices identified in the course of the review;
- h) providing reviewers from Member States and IAEA staff with opportunities to observe different approaches to regulatory oversight and to broaden knowledge in their own field (mutual learning process);
- i) contributing to the harmonization of regulatory approaches among states;
- j) promoting the application of IAEA Safety Requirements; and
- k) providing feedback on the use and application of IAEA safety standards.

### **III. BASIS FOR THE REVIEW**

#### **A) PREPARATORY WORK AND IAEA REVIEW TEAM**

At the request of the Government of Nigeria a preparatory meeting for the Integrated Regulatory Review Service (IRRS) was conducted from 27-28 June 2016. The preparatory meeting was carried out by the appointed IRRS Team Leader, Mr Lamberto Mateocci and the IAEA Team representatives, Mr. Ahmad Al Khatibeh, Mr Teodros Hailu, Team Coordinator, and Mr Tim Kotetz, Deputy Team coordinator.

The IRRS mission preparatory team had discussions regarding regulatory programmes and policy issues with the senior management of NNRA represented by Mr Lawrence Dim, Director General of NNRA, other senior management and staff. It was agreed that the regulatory framework with respect to the following facilities and activities would be reviewed during the IRRS mission in terms of compliance with the applicable IAEA safety requirements and compatibility with the respective safety guides:

- Research Reactors;
- Waste management facilities;
- Radiation sources facilities and activities;
- Decommissioning;
- Transport of radioactive materials;
- Control of medical exposure;
- Occupational radiation protection;
- Public exposure control;
- Existing exposure control;
- Selected policy issues.

Mr Lawrence Dim made presentations on the national context and the current status of NNRA. The self-assessment results to date was presented by Mr. Ademola Ogunbewon.

IAEA staff presented the IRRS principles, process and methodology. This was followed by a discussion on the tentative work plan for the implementation of the IRRS mission in Nigeria in July 2017.

The proposed composition of the IRRS review team was discussed and tentatively confirmed. Logistics including meeting and work places, counterparts and Liaison Officer identification, proposed site visits, lodging and transportation arrangements were also addressed.

The NNRA Liaison Officer for the IRRS mission was confirmed as Mr Godwin Omeje.

NNRA provided IAEA with the advance reference material (ARM) for the review at the end of February 2017. In preparation for the mission, the IAEA review team members reviewed the Nigeria advance reference material and provided their initial impressions to the IAEA Team Coordinator prior to the commencement of the IRRS mission.

#### **B) REFERENCES FOR THE REVIEW**

The relevant IAEA safety standards and the Code of Conduct on the Safety and Security of Radioactive Sources were used as review criteria. The complete list of IAEA publications used as the references for this mission is provided in Appendix VIII.

#### **C) CONDUCT OF THE REVIEW**

The initial IRRS review team meeting took place on Sunday, 02 July 2017 at Rockview (Royale) Hotel, Abuja, directed by the IRRS Team Leader and the IRRS IAEA Team Coordinator. Discussions encompassed the general overview, the scope and specific issues of the mission, clarified the bases for the

review and the background, context and objectives of the IRRS programme. The understanding of the methodology for review was reinforced. The agenda for the mission was presented to the team. As required by the IRRS Guidelines, the reviewers presented their initial impressions of the ARM and highlighted significant issues to be addressed during the mission.

The host Liaison Officer was present at the initial IRRS review team meeting, in accordance with the IRRS Guidelines, and presented logistical arrangements planned for the mission.

The IRRS entrance meeting was held on Monday 3 July 2017, with the participation of NNRA senior management and staff. Opening remarks were made by Mr Emmanuel Ibe Kachikwu, Hon. Minister of State for Petroleum Resources (HMSPR), represented by his Senior Technical Adviser, Mr Adegbite Adeniji, Mr Donald Tayo Alasoadura, Chairman, Senate Committee on Petroleum Upstream, Mr Victor Nwokolo, Chairman, House Committee on Petroleum Upstream, Mr Lawrence Dim, Director General of the NNRA, Mr Lamberto Mateocci, IRRS Team Leader and Mr Teodros Hailu, IRRS Team Coordinator. Mr Timothy Akpa gave an overview of the Nigerian context, NNRA activities and the action plan prepared as a result of the pre-mission self-assessment.

During the IRRS mission, a review was conducted for all review areas within the agreed scope with the objective of providing Nigeria and NNRA with recommendations and suggestions for improvement and where appropriate, identifying good practices. The review was conducted through meetings, interviews and discussions, visits to facilities and direct observations regarding the national legal, governmental and regulatory framework for safety.

The IRRS review team performed its review according to the mission programme given in Appendix III.

The IRRS exit meeting was held on Wednesday, 12 July 2017. The opening remarks at the exit meeting were presented by Mr Lawrence Dim, DG/CEO, NNRA and were followed by the presentation of the results of the mission by the IRRS Team Leader Mr Lamberto Mateocci. Closing remarks were made by Mr Peter Johnston, IAEA, Director, Division of Radiation, Transport and Waste Safety.

A joint IAEA and NNRA press conference took place at the end of the mission.

An IAEA press release was issued.

# 1. RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT

## 1.1. NATIONAL POLICY AND STRATEGY FOR SAFETY

The National Energy Policy promulgated by the Energy Commission of Nigeria in 2003, revised in 2013, and the National Energy Master Plan of 2014 establish the Government policy on exploitation of nuclear energy for peaceful purposes in electricity generation, application of nuclear science and technology in industry, agriculture, medicine and water resources management and exploration of nuclear mineral resources. Policy declarations contained in the above document prioritize the need to accelerate manpower development to meet the various peaceful applications of nuclear energy; the establishment of nuclear safety and environmental protection measures; the need to strengthen the Nigerian Nuclear Regulatory Authority; the need of research and development and to ensure appropriate funding provisions for nuclear science and technology. In addition, policy elements in the above documents also include references to the importance to be assigned to safety, security and safeguards as well as to ensure environmental sustainability of waste storage and disposal.

These policy documents, however, do not clearly and explicitly emphasize the fundamental safety objective, fundamental safety principles and a long-term commitment to safety as indicated in IAEA safety standards.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** There is no national policy for safety that addresses the fundamental safety objective, fundamental safety principles and a long-term commitment for safety.

|           |  |
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| (1)       | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 1, para. 2.3 states that</b> <i>“The government shall establish a national policy and strategy for safety, the implementation of which shall be subject to a graded approach in accordance with national circumstances and with the radiation risks associated with facilities and activities, to achieve the fundamental safety objective and to apply the fundamental safety principles established in the Safety Fundamentals”.</i>   |
| (2)       | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 1, para. 2.3 states that</b> <i>“The national policy and strategy for safety shall express a long term commitment to safety. The national policy shall be promulgated as a statement of the government’s intent. The strategy shall set out the mechanisms for implementing the national policy. In the national policy and strategy, account shall be taken of the following:</i><br><i>(a) The fundamental safety objective and the fundamental safety principles established in the Fundamental Safety Principles</i><br><i>(f) Adequate mechanisms for taking account of social and economic developments;</i><br><i>(g) The promotion of leadership and management for safety, including safety culture.”</i> |
| (3)       | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 1, para. 2.4 states that</b> <i>“The national policy and strategy for safety shall be implemented in accordance with a graded approach, depending on national circumstances, to ensure that the radiation risks associated with facilities and activities, including activities involving the use of radiation sources, receive appropriate attention by the government or by the regulatory body.”</i>  |
| <b>R1</b> | <b>Recommendation: The Government should establish a national policy on safety to fully</b>  |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**incorporate the fundamental safety objective, fundamental safety principles and long-term commitment to safety.**

### 1.2. ESTABLISHMENT OF A FRAMEWORK FOR SAFETY

The regulatory framework of Nigeria is based on the Nuclear Safety and Radiation Protection Act of 1995. The Act is complemented with several regulations which constitute the legally binding framework for safety in Nigeria: Nigeria Basic Ionizing Radiation Regulations, 2003, Nigerian Radioactive Waste Management Regulations, 2006, Nigerian Safety and Security of Radioactive Sources Regulations, 2006, Nigerian Transportation of Radioactive Sources Regulations, 2006, Nigerian Radiation Safety in Industrial Radiography Regulations, 2006, Nigerian Radiation Safety in Diagnostic and Interventional Radiology Regulations, 2006, Nigerian Radiation Safety in Nuclear Medicine Regulations 2006, Nigerian Radiation Safety in Radiotherapy Regulations, 2006, Nigerian Radiation Safety in Industrial Irradiator Regulations, 2008, Nigerian Naturally Occurring Radioactive Materials (NORM) Regulations, 2008 and the Nigerian Radiation Safety in Nuclear Well Logging Regulations, 2008.

The Act and the regulations and guides cover all types of activities and facilities in Nigeria. However, in certain areas, the existing framework for safety is not entirely consistent with some relevant IAEA safety standards, such as GSR Part 1, GSR Part 2, GSR Part 3, Part 4, Part 5 and Part 7 in particular with regard to:

- the safety principles for protecting people (individually and collectively), society and the environment from radiation risks, both at present and in the future;
- interfaces among safety and nuclear security;
- interface with the system of accounting for, and control of, nuclear material;
- controls on the import and export of nuclear material and radioactive material;
- allocation of responsibility for the regulatory control of medical exposure of patients;
- adoption of the optimization principle of protection to provide the highest level of safety that can be reasonably achieved;
- allocation of responsibilities and obligations in respect of financial provision for the management of radioactive waste and of spent fuel, as well as for decommissioning of facilities and termination of activities.

A new bill has been drafted to revise the Act of 1995. NNRA has also undertaken a review of the existing regulations and drafted a number of additional regulations that are awaiting finalization.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The legal framework for safety is not fully aligned with the latest IAEA Safety Requirements.

**(1)** **BASIS:** GSR Part 1 (Rev. 1) Requirement 2 para. 2.5 states that *“The government shall promulgate laws and statutes to make provision for an effective governmental, legal and regulatory framework for safety”*.

**R2** **Recommendation:** The Government should ensure that the legal framework is kept up to date and corresponds to the current IAEA Safety Requirements.



### 1.3. ESTABLISHMENT OF A REGULATORY BODY AND ITS INDEPENDENCE

The Act establishes the Nigerian Nuclear Regulatory Authority (NNRA) as the sole regulatory body that is mandated with the responsibility for nuclear and radiation safety and radiation protection regulation. The Act also establishes a Governing Board for NNRA that consists of the President of the Federal Republic, the Ministers of Defence, Health, Internal Affairs, Solid Minerals Development, Petroleum Resources and Science and Technology and Directors General of the Federal Environmental Protection Agency, Energy Commission of Nigeria, NNRA and two eminent Nigerians with cognate background and experience in nuclear science. The Board is responsible for managing and superintending the affairs of NNRA, formulating policies and guidelines for regulating nuclear safety and radiological protection and ensuring their implementation.

A number of members of the Board are affiliated with organizations that use or have interests in the promotion of nuclear technology and radiation sources, which could potentially create a conflict of interest. These members are the Ministers of Health, Solid Minerals Development, Petroleum Resources, and Science and Technology, Director Generals of Energy Commission of Nigeria, Sheda Science and Technology Complex and the National Agency for Science and Engineering Infrastructure.

NNRA is supervised by the Ministry of Petroleum Resources. This Ministry also supervises other agencies that use certain types of ionizing radiation sources in the country.

#### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA is not functionally separated from entities having responsibilities or interests that could unduly influence its decision-making.

**(1)** **BASIS: GSR Part 1 (Rev. 1) Requirement 3 states that** *“The government shall ensure that the regulatory body is effectively independent in its safety related decision making and that it has functional separation from entities having responsibilities or interests that could unduly influence its decision making.”*

**R3** **Recommendation: The Government should ensure that the NNRA is effectively independent and has functional separation from entities having responsibilities or interests that could unduly influence its decision-making.**

### 1.4. RESPONSIBILITY FOR SAFETY AND COMPLIANCE WITH REGULATIONS

The Nigeria Basic Ionizing Radiation Regulation, 2003 assigns the prime responsibility for safety to the person or organization responsible for a facility or an activity. Prime responsibility for safety is stated in the draft bill but is not reflected in the existing Act.

In addition, the Act does not state that the compliance with regulations and requirements established or adopted by NNRA does not relieve the person or organization responsible for a facility or an activity of its prime responsibility for safety.

Furthermore, the responsibility for safety may extend to other groups associated with the authorized party, such as designers, suppliers, manufacturers and constructors, employers, contractors, and consignors and carriers, in so far as their activities or products may be of significance for safety. However the Act does not have provisions that extension of responsibility does not relieve the authorized party of the prime responsibility for safety.

The responsibility for safety covers all stages in the lifetime of the facility and activity and is not transferrable to another party as the authorizations issued by NNRA are not transferable. Section 21(5) of

the Act requires authorised parties to comply with stipulated regulatory requirements and to demonstrate such compliance. NNRA is empowered to take enforcement action to ensure that all concerned persons and bodies comply with laid down regulations.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES   |  |
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| <b>Observation:</b> The Act does not assign the prime responsibility for safety and protection to the person or organization responsible for a facility or an activity. |  |
| (1)   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 5 states that</b> <i>“The government shall expressly assign the prime responsibility for safety to the person or organization responsible for a facility or an activity, and shall confer on the regulatory body the authority to require such persons or organizations to comply with stipulated regulatory requirements, as well as to demonstrate such compliance.”</i>   |
| (2)   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 6 states that</b> <i>“The government shall stipulate that compliance with regulations and requirements established or adopted by the regulatory body does not relieve the person or organization responsible for a facility or an activity of its prime responsibility for safety.”</i>  |
| (3)   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 6 para 2.14 states that</b> <i>“In addition, responsibility for safety may extend to other groups associated with the authorized party, such as designers, suppliers, manufacturers and constructors, employers, contractors, and consignors and carriers, in so far as their activities or products may be of significance for safety. However, in no case may this extension of responsibility relieve the authorized party of the prime responsibility for safety. The authorized party has the responsibility for verifying that products and services meet its expectations (e.g. in terms of completeness, validity or robustness) and that they comply with regulatory requirements.”</i> |
| (4)   | <b>BASIS: GSR Part 3 Requirement 2 para 2.15 states that</b> <i>“The government shall establish legislation that, among other things: (b) Specifies that the prime responsibility for protection and safety rests with the person or organization responsible for facilities and activities that give rise to radiation risks.”</i>  |
| <b>R4</b>   | <b>Recommendation: The Government should assign the prime responsibility for safety and protection to the person or organization responsible for a facility or an activity.</b>  |

### 1.5. COORDINATION OF AUTHORITIES WITH RESPONSIBILITIES FOR SAFETY WITHIN THE REGULATORY FRAMEWORK

The Act empowers NNRA to liaise with and foster cooperation with other organizations or other bodies having responsibilities for safety. The IRRS team was informed that NNRA cooperates with other national bodies that have responsibilities for safety within the regulatory framework. NNRA has formalized its cooperation with the Nigeria Customs Service in the area of import and export control of nuclear and radioactive material through a memorandum of understanding (MoU). In the area of siting of NPPs, NNRA is planning to establish MoU with the Ministry of Environment for the siting process of NPPs.

NNRA has not formalized its cooperation with other authorities such as those competent in the areas of safety of workers and the public, protection of the environment, regulation of radiation sources in medicine, emergency preparedness and response, liability for nuclear damage, nuclear security, safety in relation to water use and consumption of food, and the safety in the transport of nuclear and radioactive

material.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** There is a lack of formalised coordination and liaison among authorities having responsibilities for safety within the regulatory framework.

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| <b>(1)</b> | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 7 para. 2.18 states that</b> <i>“Where several authorities have responsibilities for safety within the regulatory framework for safety, the responsibilities and functions of each authority shall be clearly specified in the relevant legislation. The government shall ensure that there is appropriate coordination of and liaison between the various authorities concerned. This coordination and liaison can be achieved by means of memoranda of understanding, appropriate communication and regular meetings [...]”</i> |
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| <b>S1</b> | <b>Suggestion: NNRA should consider formalising cooperation with all authorities having responsibilities for safety.</b> |
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### 1.6 SYSTEM FOR PROTECTIVE ACTIONS TO REDUCE EXISTING OR UNREGULATED RADIATION RISKS

NNRA provides advice on the implementation of the protective action to reduce radiation risks in line with Section 4 (e) of the Act that mandates NNRA to advise the Federal Government on nuclear security, safety and radiation protection matters. NNRA works closely with the National Emergency Management Agency (NEMA) in making adequate national arrangements for the protection of workers, the public and the environment as a consequence of an accident.

NNRA has developed regulations on Naturally Occurring Radioactive Materials (NORM). NNRA is working on acquisition of baseline data of the background dose rates through desk studies and radiological monitoring assessments and intends to collaborate with the Federal Ministry of Environment. Previously, NNRA has conducted radiological assessment verification of Cs-137 contamination of Delta Steel Company Facility in Delta State and the radiological assessment of NORM waste on the Jos Plateau and the Niger Delta.

The Nigerian Safety and Security of Radioactive Sources Regulations of 2006 require the scrap metal industry to install radiation portal monitors to detect any radioactive materials that may inadvertently be found in scrap metals. Any orphaned radioactive sources are taken to the temporary storage facility at the Centre for Energy Research and Trainings (CERT) in Zaria.

NNRA has recognized and carried out activities in collaboration with the police regarding training for competent authorities, reporting on orphan sources, retrieval and storage of orphan sources in the CERT waste storage facility, to ensure control over orphan sources. NNRA also conducts search and secure activities for orphan and disused sources. However, a documented strategy for gaining and regaining control over orphan sources is not yet in place.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** There is no documented strategy for gaining or regaining control over orphan sources.

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| <b>(1)</b> | <b>BASIS: Code of Conduct on the Safety and Security of Radioactive Sources para. 8 states that</b> <i>“Every State should have in place an effective national legislative and regulatory system of control over the management and protection of radioactive sources. Such a system</i> |
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## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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|     | <i>should:</i><br><i>(c) Include national strategies for gaining or regaining control over orphan sources.</i>  |
| (2) | <b>BASIS: GSR Part 3 para. 2.26 states that</b> <i>“The government shall ensure that arrangements are in place for regaining control over radioactive sources that have been abandoned, lost, misplaced, stolen or otherwise transferred without proper authorization”.</i> |
| S2  | <b>Suggestion: The Government should consider establishing a documented strategy for gaining or regaining control over orphan sources.</b>  |

### 1.7. PROVISIONS FOR THE DECOMMISSIONING OF FACILITIES AND THE MANAGEMENT OF RADIOACTIVE WASTE AND OF SPENT FUEL

The Act empowers the NNRA to categorize and license activities involving exposure to ionizing radiation including storage and disposal of any radioactive material, nuclear material and radioactive waste. The Act also prohibits a licensee to abandon, decommission or rehabilitate installations without an authorization from the NNRA.

There are no assurances for financial resources for decommissioning, waste management and disposal.

There is a draft national policy document on waste management. NNRA has also drafted a strategy/national plan for the safe and sustainable management of radioactive waste and spent nuclear fuel.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** There is no national policy and strategy for radioactive waste management and safety of spent fuel and arrangements for decommissioning and disposal.

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| (1) | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 10 states that</b> <i>“The government shall make provision for the safe decommissioning of facilities, the safe management and disposal of radioactive waste arising from facilities and activities, and the safe management of spent fuel.”</i>  |
| (2) | <b>BASIS: GSR Part 5 Requirement 1 states that</b> <i>“The government shall provide for an appropriate national legal and regulatory framework within which radioactive waste management activities can be planned and safely carried out. This shall include the clear and unequivocal allocation of responsibilities, the securing of financial and other resources, and the provision of independent regulatory functions. Protection shall also be provided beyond national borders as appropriate and necessary for neighbouring States that may be affected.”</i>   |
| (3) | <b>BASIS: GSR Part 5 Requirement 2 states that</b> <i>“To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.”</i> |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| (4) | <b>BASIS: GSR Part 5 Requirement 6 states that</b> <i>“Interdependences among all steps in the predisposal management of radioactive waste, as well as the impact of the anticipated disposal option, shall be appropriately taken into account.”</i>  |
| (5) | <b>BASIS: SSR Part 5 Requirement 1 states that</b> <i>“The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility.”</i> |
| (6) | <b>BASIS: GSR Part 6 Requirement 4 states that</b> <i>“The government shall establish and maintain a governmental, legal and regulatory framework within which all aspects of decommissioning, including management of the resulting radioactive waste, can be planned and carried out safely. This framework shall include a clear allocation of responsibilities, provision of independent regulatory functions, and requirements in respect of financial assurance for decommissioning.”</i>  |
| R5  | <b>Recommendation: The Government should establish a national policy and strategy for radioactive waste management and safety of spent fuel, and make arrangements for decommissioning and disposal including securing of financial and other resources.</b>   |

### 1.8. COMPETENCE FOR SAFETY

A number of institutions have been set up that offer training in nuclear and radiation technology related disciplines. These include the CERT and Centre for Energy Research and Development (CERD). In the area of safety, the National Institute of Radiation Protection and Research in cooperation with the University of Ibadan offers education and training for Radiation Safety Advisers (RSA) and Radiation Safety Officers (RSO) in Radiation Protection as well as conducts research and development.

Training programmes offered by the International Atomic Energy Agency (IAEA), European Commission through ITER-Consult and ENSTTI, African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA), Forum of Nuclear Regulatory Bodies in Africa (FNRBA) and its partners are other avenues utilised to build competences for safety. An agreement has been established with Russian Federation in the area of peaceful application of nuclear energy.

NNRA takes advantage of training and education programmes outside the country, where these are not available locally. The Government through NNRA has initiated collaboration with regulatory bodies of other countries including the USNRC (USA), KINS (Republic of Korea), SA-NNR (Republic of South Africa) and Rostechnadzor (Russian Federation).

### 1.9. PROVISION OF TECHNICAL SERVICES

There is one secondary standard dosimetry laboratory at the National Institute for Radiation Protection and Research (NIRPR), which is under the NNRA. NIRPR also provides technical services for environmental monitoring and instrumentation calibration services.



Five dosimetry service providers for external radiation monitoring were approved by NNRA for the period 2015-2016. There are no internal dosimetry services.

NNRA accredits Radiation Safety Advisers who provide awareness training, radiation safety services and remediation services.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES                                   |  |
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| <b>Observation:</b> There are no internal dosimetry services currently available. |  |
| (1)   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 13 states that</b> <i>“The government shall make provision, where necessary, for technical services in relation to safety, such as services for personal dosimetry, environmental monitoring and the calibration of equipment.</i> |
| S3  | <b>Suggestion: The Government should consider making provisions for internal dosimetry services.</b>   |

### 1.10. SUMMARY

Some policy statements are made in the National Energy Policy and the Act but the Government has not promulgated a national policy and strategy on nuclear safety.

The Act and the regulations are not fully in line with latest IAEA safety standards and need to be revised.

The allocation of the responsibility for the regulation of medical exposure and the allocation of prime responsibility for safety are not stated in the Act, which should therefore be revised to address these issues.

The Act establishes the regulatory body, NNRA, albeit a functional separation from entities with responsibilities and interests in the promotion of nuclear and radiation technologies is not ensured. Coordination and liaison among authorities having responsibilities for safety within the regulatory framework has not been formalised for the majority of entities.

A national policy and strategy for radioactive waste management and safety of spent fuel and arrangements for decommissioning and disposal, including financial assurance are yet to be developed. A strategy for gaining or regaining control over orphan sources is also not in place.

Arrangements for developing and maintaining competence of all parties having responsibilities for the safety of facilities and activities should be formalised. Internal dosimetry services need also be developed.

## **2. THE GLOBAL SAFETY REGIME**

### **2.1. INTERNATIONAL OBLIGATIONS AND ARRANGEMENTS FOR INTERNATIONAL COOPERATION**

The Federal Government of Nigeria has signed and ratified the following conventions and treaties in support of the global safety regime: Nuclear non-Proliferation Treaty; Comprehensive Safeguards Agreement, African Nuclear Weapon-Free Zone Treaty (Pelindaba Treaty), Additional Protocol to the Nuclear non-Proliferation Treaty, Convention on Early Notification of a Nuclear Accident, Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency, Convention on Nuclear Safety, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Convention on Physical Protection of Nuclear Materials and Convention on Nuclear Liability. The country has registered its capability in RANET to offer and receive international assistance in case of nuclear and radiological emergency.

The Government has expressed political commitment to the Code of Conduct on the Safety and Security of Radioactive Sources. Processes towards the expression of political commitment to the supplementary guidance on import and export of radioactive sources have been initiated.

The country participates actively in the meetings and activities of the Convention on Nuclear Safety and the Joint Convention, Regional and Global Nuclear Safety and Security Network, Incident and Trafficking Database (ITDB). Nigeria is a member of the IAEA Regulatory Cooperative Forum (RCF) and the Forum of the Nuclear Regulatory Bodies in Africa (FNRBA). The country has received a number of peer review missions from the IAEA; Radiation Safety and Security Infrastructure Appraisal (RaSSIA) Mission in November 2005, Integrated Safety Assessment for Research Reactors (INSARR) Mission, December 2009, Integrated Nuclear Infrastructure Review Mission (INIR), June 2015 and Emergency Preparedness and Response Review Mission (EPRéV), June 2015.

The country has signed cooperative agreements with the European Commission through ITER-Consult and ENSTTI. The country also has a number of informal cooperative activities with other Member States and organizations in the area of nuclear safety and security of radioactive sources.

### **2.2. SHARING OF OPERATING EXPERIENCE AND REGULATORY EXPERIENCE**

NNRA participates in international conferences, workshops and meetings where operating and regulatory experiences are shared. The lessons learnt from these events are shared through in-house seminars, national workshops and publication in the NNRA's periodic magazine.

NNRA's shares regulatory experiences with regulatory bodies of other states through regular participation in the Regulatory Cooperative Forum (RCF) and other networks such as the Forum of Nuclear Regulatory Bodies in Africa (FNRBA).

### **2.3. SUMMARY**

Nigeria has signed and ratified relevant conventions and treaties in the global nuclear safety regime. It has also expressed its commitment to the code of conduct on the safety and security of radioactive sources. Expression of political commitment to the supplementary guidance on import and export control of radioactive sources has been initiated. Nigeria is a member to a number of relevant international fora and participates regularly.

### 3. RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY

#### 3.1. ORGANIZATIONAL STRUCTURE OF THE REGULATORY BODY AND ALLOCATION OF RESOURCES

NNRA’s organizational structure is made up of the Board, the Technical Advisory Committee, the Director General and the Departments of Nuclear Safety, Physical Security and Safeguards, Radiological Safety, Administration and Finance and the National Institute of Radiation Protection and Research (NIRPR). These departments are established in the Act and the Board has the power to approve more departments based on the recommendation of the Director General, such as Authorization and Enforcement, which was established in 2008. NNRA has six zonal offices whose staffing has been allocated following a graded approach to cater for the difference in workload in each zone.

NNRA is funded by the State and from the collected licensing fees.

#### 3.2. EFFECTIVE INDEPENDENCE IN THE PERFORMANCE OF REGULATORY FUNCTIONS

In accordance with the Act, a Technical Advisory Committee is set up to advise the Board. In the past NNRA has employed the services of the Technical Advisory Committee in the development of regulations and licensing guides. The IRRS team was informed that that the Technical Advisory Committee, however, has not been convened for several years by NNRA. The Technical Advisory Committee had individuals who are affiliated with organizations having responsibilities or interests in the promotion of nuclear technology and use of radiation sources. The NNRA is currently availing experts, either locally or internationally, for any technical advice when needed.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The NNRA had assigned the Technical Advisory Committee to develop regulations and guides. The Technical Advisory Committee comprised of individuals who were mainly drawn from organizations or bodies with responsibilities for facilities or for their promotion.

(1)

**BASIS: GSR Part 1 (Rev. 1) Requirement 17 para. 4.9 states that** *“To maintain its effective independence, the regulatory body shall ensure that, in its liaison with interested parties, it has a clear separation from organizations or bodies that have been assigned responsibilities for facilities or activities or for their promotion.”*

(2)

**BASIS: GSR Part 1 (Rev. 1) Requirement 20 para. 4.20 states that** *“Arrangements shall be made to ensure that there is no conflict of interest for those organizations that provide the regulatory body with advice or services. If this is not possible domestically, then the necessary advice or assistance shall be sought from organizations in other States or, as and where appropriate, from international organizations which have no such conflicts of interest.”*

(3)

**BASIS: GSR Part 1 (Rev. 1) Requirement 20 para. 4.22 states that** *“The obtaining of advice and assistance does not relieve the regulatory body of its assigned responsibilities. The regulatory body shall have an adequate core competence to make informed decisions. In making decisions, the regulatory body shall have the necessary means to assess advice provided by advisory bodies and information submitted by authorized parties and applicants.”*



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| S4 | <b>Suggestion:</b> NNRA should consider ensuring that there is no conflict of interest for those organizations that provide it with advice or services. |
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### 3.3. STAFFING AND COMPETENCE OF THE REGULATORY BODY

NNRA has a total staff of 713 employees. About 350 are technical staff whilst the rest are administrative and support staff.

NNRA lacks some competences, for example, in human factors in research reactors and assessment of transport packages, which are needed for NNRA to discharge its responsibilities in the regulatory control of all facilities and activities under its jurisdiction. The IRRS team observed during a site visit that the licensee thought that there was no sufficient training for inspectors and their competence could be enhanced. Some technical training for newly recruited NNRA staff is provided in relevant facilities.

A competence needs analysis has been conducted for the NPP programme, but has not been carried out including all facilities and activities comprehensively, to identify the number of staff, and the competences and skills needed. A human resources plan is not in place to address the competence gaps.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| <b>Observation:</b> A competence needs analysis for existing facilities and activities has not been carried out and there is no human resource plan in place. |  |
| (1)   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 18 states that</b> <i>“The regulatory body shall employ a sufficient number of qualified and competent staff, commensurate with the nature and the number of facilities and activities to be regulated, to perform its functions and to discharge its responsibilities.”</i> |
| (2)   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 18 para. 4.11 states that</b> <i>“A human resources plan shall be developed that states the number of staff necessary and the essential knowledge, skills and abilities for them to perform all the necessary regulatory functions.”</i>                                     |
| R6  | <b>Recommendation:</b> NNRA should carry out a competence and skills needs analysis for all its regulatory responsibilities, and develop and implement a human resources plan to address the existing gaps.  |

### 3.4. LIAISON WITH ADVISORY BODIES AND SUPPORT ORGANIZATIONS

NNRA has a technical support organization established through the Act, the National Institute for Radiation Protection and Research (NIRPR), which offers technical support in the form of secondary standards dosimetry laboratory, personal monitoring and environmental monitoring, and equipment calibration. A formal process for the appointment of technical support organizations has been established in the draft Strategic Plan for 2016-2020. Arrangements for preventing and handling conflicts of interests in the engagement of technical advisory bodies and technical support organizations are still to be developed. This issue is addressed in Suggestion S4 in Section 3.2.

### 3.5. LIAISON BETWEEN THE REGULATORY BODY AND AUTHORIZED PARTIES

The IRRS team was informed that NNRA conducts workshops and meetings to promote information exchange with stakeholders. NNRA utilizes print and electronic media including its website to

disseminate information to authorised parties. Justification and explanation of regulatory decisions are provided to authorised parties through written communications.

### 3.6. STABILITY AND CONSISTENCY OF REGULATORY CONTROL

NNRA has established regulatory processes for authorization, review and assessment, inspection and enforcement. NNRA has identified some policies, criteria and procedures that are used in the decision-making process and are meant to ensure stability and consistency of regulatory control. However, not all regulatory activities have documented procedures and some documents are not issued but are in draft stage.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |  |
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| <p><b>Observation:</b> NNRA has established regulatory processes for authorization, review and assessment, inspection and enforcement, however not all regulatory activities have documented procedures developed and implemented to ensure consistency in the decision-making process. NNRA does not have a licensing process and acceptance criteria related to the safety of the research reactor to support its decision-making process.</p> |  |
| (1)  | <p><b>BASIS: GSR Part 1 (Rev. 1) Requirement 22 para. 4.26 states that</b> <i>“The regulatory process shall be a formal process that is based on specified policies, principles and associated criteria, and that follows specified procedures as established in the management system. The process shall ensure the stability and consistency of regulatory control and shall prevent subjectivity in decision making by individual staff members of the regulatory body. The regulatory body shall be able to justify its decisions if they are challenged. In connection with its reviews and assessments and its inspections, the regulatory body shall inform applicants of the objectives, principles and associated criteria for safety on which its requirements, judgements and decisions are based.”</i></p> |
| (2)  | <p><b>BASIS: SSR-3 Requirement 1 para. 3.12 states that</b> <i>“Each State shall develop its own approach to acceptance criteria depending upon its particular legal and regulatory infrastructure. Acceptance criteria based on principles for safe design and operation shall be made available to the operating organizations.”</i></p>   |
| R7   | <p><b>Recommendation: NNRA should develop formal processes and procedures for authorization, review and assessment, inspection and enforcement, as necessary, that are based on specified policies, principles and associated criteria.</b></p>  |

### 3.7. SAFETY RELATED RECORDS

NNRA has the following information systems in place: Registry of Technical Files, Archive, Electronic Archive, Regulatory Authority Information System (RAIS) and National Dose Registry. The time frame that NNRA has to keep the safety related records is in accordance with the national legislation which prescribes that records should be kept for ten years.

The legislation requires authorised parties to maintain for prescribed periods all the records necessary for the safe operation of facilities and the safe conduct of activities.

### 3.8. COMMUNICATION AND CONSULTATION WITH INTERESTED PARTIES

NNRA has a strategy for public information that is included in the NNRA Strategic Plan (2016-2019). NNRA through its Information Unit organizes press conferences and media workshops to develop better awareness and understanding of nuclear and radiation safety issues.

NNRA organizes workshops and stakeholders’ meetings to promote information exchange with interested parties. NNRA utilises print and electronic media including its website to disseminate information to interested parties. Furthermore, NNRA produces Annual Reports that are distributed in hard copy. Availing the reports electronically is intended to improve their circulation and availability.

The IRRS team was informed that authorized parties are required to inform interested parties within the vicinity of the installation about safety aspects.

NNRA periodically conducts workshops for the news media to provide insights on NNRA’s regulatory activities. The fourth workshop was conducted in Abuja on February 18, 2017, and covered the principles of radiation protection, the uses of ionizing radiation sources in Nigeria, the hazards associated with ionizing radiation and the need for regulatory control and the effective and accurate dissemination of information on nuclear regulatory activities. The IRRS team considered the routine conduct of these workshops a good practice.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |  |
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| <b>Observation:</b> NNRA proactively reaches out to inform the media about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body. |  |
| (1)  | <b>BASIS: GSR Part 1 (Rev 1) Requirement 36 states that</b> <i>“The regulatory body, in its public informational and consultation, shall set up appropriate means of informing interested parties, the public and the news media about the radiation risks associated with facilities and activities, the requirements for the protection of people and the environment and the processes of the regulatory body”.</i> |
| GP1  | <b>Good practice: NNRA conducts routine workshops and training for the news media to inform them about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body.</b>   |

### 3.9. SUMMARY

NNRA has an organizational structure comprising of the Board, Technical Advisory Committee, Director General, departments, and divisions, the NIRPR and six zonal offices. In the past the NNRA has used the services of the Technical Advisory Committee in the development of regulations and authorization guides. If further use is planned for the future, potential conflict of interests connected to the request of advice from experts having liaison with entities involved in the promotion and use of nuclear technology needs to be avoided.

NNRA has a total of 713 staff, about 350 of whom are technical and the rest are support staff. NNRA does not have some of the competences necessary to discharge its statutory obligations and an action plan should be developed. NNRA’s relationship with authorized parties should be improved to address the concerns of the interested parties proactively.

Not all regulatory activities have documented procedures.

NNRA is maintaining good communication and interaction with interested parties including the media.

## 4. MANAGEMENT SYSTEM OF THE REGULATORY BODY

### 4.1. LEADERSHIP FOR SAFETY

The senior management of NNRA demonstrates leadership for safety and commitment to safety by establishing its mission, vision and core values. The NNRA mission is “to regulate radiological protection and nuclear safety so as to ensure the protection of life, health, property and the environment from the harmful effects of ionizing radiation, safety and security of radioactive sources and nuclear materials and, to enable Nigeria meet its international obligations on the peaceful uses of nuclear technology”. The mission, as well as vision and core values, are documented in different documents, i.e. draft Integrated Management System (IMS) Manual, NNRA Strategic Plan 2016 – 2019 and including on the NNRA website.

Management at all levels periodically communicate to individuals the mission, vision, core values and requirements of NNRA management system. The NNRA management holds weekly meetings with all employees in headquarters to acquaint them with the activities of the regulatory body.

The IRRS team was informed that NNRA has plans to establish a systematic approach to familiarize employees with the organizational policy, safety policy, mission, vision, behavioural expectations, individual and institutional values and expectation for safety since currently not all staff receive training related to the management system.

### 4.2. MANAGEMENT FOR SAFETY

The draft IMS manual defines the responsibility of the senior management in ensuring an integrated management system is established, implemented, assessed and continually improved to ensure safety.

The IRRS team was informed that NNRA senior management intends to appoint in the future an individual to be responsible for coordinating the development, application and maintenance of the management system.

The NNRA senior management has developed and circulated through the organization a documented set of policies such as a draft enforcement policy and draft training policy.

However, NNRA does not have in place a safety policy and an organizational management system policy that integrates all different policies that establish plans, objectives and priorities.

NNRA management has developed a Strategic Plan for 2016 – 2019 which includes specific safety goals. The IRRS team was informed that all NNRA departments participated in the preparation of the Strategic Plan. An action plan for the communication strategy is in place. The IRRS team was informed that NNRA intends to develop similar action plans also for other areas. The Strategic Plan is not yet fully implemented and periodic reviews of implementation of strategic plan have not been performed.

NNRA has defined interaction with interested parties in the draft IMS Manual. NNRA holds periodic meetings with the stakeholders, organizes public consultations related to safety and regulatory decisions.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA has not established an organizational policy for safety.

(1)

**BASIS: GSR Part 2 Requirement 3 para 4.2 states that** “Senior management shall be responsible for establishing safety policy.”

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| (2) | <b>BASIS: GS-G-3.1, para 3.10 states that</b> <i>“As part of the management system, senior management should develop and disseminate throughout the organization a documented set of policies that establish the management’s plans, objectives and priorities with regard to safety, health, environmental, security, quality and economic considerations. The policies should reflect the commitment of senior management to attaining their goals and objectives; their priorities; and the means by which continual improvement will be implemented and measured.”</i> |
| R8  | <b>Recommendation:</b> NNRA senior management should establish a safety policy.  |
| S5  | <b>Suggestion:</b> NNRA should consider developing a documented management policy which integrates safety, health, environment, security, human and organizational factors, quality, societal and economic considerations.   |

### 4.3. THE MANAGEMENT SYSTEM

The NNRA integrated management system is under development and senior management has appointed a team of five staff responsible for its establishment. NNRA has not prepared a plan for establishment, implementation, assessment and improvement of a management system where the priorities are stressed such as documenting key processes related to inspection and authorization, and defining the interactions among the processes.

The organizational structure, processes, responsibilities, accountabilities, levels of authorities and interfaces within the organization are specified in the Act and in some internal procedures. However, interfaces with external organizations are not clearly specified.

The requirement for identifying organizational changes is addressed in the Act and in the draft IMS Manual. However, NNRA does not have a documented procedure related to control of changes that could have significant implications for safety.

The draft IMS Manual provides for a graded approach. NNRA uses a graded approach to allocate resources to core activities. However, specific criteria on the application of a graded approach have not been defined in the management system. This issue is addressed in Recommendation R10 in Section 5.1.

Only some parts of the management system are documented. It was noted that NNRA, apart from the draft IMS Manual, developed several documents such as handbooks, guides, and description of some processes. However, these documents are not systematically included in the management system. The document identification system is not established. The NNRA has also recognised the documentation of management system in its action plan.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| <b>Observation:</b> NNRA does not have a fully documented and implemented management system. |  |
| (1)  | <b>BASIS: GSR Part 1 (Rev.1) Requirement 19 states that</b> <i>“The regulatory body shall establish, implement, and assess and improve a management system that is aligned with its safety goals and contributes to their achievement”.</i>                                |
| (2)  | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 19 para. 4.15 states that</b> <i>“The management system of the regulatory body has three purposes:<br/>(1) The first purpose is to ensure that the responsibilities assigned to the regulatory body are properly discharged.</i> |



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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|           | <p>(2) <i>The second purpose is to maintain and improve the performance of the regulatory body by means of the planning, control and supervision of its safety related activities.</i></p> <p>(3) <i>The third purpose is to foster and support a safety culture in the regulatory body through the development and reinforcement of leadership, as well as good attitudes and behaviour in relation to safety on the part of individuals and teams.</i></p> |
| (3)       | <b>BASIS: GSR Part 2 Requirement 6 states that</b> <i>“The management system shall integrate its elements, including safety, health, environmental, security, quality, human-and-organizational-factor, societal and economic elements, so that safety is not compromised.”</i>  |
| (4)       | <b>BASIS: GS-G-3.1 para 2.1. states that</b> <i>“An integrated management system should provide a single framework for the arrangements and processes necessary to address all the goals of the organization. These goals include safety, health, environmental, security, quality and economic elements and other considerations such as social responsibility.”</i>  |
| (5)       | <b>BASIS: GSR Part 2 Requirement 7 states that</b> <i>“The management system shall be developed and applied using a graded approach.”</i>  |
| (6)       | <b>BASIS: GSR Part 2 Requirement 8 states that</b> <i>“The management system shall be documented. The documentation on the management system shall be controlled, usable, readable, clearly identified and readily available at the point of use.”</i>   |
| (7)       | <b>BASIS: GSR Part 2 Requirement 10 states that</b> <i>“Processes and activities shall be developed and shall be effectively managed to achieve organization’s goals without compromising safety”</i>  |
| (8)       | <b>BASIS: GSR Part 2 Requirement 13 states that</b> <i>“The effectiveness of the management system shall be measured, assessed and improved to enhance safety performance, including minimizing the occurrence of problems relating to safety.</i>   |
| (9)       | <b>BASIS: GS-G-3.1 para.2.24 states that</b> <i>“Senior management should prepare a plan to achieve full implementation of the management system.....”</i>   |
| <b>R9</b> | <b>Recommendation:</b> NNRA should establish a documented management system in line with IAEA safety standards.  |

#### 4.4. MANAGEMENT OF RESOURCES

NNRA senior management is responsible for determining and providing the competences and resources necessary to carry out the activities of the organization adequately. The needs based analysis is prepared and funding is provided by the government.

NNRA senior management has established a staff training policy which is under revision. Furthermore, in view of the national nuclear programme, a document on Systematic Identification of Competency Gap and Training Needs Assessment for Nuclear Safety was developed.

Activities related to knowledge management are still at the initial phase. NNRA developed a knowledge portal as an essential part of information and knowledge management. However, the knowledge portal works on a departmental level so the information is only available to staff within the same department, and information and knowledge are not disseminated and managed in a way that everybody in the organization has access.

The IRRS team was informed that NNRA has appointed a team of five staff dedicated to systematically introduce knowledge management system in the organization. Some employees have received training

related to knowledge management at the Knowledge Management School in Trieste, Italy. This team is working on a knowledge management policy.

A systematic approach to knowledge management is not yet in place. A systematic approach to training on the basis of competences, skills and working tasks has been introduced only for the area of nuclear safety and not for the entire organization.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>   |   |
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| <b>Observation:</b> Activities related to knowledge management are still in the initial phase. |   |
| <b>(1)</b>   | <b>BASIS:</b> GSR Part 2 para. 4.27 states that <i>“Knowledge and the information shall be managed as a resource”</i> |
| <b>S6</b>  | <b>Suggestion:</b> NNRA should consider strengthening the system for knowledge and information management.            |

#### **4.5. MANAGEMENT OF PROCESSES AND ACTIVITIES**

NNRA has defined its processes and activities in the draft IMS Manual and developed an overarching process map. The core processes implemented by the regulatory body are identified in the Act. NNRA has recognized 9 key processes, 5 supporting processes and 2 management processes. NNRA also has appointed process owners responsible for each process.

Processes are described in the draft IMS Manual but procedures that define the processes in detail are not developed for all processes, with the exception of the process for preparation of regulations. The interactions and interfaces within the NNRA, and the interfaces with external parties are not defined. This issue is addressed in Recommendation R9 in Section 4.3.

#### **4.6. CULTURE FOR SAFETY**

The culture for safety of the NNRA is addressed in the draft IMS Manual in line with the IAEA Safety Standard GSR Part 2. However, only some elements of safety culture are applied in several activities implemented by the NNRA. This issue is addressed in Recommendation R9 in Section 4.3. During weekly meetings, managers discuss safety culture issues with employees. At the end of each year a meeting common for all employees is held in order to inform the employees on past NNRA activities.

Some NNRA employees have participated in IAEA workshops dedicated to promotion and assessment of safety culture and in the training course on Integrated Management Systems for regulatory bodies. It was observed that the knowledge gained has not been transferred to other employees involved in development of the regulatory body management system.

#### **4.7. MEASUREMENT, ASSESSMENT AND IMPROVEMENT**

Measurement, assessment and improvement processes are mainly related to the evaluation of the NNRA performed activities. All Directors monitor progress of their regulatory activities. Weekly reports of the activities of the various Units of the Departments are submitted to the Directors. The Departments through quarterly departmental meetings review their activities. Reports are sent to the senior management. At the end of the year an annual report of the NNRA is prepared.

The following measurement, assessment and improvement processes are identified but currently not documented and systematically implemented. This issue is addressed in Recommendation R9 in Section 4.3. These processes are only identified in the draft IMS Manual:

- Monitoring the effectiveness of the management system;
- Regular evaluation of processes;
- Evaluation of non-conformances and their causes and corrective and preventive actions;
- Conducting internal assessments (internal audits);
- Conducting self-assessments of management system;
- Conducting management system reviews;
- Conducting self-assessments and independent assessment of safety culture.

#### **4.8. SUMMARY**

NNRA has initiated some activities to introduce an integrated management system. A draft IMS Manual has been prepared and is under revision.

There is a need to continue the establishment, development, implementation and continuous improvement of a robust and effective integrated management system in line with IAEA safety standards, which should support the enhancement and improvement of safety culture and achievement of high level of safety.



## 5. AUTHORIZATION

### 5.1. GENERIC ISSUES

NNRA is empowered by the Act to categorize and authorize activities involving exposure to ionizing radiation, such as the possession, production, processing, manufacture, purchase, sale, import, export, handling, use, transformation, transfer, trading, assignment, transport, storage and disposal of any radioactive material, nuclear material, radioactive waste, prescribed substances and any apparatus emitting ionizing radiation. The Act empowers NNRA to impose such terms and conditions in the interest of health, safety and security. The Act categorizes radioactive substances, sources and practices into four categories based on associated risks.

The Act stipulates that no source or practice involving exposure of people to ionizing radiation should be authorized, except through a system of notification, registration or licensing established by the Authority. Principle of justification is provided for in the Act and applied in the authorization process.

NNRA must be notified of any activity involving exposure to ionizing radiation. In general, notification application is reviewed in the Department of Authorization and Enforcement where the decision for exemption or authorization is made. Exemption criteria are established in the Act; however, exemption certificates are issued on case by case basis due to the lack of documented procedure for exemption. This issue is addressed in Recommendation R7 in Section 3.6.

Applications for authorization are reviewed and assessed in the Department of Authorization and Enforcement. The findings of review and assessment are communicated to the applicant and the Department responsible for inspection is notified for planning and conducting pre-authorization inspection. NNRA conducts pre-authorization inspection for all applications of authorization irrespective of the facility or activity. The decision on issuing of authorization is made based on the results of inspection.

Authorization processes provided for in the legislative framework and carried out by NNRA does require authorization for different stages in the lifetime of facility or duration of activity such as site license, construction license, operating license, decommissioning license.

Technical Support Organizations, including Technical Advisory Committee and National Institute of Radiation Protection and Research, are consulted if expertise in specific field is needed; however, generally authorization process is carried out by the staff of NNRA.

Provision for different types of authorizations is included in legislation which defines that registration is issued for the premises, and for storing radioactive material and ionizing radiation sources, however, licence is issued to carry out any other activity. Activities of technical service providers, including that of radiation safety advisors, are subject to accreditation by NNRA. Registration is issued for an unlimited period of time while licences are issued for up to 2 years based on the radiation risk associated with the facilities and activities. A license is valid up to 31<sup>st</sup> December of the year (if duration period is 1 year) or the following year (if duration period is for 2 years), irrespective of the date it is issued. According to the Act, an application for renewal of a licence has to be submitted three months prior to the expiration date. Due to the short duration period of a licence and the fact that licences expire at the same time of the year (31<sup>st</sup> December) NNRA faces some challenges of ensuring continuous regulatory control over all the facilities and activities that have to renew the licence.

The duration of the licence issued is based on the associated radiation risk of the facility or activity. In addition, the involvement of a RSA is a requirement for high-risk sources or activities. However, the

extent of demonstration of radiation safety in the authorization process does not differentiate between low and high-risk sources and activities. Licence conditions imposed on licensees also do not clearly differentiate between low and high-risk facilities and activities.

Review and assessment of authorization applications is performed to the same extent and scope for all the facilities and activities due to the lack of established requirement for review and assessment to be in accordance with the risks associated with activity or facility. Pre-authorization as well as compliance inspections for sources are carried out to the same extent and in the same manner irrespective of the risks associated with activity or facility.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** Graded approach is not implemented fully in the regulatory functions carried out by NNRA.

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| (1)        | <b>BASIS: GSR Part 1 (Rev. 1) para 4.3 states that</b> “[...] <i>The performance of regulatory functions shall be commensurate with the radiation risks associated with facilities and activities, in accordance with a graded approach [..].</i> ”   |
| (2)        | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 24 para. 4.33 states that</b> “ <i>Prior to the granting of an authorization, the applicant shall be required to submit a safety assessment [9], which shall be reviewed and assessed by the regulatory body in accordance with clearly specified procedures. The extent of the regulatory control applied shall be commensurate with the radiation risks associated with facilities and activities, in accordance with a graded approach.</i> ”  |
| (3)        | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 26 states that</b> “ <i>Review and assessment of a facility or an activity shall be commensurate with the radiation risks associated with the facility or activity, in accordance with a graded approach.</i> ”   |
| (4)        | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 29 states that</b> “ <i>Inspections of facilities and activities shall be commensurate with the radiation risks associated with the facility or activity, in accordance with a graded approach.</i> ”   |
| (5)        | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 31 para. 4.54 states that</b> “ <i>The response of the regulatory body to non-compliances with regulatory requirements or with any conditions specified in the authorization shall be commensurate with the significance for safety of the non-compliance, in accordance with a graded approach.</i> ”  |
| (6)        | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 34 para. 4.62 states that</b> “ <i>The regulations and guides shall provide the framework for the regulatory requirements and conditions to be incorporated into individual authorizations or applications for authorization. They shall also establish the criteria to be used for assessing compliance. The regulations and guides shall be kept consistent and comprehensive, and shall provide adequate coverage commensurate with the radiation risks associated with the facilities and activities, in accordance with a graded approach.</i> ” |
| <b>R10</b> | <b>Recommendation: NNRA should implement fully graded approach in its regulatory activities.</b>  |

NNRA has issued practice specific guides containing instructions to fulfil the requirements for authorization set out in the Act, in NiBRIR and in several practice specific regulations. In addition, NNRA has taken steps to sensitize facilities that have not been authorized yet and to bring them under regulatory control. Most of the non-authorized facilities are diagnostic radiological facilities. A pilot

survey conducted in 2016 by NNRA in three states identified 158 X-ray equipment used in medical facilities that were not authorized. Twenty facilities have been brought under regulatory control and were issued authorizations to carry out activities in medical applications. In addition, during site visits it was observed that the facilities visited continued to work without renewing their authorization after expiration.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |   |
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| <b>Observation:</b> Not all facilities and activities, especially in medical applications, have been authorized by NNRA. Additionally, certain facilities operate on expired licenses. |   |
| (1)  | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 23 states that</b> <i>“Authorization by the regulatory body, including specification of the conditions necessary for safety, shall be a prerequisite for all those facilities and activities that are not either explicitly exempted or approved by means of a notification process.”</i> |
| R11  | <b>Recommendation: NNRA should ensure that all facilities and activities that are not either explicitly exempted or approved by means of a notification process have a valid authorization.</b>   |

Provisions for amendment, renewal, suspension and revocation of the authorization for a facility or an activity are included in the legislation. However, documented procedures to be followed by all staff of NNRA in order to ensure consistency in the decision-making process are not in place. This issue is addressed in Recommendation R7 in Section 3.6.

Information regarding authorizations, including exemption certificates, is recorded in the Regulatory Authority Information System (RAIS) where records of sources, facilities and regulatory decisions made are kept. Both positive and negative decisions on authorizations with clearly reflected basis justifying decisions are communicated to the applicants and authorized parties in accordance with an agreed timeline.

Provision for any person to appeal to the Authority against decisions relating to a licence or to an application for a licence or for renewal of licence is provided in the Act. However, NNRA has not established a formalised process for appeal and is recognised in NNRA’s Action Plan.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |  |
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| <b>Observation:</b> NNRA has not established a formal process for appeal against regulatory decisions. |  |
| (1)  | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 24 para. 4.32 states that</b> <i>“The regulatory body shall establish a process that allows the authorized party to appeal against a regulatory decision relating to an authorization for a facility or an activity or a condition attached to an authorization.”</i>  |
| (2)  | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 2 para. 2.5 states that</b> <i>“The government shall promulgate laws and statutes to make provision for an effective governmental, legal and regulatory framework for safety. This framework for safety shall set out the following:<br/>(11) provision for appeals against decisions of the regulatory body.”</i> |
| R12  | <b>Recommendation: NNRA should establish a formal process for appeal against a regulatory decision.</b>  |

Lessons learned from regulatory experiences, including the authorization process, are communicated within departments of the NNRA; however, there is no clearly established process for collecting,

evaluating and sharing experiences learned from all the regulatory core functions and using it for improvement of the regulatory processes carried out by NNRA.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>   |   |
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| <b>Observation:</b> NNRA does not have a formalised mechanism in place for using the results of authorization, review and assessment, inspection and enforcement and lessons learned as feedback information for the regulatory processes. |   |
| <b>(1)</b>   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 26 para. 4.48 states that</b> <i>“The regulatory body shall record the results and decisions deriving from reviews and assessments, and shall take appropriate action (including enforcement action) as necessary. The results of reviews and assessments shall be used as feedback information for the regulatory process.”</i>  |
| <b>(2)</b>   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 15 states that</b> <i>“The regulatory body shall make arrangements for analysis to be carried out to identify lessons to be learned from operating experience and regulatory experience, including experience in other States, and for the dissemination of the lessons learned and for their use by authorized parties, the regulatory body and other relevant authorities.”</i> |
| <b>R13</b>   | <b>Recommendation: NNRA should establish a formalised mechanism for using the results of authorization, review and assessment, inspection and enforcement as feedback information for the regulatory processes.</b>   |

## 5.2. AUTHORIZATION OF RESEARCH REACTORS

The Act establishes that the research reactor belongs to the Cat III of the categories of radioactive substances, sources and practices. The Act also empowers NNRA to license operators of practices under Cat III.

Currently, Nigeria has one licensed research reactor NIRR-1 (30 kW) operated by the CERT in Zaria, which was commissioned in 2004. Licenses for design, construction and commissioning as well as for operation were issued by NNRA in 2004. The operation Licence has validity for a maximum period of two years in the terms and conditions, and has been renewed seven times.

NNRA has defined the minimum requirements for the applicant, but is common to all types of authorization. This issue is addressed in Recommendation R10 in Section 5.1.

A formalised licensing process, including for renewal of licenses, for research reactors is still not in place. The process for safety demonstration and the review and assessment to support renewal of the licence is also not established.

NNRA has not established objectives, principles and associated criteria for safety on which its requirements, judgements and decisions are based to authorize research reactors. This issue is addressed in Recommendation R7 in Section 3.6.

There are currently no regulations for research reactors; however a draft regulation based on SSR-3 has been prepared. NNRA has prepared the draft Regulations on Safety of Research Reactors based on the IAEA safety guide, but acceptance criteria have not been developed. NNRA has plans to carry out an international benchmarking of the acceptance criteria for safe design and operations when the regulations are approved.

Safety demonstration required from the license applicant (fulfilment of criteria, requirements, safety objectives, independent assessment) is not yet specified. A Final Safety Analysis Report (FSAR) sent in 2011 was reviewed by NNRA against the relevant IAEA safety guide.

NNRA has established terms and conditions in the licences of the reactor. These licence conditions are generally non-prescriptive and set goals which CERT should comply with; amongst other things by applying detailed safety standards and safe procedures. This issue is addressed in Recommendation R20 in Section 9.1.

CERT has established a Reactor Safety Committee (RSC) that is currently independent of the reactor manager. This committee is in charge of the independent review and assessment of the submissions. The establishment of a RSC was part of the Terms and Conditions in the first NIRR-1 operation licence revisions. However, this license condition was removed.

NNRA issued three classes of reactor operator licences: A, B and C taking into account the roles and responsibilities associated to these authorizations. Terms and Conditions established in the reactor operator licences are a set of limits and conditions of the operations to ensure nuclear safety. The licences are issued following a certification process. This includes an examination where NNRA is witness. NNRA has a guide on Qualification and Licensing of Research Reactor Operators.

As part of the Terms and Conditions, CERT is required to make adequate arrangements to control any modification or experiments carried out on any part of the reactor or processes, which may affect safety. NNRA has not specified the arrangements relevant for its approval including the classification of modifications or experiments according to their safety significances. The current arrangements to manage any CERT submissions include NNRA's consent formalized by a letter from the NNRA Director General. This issue is addressed in Recommendation R7 in Section 3.6.

### **5.3. AUTHORIZATION OF RADIOACTIVE WASTE MANAGEMENT FACILITIES**

The draft Nigerian national policy and strategy for the management of radioactive waste and spent fuel, as laid down in draft documents NNRA 077 and NNRA 032, provides for the returning of disused sealed radioactive sources and spent nuclear fuel to the suppliers abroad as a preferred management option. Both disused sources and spent fuel as well as operational waste (e.g. of the research reactor) remain the responsibility of the waste generator and are required to be stored safe and secure until they are transported back to the supplier. Detailed arrangements are required to be prepared by the NAEC as the Waste Management Organization. The total amount of radioactive waste remaining in the country is relatively low. Nigeria follows the strategy to dispose of the remaining waste in disposal facilities in the future.

Radioactive waste management facilities are required to be authorized by NNRA in accordance with the Act. The Nigerian Radioactive Waste Management Regulations 2006 (NRWR. 2006) state that no person or organization should generate or manage radioactive waste without an appropriate license.

The regulatory requirements and procedures for applying for a license to conduct radioactive waste management are laid down in NRWR 2006 (draft revised version 2017). The IRRS team was informed that the draft document was reviewed to be in line with the requirements of GSR Part 5 (e.g. for radioactive waste classification and for the use of radiation dose limitation).

NNRA has authorized one Radioactive Waste Management Facility for the storage of legacy and orphan sources (Temporary Storage Facility – TSF at the Centre for Energy Research and Training Zaria - CERT). This facility is planned to expand for the treatment of radioactive waste in the future. Another

waste management facility (Centralized Radioactive Waste Management Facility – CRWMF for the storage of LLW and VLLW) is projected by NAEC as Waste Management Organization and operator.

#### 5.4. AUTHORIZATION OF RADIATION SOURCES FACILITIES AND ACTIVITIES

According to the categorization of sources prescribed in the Act, X-ray equipment and sealed sources are Category I sources and unsealed radiation sources used in medical diagnosis and therapy, agriculture, industry and research are Category II. Types of practices with ionizing radiation sources are defined in NiBIRR involving industrial radiography, processing of products, research, exposure of persons for medical treatment, use of accelerators and use of radioactive sources.

Import and export of ionizing radiation sources is licenced for a period of one year. Agreement with Customs has been established to ensure control over imported and exported sources, however, revision of the agreement is planned to include several new ports established in Nigeria. For the import of sealed sources, contract or assurance regarding the return of sources after the use to the source manufacturer or supplier is required. No framework for reuse or recycling of sources has been established in Nigeria.

The extent of radiation safety to be demonstrated to receive authorization, including the content and the scope of the safety assessment to be carried out, has not been clearly defined for low and high-risk sources. This issue is addressed in Recommendation R10 in Section 5.1.

Licence conditions imposed on licensees refer to legislative and regulatory requirements and are not based in the review and assessment carried out by NNRA.

Authorization application includes demonstration of competence of individuals having responsibilities for safety, including nomination of an appropriately trained Radiation Safety Officer for all the facilities and engaging Medical Physicist as qualified expert for medical exposure facilities.

Provision for carrying out risk assessment prior to starting the activities with ionizing radiation sources is set out in NiBIRR. One of the documents to be submitted in support of the application for authorization is safety assessment report as required in the Regulations on Safety and Security of Radioactive Sources. However, provisions for application of graded approach in the extent of safety assessment of sources commensurate with the radiation risks associated with sources have not been established in legislative or regulatory framework. This issue is addressed in Recommendation R10 in Section 5.1.

Documents required by NNRA include technical assessments of shielding, measurements, layout of facility and radiation safety programme to be submitted. An adequate overall assessment of safety is required to determine the measures that need to be taken to ensure safety; however, there are cases in which these assessments have not been submitted by the applicant. Content and extent of safety demonstrations in the authorization application does not cover radiation risks that arise from normal operation and from anticipated operational occurrences and accident conditions.

In addition, guides for the content of safety assessment to be carried out have not been established. This issue is addressed in Recommendation R20 in Section 9.1. Additionally, procedures for review of assessment submitted by the applicant have not been developed. This issue is addressed in Recommendation R7 in Section 3.6.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA does not implement its requirement for an applicant to submit an adequate demonstration of safety in support of an application for the authorization.

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| (1) | <b>BASIS:</b> GSR Part 1 (Rev. 1) Requirement 24 states that <i>“The applicant shall be required</i> |
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## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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|     | <i>to submit an adequate demonstration of safety in support of an application for the authorization of a facility or an activity.”</i>   |
| (2) | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 24 para. 4.33 states that</b> <i>“Prior to the granting of an authorization, the applicant shall be required to submit a safety assessment, which shall be reviewed and assessed by the regulatory body in accordance with clearly specified procedures. The extent of the regulatory control applied shall be commensurate with the radiation risks associated with facilities and activities, in accordance with a graded approach.”</i>   |
| (3) | <b>BASIS: GSR Part 4 (Rev. 1) Requirement 4 states that</b> <i>“The primary purposes of the safety assessment shall be to determine whether an adequate level of safety has been achieved for a facility or activity and whether the basic safety objectives and safety criteria established by the designer, the operating organization and the regulatory body, in compliance with the requirements for protection and safety as established in Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, have been fulfilled.”</i> |
| R14 | <b>Recommendation: NNRA should implement its regulatory requirement for an applicant’s submission of an adequate demonstration of safety in support of an application for the authorization.</b>   |

### 5.5. AUTHORIZATION OF DECOMMISSIONING ACTIVITIES

There are no decommissioning activities in the country and therefore no authorization for decommissioning has been issued. Nevertheless, the Act and regulations 80 and 81 of the NiBIRR contain provisions for the decommissioning. There are provisions in the Act that point out that decommissioning has to be licensed.

### 5.6. AUTHORIZATION OF TRANSPORT

According to the Act, NNRA is the Competent Authority in charge of the safe transport of radioactive material.

Different authorizations are provided by NNRA for the transport organizations:

- License for marine and land carriers based on an application containing, among others, the qualification of staff involved in the transport of radioactive material, the Radiation Protection Program and the Emergency Preparedness and Response Plan. The validity of the license provided to the carrier is one year and the carriers are required to notify NNRA for each movement/shipment of radioactive material.
- Approval of packages (package certificate), based on the review and assessment of the documentary evidence of package design certificate issued by Competent Authority of country of origin. However, there are no procedures established for the validation of package approval certificate issued by the competent authority of a different country.
- Registration for premises for temporary storage facilities used by carriers and at customs level which are inspected by NNRA.
- Export permits.
- For import accredited carriers to carry out control and verification of imported radioactive materials and report to NNRA in case of non-compliance.

The IRRS team was informed that the NNRA provides accreditation to the RSAs who provide training to the staff involved in the transport of radioactive material.

There is no package manufacturing industry in Nigeria, and packages type A, B, industrial packages and excepted packages are transported by land and sea and inland waterways.

NNRA has been empowered by regulation for transport to regulate package maintenance and servicing at a national level. The instructions for maintenance and servicing tasks have to be made available and used by the organization carrying out the maintenance to ensure safe transport of radioactive material.

The Act gives NNRA the responsibility for regulating and controlling the transit of radioactive material; however, transit of radioactive material is not covered within the regulatory activities. NNRA doesn't provide any kind of license, approval or inspection and there are no provisions in the actual regulation relating to the movement of RAM in transit.

NNRA collaborates with national organizations responsible for regulating other dangerous substances in training and for emergency preparedness and response; and with the Customs Service for the trans-boundary movement of radioactive material, training of customs officers on procedures to respond to detection of illicit trafficking of nuclear or radioactive materials and also to notify NNRA if a radioactive material is being imported or exported without license.

NNRA has not established guidance and procedures related to the transport of radioactive materials.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>   |   |
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| <b>Observation:</b> There is no guidance concerning application for an authorization of transport of radioactive material for carriers, consignor and consignee. |   |
| <b>(1)</b>   | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 24 para. 4.34 states that</b> <i>“The regulatory body shall issue guidance on the format and content of the documents to be submitted by the applicant in support of an application for an authorization. The applicant shall be required to submit or to make available to the regulatory body, in accordance with agreed timelines, all necessary safety related information as specified in advance or as requested in the authorization process”.</i> |
| <b>R15</b>   | <b>Recommendation: NNRA should develop guidance concerning application for an authorization of the safe transport of radioactive material for carriers, consignor and consignee.</b>  |

### 5.7. SUMMARY

Provision for authorization is included in the Act as well as in supporting regulations. NNRA has issued guidance materials for applicants on the minimum requirements for authorization. However, internal procedures for assessing the content of authorization applications in regard to adequate safety demonstration and safety assessment have not been established and implemented to ensure consistency in the decision-making process. A formalised mechanism for using the results of authorization, review and assessment, inspection and enforcement and lessons learned as feedback information for the regulatory processes is not in place.

Not all elements of authorization of research reactors and transport activities are established and implemented.

Facilities not authorized, especially in medical applications, have been recognized and requested to comply with authorization requirements. However, there is significant number of facilities not yet



authorized. NNRA has not implemented adequate actions to stop activities and facilities that operate on expired licences.

## **6. REVIEW AND ASSESSMENT**

### **6.1. GENERIC ISSUES**

#### **6.1.1. MANAGEMENT OF REVIEW AND ASSESSMENT**

Review and assessment of facilities and activities is performed during the authorization process, including applications for modification of authorization as well as for renewal of authorization. Additional steps of review and assessment are performed while carrying out pre-authorization inspections as well as compliance inspections. In addition, authorized facilities are required to provide periodic reports, for example for imported and exported sources.

Specific guides have been established to facilitate compliance with minimum requirements for authorization. The same guidance materials are used by NNRA staff to review and assess the application for authorization. However, these minimum requirements for authorization list the type of documents to be submitted and do not include information on their content or reference to relevant requirements. This issue is addressed in Recommendation R7 in Section 3.6.

#### **6.1.2. ORGANIZATION AND TECHNICAL RESOURCES FOR REVIEW AND ASSESSMENT**

NNRA has an adequate number of personnel available for carrying out review and assessment of the various regulated facilities and activities. The review and assessment is performed by a team of two reviewers which also involves consultation with senior managers. However, a documented procedure for training and retraining of the personnel participating in the review and assessment is not in place. The IRRS team was informed that this is expected to be incorporated in the draft IMS. Furthermore, no specific regulatory tools for performing the review and assessment (computer codes, experimental facilities) are used by NNRA. This issue is addressed in Recommendation R7 in Section 3.6.

NNRA also employs the use of a Technical Advisory Committee to advise in the review and assessment of more complex facilities and activities. The members of the Committee are selected by NNRA from other institutions and facilities.

#### **6.1.3. BASES FOR REVIEW AND ASSESSMENT**

Content of the submitted documents and evaluation of the safety demonstration of authorized party is reviewed and assessed on a case by case basis and based on the experience of NNRA staff, since there are no clearly established criteria. This issue is addressed in Recommendation R7 in Section 3.6.

The extent and the scope of review and assessment do not fully cover radiation safety issues of a facility or an activity (e.g. the radiation protection programme of transport companies). Internal procedures that NNRA currently uses for review and assessment of authorization application reflect only types of documents to be included in the application and not the content of the information that should be reviewed. Documents submitted to demonstrate the safety of planned or performed activities of the authorized party do not include deterministic and probabilistic safety analysis. This issue is addressed in Recommendation R14 in Section 5.4.

In addition to the information collected from authorization applications, the periodic reports of authorized parties and the inspection results, NNRA obtains information from dosimetry service providers, suppliers of X-ray equipment and sources and from Customs on Import and Export.

#### 6.1.4. PERFORMANCE OF REVIEW AND ASSESSMENT

Findings of review and assessment are documented and communicated to the applicant or authorized party. The results of the review and assessment are used by NNRA in order to prepare for pre-authorization inspections and in the decision-making process on authorization. The process for taking into account the previous results of inspections and reviews and assessments for a particular facility or activity is established, however, a documented procedure is not developed and implemented to ensure consistency in the performance of review and assessment. This issue is addressed in Recommendation R7 in Section 3.6.

NNRA has recognized in the Action Plan the necessary actions to be taken for formalising systematic review and assessment manual and developing relevant guidance documents for review and assessment.

#### 6.2. REVIEW AND ASSESSMENT FOR RESEARCH REACTORS

The objectives and NNRA’s responsibility for the review and assessment are presented in the Act.

NNRA has not developed documented procedures for review and assessment for the authorization of research reactors. This issue is addressed in Recommendation R7 in Section 3.6. Furthermore, there are no established regulations regarding safety of research reactors.

In the framework of the licence renewal process NNRA assesses the organization capability of the applicant for a reactor operation licence by checking the appointment of the safety significant roles in the organization such as Reactor Manager, Operators, Quality Assurance Manager. However, the financial resources are not included in the review and assessment.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA does not have a requirement for the operating organization to demonstrate sufficient financial resources to support safe operations of the research reactor.

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| (1) | <b>BASIS: Code of Conduct on the safety of Research Reactors para. 20 (d) states that</b> “The regulations and guidance established by the State or the regulatory body according to national arrangements should require the operating organization to demonstrate that it has sufficient financial and human resources to support safe operation of the research reactor;” |
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| S7 | <b>Suggestion: NNRA should consider establishing a regulatory requirement for the operating organization to demonstrate that it has sufficient finances to support safe operations of the research reactor.</b> |
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In the framework of a major project such as the conversion of NIRR-1 from HEU to LEU fuel, NNRA has defined a schedule of applications submissions and a planning of the associated authorizations. When a submission is received for approval, the review and assessment is organized based on the skills and the availability of responsible staff.

NNRA staff has a broad range of skills, such as, mechanical engineering; electrical engineering; physics; chemical engineering, etc. However, there is no matrix between the scope of the review and assessment of technical topics and the knowledge, skills and level of expertise of the NNRA experts.

In the framework of operation licence renewal of the NIRR-1, a review and assessment of the Final Safety Analysis Report (FSAR) was carried out by NNRA, based on the IAEA safety guide SSG-20. However, this work remains limited by the lack of acceptance criteria. This issue is addressed in Recommendation R7 in Section 3.6.

NIRR-1 was commissioned in 2004 and no periodic safety review (PSR) has been carried out. There is no regulatory requirement to carry out a PSR and no specific procedure for review of the periodic update of the SAR of the research reactor.

Additionally, NNRA has not developed detailed internal guidance to ensure that all the relevant safety requirements are met by the proposed design and operation.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>  |   |
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| <b>Observation:</b> There is no regulatory requirement for the operating organization to undertake periodic safety reviews. |   |
| <b>(1)</b>  | <b>BASIS: GSR Part 4 (Rev. 1) Requirement 4, para. 4.8 states that</b> <i>“The frequency at which the safety assessment shall be updated is related to the radiation risks associated with the facility or activity, and the extent to which changes are made to the facility or activity. As a minimum, the safety assessment shall be updated in the periodic safety review carried out at predefined intervals in accordance with regulatory requirements. Continuation of operation of such facilities or conduct of such activities is subject to being able to demonstrate in the reassessment, to the satisfaction of the operating organization and the regulatory body that the safety measures in place remain adequate.”</i> |
| <b>(2)</b>  | <b>BASIS: Code of Conduct on the Safety of Research Reactors para. 20 (c) states that</b> <i>“The regulations and guidance established by the State or the regulatory body according to national arrangements should require the operating organization to undertake periodic safety reviews at interval determined by the regulatory body and to make proposals for upgrading and refurbishment arising from such reviews as necessary.”</i>   |
| <b>(3)</b>  | <b>BASIS: GS-G-1.2 para. 2.19 states that</b> <i>“While the need for reassessment may arise in a number of ways (see para. 2.25), systematic safety reassessments, termed periodic safety reviews (PSRs), should be carried out by the operator at intervals to review the cumulative effects of ageing of the facility and of modifications, and the implications of operating experience and technical developments. [...] The PSR should enable the regulatory body to judge whether it is acceptable for the facility to continue to be operated until the next PSR is carried out.”</i>  |
| <b>R16</b>  | <b>Recommendation: The Government or NNRA should establish regulatory requirements for the operating organization to conduct periodic safety reviews.</b>   |

### 6.3. REVIEW AND ASSESSMENT FOR WASTE MANAGEMENT FACILITIES

NRWMR 2006 provides that the applicant submits the relevant information for a review and assessment of a radioactive waste management facility to NNRA, including a safety assessment and an environmental impact study for both normal and accident conditions. For all steps of predisposal waste management (and in general also for a disposal) a review and assessment to be carried out by NNRA of all relevant safety issues is required. NNRA has issued a draft guidance document for centralised radioactive waste management facilities that should supersede and update existing guidance.

NNRA has identified the following challenges with reference to radioactive waste management facilities:

- Formalizing the NNRA Review and Assessment Manual
- Emplacement of process for notifying applicants of reasons for regulatory decisions
- Establishing the process for appeal against a regulatory decision relating to an authorization
- Completing other relevant regulatory guidance documents

- Weak liaison with (relevant) stakeholders and low public awareness of regulatory processes
- Inadequate knowledge of regulatory process by operators

The IRRS team was informed that with the periodic renewal of authorization (e.g. for TSF at CERT), there is the opportunity to perform a periodic safety review. NNRA regularly combines periodic review of the safety assessment with a periodic renewal of authorization.

#### **6.4. REVIEW AND ASSESSMENT FOR RADIATION SOURCES FACILITIES AND ACTIVITIES**

According to the Annual Report of 2016 more than 500 authorization applications were reviewed and assessed, including more than 300 applications for registration of the premises and 77 applications for operational licences.

Specific requirements for authorization include: enlisting of RSA services, designation of RSOs, arrangements for personnel dosimetry monitoring, information regarding the competence and training of the personnel, maintenance arrangements and information on safety systems of equipment, information of appropriate storage facility, arrangements of transportation, and radiation protection programme that includes local rules applied in facility. In addition, medical facilities are required to provide information on enlisting services of a medical physicist, shielding reports approved by the manufacturer, and pre-operational radiation shielding assessment carried out by a medical physicist.

NNRA reviews appropriate information to understand the design of the facility or equipment. The depth of review and assessment does not provide for the full understanding of concepts on which the safety of the design is based and the operating principles proposed by the applicant. Therefore, during the pre-authorization inspections as well as the compliance inspections, NNRA inspectors conduct interviews with authorized parties to collect information on the operating principles of a facility or activity.

Internal procedures of NNRA for review and assessment do not include assessment of the content of documents submitted by the applicant or authorized party. This issue is addressed in Recommendation R7 in Section 3.6.

A guide for the applicant on the content of Radiation Safety Programme has been developed by NNRA and contains explicit information on the requirements and plans that have to be reflected in the programme.

#### **6.5. REVIEW AND ASSESSMENT FOR DECOMMISSIONING ACTIVITIES**

There are no decommissioning activities in the country and therefore no review and assessment has been conducted for decommissioning activities. There are no criteria to undertake a review and assessment of decommissioning at present.

#### **6.6. REVIEW AND ASSESSMENT FOR TRANSPORT**

The review and assessment of the transport of radioactive material activities is carried out by the NNRA staff during the application for authorization based on the minimum requirements for authorization for facilities and activities. The review and assessment is also carried out during the pre-shipment of radioactive material. There are no procedures established for review and assessment related to transport of radioactive material. This issue is addressed in Recommendation R7 in Section 3.6.

The assessment of the programme does not include the frequency of shipment, the category of packages handled, the duration of storage, the duration of transport, the workers categories, the contamination

checks, the frequency and the contamination check records that need to be kept in a proper way and made available to the NNRA inspectors, and the measures used for dose reduction for workers. This issue is addressed in Recommendation R7 in Section 3.6.

## **6.7. SUMMARY**

Review and assessment of facilities and activities is performed by NNRA during reviewing authorization applications, including applications for the modification as well as for the renewal of an authorization.

A process for taking into account the previous results of inspections and reviews and assessments is established; however, NNRA has not developed and implemented a documented procedure to ensure consistency in the performance of review and assessment. Moreover, the extent and the scope of review and assessment does not fully cover radiation safety issues of a facility or an activity.

NNRA does not have requirements for the operating organization to demonstrate sufficient financial resources to support safe operations of the research reactor as well as for transport organizations to have a management system. In addition, there is no regulatory requirement for the operating organization to undertake periodic safety reviews.

## **7. INSPECTION**

### **7.1. GENERIC ISSUES**

According to the Act, NNRA is empowered to appoint inspectors to inspect facilities and activities. They are appointed based on their skills and their experience level. The Act also provides for the powers of NNRA inspectors.

NNRA has developed and issued a Handbook of Guidance for Notification, Authorization, Inspection and Enforcement of Control of Radiation Sources. A guide for inspectors referred to as the Codes of Conduct for Inspectors and Procedures for Inspection has also been developed which is applied in NNRA inspections. The Code of Conduct for Inspectors addresses potential conflicts of interest. 450 inspections were planned by NNRA in 2016 and during the 1st quarter of 2016 a total of 118 inspections were carried out.

#### **7.1.1. INSPECTION PROGRAMME**

NNRA has developed a programme of inspection of facilities and activities that are contained in the Handbook on System of Notification, Authorization, Inspection and Enforcement of Control of Radioactive Sources.

NNRA performs announced and unannounced as well as reactive inspections. Pre-authorization inspections are always announced. The types of inspections carried out are:

- i. Pre-authorization inspections
- ii. Compliance inspections
- iii. Audit inspections
- iv. Pre-shipment inspections prior to the shipment of a package out of Nigeria.

Prior to the inspection, the inspectors review the previous information about the facility (e.g. previous non-compliances), as well as the results of the review and assessment of the submitted documentation as part of the pre-inspection preparation.

The frequency of the inspection of facilities and activities depends on the categorization of the facility or activity. High risk facilities or activities are inspected quarterly, while medium to low risk facilities are inspected once every two years. When resources permit, NNRA engages external experts to accompany its inspectors when high-risk facilities and activities are being inspected. NNRA's Inspection Programme specifies the manner and the extent of the inspections performed for each type of facility and activity.

There is a limited use of a graded approach in inspections as the periodicity for the inspection are not always related to the safety significance of the facility or activity. Pre-authorization inspection is also conducted for all facilities and activities irrespective of the radiation risk. This issue is addressed in Recommendation R10 in Section 5.1.

The Act requires the inspectors to submit a report of the inspection to the NNRA. The findings of the inspections are formalized in this report. Both NNRA inspectors and facility personnel are required to consent to the findings of the inspection.

#### **7.1.2. INSPECTION PROCESS AND PRACTICE**

NNRA inspectors carry out inspections using specific checklists for each facility or activity. However,

checklists are not available for transport related inspections.

The inspection checklists for facilities and activities are reviewed and updated periodically, and their use is mandatory for all inspections.

An inspection team normally comprises of at least two technical officers (a lead inspector and a supporting inspector). The IRRS team was informed that the number of the inspectors who carry out an inspection at a facility is also dependent on the category of the facility. The methodologies followed during inspections are:

- i. Entrance Briefing and Exit Briefing
- ii. General observations of work practices (tour of facility)
- iii. Examination of records
- iv. Examination of written guidance on working procedures
- v. Interview with management and workers
- vi. Independent measurements of radiation and contamination levels
- vii. Routine checks of safety control systems.

An inspection report with the related findings is prepared by NNRA's inspectors. The findings are discussed with the licensee or representatives of the facility at the exit meeting. The report is signed by both parties (NNRA's inspectors and the licensee).

There is no mechanism for utilising inspection results as feedback in the development of the regulatory process. This issue is addressed in Recommendation R13 in Section 5.1.

### **7.1.3 INSPECTORS**

New NNRA inspectors are required to attend a one-week training programme and pass an examination. The newly employed personnel are then involved in review and assessment and participate in inspections as observers. New inspectors do not participate in inspections of facilities or activities until they are evaluated.

NNRA inspectors participate in national and international training programmes and courses on radiation protection. There is no formal procedure for the training of the inspectors or refresher training for competence maintenance. This programme is expected to be included in the Integrated Management System which is still in draft form.

## **7.2. INSPECTION OF RESEARCH REACTORS**

The NNRA Handbook on inspection specifies that the research reactor is inspected quarterly.

A team of four inspectors are required to inspect the NIRR-1. The inspection programme includes announced and unannounced inspections. Reactive inspections are carried out following an event, an incident or an accident. NNRA has not established criteria to identify events significant to safety that should be reported. In addition, NNRA does not have a procedure or process to determine when to initiate a reactive inspection.

## **RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES**

**Observation:** NNRA has no established criteria to guide the operating organization to identify events significant to safety which should be reported. In addition, the criteria which initiate reactive



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

inspection, are not defined in the inspection programme or any other NNRA processes.

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| (1) | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 28 states that</b> <i>“Inspections of facilities and activities shall include programmed inspections and reactive inspections, both announced and unannounced”</i>   |
| (2) | <b>BASIS: Code of Conduct on the safety of Research Reactors para. 20 (p) states that</b> <i>“...Require the operating organization to report the occurrence of events significant to safety in accordance with criteria established by the regulatory body;”</i>        |
| (3) | <b>BASIS: GS-G-1.3 para. 3.2 states that</b> <i>“Specific responsibilities of the regulatory body in respect of inspection and enforcement include: [...] — carrying out reactive inspections, if appropriate, in response to events, incidents or accidents;” [...]</i> |
| S8  | <b>Suggestion: NNRA should consider establishing criteria to select the occurrence of events significant to safety of research reactors which need to be reported and criteria to initiate reactive inspection.</b>  |

There are no annual inspection plans. The scope and the focus of the inspection is set quarter by quarter considering the findings from the previous inspection and the current submissions under NNRA review.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA has no inspection plan for the research reactor.

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| (1) | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 29 para 4.50 states that</b> <i>“The regulatory body shall develop and implement a programme of inspection of facilities and activities, to confirm compliance with regulatory requirements and with any conditions specified in the authorization. In this programme, it shall specify the types of regulatory inspection (including scheduled inspections and unannounced inspections), and shall stipulate the frequency of inspections and the areas and programmes to be inspected, in accordance with a graded approach.</i> |
| R17 | <b>Recommendation:</b> NNRA should develop and implement a plan of inspection for Research Reactor.  |

The draft Management System manual presents the basis for the application of a graded approach: safety significance and complexity of the organization, operations or activities; hazards and magnitude of potential impacts (risks); and possible consequences for safety in the case of failure or event.

The NNRA inspection manual for research reactors specifies the objectives of the inspection and the inspection areas. Checklists for commissioning inspections and regular operation inspections are available.

The research reactor inspection programme does not require inspectors to track and follow-up on recurring non-compliances. The findings of the inspection are recorded in a report. Potential recurrence of problems or non-compliance is documented as new findings.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA has no process for tracking and following-up on recurrent problems and non-

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

compliance noticed during the inspections.

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| (1) | <p><b>BASIS: GS-G-1.3 para 3.2 states that</b> “<i>Specific responsibilities of the regulatory body in respect of inspection and enforcement include:</i></p> <p>[...]</p> <p>—tracking recurrent problems and non-compliance;</p> <p>—developing such procedures and directives as may be necessary for the effective conduct and administration of the inspection programme;</p> <p>—determining and recommending suitable enforcement actions when non-conformance with requirements is encountered.”</p> |
| S9  | <p><b>Suggestion: NNRA should consider establishing a process for tracking and following-up on recurrent problems and non-compliance noticed during the inspections.</b></p>   |

During a site visit to the NIRR-1 in the Zaria site, the IRRS team observed a routine inspection, and observed good preparation and conduct of the inspection, and good interaction and response from the operator personnel. Results of the inspection were reported at the inspection exit meeting. The facility management informed the IRRS team that they have a professional relationship with NNRA inspectors and acknowledged that they have primary responsibility for safety.

### 7.3. INSPECTION OF WASTE MANAGEMENT FACILITIES

NNRA carries out regular inspections of the TSF at CERT in accordance with the inspection programme one to two times per year. The IRRS team observed an inspection at CERT. The inspection followed an inspection plan that assessed both the process and the technical aspects of the facility and activities.

The inspection plan included an entrance briefing, visual inspection of the facility, inspection of the relevant documents and an exit briefing, where the findings of the inspectors were presented to the operator. Technical issues of the inspection were the source inventory, the facility and equipment (the condition of the provisions for the protection of the sources, measurement equipment, etc.), safety operations, area classification and demarcation, local requirements and supervisions, monitoring workers and public, emergency preparedness and records. The interaction between the operator’s personnel and the inspectors was professional.

### 7.4. INSPECTION OF RADIATION SOURCES FACILITIES AND ACTIVITIES

Inspections of facilities and activities using radiation source are performed and include the inspection of the facility, the source inventory, the radiation protection programme, the shielding assessment, the organizational structure, the radiation protection equipment, radiation safety programme, personnel monitoring, work place monitoring, records, local rules emergency procedures and security.

The IRRS team observed that, while an inspection programme exists for radiation sources, NNRA does not implement it through planned inspections. NNRA only conducts inspections when an application for a pre-authorization is received in the authorization process. NNRA does not conduct compliance inspections according to the pre-defined frequency in the inspection programme.

Estimates of the number of pre-authorization inspections only are prepared by NNRA every year in order to have a base for its budget allocations. A monthly plan of pre-authorization inspections is prepared.

Compliance inspections are not included in this planning for all the facilities and activities, taking into consideration that low risk level facilities and activities are also inspected during pre-authorization.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>  |  |
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| <b>Observation:</b> NNRA’s inspections are not conducted at the frequency defined in the programme for radiation sources. |  |
| <b>(1)</b>  | <b>BASIS: GSR Part 1 (Rev 1) Requirement 29 para. 4.50 states that:</b> <i>“The regulatory body shall develop and implement a programme of inspection of facilities and activities, to confirm compliance with regulatory requirements and with any conditions specified in the authorization. In this programme, it shall specify the types of regulatory inspection (including scheduled inspections and unannounced inspections), and shall stipulate the frequency of inspections and the areas and programmes to be inspected, in accordance with a graded approach.”</i> |
| <b>R18</b>  | <b>Recommendation:</b> NNRA should implement its inspection programme for radiation sources, facilities and activities at the predefined frequencies.  |

The IRRS team joined NNRA inspectors for a site visit to Gamma Irradiator Facility (GIF) in Sheda, Abuja to observe an announced compliance inspection. The GIF was not operating at the time. The IRRS team observed that the authorization of this facility expired in 2009 but GIF has continued its operations without authorizations. This issue is addressed in Recommendation R11 in Section 5.1. An inspection plan and an inspection checklist specific to inspection of the GIF were used; however it was not implemented to the full extent. The inspection included a follow-up of previous non-compliances that were communicated to facility in 2014. NNRA inspectors conducted a tour of the facility to evaluate the operational activities of GIF practice and to assess safety warnings and fire related emergency preparations.

The effectiveness of NNRA’s regulatory control is minimized due to the lack of established enforcement policy and inconsistent implementation of enforcement actions. This issue is addressed in Recommendation R7 in Section 3.6.

**7.5. INSPECTION OF DECOMMISSIONING ACTIVITIES**

There are no decommissioning activities in Nigeria and to date there has not been any inspections conducted related to decommissioning activities.

**7.6. INSPECTION OF TRANSPORT**

NNRA carries out inspection of the packages and organizations involved in the transport of radioactive material, including the temporary storage, to ensure compliance with the existing regulation. A monthly inspection schedule was provided to the IRRS team. There was no annual plan of inspection.

There is no checklist used for inspection of the transport organizations. This issue is addressed in Recommendation R7 in Section 3.6.

The IRRS team was informed that during inspection NNRA inspectors ensure the radioactive materials are segregated from other dangerous substance and goods during transport, and inspections are conducted at the temporary storage area. Inspection related to transport includes checking the record of the workplace monitoring results carried out by the carriers.

The results of inspection are reported at the exit meeting to the transport organization in a form of agreement statement signed by both NNRA inspector and the licensee. An official report is sent by NNRA at a later date.

Inspection program of NNRA does not include inspection of the transport organization during the transiting of a radioactive material.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>  |  |
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| <b>Observation:</b> There is no inspection carried out on transport of radioactive material during transit. |  |
| <b>(1)</b>  | <b>BASIS:</b> TS-G-1.5 Requirement para 4.63 states that <i>“A major feature of the compliance assurance programme of a competent authority will be the performance of inspections of transport operations, since such inspections can be used to monitor both the adequacy of the various regulations and the degree of compliance with those regulations by the user, as well as to produce evidence of compliance. Such inspections may be carried out during any phase of the transport or during storage in transit and may be announced or unannounced.”</i> |
| <b>S10</b>  | <b>Suggestion:</b> NNRA should consider conducting inspection on transport of radioactive material during transit.   |

## 7.7. SUMMARY

The Act empowers NNRA to inspect regulated facilities and activities. An inspection programme has been developed but is not strictly implemented. NNRA performs regular inspections of the radioactive waste facilities. Inspections for the use of radioactive sources are mostly conducted during the authorization of the facility but compliance inspections are rarely conducted. NNRA has an inspection programme and checklists for the research reactor but does not develop inspection plans or schedules to ensure that all areas are periodically inspected. Inspections are conducted at transport facilities but not during transit.

## 8. ENFORCEMENT

### 8.1. ENFORCEMENT POLICY AND PROCESS

The Act empowers NNRA to carry out enforcement actions against authorized parties for non-compliances with regulatory requirements. NNRA is empowered to demand for implementation of corrective actions that address non-compliance issues. NNRA also has authority to suspend any authorized activity as part of enforcement actions after due consideration, if this activity does not comply with the provisions of the Act.

The NNRA enforcement policy is in draft form. The draft policy document includes enforcement procedures for responding to non-compliances by authorized parties with regulatory requirements or with any conditions specified in the authorization. NNRA recognizes this issue and has put the review and approval of the draft enforcement policy and implementation of prompt enforcement actions in NNRA's action plan.

The role of the NNRA inspector is to identify non-compliances, to report on these non-compliances and make recommendations on enforcement action. The DG of NNRA approves the enforcement action to be taken.

The NNRA Handbook provides basis of NNRA guidance for implementing the enforcement system for Registrants and Licensees. There are two instruments that NNRA uses for correcting non-compliance , an informal and a formal advice.

An informal advice is given verbally by an inspector to correct a minor or potentially minor non-compliances where there is no immediate threat to health and safety. If the non-compliance could not be resolved during the inspection, it has to be recorded by the inspector.

For formal advice, NNRA uses a formal letter that is in the form of a directive.

The NNRA handbook states that enforcement action could lead to :

- i. Suspension of License
- ii. Revocation of license
- iii. Closure of facility
- iv. Prosecution in court
- v. Fine or jail term or both.

However, there is no regulatory procedure to be followed in carrying out these enforcement actions.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA has not established and implemented an enforcement policy.

(1)

**BASIS:** GSR Part 1 (Rev. 1) Requirement 30 states that *“The regulatory body shall establish and implement an enforcement policy within the legal framework for responding to non-compliance by authorized parties with regulatory requirements or with any conditions specified in the authorization.”*

R19

**Recommendation:** NNRA should establish and implement an enforcement policy within the legal framework for responding to non-compliance by authorized parties with

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

regulatory requirements or with any conditions specified in the authorization.

### 8.2. ENFORCEMENT IMPLEMENTATIONS

Non-compliances are communicated in writing by NNRA to the licensees who are instructed to take corrective actions within a prescribed period of time. NNRA takes enforcement measures when the licensee fails to carry out the corrective actions in the prescribed period.

When licensees do not respond to the initial enforcement communication, NNRA sends reminder letters to them to implement the recommended corrective actions and to inform NNRA in due time. However, the IRRS team observed that no further communication regarding the enforcement is made by NNRA to the licensee.

NNRA performs inspections to confirm the effective implementation of the corrective actions. NNRA's inspectors have to inform senior management and request for approval prior to taking any enforcement action in case of violations that may severely affect safety.

NNRA also coordinates with the Nuclear Security Committee for certain enforcement actions. In case of severe violations or when the licensee keeps not conforming to the legislative requirements, NNRA invites the Nuclear Security Committee to evaluate the related evidence and to decide about any further enforcement actions. The Nuclear Security Committee comprises of NNRA, Police, Customs, Ministry of Justice and other governmental organizations; however it has not convened for the last five years.

Although certain enforcement actions are taken, NNRA has not adopted clear enforcement procedures covering in detail its decision making approach in determining the level of actions to be taken and the way in which the actions should be taken. This issue is addressed in Recommendation R7 in Section 3.6.

Prosecution is enforced by the Ministry of Justice. The legal department of NNRA forwards the evidence to the prosecuting department for the cases to be taken to court. NNRA's inspectors may be summoned to court to testify.

Although authority for implementation of enforcement activities is provided for in legislation, NNRA does not carry out enforcement actions in line with the legislative requirements. This issue is addressed in Recommendation R19 in Section 8.1.

NNRA took enforcement action for the research reactor in January 2014 due to expired operation licence, which directed the operating organization to stop operation pending the renewal of the authorizations. Only water purification and scheduled preventive maintenance was allowed to continue.

During a site visit, the IRRS team observed that the research reactor facility and the temporary radioactive waste storage facility in Zaria has been operating without an authorization as the previous authorizations had expired and not been renewed. Additionally, the IRRS team observed during a site visit to hospital that the authorization provided by NNRA to a nuclear medicine facility had expired although the facility continued to operate. This issue is addressed in Recommendation R11 in Section 5.1.

### 8.3. SUMMARY

NNRA is empowered to carry out enforcement actions against authorized parties for non-compliance with regulatory requirements. NNRA has different enforcement tools for enforcing its regulatory decisions such as stopping operation of facilities and activities. The enforcement policy and procedures are not in place and could result in inconsistent enforcement actions.



## 9. REGULATIONS AND GUIDES

### 9.1. GENERIC ISSUES

The Act empowers NNRA to issue regulations with the approval of the President of the Federal Republic of Nigeria. NNRA can also issue guides for the applicants to facilitate compliance with regulatory requirements. The draft Integrated Management System Manual (IMS) establishes a process for developing and/or review of regulations and guides that includes provisions for external consultation and stakeholder engagement. The IRRS team noted that several regulations and guides have been developed in the recent years but not issued yet. However, prioritization of necessary regulations and guides to be established has not been provided.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |  |
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| <b>Observation:</b> NNRA has prepared several regulations that have not been issued yet. |  |
| (1)  | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 34 para. 4.61 states that</b> <i>“The government or the regulatory body shall establish, within the legal framework, processes for establishing or adopting, promoting and amending regulations and guides. These processes shall involve consultation with interested parties in the development of the regulations and guides, with account taken of internationally agreed standards and the feedback of relevant experience. Moreover, technological advances, research and development work, relevant operational lessons learned and institutional knowledge can be valuable and shall be used as appropriate in revising the regulations and guides.”</i> |
| R20  | <b>Recommendation:</b> NNRA should develop a plan for issuing regulations based upon prioritization of the facilities and activities to be regulated.  |

Some of the regulations (e.g. Regulation on transport of radioactive materials) are not in line with the most recent IAEA safety standards.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |   |
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| <b>Observation:</b> Some of the existing regulations are not in line with the most recent IAEA safety standards. |   |
| (1)  | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 34 para. 4.62 states that</b> <i>“The regulations and guides shall provide the framework for the regulatory requirements and conditions to be incorporated into individual authorizations or applications for authorization. They shall also establish the criteria to be used for assessing compliance. The regulations and guides shall be kept consistent and comprehensive, and shall provide adequate coverage commensurate with the radiation risks associated with the facilities and activities, in accordance with a graded approach.”</i> |
| S11  | <b>Suggestion:</b> NNRA should consider developing a plan to periodically review existing regulations in line with the most recent IAEA safety standards.   |

There is inadequate promotion of regulations and guides to interested parties and the public which has been recognized in NNRA’s action plan.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The regulations and guides are not promoted adequately to interested parties and the public.

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| (1) | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 34 states that</b> <i>“The regulatory body shall notify interested parties and the public of the principles and associated criteria for safety established in its regulations and guides, and shall make its regulations and guides available.”</i> |
| S12 | <b>Suggestion: NNRA should consider strengthening the promotion of regulations and guides to interested parties and the public.</b>   |

In readiness for Nigeria’s nuclear power programme, NNRA has developed the following draft regulations:

- i. Nigerian Safety Regulations for the Siting of Nuclear Power Plants
- ii. Nigerian Regulations for the Physical Protection of Nuclear Material and Installations
- iii. Nigerian Nuclear Safeguards Regulations
- iv. Nigerian Safety of Research Reactors Regulations
- v. Nigerian Safety Regulations for the Design and Construction of Nuclear Power Plants
- vi. Nigeria Regulations for Civil Liabilities and Financial Protection for Nuclear Damage
- vii. Nigerian Emergency Preparedness and Response Regulations
- viii. NPP Commissioning
- ix. NPP Operations
- x. NPP Decommissioning

The completion and issuing of regulations and guides is included in the NNRA’s action plan.

NNRA requires applicants to submit a safety assessment in support of an application for the authorization of a facility or an activity. However, there are no guides on the content of the safety assessment to be submitted.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA has not developed guides on the content of safety assessment to be submitted in support of an application for the authorization of a facility or an activity.

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| (1) | <b>BASIS: GSR Part 1 (Rev. 1) Requirement 24 para.4.34 states that</b> <i>“The regulatory body shall issue guidance on the format and content of the documents to be submitted by the applicant in support of an application for an authorization. The applicant shall be required to submit or to make available to the regulatory body, in accordance with agreed timelines, all necessary safety related information as specified in advance or as requested in the authorization process.”</i>   |
| (2) | <b>BASIS: GSR Part 4 (Rev. 1) Requirement 4 states that</b> <i>“The primary purposes of the safety assessment shall be to determine whether an adequate level of safety has been achieved for a facility or activity and whether the basic safety objectives and safety criteria established by the designer, the operating organization and the regulatory body, in compliance with the requirements for protection and safety as established in Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, have been fulfilled.”</i> |



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

S13

**Suggestion:** NNRA should consider developing guides on the content of safety assessment to be submitted in support of an application for the authorization of a facility or an activity.

### 9.2. REGULATIONS AND GUIDES FOR RESEARCH REACTORS

The regulations on safety of research reactors (DSR) is currently a draft which is mainly based on the IAEA Safety Guide SSR-3. This issue is addressed in Recommendation R20 in Section 9.1.

### 9.3. REGULATIONS AND GUIDES FOR WASTE MANAGEMENT FACILITIES

The Nigerian Radioactive Waste Management Regulations, 2006 include elements of a national waste management strategy as the prohibition of importation of radioactive waste and the return of sealed radioactive sources to the supplier abroad as well as requirements on responsibilities, characterization of radioactive waste, waste management operations and finances. The IRRS team was informed that the draft radioactive waste management regulations 2017 are in line with IAEA GSR Part 5 and also address spent nuclear fuel.

NNRA has drafted a national strategic plan for the safe and sustainable management of radioactive waste and spent fuel, a radioactive waste management policy and strategy framework and guidance document for centralised radioactive waste management facilities. The guidance document contains requirements on the identification, classification and characterization, acceptance criteria, and packaging and control arrangements.

### 9.4. REGULATIONS AND GUIDES FOR RADIATION SOURCES FACILITIES AND ACTIVITIES

Regulations related to radiation sources have been issued, and NNRA is currently reviewing these regulations to be in line with the IAEA safety standards. These regulations are:

- i. Nigeria Basic Ionizing Radiation Regulations, 2003
- ii. Nigerian Safety and Security of Radioactive Sources Regulations, 2006

Additionally, NNRA has issued additional practice specific regulations for medical applications and industrial applications:

- Nigerian Radiation Safety in Diagnostic and Interventional Radiology Regulations, 2006
- Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006
- Nigerian Radiation Safety in Radiotherapy Regulations, 2006
- Nigerian Radiation Safety in Industrial Radiography Regulations, 2006

### 9.5. REGULATIONS AND GUIDES FOR DECOMMISSIONING ACTIVITIES

Decommissioning activities concerning facilities or sources after usage are subject to Regulations of the NiBIRR and of the practice specific regulations (e.g. Draft Nigerian Regulations on the Safety of Research Reactors). They stipulate decommissioning requirements and the IRRS team was informed that the draft documents follow the content of IAEA GSR Part 6.

There are specific regulations concerning key personnel and the financial requirements given in the draft regulations for research reactors and sealed sources. The IRRS team was informed that other regulations

are foreseen such as regulations on the decommissioning of NPP. The issuing of available draft regulations is addressed in Recommendation R20 in Section 9.1.

## 9.6. REGULATIONS AND GUIDES FOR TRANSPORT

NNRA has issued the Nigerian Transportation of Radioactive Sources Regulations (2006). This regulation covers some requirements related to the approval of packages design, conditions for licensing, responsibilities of the consignors, carrier and consignees, packaging, transport index, marking and labelling, loading and segregation, transport document, radiation protection program and emergency response. The existing regulation does not cover areas such as the management system of transport organizations, transiting radioactive material, transport and storage in transit of fissile material, classification of packages and package content limits, requirements relating to transport by air and by post and the requirements related to undeliverable consignments

To ensure the consistency with international standards, NNRA has prepared a draft regulation (2016) based on SSR-6. The IRRS team was informed that a guide related to the transport related activities will be prepared and issued for the transport organizations after the approval of the drafted regulation in order to assist the consignor, carrier and consignee in complying with the requirements.

There are plans to amend the existing regulations on transport of radioactive material to adopt and harmonize with the IAEA safety requirement SSR-6 and associated IAEA Safety Guides. This issue is addressed in Recommendation R20 in Section 9.1.

NNRA does not require the availability of a management system of the organization involved in the transport of radioactive material and no audit is carried out during the review and assessment.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA does not have a requirement for transport organizations to have a management system.

(1)

**BASIS: SSR-6 Para 306 states 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, .... The manufacturer, consignor or user shall be prepared:

(b) To demonstrate compliance with these Regulations to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system.”

R21

**Recommendation:** NNRA should establish a requirement for a transport organization to have a management system.

## 9.7. SUMMARY

NNRA is empowered by the Act to issue regulations with the approval of the President of the Republic. NNRA is also empowered to issue guides. NNRA has established processes for developing, adopting, promoting and amending regulations and guides. However, significant number of regulations is in the draft stage and a plan for their promulgation according to priority criteria has to be developed. The process for promoting regulations and guides to interested parties has also to be strengthened. A periodic review of the existing regulation in line with the current relevant IAEA safety standards is needed. Guidance on the standard content of safety assessment to be submitted by applicants would foster the

authorization process. There is a need for establishing a requirement for the management system of transport organizations.

## 10. EMERGENCY PREPAREDNESS AND RESPONSE – REGULATORY ASPECTS

### 10.1. AUTHORITY AND RESPONSIBILITIES FOR REGULATING ON-SITE EPR OF OPERATING ORGANIZATIONS

The Act gives NNRA the power to establish national plans and procedures for responding to nuclear or radiological emergencies. However, the Act is not specific on authority of NNRA to regulate on-site emergency preparedness and response arrangements of the operating organizations.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |   |
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| <b>Observation:</b> The Act does not explicitly assign responsibility to NNRA to regulate on-site emergency preparedness and response. |   |
| (1)  | <b>BASIS: GSR Part 7 para. 4.11 states that</b> <i>“The government shall ensure that arrangements for preparedness and response to a nuclear or radiological emergency for facilities and activities under the responsibility of the operating organization are dealt with through the regulatory process.”</i> |
| (2)  | <b>BASIS: GSR Part 7 para. 6.2 states that</b> <i>“The authorities for developing, maintaining and regulating arrangements, both on the site and off the site, for preparedness and response for a nuclear or radiological emergency shall be established by means of acts, legal codes or statutes.”</i>       |
| S14  | <b>Suggestion: The Government should consider giving explicit authority and assigning explicit responsibility to NNRA to regulate the on-site emergency arrangements of the operating organizations.</b>  |

An on-site emergency plan is required to be verified and approved by NNRA after elaboration or revision. It is required that complete emergency preparedness arrangements should be done before commencement of operation.

It is required for the operator to evaluate exercises against response objectives. NNRA also observes and evaluates some of them as well.

The draft Emergency Preparedness and Response Regulations require that on-site emergency preparedness and response arrangements are coordinated with those of other response organizations, which is done through review and assessment.

For issues that relate to other regulators, NNRA coordinates oversight with the regulators.

There is an Emergency Planning and Preparedness Unit at NNRA. It has 5 operational staff, while the total number of NNRA employees is 713. Daily work of the unit is coordinating emergency preparedness and response issues with other Departments and working groups within NNRA, and also cooperating with other organizations.

Graded approach in emergency preparedness and response is embedded in the draft National Nuclear and Radiological Emergency Plan and in the draft Emergency Preparedness and Response Regulations by introducing emergency preparedness categories.

## 10.2. REGULATIONS AND GUIDES ON ON-SITE EPR OF OPERATING ORGANIZATIONS

The following regulations were issued by NNRA that include provisions for the on-site emergency preparedness and response as well:

- Nigeria Basic Ionizing Radiation Regulations, 2003 (Regulation 26)
- Nigerian Radiation Safety in Diagnosis and Interventional Radiology Regulations, 2006 (Regulation 57)
- Nigerian Radiation Safety in Radiotherapy Regulations, 2006 (Regulation 62)
- Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006 (Regulation 57)
- Nigerian Radiation Safety in Industrial Radiography Regulations, 2006 (Regulation 88)
- Nigerian Safety and Security of Radioactive Sources Regulations, 2006 (Regulation 14)
- Nigerian Transportation of Radioactive Sources Regulations, 2006 (Regulation 35)
- Nigerian Radiation Safety in Industrial Irradiator Regulations, 2008 (Regulation 124)
- Nigerian Radiation Safety in Nuclear Well Logging Regulations, 2008 (Regulation 83)
- Naturally Occurring Radioactive Materials (NORM) Regulations, 2008 (Regulation 83)

In addition, some of the new regulation is in draft stage:

- Draft Regulations on the Safety of Research Reactors, 2014 (Regulation 82)
- Draft Emergency Preparedness and Response Regulations, 2016
- Draft on the Establishment of Emergency Centre

The new draft emergency preparedness and response regulations, based on the new IAEA Safety Standard GSR Part 7, gives essential regulatory requirements and guidance for emergency preparedness and response for operators, covering all activities and facilities. There are overlapping provisions in regulations in force, i.e. the same areas are covered by the new draft regulations and at the same time by the existing regulations in force in a different manner. The main difference is that the new regulation is in line with GSR Part 7 and that it is comprehensive, covering all aspects. An example of overlap is emergency equipment, which is covered by reg. 79 in Nigerian Radiation Safety in Nuclear Well Logging Regulations, 2008 and by reg. 81 in the new draft regulations.

The operator is required to perform a hazard assessment as the basis for graded approach, considering all postulated scenarios. For emergency preparedness categories I and II probabilistic safety analysis have to be used. Periodical review of the hazard assessment is also required. Similarly, the operator has to revise emergency arrangements prior to any modifications.

In case of an emergency, the operator has to ensure effective transition from normal to emergency operations. The operator is required to promptly determine emergency class, initiate on-site actions and notify NNRA with periodic updates. The emergency classification system is in line with GSR Part 7.

It is required that operator promptly decides on and takes mitigatory actions on-site. To ensure prompt action is taken, the operator is obliged to make arrangements in the planning phase, which includes off-site support.

During an emergency, the operator has to assess the emergency to initiate appropriate protective actions on-site. Arrangements are required to be developed in the planning phase to support this. A single position is required to be assigned on-site at all times with the authority and responsibility to promptly recommend protective actions to the off-site notification points.

There are provisions in the draft regulation for protecting emergency workers and helpers, including medical attention.

It is required for the operator to establish arrangements for effective public communication (warnings and general information), including coordinating with off-site authorities.

The operator is responsible for safe and effective management of radioactive waste generated in an emergency.

The regulations put responsibility for the decision on termination of emergency on the operator with the regulator’s approval. However, there is no clear distinction in terms of on and off-site. Operator can make decision on termination only on-site. In addition, conditions, criteria and objectives to be met to terminate the emergency are not set.

**RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES**

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| <b>Observation:</b> The draft regulation is not clear on the scope of termination of emergency (on-site vs. off-site). In addition, conditions, criteria and objectives to be met to terminate the emergency are not required to be set. |   |
| <b>(1)</b>   | <p><b>BASIS: GSR Part 7 para. 5.100 states that</b> <i>“The government shall ensure that, as part of its emergency preparedness, arrangements are in place for the termination of a nuclear or radiological emergency. The arrangements shall take into account that the termination of an emergency might be at different times in different geographical areas. The planning process shall include as appropriate:</i></p> <p><i>(a) The roles and functions of organizations;</i></p> <p><i>(d) Conditions, criteria and objectives to be met for enabling the termination</i></p> <p><i>... ”</i></p> |
| <b>R22</b>   | <p><b>Recommendation: The Government should ensure that roles for terminating off-site emergency are clearly assigned and conditions, criteria and objectives for terminating emergency are set.</b></p>  |

The draft regulation requires operators to evaluate causes and their own response to the emergency to improve emergency preparedness and response arrangements and prevent similar events. It also requires important data and information to be protected and preserved during the emergency response and for the next 30 years.

The operator is required to assign authority and responsibility for directing the on-site emergency response.

The draft regulation stipulates that operators must assign qualified personnel to the positions on the on-site emergency team. It is required that sufficient number of qualified personnel is available at all times so that appropriate positions can be promptly staffed. It is also required to take into account managing more units at the same time for sites with multiple units and to account for long term emergency operations.

The operator is required to make arrangements for coordination of emergency response, including signing protocols for operational interfaces and harmonization of assessment results.

The draft regulation requires operators to ensure availability of adequate tools, instruments, supplies, equipment, communication systems, facilities and documentation (such as procedures, checklists, telephone numbers, email addresses and manuals). For EPC Cat. I and II alternative supplies are required as well.

The draft regulation requires operators to develop and conduct training and exercise programmes. Staff responsible for critical response functions has to participate at least once a year.

The operator is required to establish a quality management programme as part of the emergency management system. There is provision to maintain records in relation to both the emergency arrangements and the response. Maintaining, reviewing and updating of emergency plans, procedures and other arrangements is also required. However, there are no requirements for periodic and independent appraisals.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The operator is required to establish a quality management programme as part of the emergency management system, but there are no requirements for periodic and independent appraisals.

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| (1) | <b>BASIS:</b> GSR Part 7 para. 6.35 states that <i>“The programme shall also include periodic and independent appraisals against functions as specified in Section 5, including participation international appraisals”</i> |
| R23 | <b>Recommendation:</b> NNRA should require operators to conduct periodic and independent appraisals as part of their quality management programme for emergency preparedness and response.                                  |

### 10.3. VERIFYING THE ADEQUACY OF ON-SITE EPR OF OPERATING ORGANIZATIONS

The adequacy of on-site emergency preparedness and response of operator is verified by inspections, review and assessments of arrangements and by observing and evaluating the conduct of emergency drills and exercises. The review and assessment of EPR arrangements are performed by staff of the authorization and inspection department. Around 10 % of inspections are on emergency preparedness and response. However, the NNRA’s process for review and assessment of emergency preparedness and response is still in development. It is covered to some extent in the Handbook on System of Notification, Authorization, Inspection and Enforcement of Control of Radioactive Sources. There are six items related to EPR in the Checklist for Regular Inspection (Annex 7) but there is no procedure or information system to further support the process. This issue is addressed in Recommendation R7 in Section 3.6.

The complete emergency response arrangements are required to be in place before commencement of operations, including the on-site plan. So far 30 plans have been approved by NNRA. If deficiencies are found, they are communicated to the operator and followed up as appropriate. Follow-up actions related to any non-compliance identified during an EPR inspection will be made during a follow-up compliance inspection.

### 10.4. ROLES OF THE RB IN A NUCLEAR OR RADIOLOGICAL EMERGENCY

Nigeria has the National Disaster Response Plan, which covers all types of emergencies, but for nuclear and radiological emergencies, it refers to the National Nuclear and Radiological Emergency Response Plan (NNREP).

NNREP, still in a draft form, established NNRA’s role in responding to nuclear or radiological emergencies, from receiving initial notification and providing initial advice based on radiological assessments. It also designates NNRA as point of contact for the Assistance Convention. The draft NNREP assigns the role of IAEA liaison office in Nuclear Matters to Nigerian Atomic Energy Commission, and similarly for providing technical advice and recommendation to NEMA. On the other hand, NNRA is designated as the National Warning Point (NWP), National Competent Authority for Emergencies Abroad (NCA-A) and National Competent Authority for Domestic Emergencies (NCA-D) in IAEA’s USIE.



NNRA has a contact list for emergencies which includes only staff of the emergency unit. This list is available on the NNRA website and is also provided to the facilities during inspection. When an incident or accident occurs, the people in the list are contacted through their private phones, because landlines and fax communication is not available. The emergency unit also has an emergency e-mail, but it can only be accessed by the staff of the emergency unit during working hours.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES   |  |
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| <b>Observation:</b> Communication arrangements of NNRA are not adequate for performing its national notification point function and the international function as NWP under the notification convention |  |
| (1)   | <b>BASIS: GSR Part 7 para. 5.11 states that</b> <i>“An off-site notification point, or more than one, shall be established to receive notification of an actual or potential nuclear or radiological emergency. The notification point(s) shall be maintained in a state of continuous availability to receive any notification or request for support and to respond promptly, or to initiate a pre-planned and coordinated off-site emergency response appropriate to the emergency class or the level of emergency response. The notification point(s) shall be able to initiate immediate communication by suitable, reliable and diverse means with the response organizations that are providing support.”</i> |
| (2)   | <b>BASIS: GSR Part 7 para. 5.19 states that</b> <i>“The State shall make known to the IAEA and to other States, directly or through the IAEA, its single warning point responsible for receiving emergency notifications and information from other States and information from the IAEA. This warning point shall be maintained in a state of continuous availability to receive any notification, request for assistance or request for verification and to promptly initiate a response or verification....”</i>  |
| R24   | <b>Recommendation: NNRA should improve its communication arrangement by introducing diverse means that are official and available 24/7.</b>  |

Once contacted the NNRA personnel makes assessment of the situation and calls the facility to advice on the best measure. If the incident requires an emergency response, it will be activated through NEMA.

Radiation detection equipment is kept in a central storage and there is no equipment in the emergency unit. If there is a need for response using radiation detection equipment, the staff of the unit gets it from the storage after a routine approval process. Equipment includes survey meters (including tongs to measure from a distance), contamination monitors, and mobile spectrometer. NNRA also has a mobile radiological emergency laboratory installed in a car.

The NNRA emergency unit has one regular office for the four staff of the unit, who does the response. One staff of the emergency unit is currently temporarily not available. There is no dedicated emergency equipment or communications at NNRA.

| RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES  |   |
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| <b>Observation:</b> NNRA conducts its response from a regular office and the emergency unit does not have dedicated emergency equipment. |   |
| (1)  | <b>BASIS: GSR Part 7 para. 6.24 states that</b> <i>“Emergency response facilities or locations to support an emergency response under the full range of postulated hazardous conditions shall be designated and shall be assigned the following functions, as appropriate:<br/>(a) Receiving notifications and initiating the response;</i> |



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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|            | <p>(d) <i>Direction of off-site response actions and coordination with on-site response actions;</i></p> <p>(e) <i>Coordination of national response actions;</i></p> <p>(f) <i>Coordination of communication with the public;</i></p> <p>(g) <i>Coordination of monitoring, sampling and analysis;</i></p> <p>(i) <i>Managing the storage of necessary resources;...</i></p> |
| <b>R25</b> | <p><b>Recommendation:</b> NNRA should establish dedicated emergency response facility or location and dedicated emergency equipment to support its response to nuclear or radiological emergencies.</p>   |

NNRA has no procedures or other operational documents to support its role in emergency preparedness and response, although procedures for response to Emergency Preparedness Category IV are being drafted. Similarly, no programme on training or drills and exercises is in place at NNRA, while there are seminars and exercises conducted occasionally. In addition, there is no programme in place to ensure availability and reliability of supplies, equipment, communications, etc.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| <p><b>Observation:</b> NNRA has no procedures or other operational documents in place to support its role in emergency preparedness and response.</p> |  |
| <b>(1)</b>  | <p><b>BASIS:</b> GSR Part 7 para. 6.17 states that “<i>Each response organization shall prepare an emergency plan or plans for coordinating and performing their assigned functions ...</i>”</p> |
| <b>R26</b>  | <p><b>Recommendation:</b> NNRA should develop plans, procedures and other operational documents to support its role during nuclear or radiological emergency.</p>                                |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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|---|---|
| <p><b>Observation:</b> NNRA has not yet implemented internal training for emergency preparedness and response systematically.</p> |   |
| <b>(1)</b>  | <p><b>BASIS:</b> GSR Part 7 para. 6.28 states that “<i>The operating organization and response organizations shall identify the knowledge, skills and abilities necessary to perform the functions specified in Section 5. The operating organization and response organizations shall make arrangements for the selection of personnel and for training to ensure that the personnel selected have the requisite knowledge, skills and abilities to perform their assigned response functions. The arrangements shall include arrangements for continuing refresher training on an appropriate schedule and arrangements for ensuring that personnel assigned to positions with responsibilities in an emergency response undergo the specified training.</i>”</p> |
| <b>R27</b>  | <p><b>Recommendation:</b> NNRA should introduce internal training, drills and exercises program based on systematic approach to training.</p>   |

## **10.5. SUMMARY**

NNRA is empowered by the Act to establish national plans and procedures for responding to nuclear and radiological emergencies. A comprehensive emergency preparedness and response regulation is developed but is yet to be issued and implemented. The Act does not assign responsibility to NNRA to regulate on-site emergency preparedness and response explicitly as well as the regulatory function to evaluate emergency exercises conducted by the operator.

A national nuclear and radiological emergency response plan has also been drafted. There is a need for NNRA to improve its communication arrangement. NNRA should establish dedicated emergency response facility or location and dedicated emergency equipment to support its response to nuclear or radiological emergencies.

## 11. ADDITIONAL AREAS

### 11.1. CONTROL OF MEDICAL EXPOSURES

Nigeria has established a legal and regulatory framework for safety which includes provisions for the control of medical exposures. Relevant requirements for the control of medical exposures are established in the Act, the NiBIRR and the following practice specific regulations:

- Nigerian Radiation Safety in Diagnostic and Interventional Radiology Regulations, 2006
- Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006
- Nigerian Radiation Safety in Radiotherapy Regulations, 2006.

Nigerian Basic Ionization Radiation Regulations (2003) is currently revised but the revised is draft yet to be issued.

The Act establishes the categorization of sources and substances used for diagnostic and therapy medical exposures, but does not explicitly mention the protection of patients during medical exposures. The Act does not clearly give the NNRA the responsibility for enforcing regulatory requirements for the control of medical exposures. This issue is addressed in Recommendation R2 in Section 1.2.

NiBIRR regulates the use of radioactive medicinal products on patients and the control of equipment used for medical exposures. The practice specific regulations contain detailed requirements and provisions regarding the exposure of patients in diagnostic and interventional radiology, in nuclear medicine and in radiotherapy.

#### **Responsibilities of Registrants and Licensees**

The licensee is responsible for the entire extent of radiation protection in accordance with the practice specific regulations.

#### **Justification of Medical Exposure**

NiBIRR includes the generic principle of justification of any practice involving ionizing radiation.

The specific regulations require medical exposures to be justified by weighting the diagnostic or therapeutic benefits they produce against the radiation detriment they might cause, taking into account the benefits and risks of available alternative techniques that do not involve medical exposure. Stringent justification is required for pregnant women and children for diagnostic medical exposure.

According to the specific regulations, exposure of humans for medical research is deemed to be unjustified unless it is (a) in accordance with the provisions of the Helsinki Declaration and follows the guidelines for its application prepared by Council for International Organizations of Medical Sciences and the World Health Organization, and (b) subject to the advice of an ethical review committee (or any other institutional body assigned similar functions by the Federal Ministry of Health).

There is no specific requirement for justification related to radiological procedures carried out as part of a health-screening programme for asymptomatic patients.

#### **Optimization of Medical Exposure**

The specific regulations require that a medical practitioner who prescribes or conducts radiological diagnostic examinations or diagnostic applications of radionuclides should ensure that the exposures of patients are kept as minimum as necessary to achieve the required diagnostic objective, taking into

account norms of acceptable image quality established by appropriate professional bodies and relevant guidance levels for medical exposure.

The specific regulations require in all diagnostic and therapeutic irradiations, radiosensitive organs such as the gonads, lens of the eyes, breast and thyroid should be protected as appropriate. In addition, special precautions are to be taken in the irradiation of children, women of reproductive age and pregnant women, on whom only essential examinations should be done.

According to the specific regulations, an ethical review committee or other institutional body assigned with similar functions on the subject by the Federal Ministry of Health should specify dose constraints to be applied on a case by case basis in the optimization of protection for persons exposed for medical research purposes if such medical exposure does not produce direct benefit to the exposed individual.

### **Medical Physicists**

By definition in the specific regulations, a medical physicist means an individual who, by virtue of certification by appropriate boards or societies, professional licences or academic qualifications and experience, is duly recognized as having expertise in respectively radiology physics, nuclear medicine and radiotherapy.

The specific Regulations on Diagnostic and Interventional Radiology require the licensee to ensure that the imaging and the quality assurance requirements are fulfilled with the advice of a medical physicist qualified in radiology physics. Also the participation of a medical physicist is required for establishing a comprehensive quality assurance programme.

The specific Regulations on Nuclear Medicine require a nuclear medicine physicist to ensure that the equipment is in safe condition for clinical use.

The specific Regulations on Radiotherapy require the licensee to assign clear responsibilities to personnel, including medical physicists, so that radiation protection of patients, workers, and the public is ensured adequately and the need for qualified experts is determined.

There are no provisions in the regulations on the responsibility of the medical physicist in the calibration of the equipment.

### **Diagnostic Reference Levels (DRLs)**

There are no provisions for the establishment of DRLs. The process for establishing and publishing national DRLs and the associated protocols are currently under development.

### **Quality Control (QC)**

The specific regulations on Diagnostic and Interventional Radiology require a comprehensive quality control of the generators and imaging systems to be in place in the radiographic, mammography and computed tomography installations.

The specific regulations on Nuclear Medicine require the registrant and licensee to ensure that the calibration of radionuclide activity calibrators and other equipment and sources utilized for the practice of nuclear medicine is traceable to a standards dosimetry laboratory and that the calibration of the instruments is maintained by a regular quality control programme.

The specific regulations on Radiotherapy require the licensee to calibrate sources used for medical exposure, radiotherapy equipment in terms of radiation quality or energy and either absorbed dose or absorbed dose rate at a predefined distance under specified conditions. The licensee is also required to calibrate sealed sources used for brachytherapy in terms of activity, reference air kerma rate in air or absorbed dose rate in a specified medium, at a specified distance, for a specified reference date.

According to the specific regulations, the calibrations should be carried out at the time of commissioning a unit, after any maintenance procedure that may have an effect on the dosimetry and at intervals approved by the NNRA. The IRRS team was informed that the frequency of the calibrations is a license condition.

The calibrations are carried out by NIRPR who delivers a certificate of calibration which is checked during the inspections.

According to the specific regulations, all teletherapy equipment outputs should be compared at least once every two years in a national, regional or international programme for independent dose verification, such as the Thermo Luminescence Dosimetry (TLD) established by the IAEA/ World Health Organization (WHO). The IRRS team was informed that the SSDL of NIRPR participates in this inter-comparison exercise as well.

The licensee is required to develop or adopt, implement, and follow a protocol for calibration of radiation sources used for radiotherapy.

Calibration of new equipment and new radiation sources is required to be done independently by at least two different qualified experts in radiotherapy physics and preferably using different dosimetry systems and the results should be compared only after the completion of both measurements.

New brachytherapy sources are required to be calibrated.

The IRRS team was informed that implementation of requirements concerning the calibration are checked during inspections.

### **Dose Limitation**

The regulations do not have provision that indicate dose limits do not apply to medical exposures.

### **Release of Patients**

The specific Regulations on Nuclear Medicine require that a patient who has undergone a therapeutic procedure with unsealed radionuclides must not be released from hospital before the activity of radioactive substances in the body falls below the recommended guidance levels. However, there are no criteria and guidance defined for release of patients.

The specific Regulations on Nuclear Medicine require the licensee to provide written and spoken instructions to the patient concerning contact with other persons and relevant precautions for radiation protection.

### **Pregnant and Breast-Feeding Women**

The specific Regulations on Diagnostic and Interventional Radiology require that appropriate special precautions are taken in the irradiation of women of reproductive age and pregnant women, on whom only essential examinations should be carried out. Moreover, it is required that the licensee ascertains whether the female patient is pregnant before performing X-ray examination for diagnosis.

The specific Regulations on Nuclear Medicine require that the administration of radionuclides for diagnostic or therapeutic procedures to women who are pregnant or likely to be pregnant is avoided unless there are strong clinical indications. Moreover, it is required that the licensee ascertains whether the female patient is breast feeding and then recommendations are to be given to the female patient.

The specific Regulations on Radiotherapy require (a) to avoid radiotherapy procedures causing exposure of the abdomen or pelvis of women who are pregnant or likely to be pregnant unless there are strong clinical indications; (b) to plan to deliver the minimum dose to any embryo or foetus.

## Reviews and Records

The specific Regulations on Diagnostic and Interventional Radiology require the licensee, to include, as far as possible, regular and independent quality audit reviews of the quality assurance programme for radiology.

A licensee is required to keep for a period of 5 years and make available, as required, necessary information to allow retrospective dose assessment, including the number of radiographic exposures, the duration of fluoroscopic examinations, and exposure of volunteers in medical research.

The specific Regulations on Nuclear Medicine require the review of the procedures taking into account the clinical factors that may influence the results. Registrants and licensees are required to keep and make available medical records for a period of 5 years including the types of radiopharmaceuticals administered to patients and their activities, and exposure of volunteers in medical research.

The specific Regulations on Radiotherapy require the licensee to ensure that the different absorbed doses are determined and documented for each patient treated. The Specific Regulations on Radiotherapy require the licensee to include, as far as possible, regular and independent quality audit reviews of the quality assurance programme for radiotherapy procedures.

## Unintended Medical Exposures

The specific Regulations require the licensees to investigate promptly any unintended exposure, to implement any relevant corrective action, to take all practical measures to minimise the likelihood of unintended or accidental medical exposures, to compile a report on that investigation and to furnish such report to the Authority.

Although there are regulations that address medical exposure, the existing regulations on protection and safety for medical exposure do not adequately address the requirements of GSR Part 3. Most of these findings were also identified in NNRA Action Plan.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The current regulations on protection and safety for medical exposure do not adequately address the requirements of GSR Part 3 including the justification related to radiological procedures carried out as part of a health-screening programme for asymptomatic patients, the responsibility of the medical physicist in the calibration of the equipment, the establishment and the implementation of diagnostic reference levels, criteria for release of patients after radionuclide therapy.

|     |   |
|-----|---|
| (1) | <b>BASIS: GSR Part 3 Requirement 3 states that</b> <i>“The regulatory body shall establish or adopt regulations and guides for protection and safety.”</i>  |
| (2) | <b>BASIS: GSR Part 3 para 3.146 states that</b> <i>“Dose limits do not apply to medical exposures.”</i>   |
| (3) | <b>BASIS: GSR Part 3 Requirement 37 states that</b> <i>“Relevant parties shall ensure that medical exposures are justified.”</i>  |
| (4) | <b>BASIS: GSR Part 3 para 3.159 states that</b> <i>“Justification for radiological procedures to be performed as part of a health screening programme for asymptomatic populations shall be carried out by the health authority in conjunction with appropriate professional bodies.”</i> |
| (5) | <b>BASIS: GSR Part 3 para 3.167 states that</b> <i>“In accordance with para. 3.154(d) and (e), the medical physicist shall ensure that:</i><br><i>(a) All sources giving rise to medical exposure are calibrated in terms of appropriate</i>  |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

|            |  |
|------------|--|
|            | <p><i>quantities using internationally accepted or nationally accepted protocols;</i></p> <p><i>(b) Calibrations are carried out at the time of commissioning a unit prior to clinical use, after any maintenance procedure that could affect the dosimetry and at intervals approved by the regulatory body;</i></p> <p><i>(c) Calibrations of radiation therapy units are subject to independent verification prior to clinical use;</i></p> <p><i>(d) Calibration of all dosimeters used for dosimetry of patients and for the calibration of sources is traceable to a standards dosimetry laboratory. ”</i></p> |
| (6)        | <p><b>BASIS: GSR Part 3 para. 2.15 states that</b> <i>“The government shall ensure, as part of the responsibilities specified in para. 2.15, that as a result of consultation between the health authority, relevant professional bodies and the regulatory body, a set of diagnostic reference levels is established for medical exposures .... Such diagnostic reference levels shall be based, as far as possible, on wide scale surveys or on published values that are appropriate for the local circumstances. ”</i></p>   |
| (7)        | <p><b>BASIS: GSR Part 3 para 3.149 states that</b> <i>“The government shall ensure that, as a result of consultation between the health authority, relevant professional bodies and the regulatory body, the following are established:(b) Criteria and guidelines for the release of patients who have undergone therapeutic radiological procedures using unsealed sources or patients who still retain implanted sealed sources. ”</i></p>  |
| <b>R28</b> | <p><b>Recommendation: NNRA should revise the regulations on radiation safety for medical exposure to ensure compliance with IAEA Safety Requirements.</b></p>  |

### 11.2. OCCUPATIONAL RADIATION PROTECTION

#### Legal and Regulatory Framework

Nigeria has established a legal and regulatory framework for safety which includes provisions for protection against occupational exposure. Relevant requirements for the control of occupational exposures are established in the Act, NiBIRR and the following specific regulations:

- Nigerian Radiation Safety in Industrial Radiography Regulations, 2006
- Nigerian Radiation Safety in Diagnostic and Interventional Radiology Regulations, 2006
- Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006
- Nigerian Radiation Safety in Radiotherapy Regulations, 2006.

These specific regulations include the NiBIRR requirements concerning occupational radiation protection.

The Act establishes the functions of NNRA regarding the protection of the workers and NNRA is responsible for enforcing regulatory requirements for the control of occupational exposures.

The Act does not provide requirements on the responsibilities of registrants, licensees and employers concerning occupational exposure. This issue is addressed in Recommendation R4 in Section 1.4.

The Act does not establish the principle of optimisation of the doses of the workers. This issue is addressed in Recommendation R2 in Section 1.2. The Act establishes classes of conditions for workers who are exposed to ionizing radiation in connection with their work: i.e. Working Condition A and Working Condition B. Depending on their working conditions, exposed workers are classified as Type A

or Type B. Type A exposed workers are subject to special health supervision and individual dose assessment is done by individual monitoring for external radiation and internal contamination as appropriate or by indirect methods. The Act required that Dose equivalent assessment for Type B exposed workers is achieved by area monitoring. According to the Act, no person under age of 18 years can be employed in any work performed under working condition A.

NiBIRR provides requirements for occupational exposures in authorised practices involving ionizing radiation; work carried out in an atmosphere containing a certain concentration of radon gas and any work involving NORMs.

NNRA has not determined whether assessment of the exposure of aircrew due to cosmic radiation is warranted and there are no regulatory requirements on this issue. However, this is addressed in the draft NiBIRR.

There are no requirements for the protection of emergency workers. This is however addressed in the draft regulations for Emergency Preparedness and Response (EPR).

NiBIRR provides:

- Annual limits on effective dose and on equivalent dose to the lens of the eyes, the hands, the skin and the extremities, for workers of the age of 18 years or above, for trainees of the age less than 18 years, for women of reproductive capacity, for pregnant and breast feeding women, and for comforters and carers;
- Dose limits on a period of five consecutive years, in special cases where annual dose limits are impracticable.

These dose limits are in compliance with GSR part 3, except for annual equivalent dose for the lens of the eyes.

NiBIRR mentions explicitly that the conditions of service for workers have to be independent of whether they are or could be subject to occupational exposure. Compensatory arrangements or preferential considerations cannot be used as substitutes for measures for protection and safety.

NiBIRR provides requirements for occupational exposure of women of reproductive capacity, pregnant and breast feeding women.

### **General responsibilities of registrants, licensees and employers**

The regulations define and assign the responsibilities for the protection of workers to the employers and the licensees who have to ensure that protection and safety is optimized and that the dose limits for occupational exposure are not exceeded.

The regulations also require that the employer or licensee ensure that suitable and adequate facilities, personal protective devices, monitoring equipment and health surveillance are provided to exposed workers.

Every employer is required to:

- ensure that his workers are given appropriate training, information and instructions regarding the use of ionizing radiations.
- provide calibrated equipment for workplace monitoring and keep the records of this monitoring.
- ensure that the individual dose monitoring or assessment is carried out, the record of the doses and their report are made to the NNRA by authorized dosimetry service providers.



- ensure that arrangements are in place for the health surveillance of the exposed workers.

Responsibility for promoting safety culture is included in the regulations, as well as responsibilities of the employer related to the protection of female worker and persons under 18 years of age undergoing training.

In the current regulations the cooperation between employers and licensees is required.

### **General Responsibilities of workers**

The regulations attribute responsibilities to the workers for protection and safety. Consultation between employer and workers or their representatives in the area of protection and safety is clearly covered by the regulations.

### **Requirements for radiation protection programmes**

NiBIRR provides requirements on:

- implementing relevant areas of workplaces as controlled or supervised areas,
- maintaining a programme for workplace monitoring,
- providing workers with suitable and adequate personal protective equipment.

The employer is required to consult a radiation safety adviser (RSA), as necessary, and to appoint one or more radiation safety officer (RSO) for ensuring the compliance with the regulations. RSA are accredited by NNRA and can provide training and QC services. There are no criteria for appointing the RSO.

### **Monitoring programmes and technical services**

Monitoring programs for the assessment of occupational exposure are addressed in regulations. The employer has to make suitable arrangements with one or more dosimetry service providers approved by NNRA.

Dosimetry Service Providers are accredited by NNRA who has developed a draft “Information on accreditation as a dosimetry service provider.” The National Institute of Radiation Protection and Research (NIRPR), which operates a Secondary Standards Dosimetry Laboratory (SSDL), performs the calibration of the equipment and the dosimeters and delivers a certificate of calibration.

At present, 5 private dosimetry service providers, which are either accredited or ongoing an accreditation process, operate in Nigeria. Three of them provide TLD dosimeters and two provide extremity dosimeters. NIRPR provides NNRA staff with external dosimeters.

No internal dosimetry is performed in Nigeria, while activities such as nuclear medicine practices that can cause internal contamination of the workers are available in Nigeria. There is also no agreement made for the provision of internal dosimetry with a laboratory in other country. This issue is addressed in Suggestion S3 in Section 1.9.

The regulations establish that the records of the doses and their report are made available by the authorized dosimetry service providers to NNRA. The regulations establish requirements for the long term retention and maintenance of occupational exposure records. Dosimetry services send the dose reports on individual external dosimetry to NNRA which keeps them. These dose reports are currently maintained in a paper form. There is no electronic registry for national dose record.

The IRRS team was informed that NNRA has issued a draft internal guidance for developing a national dose registry.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA receives the dose reports for monitored workers as paper records and maintains a paper based national dose registry.

|     |  |
|-----|--|
| (1) | <b>BASIS: GSR Part 3 para. 3.73 (e) states that</b> <i>“The regulatory body shall be responsible, as appropriate, for provision for maintaining exposure records and results of the assessment of doses from occupational exposure.”</i> |
| S15 | <b>Suggestion:</b> NNRA should consider establishing a computerized national registry of occupational dose records.  |

The regulations require that workplace monitoring services are approved by NNRA. The IRRS team has been informed that the workplace monitoring is currently carried out by the licensees.

### Training of Workers and Training Services

There are requirements for training of exposed workers, but no requirement for maintaining records of the training provided to individual workers. The IRRS team was informed that education qualifications in radiation protection, radiation physics and health physics are provided by the University of Ibadan. NIRPR, in collaboration with the University, provides professional training for RSO for two weeks in the medical field and for one week in the industrial field. A certificate of training is issued by NIRPR. An RSA can train radiation workers and then provide them with a certificate of attendance of the training. Most non-compliances with the IAEA safety standards (GSR Part 3) were also identified in NNRA Action Plan.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The regulations on occupational radiation protection do not adequately address the requirements for the annual equivalent dose limit for the lens of the eyes, the criteria for appointing the radiation protection officer and the maintaining of the records of the training provided to individual workers.

|     |  |
|-----|--|
| (1) | <b>BASIS: GSR Part 3 Requirement 3 states that</b> <i>“The regulatory body shall establish or adopt regulations and guides for protection and safety.”</i>   |
| (2) | <b>BASIS: GSR Part 3 Schedule III-1 states that</b> <i>“For occupational exposure of workers over the age of 18 years, the dose limits are:<br/>(b) An equivalent dose to the lens of the eye of 20 mSv per year averaged over 5 consecutive years (100 mSv in 5 years) and of 50 mSv in any single year.”</i>   |
| (3) | <b>BASIS: GSR Part 3 Schedule III-2 states that</b> <i>“For occupational exposure of apprentices of 16 to 18 years of age who are being trained for employment involving radiation and for exposure of students of age 16 to 18 who use sources in the course of their studies, the dose limits are: ... (b) An equivalent dose to the lens of the eye of 20 mSv in a year.”</i> |
| (4) | <b>BASIS: GSR Part 3 para 3.94 states that</b> <i>“3.94. Employers, registrants and licensees, in consultation with workers, or through their representatives where appropriate:<br/>(e) Shall designate, as appropriate, a radiation protection officer in accordance with criteria established by the regulatory body.”</i>  |
| (5) | <b>BASIS: GSR Part 3 Requirement 26 para. 3.110 states that</b> <i>“Employers, in cooperation</i>  |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

*with registrants and licensees:*

*(c) Shall maintain records of the training provided to individual workers.”*

**R29**

**Recommendation:** NNRA should revise the regulations on occupational radiation protection to ensure compliance with IAEA safety standards.

### 11.3. CONTROL OF RADIOACTIVE DISCHARGES, MATERIALS FOR CLEARANCE, AND EXISTING EXPOSURES SITUATIONS; ENVIRONMENTAL MONITORING FOR PUBLIC RADIATION PROTECTION

The Act has empowered the NNRA to establish the regulatory framework for the control of public exposures. However, the legislation does not provide for existing exposures. The NNRA is also empowered to ensure that requirements with respect to environmental monitoring are established and implemented. The provisions of the Act are further strengthened by NiBIRR and the NRWMR.

These regulations cover all aspects of the regulatory framework for the control of public exposure, radioactive discharges and materials for clearance and are broadly in line with IAEA safety standards. The NNRA has also established responsibilities of relevant parties that are specific to public exposures as provided in GSR Part 3 in the revised draft NiBIRR (2015).

#### Clearance

The levels towards Clearance are indicated in Schedule-I of NRWMR 2006. However, the established criteria are not fully in line with the IAEA Safety Standard GSR Part 3.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The Provision for Clearance in NRWMR 2006 is not in line with criteria of Schedule-I of GSR Part-3.

**(1)**

**BASIS:** GSR Part 3 Requirement 8 para. 3.12 states that *“The regulatory body shall approve which sources, including materials and objects, within notified or authorized practices may be cleared from regulatory control, using as the basis for such approval the criteria for clearance specified in Schedule I or any clearance levels specified by the regulatory body based on these criteria.”*

**R30**

**Recommendation:** NNRA should incorporate requirements on clearance levels in line with the criteria of Schedule-I of GSR Part 3

#### Control of Radioactive discharges

The Act empowers NNRA to impose terms and conditions relating to monitoring programmes, measures and control to minimize radiation and criticality hazards and limits of radioactive release into the environment.

The NRWMR 2006 gives the limits of discharge of radioactive substances into the environment.

NNRA has established criteria for determining discharge limits to the environment in Schedule-I of NRWMR 2006.

A draft Technical Guide for Environmental Radiological Monitoring has been prepared which gives broad guidelines on a) regulatory requirements b) sampling, analytical procedures, measurements and data reporting, and c) quality assurance and control.

The IRRS team was informed that the monitoring of gaseous releases from the research reactor is not carried out because the online instrumentation for this purpose is no longer functional. The reporting of the radionuclides released into the environment through the gaseous route is not performed. Also, there is no NNRA approved environmental monitoring programme.

Additionally, the impact on the public from the management of the liquid waste generated from the discharge of I-131 during therapy from Nuclear Medicine is not assessed.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>   |  |
|--|--|
| <b>Observation:</b> NNRA does not verify compliance of the authorization conditions for discharges of radioactive material from facilities. In addition, NNRA has not approved the environmental monitoring plan for the facilities. |  |
| (1)  | <b>BASIS: GSR Part 3 Requirement 31 states that</b> <i>“Relevant parties shall ensure that radioactive waste and discharges of radioactive material to the environment are managed in accordance with the Authorization.”</i>  |
| (2)  | <b>BASIS: GSR Part 3 Requirement 32 states that</b> <i>“The regulatory body and relevant parties shall ensure that programmes for source monitoring and environmental monitoring are in place and that the results from the monitoring are recorded and are made available.”</i> |
| R31  | <b>Recommendation: NNRA should ensure that the radionuclides released to the environment comply with the conditions of the authorization.</b>  |
| R32  | <b>Recommendation: NNRA should ensure that the programmes for source monitoring and environmental monitoring are in place in all authorised facilities</b>   |

### Consumer Products

The NNRA ensures that providers of consumer products containing radioactive substances are licenced in accordance with the Act. Exemption limits have been established in NIBIRR 2003 based on Activity and Activity Concentration, to determine which products will be subjected to regulatory control.

An application for a licence to manufacture, import or distribute consumer products is approved only if the requirements of NRWMR are met.

Consumer products containing radioactive material are not manufactured in Nigeria. However, such consumer products are imported into the country. The IRRS team was informed that a permission to import is issued to the provider only when “large quantity” are brought into the country. Otherwise an exemption certificate is issued.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>   |   |
|--|---|
| <b>Observation:</b> NNRA does not have criteria and procedures for the authorization of consumer products. |   |
| (1)  | <b>BASIS: GSR Part 3 Requirement 33 para. 3.139 states that</b> <i>“Upon receipt of a request for authorization to provide consumer products to the public, the regulatory body:</i><br><i>(a) Shall require the provider of the consumer product to provide documents to</i> |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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|            | <p style="text-align: center;"><i>demonstrate compliance with the requirements in paras 3.138–3.144;</i></p> <p>(b) <i>Shall verify the assessments and the selection of parameters presented in the request for authorization;</i></p> <p>(c) <i>Shall determine whether the end-use of the consumer product can be exempted;</i></p> <p>(d) <i>Shall authorize the provision to the public of the consumer product, where appropriate, subject to specific conditions of authorization.”</i></p> |
| <b>R33</b> | <b>Recommendation: NNRA should establish criteria and procedures for authorization of consumer products.</b>   |

### Existing exposure situations

Nigeria has identified some existing exposure situations in the country:

- Existence of TENORM in the mining area of Jos plateau and the Niger Delta
- Gold mining areas in Kaduna, Zamfara and Nasarawa States
- A report of abnormal incident in Uranium minerals in Michika, Adamawa State and was being investigated at the time of the IRRS mission.
- Presence of orphan sources owing to well logging sources brought into the country before the establishment of NNRA.
- Unregulated mining activities across Nigeria

The IRRS team was also informed that there are probably other existing scenarios like such as higher radon levels in homes because of the use of NORM waste as construction material.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** Nigeria has identified some existing exposure scenarios in the country. However, not all scenarios have been evaluated to determine whether radiation protection measures are needed. A national action plan to address the identified exposures is not in place.

|            |  |
|------------|--|
| (1)        | <b>BASIS: GSR Part 3 Requirement 47 states that</b> <i>“The government shall ensure that existing exposure situations that have been identified are evaluated to determine which occupational exposures and public exposures are of concern from the point of view of radiation protection.”</i> |
| <b>R34</b> | <b>Recommendation: The Government should ensure that all existing exposure situations are identified comprehensively and systematically evaluated to determine the concern of public exposures.</b>  |

### Exposure due to radionuclides in commodities

The reference levels for exposures due to commodities have not yet been established in Nigeria. The National Institute of Radiation Protection and Research and the National Food, Drugs Administration and Control are collaborating initiatives to establish reference levels. The NNRA is required, in the Draft NiBIRR 2015, to establish reference levels for exposure due to radionuclides in commodities.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** Reference levels for exposure due to radionuclides in commodities have not been

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

established.

|     |   |
|-----|---|
| (1) | <b>BASIS: GSR Part 3 Requirement 51 states that</b> <i>“The regulatory body or other relevant authority shall establish reference levels for exposure due to radionuclides in commodities.”</i> |
| R35 | <b>Recommendation: NNRA or other relevant authority should establish reference levels for exposure due to radionuclides in commodities.</b>   |

### Public exposure due to radon indoors

The IRRS team was informed that Nigeria has certain cases where the TENORM contaminated material is used in homes, especially in the Jos Plateau of Nigeria. However, assessment of radon levels in doors has not yet been done.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** Radon indoors has not been assessed and an action plan and implemented for controlling public exposures due to radon indoors has not been established.

|     |  |
|-----|--|
| (1) | <b>BASIS: GSR Part 3 Requirement 50 states that</b> <i>“The Government shall provide information on levels of radon indoors and the associated health risks and if appropriate, shall establish and implement an action plan for controlling public exposures due to radon indoors.”</i> |
| R36 | <b>Recommendation: The Government should provide information on levels of radon indoors and the associated health risk and if appropriate establish and implement an action plan for controlling public exposures.</b>   |

### 11.4. SUMMARY

The Government and NNRA should revise the regulations on radiation safety for medical exposure and occupational radiation protection to ensure compliance with IAEA safety standards.

The Government should ensure that all existing exposure situations are identified comprehensively and evaluate them systematically to determine the concern of public exposures. The Government should also provide information on levels of radon indoors and the associated health risk and if appropriate shall establish and implement an action plan for controlling public and occupational exposures.

The NNRA should ensure that the radionuclides released to the environment comply with the conditions of authorization and ensure that the programmes for source monitoring and environmental monitoring are in place for all authorised facilities.

Further, NNRA should incorporate requirement of clearance levels in line with the criteria of Schedule-I of GSR Part 3 and should establish procedures for authorization of consumer products.

## 12. INTERFACE WITH NUCLEAR SECURITY

The regulatory aspects of nuclear safety, security and safeguards are addressed in the Act. NNRA realizes the need for an effective interface among nuclear safety, security and safeguards as these complement each other. Accordingly, draft regulations on Physical Protection of Nuclear Material and Nuclear Facilities is being developed by NNRA using the IAEA Nuclear Security Series No. 13 (INFCIRC/225/Rev5) and the IAEA model Regulations addressing such interfaces.

### 12.1. LEGAL BASIS

The Government has defined the role, functions and authority of NNRA with regard to nuclear safety, radiation protection, nuclear security and safeguards in the Act. Under the Act, Department of Nuclear Safety, Security and Safeguards has been established at NNRA. The roles and functions of NNRA related to security include advising the government, evaluation during the licensing process and conducting inspections. The matters related to establishment of infrastructural arrangements by the Government for interfaces of safety with arrangements for nuclear security was discussed with the counterparts, however, it was revealed that no such arrangements have been formally established by the Government. Considering the plan of Nigerian Government to embark on a nuclear power program, establishment of such arrangements with clearly defined responsibilities and interfaces is highly important.

The counterpart explained that this aspect has been taken care of in the new draft bill (which is under review at NNRA) which proposes for the establishment of Nigeria Nuclear Security Committee comprising members from relevant government departments and law enforcement agencies. They further informed that NNRA interacts with various relevant agencies in this aspect although formal memorandum of understanding has been signed with Customs only.

### RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The Government has not established formal infrastructural arrangements for interfaces between safety and nuclear security.

(1)

**BASIS: GSR Part 1 (Rev. 1) Requirement 12 states that** *“The government shall ensure that, within the governmental and legal framework, adequate infrastructural arrangements are established for interfaces of safety with arrangements for nuclear security and with the State system of accounting for, and control of, nuclear material.”*

R37

**Recommendation: The Government should ensure that, within the governmental and legal framework, adequate infrastructural arrangements are established for interfaces of safety with arrangements for nuclear security and with the State system of accounting for, and control of, nuclear material.**

### 12.2. REGULATORY OVERSIGHT ACTIVITIES

NNRA is responsible for the oversight of nuclear security, however, for oversight that warrants external assistance, like enforcement, the NNRA liaises with the relevant law enforcement agency.

NNRA coordinates and consults with relevant agencies regarding assessment of the configuration of facilities and activities, emergency arrangement for safety and nuclear security. The counterparts also informed that NNRA assesses physical protection aspects during the licensing stage considering factors relating to configuration of facilities and activities as well as other measures for optimization of safety as



well as safety-security interfacing arrangements to avoid compromising on nuclear safety or nuclear security.

### **12.3. INTERFACE AMONG AUTHORITIES**

Various organizations are involved in the safety and security of nuclear or radioactive materials and facilities with NNRA having the responsibility for regulatory functions. The IRRS team was informed that they have informal coordination arrangements with these organizations, however, formal coordination arrangement exists with the Customs department in the form of a memorandum of understanding. This issue is addressed in Suggestion S1 in Section 1.5.

Exercises for physical security arrangements are conducted periodically. In addition, some of these exercises are integrated with the exercises of emergency plans with the participation of relevant organizations.

### **12.4. SUMMARY**

Various government organizations have responsibilities relating to nuclear safety and security, however, the government has not established formal infrastructural arrangements for interfaces between nuclear safety and nuclear security. NNRA has the responsibility for regulating nuclear safety as well as nuclear security for which it has established formal arrangements with Customs, however, it has made informal arrangements with other relevant organizations.



### **13. INTRODUCTION TO TAILORED MODULE FOR COUNTRIES EMBARKING ON NUCLEAR POWER**

This tailored module comprises a review of the development of Nigeria's nuclear power programme against actions in the IAEA Safety Guide SSG-16, "Establishing the Safety Infrastructure for a Nuclear Power Programme." The IAEA developed SSG-16 to provide guidance on establishing a national safety infrastructure, in accordance with the IAEA safety standards. SSG-16 provides a road-map for countries embarking on a nuclear power programme to implement safety-related actions during the first three phases of the development of the programme.

#### **Nuclear Power in Nigeria**

Nigeria has been using ionizing radiation in industry and medicine for decades. During 1990s, Nigeria established various research and training centres, and issued the law that established the Nigerian Nuclear Regulatory Authority in 1995. NNRA was established in 2001 to undertake regulatory responsibilities on nuclear safety, security and safeguards, in addition regulatory responsibilities on radiation applications and sources.

An inter-Ministerial Committee on Energy Resources, established in 2004, recommended nuclear power to the Government as a major potential source for the country. Another Inter-Ministerial Committee established in 2005 performed a feasibility study for launching a national program making the nuclear power part of the electricity generation.

As an outcome of these reports, The Nigeria Atomic Energy Commission (NAEC), established by law enacted in 1976 and implemented in 2006. As provided for in the Act, NAEC is designated as the national focal agency to develop the framework and technical pathway to explore, exploit and harness atomic energy for peaceful applications for the socioeconomic development of Nigeria. In that respect, the Board of NAEC developed a Road Map and a Strategic Plan for the implementation of the National Nuclear Power Programme, both of which were approved by Federal Executive Council in 2007 and 2009, respectively. The strategic plan was revised in 2015.

According to the Road Map, the first unit of a nuclear power plant is to be connected to the national grid by 2025 and continue to increase the nuclear capacity up to 4,800 MWe by 2035.

NAEC performed preliminary siting activities, determined two candidate sites with support from IAEA, in Geregu/Ajaokuta Local Government Area of Kogi State in the North Central Zone and in Itu Local Government Area of Akwa Ibom State in the South-South Zone of the country. Detailed site characterization studies to validate suitability and identification of appropriate site-specific design criteria will be conducted during the next phase of siting.

Main parties in the nuclear power project are National Environmental Standards and Regulations Enforcement Agency (NESREA) of Fed. Min. of Environment, Energy Commission of Nigeria of the Fed. Min. of Science and Technology, Nigerian Atomic Energy Commission (NAEC), NNRA of Min. of Petroleum Resources, National Emergency Management Agency (NEMA), and Nigerian Electricity Regulatory Commission (NERC) of Fed. Min. of Power.

To coordinate the implementation of the program, Nuclear Energy Programme Implementation Committee (NEPIC) was established under the chairmanship of NAEC. Members of the committee was composed of all relevant authorities, agencies, ministries and companies.

### **13.1. CONSIDERATION OF ELEMENTS OF SSG-16**

SSG-16 establishes three phases in the development of a nuclear power programme. In Phase 1 the country is in the process of determining whether to include nuclear power in its energy policy. In phase 2 the country has determined to include nuclear power and is developing its safety infrastructure for the nuclear power programme including the regulatory framework. Nigeria is considered to be in phase 2 of developing its nuclear power programme. During this phase, the NNRA is building its regulatory framework by expanding its staff, developing regulations and guides and establishing internal procedures to license and oversee the construction and operation of the NPP. Phase 2 will end when Nigeria is ready to solicit bids or enter into a contract for the construction of an NPP.

Nineteen of the 20 elements of SSG-16 were reviewed by the IRRS team. Safety element 18 addresses the issues regarding the commissioning of nuclear power plants and has no action requirements prior to phase 3, this element is considered as out of scope for the purposes of this review.

#### **13.1.1 SSG-16 Element 01 National Policy and Strategy**

Nigeria's Energy Policy 2003 considers nuclear power as an alternative. This policy recognized the importance of nuclear safety and environmental protection measures. It also discusses the provision of adequate resources to NNRA to enforce nuclear laws and regulations and fostering the co-operation with the IAEA.

The Energy policy was updated in 2013 noting the need for Nigeria to strengthen the existing institutional and regulatory framework, adopted the policy to pay attention to safety, security and safeguards in its pursuit and implementation of nuclear programs and committed to institute the necessary nuclear safety, security and safeguards in the exploitation of nuclear energy. However, this policy has not been approved yet.

SSG-16 Action 1 suggests the government should consider all necessary elements for a national policy and strategy of safety during phase 1 and to establish the policy and strategy in phase 2. Nigeria has not yet developed this policy and strategy. This issue is addressed in Recommendation R1 in Section 1.1. Development of the Safety Policy is also addressed in the Action Plan as an action defined for NNRA to be completed by the 3rd quarter of 2017.

The Nigeria Atomic Energy Commission is mainly responsible for implementing the nuclear power project in accordance with the Road Map approved in 2007. NAEC established an inter-organizational committee to provide for the coordination of activities of different authorities, agencies and relevant public enterprises. The Committee is chaired by NAEC and representation is from senior management of the participating organizations.

Through Act 19 of 1995, the Government has identified the regulatory responsibilities and allocated these responsibilities to NNRA. However, responsibilities of the licensee, such as prime responsibility, have not been addressed in the Act. This issue is addressed in Recommendation R4 in Section 1.4. Responsibilities of different governmental authorities that would take part in a nuclear power project regarding conventional safety issues such as construction, fire safety, industrial safety and emergency response also have not been clearly allocated in the Act. The government should consider allocating such responsibilities in the Act.

The enactment of the NSSS Bill into law is reflected in Action plan for the Government targeting 4<sup>th</sup> quarter of 2017 under SSG-16 actions, and as 2019 under Module 1.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** The role and responsibilities of the licensee has not been defined. In addition, allocation of responsibilities of different authorities has not been clearly defined.

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|-----|--|
| (1) | <b>BASIS: SSG-16 Safety Action 7 states that</b> <i>“The government should ensure identification of responsibilities and their progressive allocation to the relevant organizations involved in the development of the safety infrastructure.”</i> |
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|     |   |
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| S16 | <b>Suggestion: The Government should consider providing further clarification in draft NSSS Bill on allocation of responsibilities of the licensee and different authorities that would perform regulatory functions in a NPP project, taking into account nuclear safety in facilities and activities.</b> |
|-----|---|

### 13.1.2 SSG-16 Element 02 Global nuclear safety regime

Nigeria is party to all necessary international instruments relevant to nuclear safety and security, as stated in para. 2.21 of SSG-16.

As the body responsible for the coordination and implementation of the nuclear power project, NAEC is expected to establish a dialogue with neighbouring countries with the support of NNRA and the Ministry of Foreign Affairs. However, such communication has not been initiated. In 2009, the Director General of NNRA convened a meeting with ambassadors of neighbouring states (ECOWAS), to share the national intention to embark on nuclear power programme.

Communication with neighbouring states is under consideration by NNRA who is drafting a guide on assessment of radiological impacts as a part of the environmental impact assessment, including means of communicating radiological impact of the nuclear power project over the environment with neighbouring countries.

Beside the international instruments, relevant organizations (particularly the regulatory body), are expected to establish bilateral agreements with international organizations and organizations of other states. In this respect, NNRA is working on concluding agreements with several regulatory bodies of states having nuclear power. Negotiations with Rostechndzor of the Russian Federation is in the advance stages for finalization of the agreement, but negotiations with other countries continue.

This finding is also reflected in Action Plan for NNRA and NAEC without defining a target date under SSG16 and targeting 2019 under Module 3.

The participation of Nigeria in global safety regime has also been reviewed by IRRS team and findings were given in Module 2.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** Nigeria has not initiated communications with neighbouring countries.

|     |   |
|-----|---|
| (1) | <b>BASIS: SSG-16 Safety Action 12 states that</b> <i>“The government should begin a dialogue with neighbouring States regarding its projects for establishing a nuclear power programme.”</i> |
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| S17 | <b>Suggestion: The Government should consider commencing communicating its nuclear power program to neighbouring countries.</b> |
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## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** No formal agreements have been concluded on collaboration with regulatory bodies of other states to seek advice on safety related matters.

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|-----|--|
| (1) | <b>BASIS: SSG-16 Safety Action 13 states that</b> <i>“The government and relevant organizations, if they already exist, should establish contact with organizations in other States and international organizations to seek advice on safety related matters.”</i> |
| (2) | <b>BASIS: SSG-16 Safety Action 16 states that</b> <i>“All relevant organizations should strengthen their cooperation on safety related matters with States with advanced nuclear power programmes.”</i>  |
| S18 | <b>Suggestion: The NNRA should consider finalising the agreements with regulatory bodies of States with advanced nuclear power program to seek advice on safety related matters.</b>   |

### 13.1.3 SSG-16 Element 03 Legal framework

Act 19 establishes the basis the legal framework, but should be updated to take into account the IAEA safety standards. This issue is addressed in Recommendation R2 in Section 1.2.

### 13.1.4 SSG-16 Element 04 Regulatory framework

NNRA is supervised by a Board and its Director General is a Board member. Other Members of the Board are the President of Nigeria as Chairman, Ministers of Defence, Health, Internal Affairs, Solid Mineral Development, Petroleum Resources and Science and Technology, Director-General of the Federal Environmental Protection Agency, Director-General of the Energy Commission of Nigeria, and two eminent Nigerians of relevant background. This formation of Board introduces conflict of interest for NNRA.

The Board was authorized to manage the affairs of NNRA in accordance with the Act. The chairman of the Board is authorized to relieve any member of the Board if he deems that “it is not in the interest of the Authority for the person appointed to continue the office.” This type of authority could affect the independence of the NNRA.

Similar findings were reached in review of the IRRS team under Sections 1 and 3, and the issue regarding the independence of NNRA is addressed in Recommendation R3 in Section 1.3.

Under the NNRA Director General, there are Dept. of Radiological Safety, Dept. of Nuclear Safety, Physical Security and Safeguards, Dept. of Authorization and Enforcement, Dept. of Administration and Finance and National Institute of Radiation Protection and Research. The institute is the technical support organization of the NNRA.

The Dept. of Nuclear Safety, Physical Security and Safeguards is managed through Div. of Reactor Safety, Div. of Emergency and Div. of Nuclear Security and Safeguards. However, human resources available are limited. There are approximately 50 staff in the Department and 20 in the Div. of Reactor Safety. The number appears to be inadequate to the IRRS team for implementing regulatory activities in a nuclear power program. This issue was further investigated under Elements 6 and 9 of SSG-16.

The NNRA is charged with developing the regulations necessary for oversight of safety of siting, design, construction, commissioning, operation and decommissioning of an NPP. To perform these functions, NNRA has adopted the risk informed and performance based regulatory approach according to its draft strategy paper and its draft regulations regarding nuclear safety are in line with this preference. The IRRS

team observed that the expertise in NNRA may not be sufficient to implement a performance-based regulatory approach for ensuring the safety.

The NNRA is responsible for developing necessary regulations for the nuclear power programme. Furthermore, most regulations are in draft form and are under review. To address the guidance in SSG-16, Actions 30 and 31 NNRA should use a systematic approach for developing regulations and guides which would include determining the gaps, prioritizing issues that need to be addressed with a graded approach and planning and scheduling the drafting activities keeping in mind the stage of the project.

NNRA should specify the documents which are required for a licence application, as well as the depth of review for each document submitted in support of a licence application. NNRA should consider issuing basic guidance on the format and content of the documents to be submitted by the operating organization in support of an application for licensing. These regulations and guides should be complemented with the internal procedures for basic activities like review and assessment of applications in detail, including the records to be kept during the review.

There is no direct reflection of this issue in Action Plan. However, under action 126 gazetting of all drafts was targeted for last quarter of 2017.

| <b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>   |   |
|--|---|
| <b>Observation:</b> Most of the regulations related to the safety of NPP are in draft and there is no strategy for prioritization for development of regulations and guides. |   |
| <b>(1)</b>   | <b>BASIS: SSG-16 Action 30 states that</b> <i>“The regulatory body should issue regulations and guides specifying the documentation and procedures necessary in the various steps of the licensing process and inspections to be conducted.”</i>  |
| <b>(2)</b>   | <b>BASIS: SSG-16 Action 31 states that</b> <i>“The regulatory body should specify the safety requirements that should be known for the bidding process.”</i>  |
| <b>(3)</b>   | <b>BASIS: SSG-16 Action 32 para. 2.66 states that</b> <i>“Throughout Phase 2, the regulatory body should have a firm strategy for prioritizing the development of regulations. Regulations governing site evaluation, design, construction and manufacturing should be prepared early in Phase 2 so as to be taken into account in the bidding process.... The regulatory body may complement these with a well-established set of requirements and with industrial standards (including nuclear safety standards) that are in use in States with extensive experience of nuclear power plant operation.”</i> |
| <b>S19</b>   | <b>Suggestion:</b> NNRA should consider developing a strategy for prioritizing the development of regulations and guides relevant to safety of NPPs.  |

### 13.1.5 SSG-16 Element 05 Transparency and openness

The Government of Nigeria appointed NAEC as implementing body of the nuclear power program, including informing public about benefits and risks of nuclear power. NNRA has been authorized by the Act 19 to inform public on nuclear safety and radiation protection issues.

Public involvement during the licensing process is being addressed during the environmental impact assessment process through the public hearings. Additionally, NNRA has established a public participation process in its draft “Guidance Documents for the Licensing Process for NPPs in Nigeria” prior to the decision making. The draft process requires NNRA to formally inform the applicant and other relevant stakeholders of the outcome of the public hearing. Draft also states that these public involvements should continue throughout the lifetime of the nuclear power plant.

### 13.1.6 SSG-16 Element 06 Funding and financing

There are four aspects of funding and financing that need to be reviewed regarding a new build project. Financing the development activities of human resources at a national level, financing the regulatory body to ensure proper conduct of regulatory activities, ensuring finances for the operating organization for safe operation of the NPP, and ensuring finances for the long term radioactive waste management, spent fuel management and decommissioning.

The human resource development for the new build has not been addressed due to financial limitations, but a gap analysis was performed for competence in 2013 using IAEA tool SARCoN. A suggestion has been formulated regarding this finding under Element 09 of the SSG16.

Regarding the operating organization, financial resources are provided to CAEN until a project company is established to take over the responsibilities.

Act 19 does not address the issue of availability of funds for long term radioactive waste management, spent fuel management and decommissioning. Ensuring the funding of these activities is mentioned in the draft policy on Radioactive Waste Management Policy, but even if such documents are approved, it would not constitute a legal requirement on relevant organizations to provide necessary funds for these activities.

This issue is addressed in Recommendation R5 in Section 1.7.

### 13.1.7 SSG-16 Element 07 External support organizations and contractors

The National Institute of Radiation Protection and Research, established in 2006, was organized as the technical support organization of NNRA. The competence of this organization focuses on radiation protection and the human resources are limited. NNRA is planning to procure services of external experts for the competencies that do not exist within the authority.

The IRRS team was informed by NNRA that the NIRPR should be provided with additional human resources determined in accordance with the analysis performed, and provided with financial resources for being able to perform research for the safety and regulatory purposes. Additionally, as technical support to NNRA, the Institute should expand its competence areas to perform independent confirmatory analyses, technical assistance to NNRA in the resolution of specific regulatory issues, and the development of technical bases for safety policy and regulations.

The future operating organization will have NAEC and its research centres as national TSO. No assessment or gap analysis was performed with a focus on identifying gaps in competencies needed for a new build, to support NNRA and/or operator.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** Competence of existing organizations that can provide technical support to the NNRA have not been assessed by the government to identify the gaps with respect to competence needed for licensing of new builds and to ensure safe operation of nuclear power plants.

(1) **BASIS: SSG-16 Action 62 states that** *“The government should assess the need to create or to enhance national organizations to provide technical support to the regulatory body and the operating organization for the safe operation of nuclear power plants.”*

(2) **BASIS: SSG-16 Action 85 states that** *“The government should consider a strategy for attracting, training and retaining an adequate number of experts to meet the needs of all organizations involved in ensuring safety in a prospective nuclear power programme.”*



## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

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| (3) | <b>BASIS: SSG-16 Action 100 states that</b> <i>“The government should identify gaps in the capabilities of domestic research centres to meet needs in core areas, and should plan to establish new research centres for core areas as necessary.”</i>                                |
| S20 | <b>Suggestion:</b> <b>The Government should consider assessing the competence of existing organizations that can provide technical support to NNRA or operating organization, and performing a gap analysis to identify areas in which these organizations need further support.</b> |

### 13.1.8 SSG-16 Element 08 Leadership and management for safety

NAEC established a Committee to provide for the coordination of activities and information exchange. NNRA, as the member of this Committee, undertakes the role of ensuring a high level of safety and promoting safety culture among the relevant authorities.

Regarding the leadership and management for safety, NNRA has put some efforts to develop management system for itself. The effectiveness and compliance of this management system with the IAEA standards have been reviewed by IRRS team under the scope of Module 4 and formulated necessary recommendations. The Management System Manual of the NNRA is in draft form.

### 13.1.9 SSG-16 Element 09 Human resources development

Several universities have established graduate programs in nuclear engineering and radiation protection. These universities are Obafemi Awolowo University in Ile-ife, Ahmadu Bello University in Zaria, University of Maiduguri, University of Port-Harcourt, Federal University of Technology in Owerri and National Technology Center (NTC) in Sheda.

To attract qualified experts, NNRA has introduced a new document “NNRA Condition of Service” which addresses the financial improvements for the NNRA staff.

However, in current conditions, the financing for developing human resources and competences for all relevant organizations are not sufficient to provide for the training of relevant staff. This issue has been reflected in NNRA Action Plan as various activities under Action 94.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** NNRA does not have adequate financing for developing and implementing its human resource and competence development plans.

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| (1) | <b>BASIS: SSG-16 Action 48 states that</b> <i>“The government should plan funding for education and training, and for research centres and other national infrastructure, to support the safe operation of nuclear power plants.”</i>   |
| (2) | <b>BASIS: SSG-16 Action 85 states that</b> <i>“The government should consider a strategy for attracting, training and retaining an adequate number of experts to meet the needs of all organizations involved in ensuring safety in a prospective nuclear power programme.”</i> |
| (3) | <b>BASIS: SSG-16 Action 86 states that</b> <i>“Action 86. The government should identify competences required in areas relating to nuclear safety and the approximate number of experts needed.”</i>  |
| (4) | <b>BASIS: SSG-16 Action 94 states that</b> <i>“Action 94. All relevant organizations should</i>   |

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

*commence the education and training in academic and vocational institutions of the necessary number of persons for ensuring safety.”*

S21

**Suggestion: Government should consider providing enough financial resources to NNRA to develop and implement its human resource and competence development plans.**

### 13.1.10 SSG-16 Element 10 Research for safety and regulatory purposes

Safety research centres have been established to perform research and development in nuclear technology. These centres are CERT, Ahmadu Bello University, Zaria, Kaduna State; CERD, Obafemi Awolowo University, Ile-Ife, Osun State; Nuclear Technology Centre (NTC), Sheda Science and Technology Complex, Abuja, FCT; Centre for Nuclear Energy Studies (CNES), University of Port-Harcourt, Port-Harcourt; Centre for Nuclear Energy Research and Training (CNERT), University of Maiduguri, Maiduguri; Centre for Nuclear Energy Studies and Training (CNEST), Federal University of Technology, Owerri; and FGN-IAEA Marine Contamination Coastal Field Monitoring Station (MCCFMS), Koluama.

The Government may consider performing an analysis to identify areas where in-depth knowledge would be needed in these centres, identify need for additional research centres, if any, particularly centres to work on research for safety and regulatory purposes.

### 13.1.11 SSG-16 Element 11 Radiation protection

Nigeria has used radiation technologies for many years and has the necessary awareness on radiation protection in nuclear facilities and activities. Adequacy of the regulatory structure for radiation protection was reviewed in detail by the IRRS team. Radiation protection in nuclear facilities and activities are within the jurisdiction of NNRA.

NNRA may consider establishing a close relationship with relevant regulatory bodies having responsibilities for environmental impact assessment. NNRA is currently working on formalizing the process of reviewing the radiological impact assessment with a guide within the scope of environmental impact assessment.

For the purposes of the new build project, Nigeria will need to implement regulations on radiation protection and perform baseline monitoring activities on site.

### 13.1.12 SSG-16 Element 12 Safety assessment

At early phases of a new build project, the Government needs to gain an understanding of the resources necessary to conduct and review safety assessment, and implementing organizations, such as the regulatory body, operator and technical support organization, need to acquire necessary expertise in a timely manner.

NNRA and NIRPR should develop expertise on the review of safety assessments. Government should provide financial resources to NNRA for training of its personnel. This issue has been addressed under Element 09 and a suggestion has been formulated. This issue has also been addressed in Action Plan targeting 1<sup>st</sup> quarter of 2018.



### **13.1.13 SSG-16 Element 13 Safety of radioactive waste, spent fuel management and decommissioning**

The main findings regarding the safety of radioactive waste, spent fuel management and decommissioning are the lack of national policy and strategy for safety of these activities, and lack of legal provisions on ensuring the availability of funds for these activities. The Government and the NNRA should consider implementing relevant regulations as soon as possible to avoid any hindrance of the power plant project. These issues are addressed in Recommendation R5 in Section 1.7.

### **13.1.14 SSG-16 Element 14 Emergency preparedness and response (regulatory aspects)**

The overall approach to emergency preparedness and response is considered in Section 10 of this Report.

### **13.1.15 SSG-16 Element 15 Operating Organization**

The operating organization has not been established yet. NAEC acts as operating organization to undertake the roles and responsibilities of the operating organization during early phases of embarking on nuclear power programme.

### **13.1.16 SSG-16 Element 16 Site survey, site selection and evaluation**

Site survey activities were initiated by the end of 2007 by NAEC. The IAEA Guide NS-R-3 was used as the technical basis for choosing the possible sites. Exclusion, avoidance and suitability criteria covering security, availability of cooling water, accessibility as well as engineering requirements were used in the subsequent selection of four candidate sites from the seven potential areas.

At the request of Nigeria, IAEA provided support in the siting process implemented in Nigeria. Based on the ranking criteria, number of candidate site has been reduced to two, Geregu and Itu sites. The detailed site characterization studies to validate their suitability and identification of appropriate site-specific design criteria will be conducted with the vendor (FTP) during the next phase of siting. There is no further activity conducted on site. NAEC may consider initiation of radiological monitoring activities to identify the baseline.

NNRA should consider developing guidance for the applicant regarding the format and content of the application, and review and assessment procedures as a part of its management system for this application identifying the issues to be focused on. These issues are addressed in Recommendation R7 in Section 3.6 and Suggestion 13 in Section 9.1.

### **13.1.17 SSG-16 Element 17 Design safety**

There are several side issues regarding the design safety. Grid reliability should be addressed at early stages of the project, to identify the need for enhancement of the grid in due time to ensure safe design, construction and operation of the nuclear power plant and commence with the enhancement activities by the phase two so that the grid can withstand the sudden loss of the largest unit without compromising the safety of nuclear power plant.

NNRA has drafted a regulation on design requirements for NPPs. The regulatory approach used for drafting was performance based which was discussed under the Element 04. The regulation on design will be required prior to formulating bid specifications, and should include all technical details for the use of the operating organization.

The draft regulation in design and construction of nuclear power plants addresses fundamental safety functions, defence in depth concept, definitions of plant states, design basis, design extension conditions and design limits and it should receive a high priority when issuing regulations.

### **13.1.18 SSG-16 Element 19 Transport Safety**

Regulating the transport of nuclear materials, radioactive waste originated from nuclear activities and spent fuel is within the scope of responsibility of NNRA under the transport of radioactive materials. This topic has been reviewed by IRRS team members in detail and necessary recommendations and suggestions have been formulated under the Modules 5 to 9.

### **13.1.19 SSG-16 Element 20 Interfaces with nuclear security**

This element is discussed in Section 12.

## **13.2. SUMMARY**

The intention to build a NPP in Nigeria was stated first in the National Energy Policy approved in 2003. Initial steps were taken regarding the new build, such as establishing regulatory body (NNRA) and coordinating organization (NAEC), initiating the siting activities and determining two candidate sites.

Having dealt with construction, authorization and operation of the research reactor, NNRA became more familiar with the nuclear safety. NNRA has used this experience to draft the regulations that would be needed at early stages of the nuclear power program. These drafts include replacing the Act 19 with NSSF Bill and several draft regulations on NPP safety and licensing. As the finalization of the drafts are prolonged, they could be outdated or would be late for the nuclear power project, since draft regulations cannot be used as the basis for the design, and review and assessment purposes.

The IRRS team has observed that NNRA may face a challenge in implementing a performance-based regulatory approach in line with the guidance provided in SSG16 para. 2.64.

NNRA lacks sufficient funds to address its competency needs as identified in 2013.

The IRRS team emphasizes the benefit of repeating the self-assessments based on the IAEA guidance in SSG-16 as the nuclear power programme progresses in order to monitor progress at different stages.

## **APPENDIX I POLICY ISSUES**

### **Independence of the Regulatory Body**

This policy issue discussion focused on providing some insights on enhancing effective independence of NNRA. The challenges that NNRA faces in ensuring effective independence is the length of time that takes to enact a legislation but also the composition of the board, some members being from organizations responsible for promoting nuclear and radiation technology or use radiation sources.

The IRRS team also noted enacting new legislation is a challenge for many countries due to the normally lengthy process. The IRRS team shared experiences that in some countries executive orders of the highest level of government could provide as a transition measures until the required legislation is enacted and enters into force. An experience was shared that sensitization activities to the legislative bodies on the urgency of the need also enhances the process.

The IRRS team noted that independence could be de jure and de facto and independence is effective independence considering that a government entity has to report to another government organization. The independence could also be financial independence that regulatory funds are directly provided by the Government and from undue influence in the decision making process. The IRRS team members shared that in some countries regulatory bodies were established under organizations with responsibilities for promoting nuclear and radiation technology and to ensure the independence, the national legal framework was revised to provide functional separation of the regulatory body from those organizations that has promotional responsibilities. De facto independence has to be reflected in the regulatory process including by the staff of the regulatory body in conducting their regulatory activities. Independence issue could affect the credibility of the regulatory body and affect its effectiveness.

The IRRS team shared that in some countries, members of the Board are made full time members, instead of a group that convenes at certain time interval, to ensure that members are not affiliated to any organization avoiding any potential conflict in the decisions of the regulatory body. Awareness creation programmes for Board members and other government decision makers on the need for effective independence of the regulatory body, including sharing experience from other countries, would be beneficial.

### **Openness, transparency and stakeholders' involvement (including public communications)**

The focus of this policy discussion was to provide NNRA with insights on how other Member States reach out to the public using public hearings, the media and by conducting public workshops and meetings. The major challenges that NNRA faces in communications with stakeholders in Nigeria are the negative view of the public regarding the nuclear industry, transparency of its regulatory functions and how to consult with local citizens. NNRA was also interested in methods to better inform the public on their role in the safe oversight of nuclear and radiological facilities and activities, including explaining the regulatory processes (e.g., licensing, inspection, enforcement and emergency response).

The IRRS team noted that many countries that are considering initiating a nuclear power programme struggle with the same difficulties. To gain public trust and confidence NNRA needs to demonstrate that it is a strong regulator. The public needs to be able to trust NNRA in the protection of the public and environment. One way to accomplish this is to make all regulatory decisions transparent to the public by making them publicly available and easily accessible, such as, for example, making as much information on regulatory decisions available on the NNRA website.

Other advice provided by the IRRS team included ensuring that NNRA communicate using simple language and avoiding highly technical information. When discussing the risks associated with the use of

nuclear power NNRA should consider comparing the risks to other, more common, activities that the public experiences periodically or even every day (e.g., dental X-rays, exposure to the sun, background radiation).

The IRRS team suggested that NNRA start holding public meetings and workshops near the proposed sites for the NPPs. NNRA should reach out to the public early and ask the residence what their concerns and questions are.

It was also suggested that NNRA reach out to regulatory forums, such as the IAEA Regulatory Cooperation Forum, for assistance in conducting workshops on public outreach and visit the regulatory bodies of countries with more advanced nuclear power programmes to learn how they address this issue.

### **Enhancing NNRA effectiveness and competence**

NNRA is exploring approaches to enhance the effectiveness and competence of its regulatory functions. Specifically, NNRA would like to improve its effectiveness in training its staff, retaining competent staff and developing its regulatory documents (e.g., guides, procedures, etc.).

To improve its effectiveness and competence, NNRA faces several challenges including obtaining sufficient resources from the government, finalizing MoUs with regulatory bodies from countries with advanced nuclear power programmes and the identification and solicitation of TSOs to assist in the regulatory processes.

The IRRS team emphasized that NNRA cannot be effective if it is not competent. Competency is gained by classroom and in-the-field training. Neither of these is possible without sufficient funding from the Government. However, NNRA cannot expect an overabundance of resources and must learn to efficiently use what it is provided.

The way in which the regulator interacts with the licensee is also important. Communications must be very clear to convey regulatory expectations to the licensee. Strong communications are extremely important during authorization and inspection activities. To be effective in these activities NNRA needs to establish processes and procedures to ensure consistency and predictability in their decision making.

The IRRS team discussed training options used in their countries. First, it is very important to identify the specific training needs for the regulatory body. The regulatory body then must identify the most efficient way to obtain effective training. For example, one country developed its own training centre. If the training centre could not provide the specific training the regulatory body, then it looked to other training and educational institutions in the country. Only when the regulatory body could not obtain the desired training within the country did it look outside. This was an efficient way to expend its limited financial resources.

To improve effectiveness, the IRRS team also suggested NNRA increase its use of sharing information with stakeholders and should strive to make as much information about its regulatory activity and processes available on its website as possible.

## APPENDIX II

## LIST OF PARTICIPANTS

| INTERNATIONAL EXPERTS |                    |  |                                    |
|-----------------------|--------------------|--|------------------------------------|
| 1.                    | MATTEOCCI Lamberto | National Institute for Environmental Protection and Research (ISPRA) | lamberto.matteocci@isprambiente.it |
| 2.                    | MANSOOR Faizan     | Pakistan Nuclear Regulatory Authority (PNRA)                         | f.mansoor@pnra.org                 |
| 3.                    | SEVERA Reward      | Radiation Protection Authority of Zimbabwe                           | rsevera@rpaz.co.zw                 |
| 4.                    | SLOKAN DUSIC Darja | Ministry of the Environment and Spatial Planning                     | Darja.Slokan-Dusic@gov.si          |
| 5.                    | AIZPURIETE Agnese  | Radiation Safety Centre of State Environmental Service of Latvia     | agnese.dravniece@rdc.vvd.gov.lv    |
| 6.                    | HOFFMANN Michael   | Federal Office for the Safety of Nuclear Waste Management            | michael.hoffmann@bfe.bund.de       |
| 7.                    | GANDOLIN Mickael   | Autorité de sureté nucléaire (ASN)                                   | mickael.gandolin@asn.fr            |
| 8.                    | PERRIN Marie-Line  | Senior Safety Expert   | marie-line.perrin@wanadoo.fr       |
| 9.                    | ECONOMIDES Sotiris | Greek Atomic Energy Commission (EEAE)                                | sotiris.economides@eeae.gr         |
| 10.                   | ZEROUAL Soumia     | National Centre for Radiation Protection                             | soumia_ze@yahoo.com                |
| 11.                   | VANURADHA Anuradha | Atomic Energy Regulatory Board (AERB)                                | vanuradha@aerb.gov.in              |
| 12.                   | ALTAN Serhat       | Turkish Atomic Energy Authority (TAEK)                               | Serhat.Altan@taek.gov.tr           |
| IAEA STAFF MEMBERS    |                    |  |                                    |
| 1.                    | HAILU Teodros      | Division of Radiation, Transport and Waste Safety                    | T.Hailu@iaea.org                   |

|                        |                  |  |                       |
|------------------------|------------------|--|-----------------------|
| 2.                     | KOBETZ Tim       | Division of Nuclear Installation   | T.J.Kobetz@iaea.org   |
| 3.                     | DOETSCH Rebeka   | Division of Radiation, Transport and Waste Safety                                    | R.Doetsch@iaea.org    |
| <b>LIAISON OFFICER</b> |                  |  |                       |
| 1.                     | Mr. Godwin Omeje | Liaison Officer<br>Department of Nuclear Safety,<br>Physical Security and Safeguards | ogomeje2002@yahoo.com |

## APPENDIX III

## MISSION PROGRAMME

### NIGERIA IRRS MISSION PROGRAMME, 2 – 12 July 2017

| <b>IRRS MISSION PROGRAMME</b>                |  |   |
|--|--|---|
| <b>Sunday, 2 July 2017</b>                   |  |   |
| <b>IRRS Initial IRRS Review Team Meeting</b> |  |   |
| 13:30 - 17:30                                | Opening remarks by the IRRS Team Leader<br>Introduction by IAEA<br>Self-introduction of all attendees<br>IRRS Process (IAEA)<br>Report writing (IAEA)<br>Schedule (TL, IAEA, LO)<br>First impression from experts arising from the Advanced Reference Material (ARM) (All Experts)   | Venue: <i>Rockview Royale Hotel</i><br>Participants: the IRRS Team + 2 Management Staff + the LO + 1 other Officer<br>Total number of participants = 20<br>Welcome reception (Dinner)                 |
| 18:30 –20: 30                                | Administrative arrangements (IRRS Liaison Officer, IAEA): Detailed Mission Programme<br>Welcome Reception (Dinner)   |   |
| <b>Monday, 3 July 2017</b>                   |  |   |
| <b>IRRS Entrance Meeting</b>                 |  |   |
| 09:00 – 12:00                                | 09:00 Arrival, registration,<br>09:30 (Government Official) – Welcoming Address<br>09:45 IRRS Coordinator – The IRRS programme<br>10:00 IRRS Team Leader – Expectations for the Mission and introduction of the IRRS Team<br>Introduction of the Main Nigerian Counterparts<br>Group photo of the meeting participants<br>10:30 Coffee<br>11:00 NNRA Presentation – Regulatory Overview, SARIS results (strength, challenges, action plan) | Venue: <i>Rockview Royale Hotel (Coffee/Lunch in Hotel)</i><br>Participants: High Level Government Official, NNRA Management and staff, Officials from relevant organizations, the IRRS Team + the LO |
| 12:00 – 13:00                                | Lunch  | <i>Rockview Royale Hotel</i>  |
| 13:00 -13:30                                 | Travel to NNRA headquarters  |   |
| 13:30 – 17:00                                | Interviews and Discussions with Counterparts (parallel discussions)  | IRRS Reviewers<br>Counterparts offices: NNRA Headquarters   |
| 17:00-17:30                                  | Travel to <i>Rockview Royale Hotel</i>   |   |

| <b>IRRS MISSION PROGRAMME</b>         |  |  |
|---------------------------------------|--|--|
| 17:30 - 18:30                         | Daily IRRS Review Team meeting   | Venue: <i>Rockview Royale Hotel</i><br>Participants: the IRRS team + LO. |
| 18:30-                                | Writing the report   | IRRS team  |
| <b>Tuesday, 4 July 2017</b>           |  |  |
| <b>Daily Discussions / Interviews</b> |  |  |
| 09:00 – 17:00                         | Interviews and discussions with counterparts (parallel discussions)  | Counterparts offices: NNRA headquarters                                  |
| 12:00 – 13:00                         | Lunch  | NNRA Headquarters  |
| OVP;HMSPR                             | Visit Government /Ministry(ies)  | Participants: IRRS TL, DTL, TC ,<br>DTC Reviewer Modules 1,2, and 3      |
| 17:00-17:30                           | Travel to <i>Rockview Royale Hotel</i>   |  |
| 17:30 – 18:30                         | Daily IRRS Review Team meeting   | Venue: <i>Rockview Royale Hotel</i><br>Participants: the IRRS team + LO. |
| 18:30-                                | Writing the report   | IRRS team  |
| <b>Wednesday, 5 July 2017</b>         |  |  |
| <b>Daily Discussions / Interviews</b> |  |  |
| 09:00 – 17:00                         | Follow-up interviews and discussions with counterparts for all modules   | Counterparts offices: NNRA Headquarters                                  |
| 08:30 – 17:00                         | Site Visit (National Hospital Abuja; Gamma Irradiation Facility, Sheda Abuja; Center for Energy Research and Trainings, Zaria) | NNRA Inspectors and IRRS Team  |
| 12:00 – 13:00                         | Lunch  | NNRA Headquarters  |
| 13:00 – 17:00                         | Writing first draft of preliminary findings (Rs, Ss and GPs)   | IRRS team  |
| 17:00 – 17:30                         | Travel to <i>Rockview Royale Hotel</i>   |  |
| 17:30 – 17:45                         | Quick briefing on site visits  | IRRS team  |
| 17:45– 20:30                          | Daily IRRS Review Team meeting<br>(First draft of Rs, Ss)  | Venue: <i>Rockview Royale Hotel</i><br>Participants: the IRRS team + LO. |
| 20:30 -                               | Writing the report   |  |
| <b>Thursday, 6 July 2017</b>          |  |  |
| <b>Daily Discussions / Interviews</b> |  |  |
| 9:00 – 16:00                          | Follow-up Interviews and discussions with counterparts (parallel discussions as needed)  | IRRS Team<br>Counterparts Offices  |
| 12:00 – 13:00                         | Lunch  | NNRA Headquarters  |
| 16:00 – 16:30                         | Travel to <i>Rockview Royale Hotel</i>   |  |
| 16:30 – 23:00                         | Daily IRRS Review Team Meeting:  | Venue: <i>Rockview Royale Hotel</i>                                      |



## IRRS MISSION PROGRAMME

|  |   |   |
|--|---|---|
|  | observations, recommendation, suggestions and good practices  | Participants: the IRRS team + LO.                                   |
| <b>Friday, 7 July 2017</b>                       |   |   |
| <b>Daily Discussions / Interviews</b>            |   |   |
| 09:00 – 16:00                                    | Finalize Observations, Recommendations, Suggestions and Good Practices<br><br>Team members write draft report (individually). | IRRS Team   |
| 12:00 -13:00                                     | Lunch   | NNRA Headquarters   |
| 13:00 – 16:00                                    | Policy issue discussion:<br>Parallel discussion sessions if needed  | Reviewers and Counterparts and Officers<br>Venue :NNRA headquarters |
| 16:00 – 16:30                                    | Travel to <i>Rockview Royale Hotel</i>  |   |
| 16:30 – 22:00                                    | Daily Team Meeting:<br>Cross Reading<br><br>Team finalizes Observations, Recommendations, Suggestions and Good Practices      | IRRS Team + LO<br><br>Venue : <i>Rockview Royale Hotel</i>          |
| <b>Saturday, 8 July 2017</b>                     |   |   |
| <b>Daily Discussions/ Interviews (if needed)</b> |   |   |
| 08:30 – 22:00                                    | Team finalize the report together   | IRRS Team + LO<br>Venue: <i>Rockview Royale Hotel</i>               |
| <b>Sunday, 9 July 2017</b>                       |   |   |
| 8:00 -10:00                                      | TL, DTL, TC and DTC Review the draft report and draft report submitted to NNRA for comments                                   | TL, DTL, TC and DTC<br>Venue: <i>Rockview Royale Hotel</i>          |
| 10:00-   | IRRS Team rest day and Social Event   |   |
| <b>Monday, 10 July 2017</b>                      |   |   |
| <b>Daily Discussions</b>                         |   |   |
| 08:00 – 16:00                                    | NNRA review draft report  | NNRA Headquarters   |
| 16:00 –  | NNRA submits comments to IRRS team  |   |
| 16:00- 19:00                                     | IRRS Team Reviews comments  | IRRS Team<br>Venue: <i>Rockview Royale Hotel</i>                    |

## IRRS MISSION PROGRAMME

**Tuesday, 11 July 2017**

### Daily Discussions

|               |                                     |  |
|---------------|-------------------------------------|--|
| 09:00 – 12:00 | Finalize the draft report with NNRA | Venue: NNRA Headquarters<br>IRRS Team and NNRA |
| 13:00 -       | Draft report hand over to NNRA      | IRRS Team                                      |

**Wednesday, 12 July 2017**

|               |   |  |
|---------------|---|--|
| 09:00 – 11:00 | <b>EXIT MEETING</b><br>Main findings of the IRRS mission<br>(Team Leader) | Venue: NNRA Headquarters<br><br>Participants: Government<br>Officials, NNRA<br>Management and<br>staff, Officials from relevant<br>organizations, the IRRS Team<br>+ the LO + counterparts |
|               | Remarks by NNRA in response to the<br>mission findings                    |  |
|               | Closing Remarks by IAEA Official<br>(NSRW Director)                       |  |
|               | Press Conference  |  |

## **APPENDIX IV      SITE VISITS**

1. Gamma Irradiator Facility (GIF), Sheda, Abuja
2. Center for Energy Research and Trainings, Zaria
3. National Hospital, Abuja

**APPENDIX V LIST OF COUNTERPARTS**

| <b>IRRS EXPERTS</b>  | <b>COUNTERPART</b>   |
|--|--|
| <b>RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT</b>  |  |
| Reward Severa  | Lawrence Dim<br>Timothy Akpa<br>Yau Idris<br>Nasiru Bello<br>Mbet Akpanowo<br>John Adamu |
| <b>GLOBAL SAFETY REGIME</b>  |  |
| Reward Severa  | Lawrence Dim<br>Timothy Akpa<br>Yau Idris<br>Nasiru Bello<br>Mbet Akpanowo<br>John Adamu |
| <b>RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY</b>   |  |
| Reward Severa  | Lawrence Dim<br>Timothy Akpa<br>Yau Idris<br>Nasiru Bello<br>Mbet Akpanowo<br>John Adamu |
| <b>MANAGEMENT SYSTEM</b>   |  |
| Darja Slokan Dusic   | Nasiru Bello<br>Isa Sambo<br>Tukur Faru<br>Mbet Akpanowo<br>John Adamu                   |
| <b>AUTHORIZATION, REVIEW AND ASSESSMENT, INSPECTION, ENFORCEMENT, REGULATIONS AND GUIDES – Radiation Sources</b> |  |
| Sotiris Economides<br>Agnese Aizpuriete  | Timothy Akpa<br>Tuur Faru<br>Audu Mohammed<br>John Adamu<br>Yunusa Muhammad              |

| IRRS EXPERTS  | COUNTERPART  |
|---|--|
| <b>AUTHORIZATION, REVIEW AND ASSESSMENT, INSPECTION, ENFORCEMENT, REGULATIONS AND GUIDES – Waste Management Facilities, Decommissioning</b> |  |
| Michael Hoffmann  | Samuel Oyeyemi<br>Jamil Salau<br>Tanko Yusuf<br>Taiye Jimoh                                |
| <b>AUTHORIZATION, REVIEW AND ASSESSMENT, INSPECTION, ENFORCEMENT, REGULATIONS AND GUIDES – Research Reactor</b>                             |  |
| Michael Gandolin  | Nasiru Bello<br>Akpanowo Mbet<br>Moyosola Abubakar<br>Olaide Oyedokun<br>Godwin Omeje      |
| <b>AUTHORIZATION, REVIEW AND ASSESSMENT, INSPECTION, ENFORCEMENT, REGULATIONS AND GUIDES – Transport</b>                                    |  |
| Soumia Zerioual   | Timothy Akpa<br>Yau Idris<br>Adamu Hussani<br>Sadiat Okunnubi<br>Andrew Amofuokhai         |
| <b>EMERGENCY PREPAREDNESS AND RESPONSE</b>  |  |
| Marjan Tkavec<br>Teodros Hailu  | Nasiru Bello<br>Isa Sambo<br>Saiyadi Imam<br>Ali Jidda<br>Ibrahim Abdulmajeed              |
| <b>ADDITIONAL AREAS - Medical Exposure</b>  |  |
| Marie-Line Perrin   | Timothy Akpa<br>Okoya Olatunji<br>Ige Fatima<br>Godwin Ekong<br>Mfon Ebong<br>John Ogwuche |
| <b>ADDITIONAL AREAS - Occupational Radiation Protection</b>   |  |
| Marie-Line Perrin   | Timothy Akpa<br>Okoya Olatunji<br>Ige Fatima<br>Godwin Ekong<br>Mfon Ebong                 |

| IRRS EXPERTS   | COUNTERPART   |
|--|---|
|  | John Ogwuche  |
| <b>ADDITIONAL AREAS - Interface with Nuclear Security</b>      |   |
| Faizan Mansoor   | Samuel Oyeyemi<br>Okoya Olatunji<br>Godwin Ekong<br>Mfon Ebong                                      |
| <b>ADDITIONAL AREAS – Countries embarking on Nuclear Power</b> |   |
| Serhat Alten   | Nasiru Bello<br>Adamu Abdul<br>Mbet Akpanowo<br>Ethel Ofoegbu<br>Jonathan Oruru<br>Lukman Abdulrauf |

**APPENDIX VI      RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES**

| Area |   | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices  |
|------|---|---|---|
| 1.   | <b>RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT</b> | R1  | The Government should establish a national policy on safety to fully incorporate the fundamental safety objective, fundamental safety principles and long-term commitment to safety.                    |
|      |   | R2  | The Government should ensure that the legal framework is kept up to date and corresponds to the current IAEA Safety Requirements.   |
|      |   | R3  | The Government should ensure that the NNRA is effectively independent and has functional separation from entities having responsibilities or interests that could unduly influence its decision-making. |
|      |   | R4  | The Government should assign the prime responsibility for safety and protection to the person or organization responsible for a facility or an activity.  |
|      |   | S1  | NNRA should consider formalising cooperation with all authorities having responsibilities for safety.   |
|      |   | S2  | The Government should consider establishing a documented strategy for gaining or regaining control over orphan sources.   |
|      |   | R5  | The Government should establish a national policy and strategy for radioactive waste management and safety of spent fuel, and make arrangements for decommissioning and disposal including securing     |

| Area |  | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices   |
|------|--|---|--|
|      |  |   | of financial and other resources.  |
|      |  | S3  | The Government should consider making provisions for internal dosimetry services.  |
| 2.   | <b>GLOBAL SAFETY REGIME</b>                                  | NA  |  |
| 3.   | <b>RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY</b> | S4  | NNRA should consider ensuring that there is no conflict of interest for those organizations that provide it with advice or services.   |
|      |  | R6  | NNRA should carry out a competence and skills needs analysis for all its regulatory responsibilities, and develop and implement a human resources plan to address the existing gaps.                                       |
|      |  | R7  | NNRA should develop formal processes and procedures for authorization, review and assessment, inspection and enforcement, as necessary, that are based on specified policies, principles and associated criteria.          |
|      |  | GP1   | NNRA conducts routine workshops and training for the news media to inform them about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body. |
| 4.   | <b>MANAGEMENT SYSTEM OF THE REGULATORY BODY</b>              | R8  | NNRA senior management should establish a safety policy.   |
|      |  | S5  | NNRA should consider developing a documented management policy which integrates safety, health, environment, security, human and organizational factors, quality, societal and economic considerations.                    |



| Area |                              | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices   |
|------|------------------------------|---|--|
|      |                              | R9  | NNRA should establish a documented management system in line with IAEA safety standards.   |
|      |                              | S6  | NNRA should consider strengthening the system for knowledge and information management.  |
| 5.   | <b>AUTHORIZATION</b>         | R10   | NNRA should implement fully graded approach in its regulatory activities.  |
|      |                              | R11   | NNRA should ensure that all facilities and activities that are not either explicitly exempted or approved by means of a notification process have a valid authorization.                     |
|      |                              | R12   | NNRA should establish a formal process for appeal against a regulatory decision.   |
|      |                              | R13   | NNRA should establish a formalised mechanism for using the results of authorization, review and assessment, inspection and enforcement as feedback information for the regulatory processes. |
|      |                              | R14   | NNRA should implement its regulatory requirement for an applicant's submission of an adequate demonstration of safety in support of an application for the authorization.                    |
|      |                              | R15   | NNRA should develop guidance concerning application for an authorization of the safe transport of radioactive material for carriers, consignor and consignee.                                |
| 6.   | <b>REVIEW AND ASSESSMENT</b> | S7  | NNRA should consider establishing a regulatory requirement for the operating organization to demonstrate that it has sufficient finances   |

| Area |                              | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices  |
|------|------------------------------|---|---|
|      |                              |   | to support safe operations of the research reactor.   |
|      |                              | R16   | The Government or NNRA should establish regulatory requirements for the operating organization to conduct periodic safety reviews.  |
| 7.   | <b>INSPECTION</b>            | S8  | NNRA should consider establishing criteria to select the occurrence of events significant to safety of research reactors which need to be reported and criteria to initiate reactive inspection.                                |
|      |                              | R17   | NNRA should develop and implement a plan of inspection for Research Reactor.  |
|      |                              | S9  | NNRA should consider establishing a process for tracking and following-up on recurrent problems and non-compliance noticed during the inspections.  |
|      |                              | R18   | NNRA should implement its inspection programme for radiation sources, facilities and activities at the predefined frequencies.  |
|      |                              | S10   | NNRA should consider conducting inspection on transport of radioactive material during transit.   |
| 8.   | <b>ENFORCEMENT</b>           | R19   | NNRA should establish and implement an enforcement policy within the legal framework for responding to non-compliance by authorized parties with regulatory requirements or with any conditions specified in the authorization. |
| 9.   | <b>REGULATION AND GUIDES</b> | R20   | NNRA should develop a plan for issuing regulations based upon prioritization of the facilities and activities to be regulated.  |
|      |                              | S11   | NNRA should consider developing a plan to periodically review existing regulations in line with the most recent IAEA safety   |

| Area |  | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices  |
|------|--|---|---|
|      |  |   | standards.  |
|      |  | S12   | NNRA should consider strengthening the promotion of regulations and guides to interested parties and the public.  |
|      |  | S13   | NNRA should consider developing guides on the content of safety assessment to be submitted in support of an application for the authorization of a facility or an activity.           |
|      |  | R21   | NNRA should establish a requirement for a transport organization to have a management system.   |
| 10.  | <b>EMERGENCY<br/>PREPAREDNESS AND<br/>RESPONSE</b> | S14   | The Government should consider giving explicit authority and assigning explicit responsibility to NNRA to regulate the on-site emergency arrangements of the operating organizations. |
|      |  | R22   | The Government should ensure that roles for terminating off-site emergency are clearly assigned and conditions, criteria and objectives for terminating emergency are set.            |
|      |  | R23   | NNRA should require operators to conduct periodic and independent appraisals as part of their quality management programme for emergency preparedness and response.                   |
|      |  | R24   | NNRA should improve its communication arrangement by introducing diverse means that are official and available 24/7.  |
|      |  | R25   | NNRA should establish dedicated emergency response facility or location and dedicated emergency equipment to support its response to nuclear or radiological emergencies.             |

| Area |   | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices  |
|------|---|---|---|
|      |   | R26   | NNRA should develop plans, procedures and other operational documents to support its role during nuclear or radiological emergency. |
|      |   | R27   | NNRA should introduce internal training, drills and exercises program based on systematic approach to training.                     |
| 11.1 | <b>CONTROL OF MEDICAL EXPOSURES</b>   | R28   | NNRA should revise the regulations on radiation safety for medical exposure to ensure compliance with IAEA Safety Requirements.     |
| 11.2 | <b>OCCUPTIONAL RADIATION PROTECTION</b>   | S15   | NNRA should consider establishing a computerized national registry of occupational dose records.                                    |
|      |   | R29   | NNRA should revise the regulations on occupational radiation protection to ensure compliance with IAEA safety standards.            |
| 11.3 | <b>CONTROL OF RADIOACTIVE DISCHARGES AND MATERIAL FOR CLEARANCE, ENVIRONMENTAL MONITORING ASSOCIATED WITH AUTHORIZED PRACTICES FOR PUBLIC RADIATION PROTECTION PURPOSES</b> | R30   | NNRA should incorporate requirements on clearance levels in line with the criteria of Schedule-I of GSR Part 3                      |
|      |   | R31   | NNRA should ensure that the radionuclides released to the environment comply with the conditions of the authorization.              |
|      |   | R32   | NNRA should ensure that the programmes for source monitoring and environmental monitoring are in place in all authorised facilities |
|      |   | R33   | NNRA should establish criteria and procedures for authorization of consumer products.   |
|      | <b>CONTROL OF CHRONIC EXPOSURES</b>   | R34   | The Government should ensure that all existing exposure situations are identified comprehensively and systematically evaluated to   |

| Area |   | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices   |
|------|---|---|--|
|      |   |   | determine the concern of public exposures.   |
|      |   | R35   | NNRA or other relevant authority should establish reference levels for exposure due to radionuclides in commodities.   |
|      |   | R36   | The Government should provide information on levels of radon indoors and the associated health risk and if appropriate establish and implement an action plan for controlling public exposures.  |
| 12.  | <b>INTERFACE WITH NUCLEAR SECURITY</b>  | R37   | The Government should ensure that, within the governmental and legal framework, adequate infrastructural arrangements are established for interfaces of safety with arrangements for nuclear security and with the State system of accounting for, and control of, nuclear material.     |
| 13.  | <b>INTRODUCTION TO TAILORED MODULE FOR COUNTRIES EMBARKING ON NUCLEAR POWER</b> | S16   | The Government should consider providing further clarification in draft NSSS Bill on allocation of responsibilities of the licensee and different authorities that would perform regulatory functions in a NPP project, taking into account nuclear safety in facilities and activities. |
|      |   | S17   | The Government should consider commencing communicating its nuclear power program to neighbouring countries.   |
|      |   | S18   | The NNRA should consider finalising the agreements with regulatory bodies of States with advanced nuclear power program to seek advice on safety related matters.  |
|      |   | S19   | NNRA should consider developing a strategy for prioritizing the development of regulations and guides relevant to safety of NPPs.  |

| Area |  | R: Recommendations<br>S: Suggestions<br>G: Good Practices | Recommendations, Suggestions or Good Practices   |
|------|--|---|--|
|      |  | S20   | The Government should consider assessing the competence of existing organizations that can provide technical support to NNRA or operating organization, and performing a gap analysis to identify areas in which these organizations need further support. |
|      |  | S21   | The Government should consider providing enough financial resources to NNRA to develop and implement its human resource and competence development plans.  |

## APPENDIX VII REFERENCE MATERIAL USED FOR THE REVIEW

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| 3.  | NNRA 006- NIGERIAN TRANSPORTATION OF RADIOACTIVE SOURCES REGULATIONS 2006.pdf                               |
| 4.  | NNRA 007- NIGERIAN RADIATION SAFETY IN INDUSTRIAL RADIOGRAPHY REGULATIONS 2006.pdf                          |
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| 6.  | NNRA 009- NIGERIAN RADIATION SAFETY IN NUCLEAR MEDICINE REGULATIONS 2006.pdf                                |
| 7.  | NNRA 010- NIGERIAN RADIATION SAFETY IN RADIOTHERAPY REGULATIONS 2006.pdf                                    |
| 8.  | NNRA 011- NIGERIAN RADIATION SAFETY IN INDUSTRIAL IRRADIATOR REGULATIONS 2008.pdf                           |
| 9.  | NNRA 012- NIGERIAN NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM) REGULATIONS 2008.pdf                    |
| 10. | NNRA 013- NIGERIAN RADIATION SAFETY IN NUCLEAR WELL LOGGING REGULATIONS 2008.pdf                            |
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| 18. | NNRA 024- DRAFT NIGERIAN REGULATIONS ON PHYSICAL PROTECTION OF NUCLEAR MATERIAL AND NUCLEAR FACILITIES, 2016.pdf              |
| 19. | NNRA 025- DRAFT REGULATIONS ON SAFETY OF RESEARCH REACTORS.pdf  |
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| 22. | NNRA 027- DRAFT NIGERIAN TRANSPORTATION OF RADIOACTIVE MATERIALS REGULATIONS, 2016.pdf  |
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| 24. | NNRA 030- DRAFT NIGERIAN RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL MANAGEMENT REGULATIONS.pdf                                  |
| 25. | NNRA 031- DRAFT STRATEGY-NATIONAL PLAN FOR THE SAFE AND SUSTAINABLE MANAGEMENT , 2013.pdf                                     |
| 26. | NNRA 032- DRAFT NIGERIA RADIOACTIVE WASTE MANAGEMENT POLICY AND STRATEGY FRAMEWORK, 2013.pdf                                  |
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| 36. | NNRA 050- MINIMUM STANDARDS FOR ACCREDITATION OF RADIATION SAFETY ADVISERS (RSA)-CONSULTANT.pdf               |
| 37. | NNRA 051- NNRA MINIMUM REQUIREMENTS FOR AUTHORIZATION OF DIAGNOSTIC RADIOLOGY FACILITIES IN NIGERIA.pdf       |
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| 52. | Interfaces with nuclear security.pdf  |
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| 60. | 03. Responsibilities and Functions of the Regulatory Body.pdf                       |
| 61. | 04. Management System for the Regulatory Body.pdf                                   |
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| 70. | Final ARM report  |

## **APPENDIX VIII IAEA REFERENCE MATERIAL USED FOR THE REVIEW**

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7. INTERNATIONAL ATOMIC ENERGY AGENCY – Decommissioning of Facilities General Safety Requirement Part 6, No. GSR Part 6, IAEA, Vienna (2014)
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21. INTERNATIONAL ATOMIC ENERGY AGENCY – Safety Assessment for the Decommissioning of Facilities Using Radioactive Material, Safety Guide Series No. WS-G.5.2, IAEA, Vienna (2009)
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23. INTERNATIONAL ATOMIC ENERGY AGENCY - Disposal of Radioactive Waste Specific Safety Requirements 5, No. SSR 5, IAEA, Vienna (2011)

## APPENDIX IX ORGANIZATION CHART

