



OCCUPATIONAL RADIATION PROTECTION APPRAISAL SERVICE (ORPAS)

MISSION TO THE FEDERAL REPUBLIC OF NIGERIA

10 – 15 July 2022

Conducted under the IAEA Project on Occupational Radiation Protection and the IAEA Project under Technical Co-operation Programme

DEPARTMENT OF NUCLEAR SAFETY
AND SECURITY
Division of Radiation, Transport and Waste Safety

DEPARTMENT OF TECHNICAL
CO-OPERATION
Division for Africa



Occupational
Radiation Protection
Appraisal Service
ORPAS

The ORPAS Mission was conducted under the IAEA Project on Occupational Radiation Protection, using funds from the Extra Budgetary Project financed from USA: “Enhancing Radiation Protection through the Occupational Radiation Protection Appraisal Service (ORPAS) in the Member States” (Project #126/4) and the Technical-Co-operation Project RAF9068 – “Enhancing Regional Capabilities on Occupational Radiation Protection (AFRA)”.

OCCUPATIONAL RADIATION PROTECTION APPRAISAL SERVICE

MISSION REPORT TO THE GOVERNMENT OF FEDERAL REPUBLIC OF NIGERIA

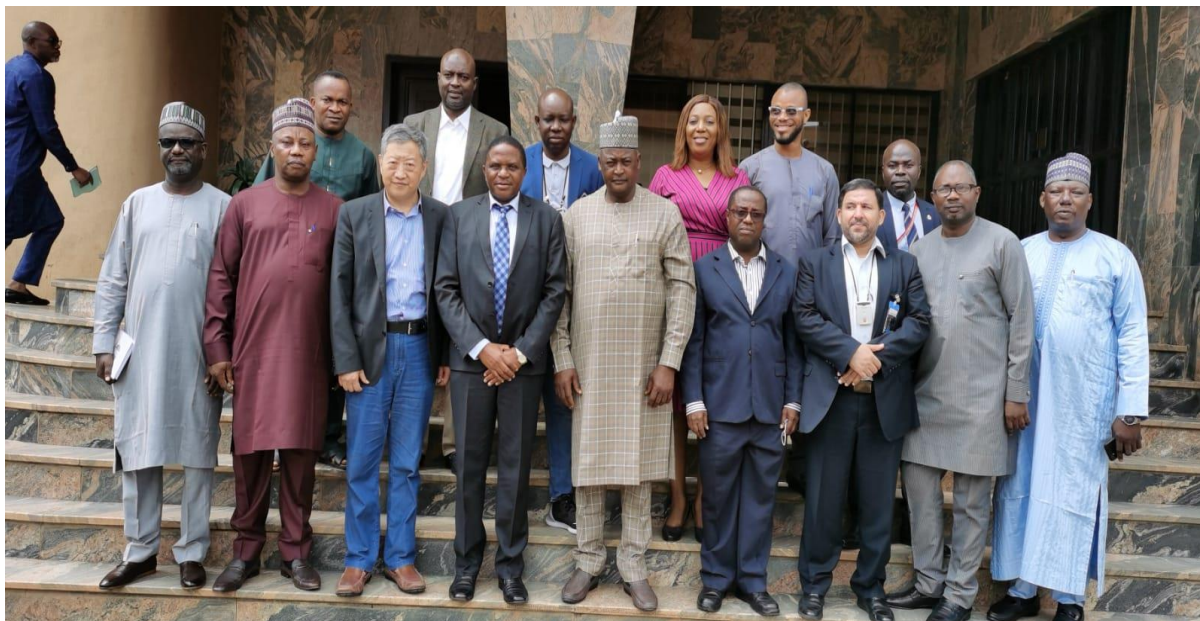
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Organized by: IAEA

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This mission was conducted under the IAEA project on occupational radiation protection, using funds from the IAEA Extra Budgetary project financed from USA: Enhancing Radiation Protection through the Occupational Radiation Protection Appraisal Service (ORPAS) in the Member States (Project #126/4) and the TC project RAF9068 - Enhancing Regional Capabilities on Occupational Radiation Protection (AFRA).

The number of recommendations, suggestions and good practices is in no way a measure of the occupational radiation protection status and arrangements of participating organisations in the host country.

Comparisons of such numbers between ORPAS reports from different countries should not be attempted.

EXECUTIVE SUMMARY

At the request of the Government of the Republic of Nigeria addressed to the International Atomic Energy Agency (IAEA) to conduct an Occupational Radiation Protection Appraisal Services (ORPAS) mission, the Agency organized the ORPAS in the Republic of Nigeria during 10-15 July 2022 with a Team of five international experts that include a Team Leader and an Agency Coordinator. The Nigeria Nuclear Regulatory Authority (NNRA) acted as the national contact point for the mission.

The purpose of this mission was to appraise the regulatory and practical implementation of the occupational radiation protection arrangements in Nigeria. Prior to this mission, a pre-mission was conducted to determine the participating organizations, arrange for a self-assessment by those organizations using the ORPAS questionnaires prepared by the Agency, and to agree upon the scope and dates of the mission. Accordingly, the organizations participated in the ORPAS mission were: the NNRA (Nigerian Nuclear Regulatory Authority), two dosimetry service providers (Radiation Safety Technology (RST), and National Hospital Abuja)), one Secondary Standard Dosimetry Laboratory (SSDL), Operators including, two non-destructive testing companies and two hospitals.

The review compared the Nigeria's arrangements for occupational radiation protection against the IAEA Safety standards as the international benchmark for protection and safety. The mission was also used to exchange information and experience between the Team members and the Nigeria's counterparts. NNRA provided the review team with advance materials that are relevant to the mission including the self-assessment carried out by the participating organizations.

This report provides the main findings, recommendations, and good practices identified during the mission. In general, the main conclusions of the mission are:

1. The Occupational Radiation Protection Programmes at the Operator facilities are managed in compliance with the requirements stated in GSR Part 3;
2. The arrangements for provision of technical services comply with IAEA Safety Standards and other international standards such as those of ISO and IEC.

However, specific set of recommendations and suggestions is directed to the Regulatory body and the Managements of the facilities that were covered during the ORPAS mission. Detailed specific findings for the facilities are provided in Appendices I -VIII.

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1. INTRODUCTION

1.1 BACKGROUND

The International Atomic Energy Agency (IAEA) is authorized by its Statute to establish international standards for the safety and protection of health, environment and property against ionizing radiation. This has led to the publication, inter alia, of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (IAEA GSR Part 3). The IAEA has also a statutory responsibility to provide assistance for the application of these Basic Safety Standards (BSS) in Member States. To check whether the application of the standards is appropriate, the IAEA carries out appraisal reviews. This document is intended to assist in the appraisal of one area of application of the BSS, namely Occupational Radiation Protection (ORP).

To assist Member States in occupational radiation protection, the IAEA has published safety guides which are jointly sponsored by the IAEA and the International Labour Organization (ANNEX I). The IAEA has also published additional technical information on particular techniques. These are the specific publications against which the appraisal described in this document is conducted.

1.2 CONCEPT OF APPRAISAL

An evaluation, or appraisal, of occupational radiation protection arrangements following a development and implementation programme, and periodically thereafter, is an effective way to ensure that those arrangements are optimized and effective. An appraisal provides an opportunity for a Member State to have its occupational radiation protection programme independently assessed and evaluated. An independent assessment is often useful to maintain or enhance the effectiveness of the programme and to identify in an objective and unbiased manner the areas where improvements may be required. A secondary benefit is that an independent appraisal allows information on best practices from the host country to be made available to other Member States. It is also the intention that in due course, countries will be able to carry out their own self-assessment using similar procedures to those described in this document.

1.3 SCOPE

This document is a report of an appraisal team's mission to the REPUBLIC OF NIGERIA, primarily to check the regulatory and practical implementation of occupational radiation protection arrangements. It includes some background as to the appraisal methods that were used. Conclusions and recommendations are made for the Republic of Nigeria. The document also includes recommendations to the IAEA with regard to the structure and conducts of future such appraisals.

1.4 STRUCTURE

The document consists of four chapters of main text, supported by seven appendices that mostly provide the detailed findings of the mission.

2. DESCRIPTION OF THE OCCUPATIONAL RADIATION PROTECTION APPRAISAL SERVICE

2.1 OBJECTIVES

The purpose of the appraisal is to check the regulatory and practical implementation of occupational radiation protection arrangements. In other words, the review tries to answer the question “are the arrangements adequate and will they work?” given the national context in which they are applied. An appraisal also aims at identifying specific strengths and good practices that can be shared with other Member States. Finally, an appraisal provides a basis for determining where improvements may be required and for recommending actions to make such improvements.

In support of the purpose, the key objectives of the appraisal are to:

- provide the Republic of Nigeria with an objective assessment of the provisions for occupational radiation protection;
- identify areas where performance should be improved to meet international standards;
- make recommendations on actions to be taken to achieve such improvements; and
- identify the strengths in the host country which are unique and worthy of bringing to the attention of others.

2.2 METHODOLOGY AND EVALUATION CRITERIA

The evaluation criteria applied are based on the performance requirements as set out in the following three Safety Requirements and Guides:

- Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (IAEA General Safety Requirements Part 3 No. GSR Part 3, 2014);
- Governmental, Legal and Regulatory Framework for Safety (IAEA General Safety Requirements Part 1 No. GSR Part 1, Rev.1, 2016)
- Leadership and Management for Safety (IAEA General Safety Requirements, Part 2 No. GSR Part 2, 2016)
- Occupational Radiation Protection (IAEA Safety Standards Series No. GSG 7, 2018)

Accordingly, questionnaires have been developed by the IAEA for the purpose of gathering the necessary information against which to judge the appraised country’s provisions for occupational radiation protection. The questionnaires were developed from the BSS and the supporting safety guides. Prior to the mission, these questionnaires were made available to all persons and organizations involved in the mission for their self-assessment.

2.3 ORPAS PROCESS

The ORPAS process flowchart is provided in Figure 1. It consists of the following phases:

- Preparatory phase;
- Conduct of the mission;
- Completion and dissemination of the report and preparation of action plan by the host country;
- Follow-up mission, if requested.

The ORPAS mission is performed by an international team comprising senior experts with broad knowledge of occupational radiation protection and its application together with extensive related experience, often in specialized areas. The ORPAS Team comprises designated IAEA staff and experienced international experts and is led by a senior expert from a Member State designated as the ORPAS Team Leader.

The outcome of an ORPAS mission is a report that is submitted through official channels to the host country. The ORPAS report's initial distribution is restricted to the participants concerned (e.g., National Counterparts) by the National Coordinator, the contributors to the report and the responsible IAEA staff.

Countries are encouraged to make their ORPAS mission report public.

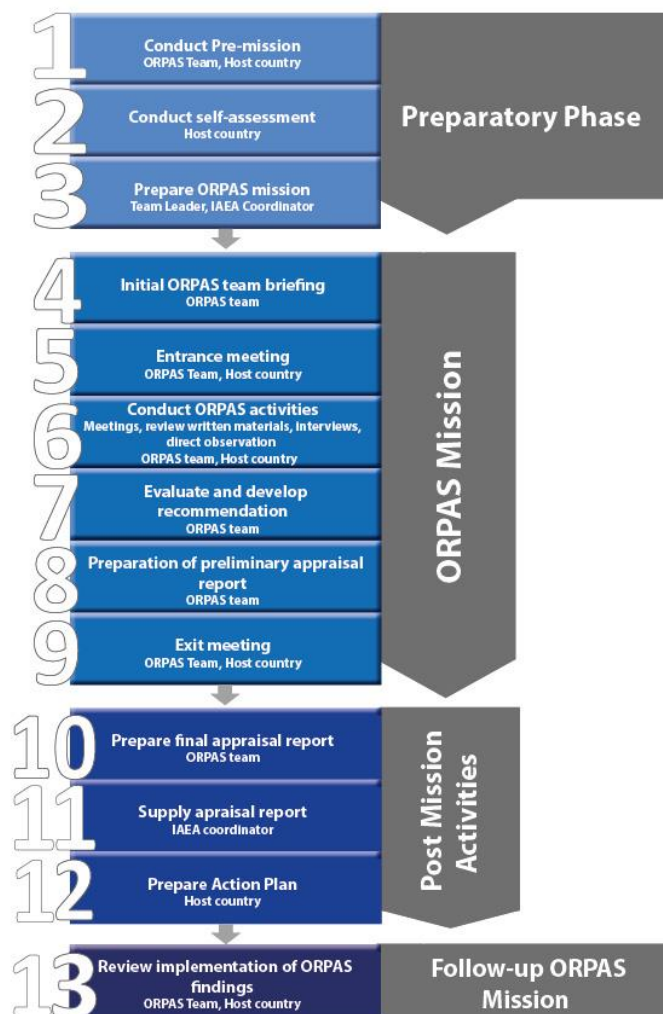


FIG.1. The ORPAS Review Process.

2.4 EVALUATION OF FINDINGS – STRENGTHS WORTHY OF SPECIAL MERIT

It is far easier to criticize and point out failures than it is to identify aspects that represent best practice or are particularly good. However, throughout the mission, the appraisal team was careful to identify those aspects that they considered to be representative of good practice in particular areas. In this context, **good practice** was considered to be an approach, methodology or system which, within the framework of the overall occupational radiation protection programme, was highly likely to achieve the required objective.

2.5 EVALUATION OF FINDINGS - WEAKNESSES AND CONSEQUENT RECOMMENDATIONS AND SUGGESTIONS

Identified deficiencies were assessed according to their perceived impact on the protection of workers, and recommendations for improvements have been made to the Republic of Nigeria.

The appraisal team considered the actual or potential consequences arising from each identified area of limited effectiveness and has reflected this in the provision of the associated recommendations or suggestions. The recommendations are proposed where arrangements to meet the IAEA Safety requirements are missing, incomplete or inadequately implemented. The recommendations are specific, realistic and designed to result in tangible improvements to the occupational radiation protection programme effectiveness. Therefore, in this report, recommendations were based on the IAEA Safety Requirements and the basis (i.e., the relevant requirements) for the recommendations was clearly documented.

Suggestions are provided where there is an opportunity for improvement, which is not directly related to inadequate conformance with the IAEA Safety Requirements. Suggestions can contribute to improvements in national arrangements for occupational radiation protection but are primarily intended to stimulate the national Counterpart's management and staff to consider new or different approaches that could enhance performance.

3. APPRAISAL PROCEDURE

3.1 THE REQUEST OF THE GOVERNMENT OF THE REPUBLIC OF NIGERIA AND RESPONSE

The Republic of Nigeria requested the IAEA, in accordance with Milestone 2 of the model project on upgrading radiation protection infrastructure, to carry out a peer review of the occupational exposure control in the country. The National counterpart for the mission was the Nigerian National Regulatory Authority (NNRA). The IAEA Coordinator contacts the host country in order to arrange a date for the preparatory meeting to discuss the scope and expectations for the ORPAS self-assessment in preparation for the review mission.

3.2 PRE-MISSION VISIT AND OUTCOMES

A pre-mission visit to the Republic of Nigeria was conducted from 5 to 7 August 2019 by Mr Wilbroad Muhogora (TAEC, Tanzania) expert on behalf of the IAEA and Mr Jizeng Ma, Unit Head, Occupational Radiation Protection, Section of Radiation Safety and Monitoring, IAEA Division of Radiation, Transport and Waste Safety as the IAEA coordinator for the mission. The mission was held in the facilities of the National counterpart at NNRA in Abuja. The mission objectives were to:

- discuss the scope of the full ORPAS mission;
- visit all potential facilities;
- provide a set of documents and tools for the self-assessment; and
- plan with the main counterpart and prepare a schedule for the subsequent appraisal mission.

The duration of the appraisal mission, the provisional schedule and the starting date were discussed with the host country, based on the availability of the participants and the completed questionnaires prior to the mission. Thus, one week mission during March 2020 was suggested. It was intended that participating organizations should complete their questionnaires and return them to the IAEA by October 2020 so that briefing material could be prepared for the mission team members. Discussions and visits were made to the potential participating facilities:

- Nigeria Nuclear Regulatory Authority (NNRA)
- SSDL in the National Institute of Radiation Protection and Research, University of Ibadan, Ibadan
- Medical facility: National Hospital Abuja
- OSL Dosimetry Service Laboratory, National Hospital Abuja
- Dosimetry service laboratory: Radiation Safety Technology -
- Industrial facility: SGS Inspection Services, Apapa, Lagos, Nigeria
- Medical facility: Reddington Multi-specialist Hospital

The industrial facility, Dorman Long Engineering Limited was added based on the communication with the ORPAS contact point after the preparatory mission.

3.3 AGREED SCOPE

During the pre-mission visit it was agreed that the mission should involve appraisals of technical services and of practices (i.e., Operators of radiation sources).

3.4 TEAM

It was decided that the scope and duration of the appraisal required a team of five experts, including the IAEA team coordinator, experienced specialists in ORP and technical service providers. The team members were recruited for the appraisal mission in accordance with IAEA procedures.

3.5 MISSION PLANNING

After receiving the relevant information and self-assessment by the counterpart, detailed planning for the mission took place during the period 10-15 July 2022. This included:

- Detailed discussions with the IAEA team coordinator;
- Study of a large amount of relevant background information and material;
- Creation of a guidance document for team members and for the NNRA counterpart (including draft programme for the full mission); and
- Compilation of an information package that was sent to team members.

3.6 MISSION PROGRAMME

The preliminary programme required slight amendments and the programme given in Annex-II was followed.

3.7 CONDUCT OF VISITS

It was agreed at the initial briefing team meeting that visits should focus on the compilation of information and data necessary to complete the template questionnaire that was relevant to the purpose of the visit. Prior to each visit, the team members had the opportunity to evaluate the pre-mission questionnaires provided by each participating organization. This was valuable in preplanning aspects of each visit and concentrating on important issues. The list of the participants met during this mission is provided as ANNEX III.

Visits included a tour of each facility in order to obtain a comprehensive understanding of the information being gathered. It was noted that the briefing meeting organized on the first of the mission had provided valuable introduction of the purpose and conduct of the appraisal to the participating organizations and relevant staff.

During each visit, the opportunity was taken to collect available documentation evidence that would be of value in the subsequent evaluation of the findings. As appropriate to each individual visit, these documents included:

- Authorization;
- Radiation protection management structure;
- Radiation protection programme;
- Control and accountability of radioactive material (if applicable);
- Control of sealed sources (if applicable);

- Radiation protection measures;
- Workplace monitoring programme;
- Individual monitoring programme;
- Staff selection, information and training;
- Co-operation to ensure the protection and safety of itinerant workers;
- Emergency arrangements (emergency plans);
- Health surveillance programme;
- Quality management systems;
- Procedures for dosimetry laboratories such as calibration protocols;
- Traceability;
- Results of performance tests or intercomparisons;
- Quality management documentation;
- Examples of optimization or ‘ALARA’ studies;
- Examples of local rules etc.; and
- Investigation reports on overexposures.

3.8 REPORTS

3.8.1 Reporting Schedule

The following reporting schedule was agreed at the exit meeting:

Action	Completion Date (<i>not later than</i>)
Compilation of first draft of report by team leader and circulation to team members for comments	4 weeks after the mission (7 August 2022)
Comments from team members back to team leader	2 weeks after receipt from team leader members (21 August 2022)
Final draft from team leader to IAEA coordinator for editing and internal approval	4 weeks after comments from team members (4 September 2022)
Approved report back to team leader for final acceptance	4 weeks after receipt from IAEA coordinator (2 October 2022)
Report returned to IAEA by team leader	Immediate (2 days) (4 October 2022)
Report sent from the IAEA to counterpart for comments	Immediate (2 days) (6 October 2022)
Comments by counterpart to IAEA coordinator	2 weeks after receipt from IAEA coordinator (20 October 2022)
Issue of final report	4 weeks after receipt from counterpart (20 November 2022. A total of 20 weeks after the mission)

The basic structure of the report includes:

3.8.2 Participating Establishments

Regulatory Authority

Nigerian Nuclear Regulatory Authority.

Operators

The following establishments with the corresponding facilities were visited:

Establishment	Facilities
National Hospital Abuja	Radiology and CT, Radiotherapy and Nuclear medicine
SGS Inspection Services Nigeria	Industrial radiography
Reddington Multi-specialist Hospital	Radiology and CT, Radiotherapy
Dorman Long Engineering Limited	Industrial radiography

Technical Services

Establishment	Services
SSDL of the National Institute of Radiation Protection and Research	Calibration
Dosimetry Service Laboratory, National Hospital Abuja	External dosimetry
Radiation Safety Technology	External dosimetry

3.9 BRIEF DESCRIPTION OF THE FACILITIES

The Institutions were classified as Regulatory authority, Operators and Technical Service Providers. All Operators carry out work involving the use of ionising radiation in two medical practices (radiotherapy, nuclear medicine, radiology) and in two industrial facilities (industrial radiography). The two industrial facilities, one medical facility and one dosimetry service provider are located in Lagos; the SSDL is located in Ibadan. The regulatory authority, one medical facility and one dosimetry service provider are located in Nigerian capital, Abuja.

4. GENERAL CONCLUSIONS AND RECOMENDATIONS OF THE APPRAISAL

On 15 July 2022, the ORPAS Team presented the conclusions and recommendations of the appraisal to the counterparts of the ORPAS mission at the Exit Meeting at NNRA.

4.1 CONCLUSIONS

In general, the main conclusions of the mission are:

1. The Occupational Radiation Protection Programmes at operator facilities are managed in compliance with the requirements stated in GSR Part 3;
2. The arrangements for provision of technical services comply with IAEA Safety Standards and other international standards such as those of ISO and IEC.

However, a set of recommendations is directed to the Regulatory body and the Managements of the facilities that were covered during the ORPAS mission.

Some good practices were identified during the mission and are listed below:

- Publication of annual report on the activities of NNRA. This provides feedback to the stakeholders thus leading to public trust and hence a motivation to improving compliance to regulatory requirements;
- The national dose registry is available and operational, and is used to confirm the compliance of licensees or registrants with the regulatory requirements;
- The Government of Nigeria has an established programme for education, training, qualification and competence in protection and safety; and
- Some operators are formally accredited or certified by recognized standard bodies.

4.2 RECOMMENDATIONS TO THE REGULATORY BODY

- The Regulatory body should enforce the requirements for the monitoring, assessment and recording of occupational exposure;
- The Regulatory body should ensure that the final draft of revised Nigeria Basic Ionizing Radiation Regulations is promulgated; and
- NNRA should include the doses of all itinerant workers in the national registry and review the related measurement programme

4.3 SUGGESTION TO THE REGULATORY BODY

- The Regulatory body should consider the inclusion of a condition of ISO/IEC 17025 accreditation in the approval of personal dosimetry and calibration services

INDIVIDUAL FACILITY SPECIFIC (NATIONAL COUNTERPARTS) OBSERVATIONS

Detailed findings of the individual facilities appraisal

Conclusions, recommendations, and suggestions

APPENDIX I: NIGERIAN NUCLEAR REGULATORY AUTHORITY

Facilities and Service:	Nigerian Nuclear Regulatory Authority
Location:	Abuja
Date:	14 July 2022
ORPAS Team:	W.Muhogora, J. Amoako, M. Zaryah, T.Solomon, J.Ma
NNRA representatives:	I. Sambo, G.Ekong, N. A. Bello, A. Hussaini, M.Vyonku

INTRODUCTION

The Nigerian Nuclear Regulatory Authority is the Regulatory Body for radiation and nuclear safety. It was established by the Nuclear Safety and Radiation Protection Act of 9th August 1995. The law provides status, functions and authority and is mainly funded from the budget of the country to implement the regulatory programme. The NNRA became operational in 2001 and it reports to the Governing Body whose Chairperson is His Excellency, President of Republic of Nigeria. The Ministry of Petroleum Resources is the deputy chairperson of the Governing Body. The headquarters of office is in Abuja and six zonal offices have been established countrywide.

GENERAL INFORMATION

The NNRA is organized as follows:

- Department of radiological safety;
- Department of nuclear safety, physical security and safeguards;
- Department of authorization and enforcement;
- Department of administration and finance; and
- The National Institute of Radiation Protection and Research.

The zone offices are available as follows:

- North central zone (in Benue State);
- Northeast zone (in Gombe State);
- Northwest zone (in Katsina state);
- South-south zone (in Rivers State);
- Southwest zone (in Lagos); and
- Southeast zone (in Enugu).

The NNRA has other four operational offices in Kwara state, Ogun state, Kano state and Maiduguri.

QUALIFIED STAFF/INSPECTORS

The organizational chart of NNRA (Figure 1) is planned for 955 total positions. At present 745 positions are filled (Technical and Non-technical), 573 of those have a university first degree, 163 masters degrees and 9 doctorate degrees. Out of these, 56 staff members of the authorization and enforcement department work solely on the implementation of regulatory programme. The current number of radiation safety inspectors nationwide is 399.

The current number of staff may be adequate to operate the national regulatory system. Despite that, there is a human resource development plan to build the necessary resources in order to cover all responsibilities efficiently and effectively.

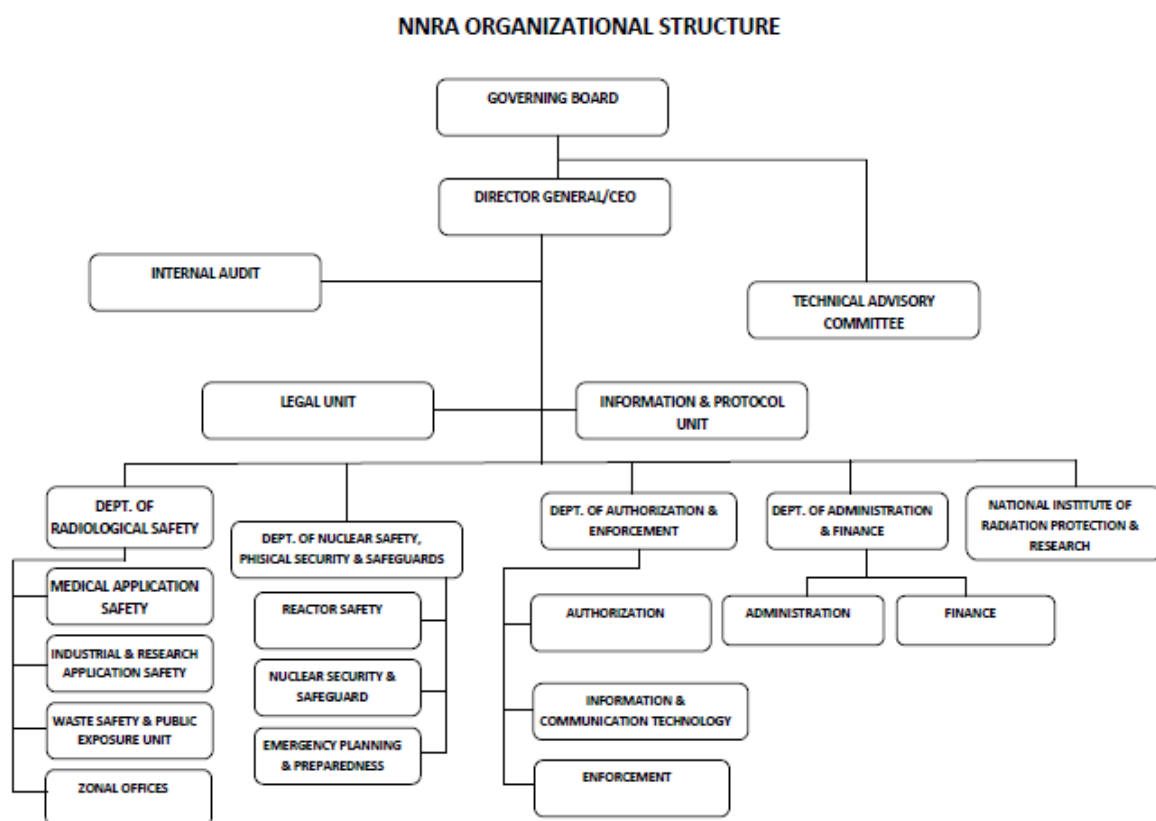


FIG. 1: Organizational chart of NNRA

EQUIPMENT

The list of available equipment at NNRA includes, but is not limited to:

- Various survey meters
- Radionuclides Identi-Finders
- Personal Dosimeters
- Backpackers
- Geiger Müller counters
- Contamination monitors
- OSL Reader / dosimeters
- Handheld HpGe detector
- Mobile radiological response equipment

Therefore, equipment arrangements are in place for monitoring and inspection of licensing facilities.

APPRAISAL FINDINGS

LEGAL REGULATORY FRAMEWORK

Currently, there are sixteen (16) regulations all in English language, which include:

- Nigeria Basic Ionizing Radiation Regulations (NiBIRR), 2003
- Nigerian Radiation Safety in Radiotherapy Regulations, 2006
- Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006
- Nigerian Radiation safety in Diagnostic and Interventional Radiation 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 Radioactive Waste Management Regulations, 2006
- Nigerian Radiation Safety in Nuclear Well Logging Regulations, 2008
- Nigerian Naturally Occurring Radioactive Materials (NORM) Regulations, 2008
- Nigerian Radiation safety in Industrial Irradiation Regulations, 2008.
- Nigerian Nuclear safeguards Regulations 2021
- Nigerian Safety of Research Regulations 2021
- Nigerian Physical Protection of Nuclear materials and Facilities Regulations 2021
- Nigerian Safety Regulations on Licensing of Site for Nuclear Power Plants 2021
- Nigerian Uranium Exploration, Mining and Processing Regulations 2021

In the current NiBIRR, 2003 responsibilities and requirements specific to occupational exposure are available. The ORPAS Team has observed that the regulatory framework based on the law and the different regulations is generally in line with IAEA GSR Part 3 requirements. Therefore, most aspects of occupational exposure control can be regulated. A revised Nigeria Basic Ionizing Radiation Regulations to achieve full compliance with GSR Part 3 requirements has been reviewed by key stakeholders and is awaiting promulgation. A copy of this draft was provided to the ORPAS Team. There is an enforcement system implemented on structured enforcement policy and procedures. The ORPAS team observed compliance at the visited centres.

NNRA is an independent regulatory body and it maintains an inventory of radiation sources using a RAIS 3.4 version.

ESTABLISHMENT OF REGULATIONS AND STAKEHOLDERS' INVOLVEMENT

Regulations are prepared and issued by NNRA in accordance with the Nuclear Safety and Radiation Protection Act 1995. In fulfilling one of its guiding values of transparency, the NNRA engage national and international stakeholders including the International Atomic Energy Agency (IAEA) to give comments before the regulations are finalized. Figure 1 summarizes the process of stakeholders' involvement during regulations development. Therefore there is a stakeholders' involvement during development of regulations, which has led to improved regulatory compliance. The regulations are approved by President of the Nigeria Republic for implementation. The enforcement is required and it is implemented in accordance to sections 32 and 45 of the Nuclear Safety and radiation protection Act, 1995, and the policy and procedure of 2021.

NOTIFICATION, AUTHORIZATION AND APPROVAL

There is functional separation of authorization and enforcement department, and other technical support departments. This enhances effectiveness of regulatory system. The requirements of notification and authorization of practices involving ionizing radiation are described in Nigerian Basic Ionizing Radiation Regulations, 2003. Authorization is by registration or licensing according to graded approach. The regulations also require the approval of dosimetry services implying also secondary standard dosimetry laboratory activities. The review of one approval certificate showed that the criteria and conditions of approval of such services is described but does not include ISO/IEC 17025 accreditation. The regulatory requirements for approval of other technical and advisory services in existing regulations are not indicated though approval of training services, dose registry, workplace monitoring, and radiation protection consultancy and maintenance services is done in practice.

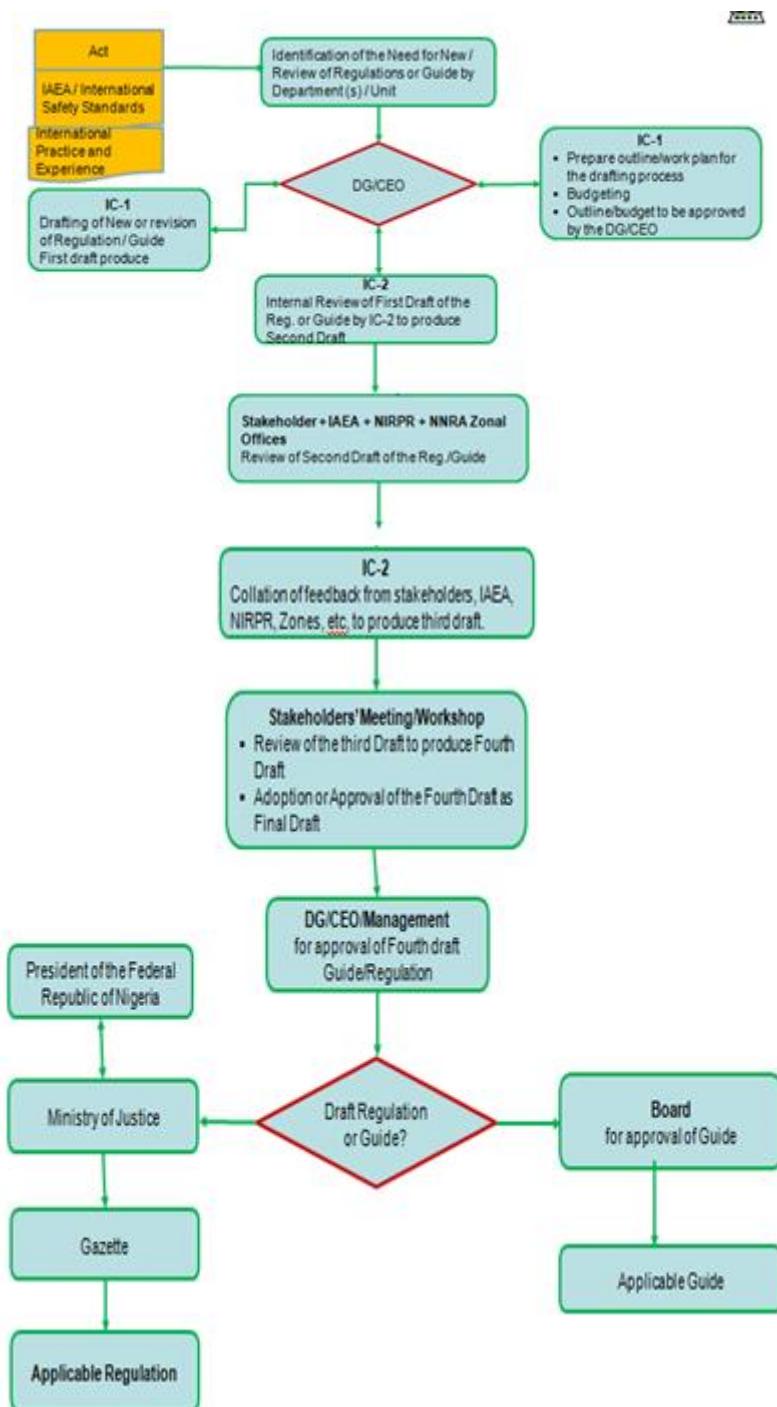


Figure 1: Development process of regulations in Nigeria

RESPONSIBILITIES

The regulations stipulate requirements of responsibilities of registrants and employers, responsibilities of workers, monitoring programs of technical services and requirements for radiation protection programme. However, they do not fully address all GSR Part 3 requirements. For example, the following are not fully addressed:

- Responsibilities of registrants and employers with regards to emergency workers, response organization, involvement of workers in optimization through their representatives, safety culture etc.
- Responsibilities of workers with regards to following applicable rules and procedures, use of hierarchy of preventive measures, provision of information on their past and current work, etc

DOSE LIMITATION AND OPTIMIZATION

Dose limits are defined in Nigerian basic ionizing radiation regulations, 2003. Except the dose limit to the eye lens, other dose limits comply to GSR Part 3 requirements. Employers or licensees are required to ensure that for activities that involve or could involve occupational exposures radiation safety is optimized. The enforcement is required in accordance to sections 32 and 45 of the Nuclear Safety and radiation protection Act, 1995, and the policy and procedure of 2021. According to these regulations, dose constraints that do not exceed dose limits can be established by NNRA. An investigation level to workers of 15 mSv or such other lower effective dose as the employer may specify, is set in regulations.

COOPERATION BETWEEN EMPLOYERS AND REGISTRANTS AND LICENSEES

The employers are required to cooperate in order to protect their employees from ionizing radiation. Such cooperation is on specific assessment of dose received by workers and clear allocation and documentation of respective responsibilities. Requirements on development and use of specific restrictions on exposure for work that is not under control of their employer and provision of previous occupational exposure history of workers are not addressed in the regulations although they are being practiced.

RADIATION PROTECTION PROGRAMME

The requirements of the elements of radiation protection programme are available in the regulations. These include designation of controlled and supervised areas, local rules and appointment of radiation safety supervisors and, dose monitoring. Others are information to non-classified persons, prevention of contamination, monitoring of designated areas, selection, maintenance and testing of equipment and monitoring and test records. Information for the authorized dosimetry service, dosimetry for accidents and health surveillance are also available. Some aspects of GSR Part 3 requirements are not addressed. For example, the requirements of administrative control and procedures with regards to designated areas are not explicitly stated.

WORKPLACE MONITORING

The requirements of monitoring of designated areas, selection, maintenance and testing of equipment used for monitoring designated areas can be considered as workplace monitoring requirements and therefore satisfactory. Detailed requirements of workplace monitoring programme including types and frequency of such monitoring are not clearly stated. The applications of workplace monitoring to review of the classification of areas and basis of such measurements i.e. dose rate, activity concentrations etc both in normal and accident conditions as well as the data availability to workers are not also fully addressed in the existing regulations.

INDIVIDUAL MONITORING

The requirements of individual monitoring and dose recording for planned and emergency exposure situations are available. Similar requirements in existing exposure situations need improvements. The dosimetry services are provided by six service providers approved by NNRA and each of these is required to submit the annual dose records to NNRA. The NNRA operates a national dose registry and undertakes annual review of dose records to establish dose distribution and trends. For example, the annual report of 2020 showed that for 1475 total monitored workers, ≤ 0.5 mSv was distributed to 74.1 % of workers. The current number of workers under individual monitoring programme is 2000. There is a need to approve dosimetry services on basis of ISO/IEC 17025 quality management system or preferably related accreditation. The ORPAS team was informed that future approval of dosimetry services will be subject to such ISO/IEC 17025 accreditation condition. The requirements for monitoring of intake are not available as they are currently not relevant. On the practice, the coverage of individual monitoring is 100% for industrial and mining sectors, while for diagnostic and interventional radiology is between 25% and 30% and therefore improvements needed. The NNRA through the department of nuclear safety, physical security and safeguards has acquired an OSL dosimetry system mainly to monitor NNRA staff and render service to improve the dosimetry coverage in diagnostic and interventional radiology. The latter need has been prompted by the fact that many of the diagnostic radiology facilities are not price competitive to commercial dosimetry service providers.

HEALTH SURVEILLANCE

The requirements of medical surveillance are available including the need for occupationally exposed worker to be under this surveillance, continued fitness check-ups by appointed occupational health physician and related records keeping. The requirements include also if a worker is exposed to a source, which is not under control of their employers. It is not clear if the requirements imply that such medical surveillance should be based on general principles of occupational health. Requirement of provision of alternative employment in case a worker is unfit for work in the existing regulations, is also not addressed.

SPECIAL ARRANGEMENTS FOR OCCUPATIONAL PROTECTION AND SAFETY

There are requirements for protection and safety for female workers and for persons fewer than 18 years of age undergoing training. These include provision of information to female pregnant on the risk to the embryo or foetus and the importance for such female worker to notify his employer as soon pregnancy is suspected or if she is breast feeding. However, there is no provision that such notification shall not be considered a reason to exclude he female worker from work. There is also no provision to ensure that in once notification is done, the employer should adapt working conditions in respect of occupational exposure to embryo, foetus or breastfed infant is afforded the same broad level of protection as required for members of the public. The regulations set a dose equivalent constraint from external radiation of 13 mSv averaged throughout the abdomen of pregnant female in any consecutive period of 3 months during the gestation period.

The regulations do not allow a person under the age of 16 years to be subjected to occupational exposure. Although the dose limit of persons under the age of 18 years is available, there is no provision the person shall be allowed to access a controlled area only under supervision and only for purpose of training for employments.

INFORMATION, INSTRUCTION AND TRAINING

Employers are required to provide appropriate information, instruction and training to workers involved in work with ionizing radiation. The information and training include health risks, precautions to be taken and importance of complying with medical, technical and administrative requirements of the regulations. The requirements of periodic training and maintenance of training records are not addressed in the existing regulations although they are being practiced as one of the authorization conditions. The requirement of training of emergency workers is not explicitly indicated.

OCCUPATIONAL EXPOSURE DUE IN EXISTING EXPOSURE SITUATIONS

There are some occupational exposure requirements on Radon and NORM while none on cosmic radiation. The ORPAS team has observed that the regulatory framework does not fully address the requirements of GSR Part 3 in terms of occupational exposure in existing exposure situations. The ORPAS team was informed that this topic is among the aspects revised and is part of regulations awaiting promulgation.

OCCUPATIONAL EXPOSURE IN EMERGENCY EXPOSURE SITUATIONS

The ORPAS team has observed that the regulatory framework does not fully address the requirements of GSR Part 3 in terms of occupational exposure in existing exposure situations. The ORPAS team was informed that this topic is among the aspects revised and is part of regulations awaiting promulgation.

RECORD KEEPING

The NNRA maintains records of the following among others

- Act, regulations and safety guides
- Inventory of radiation sources
- Notifications
- Authorized practices

- Approved dosimetry service providers
- Nuclear activities
- Nuclear security matters
- Nuclear and radiological emergency activities
- Technical services
- Review and assessment
- Inspection programme and inspection reports
- Enforcement findings and decisions
- Regulatory Authority Information System, version 3.4
- National dose registry using IAEA RAIS and a software provided from China

The records are analyzed, published in annual report and made available to the public.

QUALITY MANAGEMENT SYSTEM

NNRA has a well organized documentation system of regulatory programmes and records. It operates RAIS version 3.4 and NDR software and currently developing an integrated management system. The ORPAS team observed a strong commitment at management and staff levels demonstrated by availability of adequate resources and implementation of the national regulatory programme. A salient feature of the NNRA organization is the fact that it leads by being a good example of implementation of regulatory requirements. This transparency has created a public trust which is an important pillar to strong occupational radiation system in the country.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: Not all occupationally exposed workers in diagnostic and interventional radiology participate in individual monitoring programme	
(1)	BASIS: GSR Part 3 Requirement 20 states that <i>“The Regulatory body shall establish and enforce requirements for the monitoring and recording of occupational exposure in planned exposure situations”</i> .
(2)	BASIS: GSR Part 3 Requirement 25 states that <i>“Employers, registrants and licensees shall be responsible for making arrangements for assessment and recording of occupational exposures and for workers’ health surveillance”</i> .
R1	Recommendation: The NNRA should enforce the requirements for the monitoring, assessment and recording of occupational exposure
Observation: The final draft of the revised Nigeria Basic Ionizing Radiation Regulations reviewed by stake holders and submitted to government is not yet promulgated	
(1)	BASIS: GSR Part 3 Requirement 3 states <i>that the regulatory body shall establish or adopt regulations and guides for protection and safety and shall establish a system to ensure their implementation</i>
R2	Recommendation: The NNRA should ensure that the final draft of revised Nigeria Basic Ionizing Radiation Regulations is promulgated
Observation: The occupational exposures of some itinerant workers are unknown and not included in the national dose registry (See Appendix IV)	

(1)	BASIS: GSR Part 3, Requirement 14 states that <i>Registrants and licensees and employers shall conduct monitoring to verify compliance with the requirements for protection and safety.</i> 3.37. <i>The regulatory body shall establish requirements that monitoring and measurements be performed to verify compliance with the requirements for protection and safety. The regulatory body shall be responsible for review and approval of the monitoring and measurement programmes of registrants and licensees.</i>
R3	Recommendation: NNRA should include the doses of all itinerant workers in the national registry and review the related measurement programme
Observation: The criteria and conditions for approval of dosimetry and calibration service providers do not include accreditation in accordance to ISO/IEC 17025	
(1)	BASIS: The GSG No. 7 on the approval of dosimetry service, section 7.113 states that <i>the approval process may involve the following aspects which should be considered (b) accreditation of the management system in accordance with international standards such as Ref [90] (ISO/IEC 17025)</i>
S1	Suggestion: The NNRA should consider the inclusion of a condition of ISO/IEC 17025 accreditation in the approval of personal dosimetry and calibration services
Observation: The annual report on the progress of regulatory and technical activities is published and disseminated to the public	
(1)	BASIS: GSR Part 3 Requirement 2, section 2.19 (b) states that <i>the Government shall establish mechanisms to ensure that Interested parties are involved as appropriate in regulatory decision-making processes or regulatory decision aiding processes</i>
GP1	Good practice: Publication of annual report on the activities of NNRA. This provides a feedback to the stakeholders thus leading to public trust and hence a motivation to improving compliance to regulatory requirements
Observation: The review of occupational exposure is performed once in a year and the data used as an input to the national dose registry	
(1)	BASIS: GSR Part 3, Requirement 20, section 3.73 (d) and states that <i>the regulatory body shall be responsible, as appropriate, for:</i> <i>(d) Review of periodic reports on occupational exposure (including results of monitoring programmes and dose assessments) submitted by employers, registrants and licensees;</i> <i>(e) Provision for maintaining exposure records and results of the assessment of doses from occupational exposure</i> <i>(f) Verification of compliance of an authorized practice with the requirements on the control of occupational exposure.</i>
GP2	Good practice: The national dose registry is available and operational, and is used to confirm the compliance of licensees or registrants with the regulatory requirements
Observation: The qualification and training programme for radiation protection officers (RPO) is offered by the well-structured Institute of Radiation Protection and Research in Ibadan	

(1)	<p>BASIS: GSR Part 3, Requirement 2, Section 2.21, states that: <i>the government shall ensure that requirements are established for:</i></p> <p><i>(a) Education, training, qualification and competence in protection and safety of all persons engaged in activities relevant to protection and safety;</i></p> <p><i>(b) The formal recognition of qualified experts;</i></p> <p><i>(c) The competence of organizations that have responsibilities relating to protection and safety.</i></p>
GP3	<p><u>Good practice:</u> The Government of Nigeria has an established programme for education, training, qualification and competence in protection and safety</p>

APPENDIX II: RADIATION SAFETY TECHNOLOGY (RST)



Facilities and services:	Radiation Safety Technology, Individual Monitoring of External Radiation
Location:	Lagos
Date:	11 th July 2022
ORPAS Team:	Wilbroad MUHOGORA, Tshegofatso SOLOMON, Jizeng MA
Persons met:	Mr Solivajs, Director for Dosimetry Services and Radiation Protection Officer
NNRA Staff:	Taye ADEWARA

INTRODUCTION

The scope of the visit to Radiation Safety Technologies (RST) was to assess its ability to provide individual monitoring of external radiation services (IMERS) for the end users/operators in Nigeria. The visit started with an entrance meeting to provide the participating RST staff with an introduction to the purpose and conduct of the appraisal. During the visit, the team had the opportunity to review the following which assisted in the evaluation:

- Registration certificate
- Quality management system
- Calibration and system performance assessment
- Dose reports
- Interaction with customers, and
- Specimen of dosimeters

The visit concluded with an exit meeting to inform the RST staff findings and recommendations of the evaluation.

GENERAL INFORMATION

The RST was established in 2000 as the first private IMERS provider and is authorized to provide IMERS in the field of occupational exposure. The RST provides individual monitoring service with thermoluminescent dosimeter (TLD) technology using an automated Harshaw 6600 Plus TLD reader system and a manual Harshaw 4500 TLD reader system as a backup. The two TLD reader systems use two element Harshaw dosimeters. However, the latter is currently malfunctioning. The TLD systems are both connected to same power stabilization and uninterruptible power supply (UPS) systems. Currently, RST monitors 1310 occupational exposed workers in different sectors.

APPRAISAL FINDINGS

LEGAL REQUIREMENTS

According to Nigerian Basic Ionizing Radiation Regulations, (NiBIRR) of 2003, technical services that provide individual monitoring are required to be authorized by NNRA. RST has a registration certificate NNRA/DSP/AUT/ACR/437/2022, which was issued on 30th May 2022 and will expire after two years. To receive a renewal in the registration, the registrant must carry a proficiency test six month before at a laboratory traceable to Secondary Standard Dosimetry Laboratory in Nigeria and report submitted to NNRA. The scope of registration is the measurement of personal dose equivalent at depth, 10 mm, Hp(10) and personal dose equivalent at depth, 0.07 mm, Hp(0.07).

DOSIMETRIC QUANTITIES

The dosimetric quantity used for monitoring and reporting occupational exposure is Hp(10) for photon (gamma and x-ray) radiation. Skin dose (quantity Hp(0.07)) is also measured but extremity doses (hp(0.07), eye lens doses (Hp(3)) and neutron doses are not measured. The dosimetry system is capable of measuring doses up to 10 Sv for emergency exposure situations. The laboratory uses control (transport) dosimeters for background subtraction

MONITORING FREQUENCY

The monitoring frequency is one month for oil and gas industry as per regulatory requirements, two months for classified workers or quarterly for medical and industrial sectors.

CALIBRATION

The RST laboratory does calibrate its TLD reader systems on annual basis, its irradiations for calibration TLDs is performed at the SSDL in the Nuclear Institute of Radiation Protection and Research in Ibadan.

TYPE TESTING

RST does not conduct type testing for its new TLDs

PERIODIC AND PERFORMANCE TESTING

RST conducts performance testing with the NNRA and it does not participate in any proficiency testing exercises.

DOSE RECORD KEEPING AND REPORTING

RST maintains its dose records in the laboratory and sends dose results reports to the regulator (NNRA) on quarterly basis for the national dose registry updating. Currently RST has no automated laboratory information management system software and uses Microsoft excel spreadsheet for managing its dose records database.

INTERCOMPARISON

RST has not yet participated in any intercomparison exercise.

STAFFING AND TRAINING

RTS is staffed with eight (8) technical personnel and duties separated for each staff as per their positions. RST staff was trained during installation and commissioning of the TLD reader systems by the manufacturers.

WORK PROCESSES IN THE LABORATORY

The laboratory does not have Quality Management System on the basis of ISO/IEC 17025 standard. It has however started the process to accreditation as it is in contact with the accreditation body in Ghana. RST has a procedure for operation of its dosimetry systems.

UNCERTAINTY ASSESSMENT

The RST Laboratory does not calculate its measurement uncertainty.

CUSTOMER FEEDBACK

RST conducts customer survey/feedback. The laboratory sends customer survey questionnaire through email to its customers.

RELIABILITY OF SERVICE

RST has trained personnel and have two TLD systems though the back-up system is under maintenance. The stabilization and UPS systems are working though both TLDs systems use one system.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: The dosimetry service does not have a comprehensive system for maintaining dose records of its workers	
(1)	BASIS: GSR Part 3 requirement 25 Section 3.103 states that <i>employers, registrants and licensees shall maintain records of occupational exposure for every worker for whom assessment of occupational exposure is required.</i>
R4	Recommendation: The Dosimetry Service should have a suitable tool for Dose Record Management
R5	Recommendation: The Dosimetry Service should develop a QMS according to ISO/IEC 17025 standard
Observation: The dosimetry service does not perform neither type testing nor uncertainty estimation	
(1)	BASIS: GSG No.7 section 7.72 states that <i>type testing of a dosimetry system for external exposure involves testing the performance characteristics of the system as a whole under irradiation condition and storage conditions. In particular, those sources of uncertainty discussed in paras 7.64-7.67 should be quantified.</i>
(2)	BASIS: GSG No.7 section 7.74 states that <i>dosimetry systems should preferably be type tested in accordance with the relevant standard of the IEC and/or ISO</i>
(3)	BASIS: GSG No. 7 section 7.82 states that <i>in addition to the type testing of a personal dosimetry system, in which the functioning of the whole system is carefully analysed in order to verify that it meets the accuracy criteria, performance testing should be conducted at regular intervals (typically annually) to demonstrate that this standard of performance is maintained.</i>
S2	Suggestion: The dosimetry service should consider performing type testing and uncertainty estimation according to ISO/IEC/17025 standard
Observation: The Harshaw 4500 TLD system was malfunctional and the laboratory had no capability to repair the equipment	
	BASIS: GSG No. 7 section 8.87 state that <i>the laboratory should possess adequate equipment to perform the necessary services for the customers, including sampling, sample preparation, measurement or calibration, calculations and reporting. The equipment necessary to produce the results of measurements should be functional and should be capable of being used for day-to-day measurements</i>
S3	Suggestion: The laboratory should consider establishing the capability or the approach for routine maintenance of dosimetry system
Observation: The Harshaw 4500 TLD system was malfunctional and the laboratory had no capability to repair the equipment	
(1)	BASIS: GSG No. 7 section 8.87 state that <i>the laboratory should possess adequate equipment to perform the necessary services for the customers, including sampling, sample preparation, measurement or calibration, calculations and reporting. The equipment necessary to produce the results of measurements should be functional and should be capable of being used for day-to-day measurements</i>
S3	Suggestion: The laboratory should consider establishing the capability or the approach for routine maintenance of dosimetry system
Observation: The laboratory has not yet participated in any intercomparison exercise	

(1)	BASIS: The GSG No 7 section 7.87 states <i>that an intercomparison exercise among dosimetry service providers can be regarded as an announced performance test..... Participation in such intercomparison exercises is often a requirement for approval and also a part of QMS</i>
S4	Suggestion: The laboratory should consider regularly participating in intercomparison exercises such as those organized by IAEA under a regional project.
Observation: The laboratory maintains good working relationships with its customers by training and inviting them for visits	
(1)	BASIS: The GSG No 7 section 8.78 states <i>that in addition to maintaining good communication with clients, laboratories may be required to allow clients to monitor their performance. This can be accomplished by allowing client reasonable access to the laboratory for the purpose of witnessing tests or calibrations.</i>
GP4	Good practice: The laboratory is regularly training its customers on proper use, care and storage of dosimeters and allows them to see laboratory activities.

APPENDIX III: SGS COMPANY APAPA OFFICE



Facilities and services:	SGS Apapa Office
Location:	Apapa Lagos
Mission Dates:	11 July 2022
ORPAS Reviewers:	Mr Vanhavere, Mr Navarro
Persons met:	Olawale Ogunsola (BM), Ireogbu Anayo H. (RSO)
Accompanying NNRA representative:	Nnubia Patricia, Olaobaju Afolake M.

INTRODUCTION

The purpose of the appraisal service mission team to the SGS office in Apapa Lagos was to review the arrangements for occupational radiation protection at the company.

The company's main activities among others are: inspection, inspection and testing. The team had an entrance meeting with the main stakeholders of the company. There was a briefing by the Health and Safety Officer and the RSO of the company on the safety issues and programmes of the company.

The company is ISO 9001:15 certified and has an excellent documentation of the processes and operational procedures. The company is committed to safety issues and has demonstrated a safety culture.

Staff: Radiographers are hired on a contract basis when a job is available; The company has two officers responsible for safety. One is the RSO.

Workload: 500 films/ exposures/ Year

Equipment: One Ir-192 and one mobile X ray machine

The scope of the appraisal at the SGS Inspection Services Nigeria (SGS) as an operator was to evaluate the Occupational Radiation Protection Programme with regard to:

- Individual monitoring for external and internal exposures;
- Workplace monitoring;
- Implementation of the requirements of international safety standards /national regulations, e.g. radiation protection programme and measures;
- Quality management system.

The following documents were reviewed:

- Registration/License certificate
- Radiation protection program
- Staff training records
- Dose records
- Health surveillance program
- Quality assurance programme

APPRAISAL FINDINGS

LEGAL REQUIREMENTS

The SGS premises and activities have been licensed by the Nigerian Nuclear Regulatory Authority for use of both Gamma source and X-rays. The team inspected the three authorisation certificates with numbers: NNRI/IR/AUT/PRM/373/2022; NNRI/IR/AUT/USE/374/2022; NNRI/IR/AUT/USE/375/2022;

RADIATION SOURCES

The company has two sources stored in its premises in a well secure underground storage facility with adequate physical protection. The sources are one (1) Ir -192 and one (1) mobile X ray machine

OPERATING PROCEDURES

The standard operating procedures for all its activities are documented in the Quality Manual of the company. The company has received ISO 9001:15 certification.

RADIATION PROTECTION PROGRAMME

The Company has a well-documented Radiation Protection Programme in a manual and it is implemented under the supervision of a licensed RSO. In addition to the RSO, the company has hired a licensed Radiation Safety Adviser (RSA) to provide advisory service on matters relating to radiation protection. The radiation protection programme of the company has been documented in the Safety Manual for Radiography.

STAFF SELECTION, INFORMATION AND TRAINING

There are well trained staff with American Society for Non-destructive Testing certificate, NDT level 1, Level 2, and level 3. The occupationally exposed workers receive in house training organised by the RSA every year. The RSO has received training from the National Institute for Radiation Protection and Research in Ibadan. The team sighted the annual training plan for 2022.

The company sometime depends on itinerary workers to undertake some of their activities.

CONTROL OF RADIOACTIVE MATERIAL

The gamma camera and the gamma source are stored in a well-constructed pit, physical protection fencing on the surface. At the time of the visit only the RSO has access to the storage facility with all the keys in his possession.

RADIATION MEASURES

The company has in place a number of radiation protection measures for the protection of the staff including provision of PPEs, access control measures, warning signs. Radiation protection measures for field work are outlined in the standard operating procedures

WORKPLACE MONITORING PROGRAMME

The RSO undertake the weekly monitoring of the vicinity of the source storage facility and data stored in MS Excel spread sheet.

TRANSPORTATION OF SOURCES

The company has a valid contract with Daudeen Freight Forwarding and Transportation company to transport their sources on behalf of the company.

INDIVIDUAL MONITORING PROGRAMME

The company has a contract with Radiation Monitoring and Protection Services at Lagos State University for the monitoring of the occupationally exposed workers. This includes monitoring of itinerary workers. The monitoring reports are stored in electronic format.

EMERGENCY

The company has an emergency plan in place for various accident scenarios during field work. There was only one emergency number in the plan sighted by the team.

HEALTH SURVEILLANCE

The company has a contract with a health facility, Tincan Hospital, Olodi Apapa to undertake annual health surveillance for the staff.

QUALITY ASSURANCE

The RSO undertake periodic radiation leakage test around the source house with a survey meter in accordance with recommended method outline in SOP. However, no wipe test is done to check for possible leakage and contamination.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: The company uses TLDs and Quartz fibre dosimeters for their operations. These devices do not have alarm or any warning functions in case of doses exceed alert threshold	
Observation: The company does not perform periodic leak or contamination test on the gamma camera to check for possible leakage or contamination.	
(1)	Basis: GSR Part 3 Requirement 24 Section 3.90 (f): <i>Licensee and Registrants Shall provide, as appropriate, at entrances to controlled areas:</i> (i) <i>Personal protective equipment;</i> (ii) <i>Equipment for individual monitoring and workplace monitoring;</i> (iii) <i>Suitable storage for personal clothing.</i>
R6	Recommendation: SGS should make the use of Electronic Personal Dosimeters (EPDs) in addition to TLDs for monitoring of workers. EPDs are most appropriate for NDT activities
(1)	Basis: GSR Part 3 Requirement 24 Section 3.90 (g): <i>Licensees and Registrants Shall provide, as appropriate, at exits from controlled areas:</i> (i) <i>Equipment for monitoring for contamination of skin and clothing;</i> (ii) <i>Equipment for monitoring for contamination of any objects or material being removed from the area;</i> (iii) <i>Washing or showering facilities and other personal decontamination facilities;</i> (iv) <i>Suitable storage for contaminated personal protective equipment.</i>
R7	Recommendation: The SGS should ensure periodic contamination test of the gamma camera in addition to radiation measurement
Observation: Facility does not have information of dose history of itinerary workers before they are hired	
(1)	Basis: GSR Part 3 Requirement 23 states that employers and registrants and licensees shall cooperate to the extent necessary for compliance by all responsible parties with the requirements for protection and safety. 3.87. As part of the cooperation between parties, the registrant or licensee responsible for the source or for the exposure as appropriate: (a) <i>Shall obtain from the employers, including self-employed persons, the previous occupational exposure history of workers as specified in para. 3.103, and any other necessary information</i>
R8	Recommendation: The SGS should request the dose history of itinerary worker before employing them.
Observation: It was observed that only the RPO has access key to the radioactive storage facility	

(1)	Basis: The GSG No. 7 Section 2.24 states that <i>the “principal parties shall demonstrate commitment to protection and safety at the highest levels within the organizations” and “shall ensure that the management system...is designed and applied to enhance protection and safety” while maintaining coherence between measures for protection and safety and other measures, such as those addressing operational performance and security.”</i>
S5	Suggestion: The SGS should consider assigning the responsibility to keep in custody the three access keys to the radioactive source bunker at least to two different staff to ensure radioactive source accountability
Observation: The radiation protection programme is integrated in the management system of the company	
(1)	Basis: GSR Part 3 Requirement 5 states that <i>the principal parties shall ensure that protection and safety are effectively integrated into the overall management system of the organizations for which they are responsible.”</i>
GP5	Good practice: The SGS is formally certified to ISO 9001 :2015 standard

APPENDIX IV: REDDINGTON MULTI-SPECIALIST HOSPITAL



Facilities and services:	Reddington Multi-specialist Hospital (RMH), Diagnostic Radiology
Location:	2 Idowu Martins Street, Victoria Island, Lagos
Date:	11 July 2022
ORPAS Team:	Wilbroad Muhogora, Tshegofatso Solomon, Jizeng Ma
CP Representative(s)	T. Adewara
Persons met:	O. Omoyele (Radiologist), R. Aderonmu (Chief Radiographer, RSO), E. Agiande (Radiographer)

INTRODUCTION

The purpose of this ORPAS mission conducted at the Reddington Multispecialist Hospital (RMH) was to:

- Carry out a detailed, consistent appraisal of the provisions for occupational radiation protection and the programme for exposure control with regard to international standards and other relevant IAEA publications;
- Identify areas where Occupational Radiation Protection Programme should be improved to meet international safety standards and best practice;
- Recommend actions and improvements in areas where shortcomings and deficiencies (against relevant international standards) have been identified;
- Identify good practice; and
- Provide conclusions and recommendations based on the findings of the mission.

The scope of the appraisal at RMH as an operator was to evaluate the Occupational Radiation Protection Programme with regard to:

- Individual monitoring for external and internal exposures;
- Workplace monitoring;
- Implementation of the requirements of international safety standards /national regulations, e.g. radiation protection programme and measures; and
- Quality management system.

GENERAL INFORMATION

The RHM is a private hospital established in 2019 and is registered by the Nigerian Nuclear Regulatory Authority (NNRA) to carry out diagnostic radiology practices. The hospital uses one fixed X ray equipment, one mobile X ray equipment and one C-arm fluoroscopy equipment. There are 17 radiation exposed workers. The hospital is certified by the Health Facility Monitoring and Accreditation Agency (HEFAMAA) of Nigeria

Staff:	17
Workload:	15-25 patients/month
Equipment:	1 CT scanner, 1 fixed diagnostic X ray unit, 1 fluoroscopy unit and 1 mobile X ray unit

APPRAISAL CONDUCTION

The appraisal started with a meeting with the management representative to explain the purpose of the ORPAS mission and its process. Discussions with the staff were held followed by the visit to the Radiology Department where observation of the activities was done and the existence of the supporting documents were checked.

The following documents were reviewed:

- Registration/License certificate
- Radiation protection program
- Staff training records
- Dose records
- Health surveillance program
- Quality assurance programme

Discussions were held on various aspects of occupational radiation protection programme. The visit concluded with an exit meeting to inform the RMH staff findings and recommendations of the evaluation.

APPRAISAL FINDINGS

ORGANIZATION STRUCTURE AND FUNCTIONS

The hospital is organized into two main offices, the chief operation officer and group medical directorate. The radiology department is located under the group medical directorate and is supervised by the chief radiologist, who is a member of the management. The radiation safety officer (RSO) reports to the chief radiologist. The team was informed that radiation protection matters are communicated to the management through the chief radiologist.

LEGAL REQUIREMENTS

According to Nigerian Basic Ionizing Radiation Regulations, (NiBIRR) of 2003, practices using ionizing radiation are required to be authorized by NNRA. The RHM has authorization, NNRA/RSA/AUT/ACR/405/2022, for use of ionizing radiation in diagnostic radiology. The authorization will expire after one year and to receive a renewal in the registration, all required documentation relevant to radiation protection programme must be submitted to NNRA for consideration.

RADIATION PROTECTION PROGRAMME

The RHM has a radiation protection programme (RPP) for handling all radiation protection matters. The current Radiation Safety Officer (RSO) was formally appointed and his job description include supervision the implementation of RPP as well as radiation safety matters. The RSO reports directly to the Head of Department, who is a member of Management Committee. The copy of radiation protection manual in use was made available to ORPAS reviewers. Among others, this manual contains organizational structure for radiation protection, roles and responsibilities, operating procedures, workplace and individual monitoring, health surveillance program, training activities, quality assurance and records

STAFF SELECTION, INFORMATION AND TRAINING

Occupationally exposed workers are selected according to their professions e.g. radiologists, radiographers etc. Others are selected on their potential to be exposed to ionizing radiation e.g. support staff. A training course on radiation protection for RSO is a mandatory legal requirement every two years for diagnostic radiology. An in-house training programme on radiation protection matters tailored on the specific needs is available for all radiology department staff.

RADIATION PROTECTION MEASURES

An inventory of all radiation devices is available. Radiation protection instructions are provided and the document signed by each worker to confirm their awareness of such instruction is available. The personal protective equipment (PPE) such as lead aprons and lead groves were available except in mobile X ray equipment. The reviewers were informed that they are kept by RSO after use to maintain their shielding integrity.

WORKPLACE MONITORING PROGRAMME

The department possesses one radiation survey meter recently calibrated in terms of Hp(10) quantity by Radiation Protection Institute's Secondary Standard Dosimetry Laboratory (SSDL) in 2022. This instrument is used to perform workplace monitoring at the location of control console of X ray units. Workplace monitoring records were made available to reviewers.

INDIVIDUAL MONITORING PROGRAMME

All seventeen (17) occupationally exposed workers are monitored using RADOS Thermoluminescent dosimeters (TLDs) provided by Lagos State University of Nigeria. The service provider is authorized by NNRA and provides the service quarterly. Individual dose records are maintained in files and were seen during this visit.

HEALTH SURVEILLANCE

Medical check-ups based on general principles of occupation medicine are available for new and continuing staff. The program is supervised by the hospital's occupational health physician and individual records files were available. The reviewers were informed that the program allows temporary relocation of staff to suit the specific needs e.g. pregnant staff.

QUALITY ASSURANCE

The overall quality supervision is performed by the hospital's quality assurance department. At the level of radiology department, quality assurance procedures are overseen by the head of department.

QUALITY MANAGEMENT SYSTEM

The hospital implements a quality management system. There is a sister department responsible to oversee quality assurance activities at the hospital including the radiology department. The hospital is certified by the Health Facility Monitoring and Accreditation Agency of Nigeria. The ORPAS team observed a strong commitment at the hospital (management, RSO and staff) on the implementation of radiation protection programme as the compliance level to the regulatory requirements was adequate.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: There is no formal cooperation between hospital and foreign contracted maintenance companies to comply with occupational radiation protection requirements	
(1)	BASIS: GSR Part 3 Requirement 23 states that “ <i>Employers and registrants and licenses shall cooperate to the extent necessary for compliance by all responsible parties with the requirements for protection and safety. 3.87 As part of the cooperation between parties, the registrants or licensee responsible for the source or for the exposure as appropriate (a) shall obtain from the employers, including self-employed persons, the previous occupational exposure history of workers as specified in para 3.103 and any other necessary information.</i> ”
R9	Recommendation: The hospital should formally arrange cooperation with employers of the contracted X ray equipment maintenance staff to ensure such workers are protected in different workplaces
Observation: The lead aprons were not available at the location of mobile X ray unit in Intensive care unit, which could lead to its non-utilization especially during usual emergency situations	
(1)	BASIS: GSR Part 2 Requirement 24 section 3.93 states that <i>employers/registrants and licensees shall ensure that (a) Workers are provided with suitable and adequate personal protective equipment that meets relevant standards or specifications including as appropriate (i) protective clothing (ii) respiratory protective equipment the characteristics of which are made known to users (iii) protective aprons, protective gloves and organ shields</i>
R10	Recommendation: The hospital should ensure that protective gears are available in all X ray equipment locations and are used as may be appropriate
Observation: Dosimeters being worn by staff bear no wearer's names, which can lead to a risk of dosimeters being worn by more than one staff	

(1)	BASIS: GSR Part 3 Req. 25. states that “3.99 ... <i>shall ensure that arrangements are made with authorized or approved dosimetry service providers that operate under a quality management system.</i> ”
R11	<u>Recommendation:</u> The hospital should require the dosimetry service provider to indicate the wearer’s names on individual dosimeters as per quality management system requirements
Observation: The hospital maintains a quality management system which enables easy retrieval of radiation protection related documents	
(1)	BASIS: GSR Part 3 Requirement 5 states that <i>the principal parties shall ensure that protection and safety are effectively integrated into the overall management system of the organizations for which they are responsible.</i> ”
GP6	<u>Good practice:</u> The hospital is accredited by Health Facility Monitoring and Accreditation Agency as medical service provider including radiology services. This provides a motivation for continuous improvement of occupational radiation protection system

APPENDIX V: DORMAN LONG ENGINEERING

Facilities and services:	Dorman Long Engineering
Location:	12/14 Agege Motor Rd, Idi-Oro, Mushin, P. O. Box 256, Lagos State
Date:	11 July 2022
ORPAS Reviewers:	J. Amoako and M. Zaryah
Persons met:	Uche Ike, Nataniel Oruror, Philip Ezenwa

INTRODUCTION

The purpose of the ORPAS mission to the DORMAN LONG company was to review their arrangements for occupational radiation protection and to provide an appraisal report with findings, conclusions, and recommendations for strengthening the occupational radiation protection programme within the company.

GENERAL INFORMATION

Dorman Long Engineering is a company founded in 1949 which provides services such as engineering design, fabrication, galvanization and procurement of material. As examples, the company produces platform and pipeline and provides also maintenance services. For controlling products manufactured some Non-Destructive Tests are required but not implemented by Dorman Long Engineering company. The company have agreements with subcontractors for implementing the Non-Destructive Tests and some persons from the company are present during these activities.

APPRAISAL FINDINGS

AUTHORIZATION DETAILS

The company has a registration of premises certificate (n° NNRA/IR/AUT/PRM/463/2022 delivered on 6 June 2022 and expires on the 31 December 2022. According to the national regulation, the company has to request annually a new authorization. Dorman Long Engineering does not have authorization for holding and handling radioactive sources or devices emitting ionizing radiation. But Dorman Long Engineering checks and request from the subcontractor that a such authorization is available and valid over the agreement contract process.

RADIATION SOURCES

The subcontractor brings its own radioactive sources or X ray devices for implementing NDT.

RADIATION PROTECTION PROGRAM

Dorman Long Engineering designed a RPP through documented provisions based, at least, on a Radiation Safety Manual (updated on 2022), a Radiation Emergency Procedure (2018 version), a Local Rules Procedure (2018 version) including specific provisions for female worker and a Radiography Inspection Procedure (2018 version).

CONTROLLED AREA

Within the company's premises non-permanent controlled area are delimited during the NDT operation.

INFORMATION, INSTRUCTION AND TRAINING

According to the national regulation the company has appointed two Radiation Safety Officer (RSO) and has a service agreement with a Radiation Safety Adviser. RSO attended trainings at the National Institute of Radiation Protection and Research in Ibadan by the end of 2020 and October 2021. Certificates provided by the National Institute of Radiation Protection and Research expire respectively in December 2022 and 2023. Internal trainings for Radiation Workers are performed by the RSA. A training plan program for 2022 has been designed on February 2022.

INDIVIDUAL MONITORING

Individuals working under ionizing radiation have a quarterly external exposure monitoring from the Lagos University which is a dosimetry service provider. Dorman Long Engineering checks and requests from the subcontractor that the individuals implementing NDT have also an individual monitoring.

WORKPLACE MONITORING

During the NDT operation a handheld survey meter is used for monitoring the ambient radiation level. A form is filled with the value measured ($0 \mu\text{Sv/h}$) as the equipment is not able to assess exposition less than $0.2 \mu\text{Sv/h}$. But the survey meter is calibrated at the SSDL of the National Institute of Radiation Protection and Research in Ibadan.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: The company and the contractor do not use Electronic Personal Dosimeters.	
(1)	BASIS: GSG 7 Section 7.26 states that <i>“There are situations in which the radiation field experienced by a worker could increase unexpectedly and significantly (e.g. by a factor of ten). For the control of doses in such situations, supplementary dosimeters should be worn that can give early information on short term changes in the radiation field in the working environment. An example of a dosimeter of this type is the active warning dosimeter, which provides an audible or visual alarm if a certain level of dose or of dose rate is exceeded.”</i>
S6	Suggestion: Dorman Long Engineering should specify in the individual monitoring program under which conditions a direct reading dosimeter with alarm function should be worn and ensure that the RSOs and workers of the subcontractor uses EPDs in addition to TLD and Quartz fiber dosimeters.
Observation: The main Safety document (Radiation Safety Manual) has been updated on 2022 and other document linked to this manual have a 2018 version. Some terminologies are not still used.	
(1)	BASIS: GSR Part 3 Req. 5. states that <i>“2.48. The principal parties shall ensure that the management system¹⁵ is designed and applied to enhance protection and safety by: (a) Applying the requirements for protection and safety coherently with other requirements, including requirements for operational performance, and coherently with guidelines for security; (b) Describing the planned and systematic actions necessary to provide adequate confidence that the requirements for protection and safety are fulfilled; (c) Ensuring that protection and safety are not compromised by other requirements; (d) Providing for the regular assessment of performance for protection and safety, and the application of lessons learned from experience; (e) Promoting safety culture.”</i>
R12	Recommendation: Dorman Long Engineering should consider procedures and other document review so as all documents are in line with the new version of the Radiation Safety Manual and to reflect current terminologies and practices.
Observation: The radiation protection programme is integrated in the management system of the company	
(1)	BASIS: GSR Part 3 Requirement 5 states that <i>the principal parties shall ensure that protection and safety are effectively integrated into the overall management system of the organizations for which they are responsible.”</i>
Observation: The company and the contractor do not use Electronic Personal Dosimeters	
(1)	BASIS: GSG 7, section 7.26 states that <i>“There are situations in which the radiation field experienced by a worker could increase unexpectedly and significantly (e.g. by a factor of ten). For the control of doses in such situations, supplementary dosimeters should be worn that can give early information on short term changes in the radiation field in the working environment. An example of a dosimeter of this type is the active warning dosimeter, which provides an audible or visual alarm if a certain level of dose or of dose rate is exceeded.”</i>

S7	<u>Suggestion:</u> SGS company should consider using direct reading dosimeters with alarm functions for optimization purposes
GP7	<u>Good practice:</u> The Dorman Long Engineering is formally certified to ISO 9001 :2015

APPENDIX VI: NATIONAL INSTITUTE OF RADIATION PROTECTION AND RESEARCH



Facilities and services:	National Institute of Radiation Protection and Research
Location:	University of Ibadan, Oyo State
Dates:	12 July 2022
ORPAS Reviewers:	Joseph Amoako, Mohamed ZARYAH, Solomon TSHEGOFATSO, Wilbroad MUHOGORA, Jizeng MA
Persons met:	Samuel OYEYEMI (Ag Head), Olumide AKERELE (SSDL Officer); Bamdele ADEMIRAM
Accompanying NNRA representative:	Olatunji OKOYA (DGM, ZC)

INTRODUCTION

The Secondary Standards Dosimetry laboratory (SSDL) is part of the National Institute of Radiation Protection and Research of NIRPR. The SSDL is authorised by the Nuclear Regulatory Authority. The Institute is headed by a Director and is the technical support of the NNRA but enjoys sufficient independence as far as their operations are concern.

GENERAL INFORMATION

The SSDL is located within the premises of the NIRPR situated on the compound of the University of Ibadan, Oyo State.
During the visit the appraisal team had the opportunity to

APPRAISAL FINDINGS

LEGAL REQUIREMENTS

The SSDL has been licensed by the Nuclear Regulatory Authority. The certificate of authorisation is NNRA/CSR/AUT/PRM/541/2022.

SOURCES

The SSDL has three radiation sources at the radiation protection level section. The sources are: 200MV Hopewell Design Inc X ray machine; Cs-137 with initial activity of 740Gqbq at 1996 also from Hopewell Design Inc. and a Co-60 irradiator with which not in use because source is spent.

The Therapy Level section has one Hopewell Design Inc. irradiator with activity ~60 TBq.

RADIATION PROTECTION PROGRAMME

The Institute has a comprehensive radiation protection programme (RPP) in place which covers the operations of the SSDL and other research activities. The RPP documented in a well written manual which was reviewed by the appraisal team. The programme covers area classification, individual monitoring, workplace monitoring, warning signs, etc. The RSO is responsible for the implementation of the RPP. In general, the SSDL is committed to safety and documentation system.

INDIVIDUAL MONITORING

The occupationally exposed workers are monitored using TLDs supplied by the Monitoring and Protection Services in the Lagos State University.

WORKPLACE MONITORING

The RSO undertake routine workplace monitoring of the therapy level laboratory.

CALIBRATIONS

The reference ionisation chambers have been calibrated at the IAEA SSDL at Seibersdorf in Austria. The laboratory has capacity to calibrate Radiation Protection Level and Therapy level ionisation chambers as well as radiation survey meters. An average of between 600-650 radiation survey meters and 6 ionisation chambers are calibrated annually.

PERIODIC AND PERFORMANCE TESTING

There was evidence of the centre undertaking periodic QC and performance test on the different equipment. The team reviewed the written procedures used for these activities.

DOSE RECORD KEEPING AND REPORTING

The SSDL has in place a comprehensive documentation of its procedures, records, data, certificated forms etc. The team reviewed these documents.

INTERCOMPARISON

There was evidence of the SSDL's participation in IAEA intercomparison exercises for SSDL. The SSDL is yet to participate in any intercomparison exercise involving the use of Cs-137.

STAFFING AND TRAINING

The SSDL has eight workers – four at protection level laboratory and four at the therapy level laboratory. The SSDL officers have received training organised by the IAEA and supplier of equipment. Other staff have also received on-job training and are made to undertake calibrations after at least two years on the job.

WORK PROCESSES IN THE LABORATORY

The SSDL has a system in place from request of calibration, receipt of equipment, calibration and dispatch of calibrated equipment and report/certificate.

UNCERTAINTY ASSESSMENT

The Laboratory has in place as part of documented calibration procedure, method of estimating the uncertainty in the results.

CUSTOMER FEEDBACK

Customers are provided with all relevant information needed and their complaints are addressed as per the procedure on Risk and Opportunity Management.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: The appraisal team observed that the reference standard chambers were calibrated at another SSDL instead of a primary standard laboratory	
(1)	Basis: GSR Part 3, Requirements 14: Section 3.38. <i>Registrants and licensees and employers shall ensure that:</i> (b) <i>Suitable equipment is provided and procedures for verification are implemented;</i> (c) <i>Equipment is properly maintained, tested and calibrated at appropriate intervals with reference to standards traceable to national or international standards;</i>
R13	Recommendation: The SSDL should calibrate its reference standard at a primary standard laboratory to ensure traceability to international standard
Observation: The team observed that only the Director of the Institute signs calibration certificates	
(1)	Basis: The IAEA SSDL Charter section 3.4 recommends the Head of the SSDL to be responsible for calibration procedures and certification.
S8	Suggestion: The SSDL should consider making signatories on the calibration certificate to include the Head of the SSDL

APPENDIX VII: NATIONAL HOSPITAL, ABUJA



Facilities and services:	NATIONAL HOSPITAL, ABUJA
Location:	ABUJA
Dates:	13 July 2022
ORPAS Reviewers:	Joseph AMOAKO, Wilbroad MUHOGORA, Mohamed ZARYAH, Jizeng MA
Persons met:	Dr Aisha UMAR, Dr D.A. KATAGUM, Ms Hephzibah UMOREN, Mr Isaac PADA
Accompanying NNRA Representative:	Dr Godwin Ekong

INTRODUCTION

The scope of the appraisal at the National Hospital, Abuja was to review the occupational radiation protection programme arrangement at the hospital. The exercise started with an entrance meeting with the representatives of the hospital management. These are Dr Aisha Umar, the Acting Chief Medical Director, Dr D. A. Katagum, Director Clinic Services, Ms Hephzibah Umoren, Head of Department of the Medical Physics Department and Mr Isaac Pada, The RSO of the hospital. The purpose of this meeting was to afford the IAEA team the opportunity to explain the rationale for the mission. During the visit the team reviewed documents, interviewed some staff, observe at first hand some of the equipment. The documents review include: standard operating procedures, certificates of authorisation, radiation protection manuals emergency procedures, personal monitoring records and workplace monitoring record. At the end of the mission there was an exit briefing where the outcome of the mission was communicated pending the submission of the draft and final reports.

GENERAL INFORMATION

The National Hospital, Abuja is the premier hospital in Nigeria providing high level clinical care. The occupational radiation programme covers about 206 occupational exposed workers of the hospital from seven departments. The departments include the diagnostic radiology department, external beam radiation therapy department, brachytherapy department, nuclear

medicine department, Individual monitoring department and dental department. The hospital uses Landauer Inlight MicroStar OSL manual reader and cards for monitoring the OEWs of the hospital and staff of 300 other facilities in the city. The Nuclear medicine unit, undertake both diagnostic and therapy using radioisotopes. Some of the treatment involve bone scan, thyroid treatment, kidney scan etc has an annual workload of between 400 – 500 patients. The Management demonstrate high level of commitment and the hospital possesses good documentation system of procedures.

APPRAISAL FINDINGS

LEGAL REQUIREMENTS

At the time of the visit, the authorisation certificate for the Individual monitoring Service has expired and yet to be renewed. The hospital, however, has valid authorisation for diagnostic and radiation therapy including nuclear medicine from the Nigerian Nuclear regulatory Authority.

RADIATION SOURCES

The hospital has two Mammogram machines, three CT machines (two were not functional at time of visit), two Conventional X ray machines and two Fluoroscopy machines (not functional) at Diagnostic radiology department. At the External beam radiotherapy department, there are two Elekta Synergy platform linear accelerators installed in 2017 and 2019 respectively and one CT simulator. The Brachytherapy department is equipped with a High Dose rate Co-60 machine. The Nuclear medicine department uses SPECT diagnosis and radionuclides therapy for treatment. Some of the radionuclides in use include I-131 and Tc-99m. At the dental department there are two X ray machines (1 OPG and one intral Oral)

RADIATION PROTECTION PROGRAMME

The hospital has a radiation protection programme (RPP) in place. This was developed by the Medical Physics Department. This department is responsible for overseeing the RPP in the hospital. The department workplace monitoring, individual monitoring, quality control of the equipment, training of staff in radiation protection and health surveillance. The department has eight (8) medical physicists including the RSO. The RSO reports to the head of the medical physics department.

The RSO demonstrated sufficient knowledge about his roles and responsibilities in the hospital.

In addition to the RSO, the hospital has a Radiation Safety Adviser (RSA) who is responsible for organising periodic in-house training for the occupationally exposed workers in conjunction with the medical physics department. The hospital has a radiological emergency procedure in place at the radiation therapy department.

OPERATING PROCEDURES

The hospital has standard operating procedures for the different sections of their activities which include the implementation of the RPP.

STAFF SELECTION, INFORMATION AND TRAINING

Different categories of professionals are employed at the hospital based on their roles and skills. The occupationally exposed workers are training in radiation protection every two years. The RSO is trained at the National Institute of Radiation Protection and Research in Ibadan.

CONTROL OF RADIOACTIVE MATERIAL

The nuclear medicine department was found to be the only section that uses radioactive material. There was a procedure in place to ensure that floors, objects and the workers are not contaminated with radioactive material. Patients under treatment are kept in quarantine till decay of the radioactive material administered.

RADIATION PROTECTION MEASURES

Radiation Protection measures are in place at the different sections of the hospital where radiation sources are used. These include the availability of personal protection equipment such as Lead aprons, lead skirts, thyroid collars, etc. There are warning signs displayed in English and local languages, warning lights and local rules posted at vantage locations.

Arrangements for pregnant women are also provided.

WORKPLACE MONITORING PROGRAMME

Workplace monitoring are performed at the radiation therapy sections – External beam therapy area and the Brachytherapy area. There is also workplace monitoring at the nuclear medicine section. The workplace monitoring is limited to radiation survey using dose rate meters.

INDIVIDUAL MONITORING PROGRAMME

Individual monitoring programme for the occupationally exposed workers is in place. The unit uses the Landauer Inlight MicroStar OSL reader. About 200 occupationally exposed workers of the hospital are monitored using OSL dosimeter by the hospital's dosimetry section. The section has 1000 OSL dosimeter for their operation. The section also monitored more than 300 hundred workers from other hospitals. The data collected is managed in MS Excel spread sheet and hardcopies.

EMERGENCY RESPONSE AND PREPAREDNESS PLAN

The team saw a response emergency plan for the External Beam Radiotherapy section post at the department with emergency numbers boldly displayed on the notice boards.

HEALTH SURVEILLANCE

There is a policy for routine health surveillance exist but not fully implemented for the benefit of the occupationally exposed workers.

QUALITY ASSURANCE

Routine quality assurance procedures are in place and implemented in some case. Quality Assurance test are performed on some of the equipment. The unavailability of some QC kit was cited as one reason for not performing the QC test in some cases.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: It was observed that the authorisation certificate for the individual monitoring section has expired.	
(1)	Basis: GSR Part 3 Requirement 7: section 3.8 states <i>Any person or organization intending to carry out any of the actions specified in para. 3.5 shall, unless notification alone is sufficient, apply to the regulatory body for authorization¹⁸, which shall take the form of either registration or licensing.</i>
R14	Recommendation: The hospital should obtain the needed authorization for the individual monitoring department.
Observation: The nuclear medicine section did not have radioactivity contamination survey equipment for their daily operations	
(1)	Basis: GSR Part 3 Requirement 24 section 3.90 states service providers “ <i>Shall provide, as appropriate, at exits from controlled areas:</i> <i>(i) Equipment for monitoring for contamination of skin and clothing;</i> <i>(ii) Equipment for monitoring for contamination of any objects or material being removed from the area;</i> <i>(iii) Washing or showering facilities and other personal decontamination facilities;</i> <i>(iv) Suitable storage for contaminated personal protective equipment</i>
R15	Recommendation: The Nuclear medicine department should acquire and use appropriate contamination monitor for their daily activities.

APPENDIX VIII: DOSIMETRY SERVICE LABORATORY, NATIONAL HOSPITAL ABUJA

Facilities and services:	National Hospital Abuja, OSL Dosimetry Service
Location:	Garki, Abuja, F.C.T. Nigeria
Dates:	2022-07-13
ORPAS Reviewers:	W. Muhogora, J. Amoako, M. Zaryah and T. Solomon, Jizeng MA
Persons met:	Dr Aisha Umar, Dr D.A. Katagum, Ms Hephzibah Umoren, Mr Isaac Pada

INTRODUCTION

The purpose of the ORPAS mission to the OSL Dosimetry Service of the National Hospital at Abuja was to review their arrangements for occupational monitoring of external exposure and to provide an appraisal report with findings, conclusions, and recommendations for strengthening the service provided to the worker under ionizing radiation in the medical field.

GENERAL INFORMATION

The OSL Dosimetry Service is a part of the National Hospital of Abuja. The service has a MicroStar OSL reader, an annealer and around one thousand dosimeters for occupational monitoring. The laboratory is operated by a physician and a person from the brachytherapy service who are not fully assigned to this activity. Around 300 workers from National Hospital of Abuja and from thirty-seven other medical services are monitored. The National Hospital charges the other medical services for this occupational monitoring service. Workplace monitoring is conducted at the radiotherapy wings and nuclear medicine level.

APPRAISAL FINDINGS

LEGAL REQUIREMENTS

The OSL Dosimetry Service already had an agreement as Dosimetry Service Provider from the Nigerian Nuclear Regulatory Authority (NNRA) and is currently renewing this agreement.

DOSIMETRIC QUANTITIES

The OSL Dosimetry Service provide Hp(10) and Hp(0.07) monitoring.

MONITORING FREQUENCY

The frequency is on quarterly basis.

CALIBRATION

The service has a Calibration Kit provided by the manufacturer of the reader with a certificate of irradiation dated in 2018.

TYPE TESTING

The service is not under an ISO/IEC 17025 standard process and does not apply the ISO/IEC 62387 standard on *radiation protection instrumentation - Dosimetry systems with integrating passive detectors for individual, workplace and environmental monitoring of photon and beta radiation*.

PERIODIC AND PERFORMANCE TESTING

A Quality Control Kit provided by the manufacturer of the reader is also available and used periodically. There is no subcontract for the maintenance of the reader and the annealer. If needed, the service contacts the provider for fixing the issues.

DOSE RECORD KEEPING AND REPORTING

The service keeps the results on the laboratory laptop. There is no software or application for managing worker doses back-up of data. Results are communicated to customers and to the NNRA on a quarterly basis. Based on certain circumstance, results communication to the NNRA can be delayed.

INTERCOMPARISON

The service also took part to a regional intercomparison over the last two years and the results were accepted. The service plan to take part to the next regional intercomparison organized under a regional IAEA project (RAF).

STAFFING AND TRAINING

The OSL laboratory service is operated by two persons not fully assigned to the dosimetry service. They received a technical training by the manufacturer when the equipment was being commissioned. The persons did not have the opportunity to be retrained. The Medical Physicist responsible for the dosimetry service is a Radiation Safety Officer and have regular training at the National Institute of Radiation Protection and Research at the University of Ibadan.

WORK PROCESSES IN THE LABORATORY

The service does not have a formal Quality Management System according to ISO/IEC 17025 standard. There is a procedure for operating the reader and dosimeters. The dose report is validated at the Head of Service level.

UNCERTAINTY ASSESSMENT

The laboratory does not have in place the uncertainty budget for the dose assessment.

CUSTOMER FEEDBACK

The service had the opportunity to assess the feedback of the customers but not on regularly basis.

RELIABILITY OF SERVICE

The service has trained personnel, implements quality control and take part to intercomparisons.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: The service uses Calibration and Quality controls kits with certificate dated on 2018. This Dosimeters could be altered due to fading phenomena and accumulated background.	
(1)	BASIS: GSG 7 Section 8.88 states that <i>“The following activities should be undertaken:</i> <i>(a) Periodic and documented calibrations should be performed to guarantee correct results of measurements.</i> <i>(b) Periodic and documented functional tests should be performed between the calibration times to test the correct functioning of the equipment.</i> <i>(c) All maintenance work provided for by the equipment manufacturer should be done and should be documented in an equipment file.</i> <i>(d) Training and periodic retraining of every equipment operator should be completed to ensure that staff members are familiar with the equipment.”</i>
R16	Recommendation: the OSL Dosimetry Service should renew periodically Calibration and Quality Control kits.
Observation: The dosimetry service does not have a comprehensive system for maintaining dose records of its workers	
(1)	BASIS: GSR Part 3 Requirement. 25. states that <i>“3.105. Records of occupational exposure shall include:</i> <i>(a) Information on the general nature of the work in which the worker was subject to occupational exposure;</i> <i>(b) Information on dose assessments, exposures and intakes at or above the relevant recording levels specified by the regulatory body and the data upon which the dose assessments were based.”</i>
(2)	BASIS: BASIS: GSR Part 3 requirement 25 Section 3.103 states that <i>employers, registrants and licensees shall maintain records of occupational exposure for every worker for whom assessment of occupational exposure is required.</i>
R17	Recommendation: the OSL Dosimetry Service should have a suitable tool for Dose Records Management.
Observation: The authorization of the dosimetry service has expired since 2021 though the laboratory is .currently renewing this authorization. The service does not have a formal QMS in place and does not document provisions according to the ISO 17025.	
(1)	BASIS: GSR Part 3 Requirement 25. states that <i>“3.99 ... shall ensure that arrangements are made with authorized or approved dosimetry service providers that operate under a quality management system.”</i>
R18	Recommendation: the OSL Dosimetry Service should finalize the process for renewing its authorization.
R19	Recommendation: the OSL Dosimetry Service should develop a QMS according to the ISO 17025 standard requirements
Observation: The dosimetry service does not have back-up equipment to ensure continuous monitoring in case the available one breaks down	
(1)	BASIS: GSR Part 3 Requirement 21 section 3.76 states that <i>employers, registrants and licensees shall ensure, for all workers engaged in activities in which they are or could be subject to occupational exposure, that:</i> <i>(a) Occupational exposure is controlled so that the relevant dose limits for occupational exposure specified in Schedule III are not exceeded</i>

R20	<u>Recommendation:</u> the OSL Dosimetry Service should consider to make arrangements (subcontract or agreement) with another dosimetry service provider to maintain uninterrupted workers monitoring service.
Observation: The service has a limited staff for managing dosimeters	
(1)	BASIS: The GSG No 7 section 3.100 states <i>that the monitoring programme should be designed in consultation with an appropriate qualified expert on the basis of the prior radiological evaluation discussed in paras 3.53–3.59, with due account being taken of regulatory requirements.</i>
S8	<u>Suggestion:</u> the OSL Dosimetry Service should consider providing additional staff to manage and validate results on a technical basis.

ANNEX I: REFERENCES

- [1] Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (IAEA General Safety Requirements GSR No. Part 3, 2014);
- [2] Calibration of Radiation Protection Monitoring Instruments
- [3] Safety Reports Series No. 16, STI/PUB/1074, ISBN 92-0-100100-2; Vienna: IAEA, 1999.
- [4] Radiation Protection and Safety in Medical Uses of Ionizing Radiation, (IAEA Safety Standards Series) No. SSG 46, 2018)
- [5] Occupational Radiation Protection (IAEA Safety Standards Series No. GSG 7,2018)

ANNEX II: NATIONAL REQUEST FROM NIGERIA TO IAEA

J3,05

NIGERIAN NUCLEAR REGULATORY AUTHORITY (ESTABLISHED BY ACT 19 OF 1995)

Plot 564/565, Independence Avenue, Central Business District, P. M. B. 559, Garki, Abuja FCT
Tel: +234 (0)9 2918556 E-mail: official.mail@nnra.gov.ng Website: www.nnra.gov.ng

Prof. L. A. Dim (FNIP)
Director-General / CEO



Juan Carlos LENTIJO
Deputy Director General
Head of Department of Nuclear Safety and Security
International Atomic Energy Agency
PO Box 100
A-1400 Vienna/ Austria

Date: 12 February 2019

Dear Mr Lentijo,

REQUEST FOR IAEA's OCCUPATIONAL RADIATION PROTECTION APPRAISAL SERVICE (ORPAS) MISSION TO THE FEDERAL REPUBLIC OF NIGERIA

Please refer to the subject above.

I have the pleasure to convey our highest appreciation to the IAEA assistance in the establishment of our national regulatory infrastructures. We have committed to further strengthen our capabilities through various activities and projects under the auspices of the IAEA.


In this regard, the Government of the Federal Republic of Nigeria through the Nigerian Nuclear Regulatory Authority would like to have an independent peer review on the status of occupational radiation protection arrangements in the country for further improvement.

We are therefore requesting an Occupational Radiation Protection Appraisal Service (ORPAS) mission. For planning purposes, it would be appreciated if the Mission is undertaken in August 2019 for pre-ORPAS and full mission in October 2019.

I sincerely hope that you will be able to accept our proposal. For other details concerning the mission could be an attention of Dr. Isa Sambo, General Manager, as the appointed responsible person for this mission (E-mail: isa.sambo@nnra.gov.ng)

I, once again, thank you very much for your continuous support. I look forward to your positive response on our proposal.

Yours faithfully,


Dr. Isa Sambo, fsi
For: Director General/CEO

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ANNEX III: MISSION PROGRAMME

Occupational Radiation Protection Appraisals Mission REPUBLIC OF NIGERIA

10-15 July 2022

Day & Date	Place	Time	Activity	Person(s)/Reviewers
Sunday 10 July	Lagos	10:00-17:00	Team briefing/Documents preparation and questionnaire check	IAEA Coordinator & External Expert(s)
Monday, 11 July	Lagos	9.00-10.30	<u>2 groups (parallel session)</u> Visit to the dosimetry service laboratory:	Wilbroad, Tshegofatso, Jizeng
		10.30-12.30	Radiation Safety Technology - Visit to the industrial facility: SGS Inspection Services Nigeria	Joseph Mohamed
			LUNCH	
		13.30-17.00	Visit to medical facility: Reddington Multi-specialist Hospital	Wilbroad, Tshegofatso, Jizeng
			Visit to the industrial facility: Dorman Long Engineering Limited	Joseph, Mohamed,
Tuesday, 12 July	Lagos/Ibadan	8.00-9.00	Move from Lagos to Ibadan	All team members
		9.00-10.30	Visit to the SSDL the National Institute of Radiation Protection and Research, University of Ibadan	All team members
		10.30-12.30		Main reviewers: Joseph, Mohamed
		12.30-13.30	LUNCH	
		13.30-15.30	Continue work at the SSDL	All team members

		15.30-16.30	Move from Ibadan to Lagos	Main reviewers: Joseph, Mohamed
	Move from Lagos to Abuja			
Wednesday 13 July	Abuja	9.00-10.30	Visit to the National Hospital Abuja	All team members Main reviewers: Wilbroad, Joseph
		10.30-12.30		
		12.30-13.30	LUNCH	
		13.30-17.00	Visit to the OSL dosimetry service laboratory in the hospital	All team members Main reviewers: , Mohamed, Tshegofatso
Thursday 14 July	Abuja	9.00-10.30	Visit to Regulatory Body	All team members Main reviewers: Wilbroad, Joseph
		10.30-12.30		
		12.30-13.30	LUNCH	
		13.30-16.00	Report preparation	All team members
Friday 15 July	Abuja	9.00-10.30	Report preparation	All team members
		10.30-12.30		All team members
		12.30-13.30	LUNCH	
		13.30-16.00	Exit meeting Presentation on findings and recommendations of the ORPAS mission	ALL
Saturday 16 July	Departure			

ANNEX IV: LIST OF PARTICIPANTS

**Exit meeting
6 July 2022**

	Name	Function	Organization
1	Prof. Yusuf A. Ahmed	The President	Nigeria Atomic Energy Commission
2	Dr. Yau Usman Idris	Director General	Nigerian Nuclear Regulatory Authority (NNRA)
3	Dr. Isa Samabo	Director, Radiological safety	NNRA
4.	Dr N.A. Bello	Director, Nuclear Safety, Physical security and Safeguards	NNRA
5.	Mr. Adamu M. Hussaini	Director Authorization and Enforcement	NNRA
6.	Mr.Mathias Vyonku	Director of Finance and Administration	NNRA
7	Dr. Godwin Ekong	Radiological safety	NNRA
8	Mrs A.Bassey	Assistant General Manager, Information Unit	NNRA
9	Eng. Yunusa Muhammad	Authorization and Enforcement	NNRA
10	Ireogbu Anayo H.	RSO/NDT Supervisor	SGS Apapa office
11	Olayinka Bamgbose	Coordinator	SGS Apapa office
12	Oladimeji Popoola	Project Coordinator	SGS Apapa office
13	Olawale Ogunsola	Business Manager	SGS Apapa office
14	Nnubia Patricia	Radiological safety	NNRA
15	Olaobaju Afolake M.	Radiological safety	NNRA
16	Hephzibah Umoren	Medical Physics Dept	National Hospital Abuja (NHA)
17	Isaac Pada	RSO/Medical Physicist	NHA
18	Dr. Aisha Umar	Ag.Chief Medical D, NHA	NHA
19	Macha Matthew M.	Regulatory Officer	NNRA
20	Alabi Jacob A	Administrative Officer	NNRA
21	Adeniram Bamdele M	SSDL Officer	NNRA
22	Akerele Olumide	SSDL Officer	NNRA
23	Dr. Oyeyemi Samuel	Acting Head, SSDL	NNRA
24	Okoya Olatunji	Zone office, Lagos	NNRA

25	Mac-Etoly Humphrey	Technical Assistant-DG	NNRA
26	Asamu Abdul	Deputy Director, NSC	NNRA
27	Ayo Aseyim Joseph	Assistant Manager(Acct)	NNRA
28	Ekatte Bassey	Assistant General Manager	NNRA
29	Tijjani Hassan G.	SRO(RS)	NNRA
30	Okoye Valentine I	Assistant Manager	NNRA
31	Chikwado A. Charles	Higher Technical Officer	NNRA
32	Honesty Eyoan Eyo	Occupational Exposure	NNRA
33	Hauwa'u Shehu Bala	Occupational Exposure	NNRA
34	Engr. Uche Ike	Quality Manager (DLE)	Dorman Long
35	Nathaniel Obuzor	RSO(DLE)	Dorman Long
36	Philip Ezenwa	RSO(DLE)	Dorman Long
37	Oladmeji Popoola	Project Coordinator	SGS
38	Olawale Ogumsola	Business Manager	SGS
39	Austin Omagbemi	NDT Tech	Dorman Long
40	Nnamani Samuel	DLE Welding Engr	Dorman Long
41	Ifeoma Peter Pinoha	HSE Rep	Dorman Long
42	Iroegbu Anayo H.	RSO/NDT Supervisor	SGS
43	T. Adewara		NNRA
44	Dr O.Omoyele	Radiologist	Reddington Multispecialist Hospital (RMH)
45	R. Aderonmu	Chief Radiographer/RSO	RMH
46	E. Agiande	Radiographer	RMH