

REGULATORY FRAMEWORK AND INTERNATIONAL REGIONAL PARTNERS' CONTRIBUTION TO THE IMPLEMENTATION OF NON-PROLIFERATION AND NUCLEAR SAFEGUARDS IN NIGERIA

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ABSTRACT

Nigeria's pursuit of nuclear energy for peaceful purposes necessitates a comprehensive regulatory framework and appropriate regional and international cooperation to ensure compliance with global and regional safeguards and other nuclear nonproliferation undertakings. This paper provides an in-depth analysis of how Nigeria's regulatory framework and regional and international cooperation play a pivotal roles in enhancing the implementation of country's nuclear nonproliferation related obligations in the country.

Keywords: regulatory framework, NPT, CSA, AP, AFCONE, USDOE, safeguards, IAEA, NNRA, Treaty of Pelindaba, FNRBA, CTBTO.

1.0 INTRODUCTION

The need to mitigate nuclear proliferation of nuclear weapons and to foster global peace and security have necessitated the establishment of robust nuclear regulatory frameworks and international collaboration to ensure the effective implementation commitments by States under various nuclear Non-Proliferation and safeguards arrangements across the globe. This paper examines Nigeria's nuclear regulatory framework, as well as cooperation between Nigeria and various stakeholders, including the International Atomic Energy Agency (IAEA), the United States Department of Energy (USDOE) - International Nuclear Safeguards Engagement Program (INSEP), the African Commission on Nuclear Energy (AFCONE), the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO), and the Forum of Nuclear Regulatory Bodies in Africa (FNRBA) in supporting the implementation of safeguards in Nigeria.

Nigeria is committed to peaceful nuclear energy, has established various legislative measures, including the Nuclear Safety and Radiation Protection Act of 1995 and the Nuclear Safety, Security and Safeguards Bill. Adherence to International treaties and establishment of relevant partnerships, enhance

Nigeria's nuclear nonproliferation capacity through technical assistance and training. The paper concludes that Nigeria's regulatory framework and international international cooperation are key to furthering nuclear nonproliferation and enhancing global peace and security

2.0 OVERVIEW OF NIGERIA

The Federal Republic of Nigeria popularly known as Nigeria, is a democratic secular nation, located on the Gulf of Guinea along Atlantic Ocean in western Africa with a population of over 228 million in June, 2024. The State capital is Abuja, situated in the heart of the country. Nigeria comprises of 36 States, 6 Geopolitical Zones, and 3 major languages of Hausa, Igbo, and Yoruba. The country has four major International Airports, namely: (Abuja, Lagos, Port-Harcourt and Kano), and four major sea ports (Port-Harcourt, Calabar, Lagos and Warri), through which goods and services are imported into the country . The country is bounded by Benin Republic to the West, Niger to the North, Cameroon to the East, and Chad to the North-East.

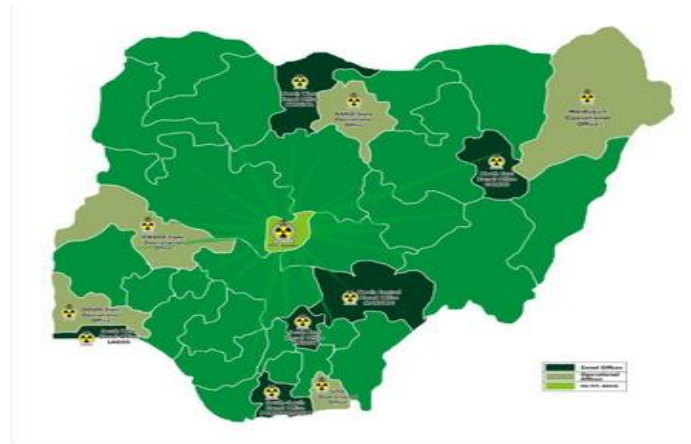


Fig 1. Map of Nigeria showing locations where nuclear activities are carried out

3.0 REGULATORY FRAMEWORK IN NIGERIA

1. Nuclear Safety and Radiation Protection Act 19 of 1995

The foundation of Nigeria's regulatory framework for nuclear safety and radiological protection is the Nuclear Safety and Radiation Protection Act 19 of 1995. This act established the Nigerian Nuclear Regulatory Authority (NNRA), which is charged with the responsibility of regulating all activities involving ionizing radiation in Nigeria. The NNRA's mandate includes ensuring the protection of people and the environment from the harmful effects of ionizing radiation by implementing international safety standards and practices.

The NNRA achieves its objectives through the following measures:

- Authorization, inspection and licensing of nuclear facilities.
- Regulatory oversight of radioactive sources and nuclear materials.
- Enforcement of compliance with safety regulations and standards.
- Development of guidelines and regulations for safe practices in the use of nuclear materials.
- Emergency Planning and Response

4.0 NUCLEAR SAFETY, SECURITY, AND SAFEGUARDS BILL (NSSSBILL)

The NSSS Bill is a critical legislative measure designed to enhance Nigeria's nuclear regulatory framework. This bill empowers the NNRA the responsibility of the State Authority responsible for safeguards implementation (SRA) and management of the State System of Accounting for and Control of nuclear material (SSAC). The SSAC is essential for ensuring that all nuclear materials within the country are adequately accounted for and controlled, thus preventing unauthorized access and use, as well as diversion for proscribed by Nigeria's comprehensive safeguards agreement CSA), as well as by the Treaty of Pelindaba. The SSAC is also responsible for facilitating cooperation with the IAEA and AFCONE under the CSA and the Treaty of Pelindaba respectively.

The NSSS Bill includes provisions for:

- i. Strengthening the legal framework for nuclear security, safety and safeguards.
- ii. Establishing comprehensive procedures for the management of nuclear materials.
- iii. Enhancing the capability of the NNRA to conduct inspections and enforce regulations.
- iv. Providing a legal basis for international cooperation and assistance in nuclear security matters.

5.0 INTERNATIONAL & REGIONAL COMMITMENTS AND LEGAL INSTRUMENTS

Nigeria has committed to various international treaties and agreements that form the backbone of its nuclear non-proliferation and safeguards regime:

- i Non-Proliferation Treaty (NPT): Signed in 1970, the NPT is a cornerstone of Nigeria's commitment to preventing the spread of nuclear weapons and promoting the peaceful use of nuclear energy.
- ii Comprehensive Safeguards Agreement (INFCIRC/358): Signed and entered into force on 29 February 1988, this agreement with the IAEA ensures that all nuclear materials in Nigeria are subject to safeguards to verify that they are not diverted to nuclear weapons or other nuclear explosive devices.
- iii Additional Protocol (INFCIRC/358/Add.1): Entered into force on 4 April 2007. The Additional Protocol enhances the IAEA's ability to verify the peaceful use of all nuclear material and activities in Nigeria.
- iv African Nuclear Weapon Free Zone Treaty (The Treaty of Pelindaba): Nigeria is party to the African Nuclear Weapon Free Zone Treaty (The Treaty of Pelindaba). Nigeria signed the Treaty on 11 April 1996, and deposited its instruments of ratification on 18 June 2001. Nigeria's membership in the Treaty of Pelindaba strengthens the nonproliferation regime and advances regional and international peace and security through obligations to use nuclear energy only for peaceful purposes, as well as obligations on safeguards; complete disarmament; nuclear security; renunciation of nuclear weapons; prevention of stationing of nuclear explosive devices; prohibition of testing of nuclear explosive devices; declaration, dismantling, destruction or conversion of nuclear explosive devices and the facilities for their manufacture; prohibition of dumping of radioactive wastes; and prohibition of armed attack on nuclear installations.
- i Comprehensive Nuclear test Ban Treaty: Comprehensive Nuclear test Ban Treaty (CTBT): Nigeria is a Party to the CTBT since 27 September 2001. The Comprehensive Nuclear Test-Ban Treaty (CTBT) bans all nuclear explosions, whether for military or peaceful purposes. This aligns with Article 5 of the Treaty of Pelindaba through which Nigeria undertakes not to test any nuclear explosive device in Nigeria, and not to assist or participate in the testing of any nuclear explosive device anywhere. Nigeria's adherence to the CTBT also aligns with the following text from the preamble of the NPT: "Recalling the determination expressed by the Parties to the 1963 Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water in its Preamble to seek to achieve the discontinuance of all test explosions of nuclear weapons for all time and to continue negotiations to this end.

6.0 APPLICATION OF NUCLEAR TECHNOLOGY IN NIGERIA

There are diverse applications of nuclear techniques and radioactive sources in Nigeria. Some of which include:

- Oil and Gas Industries
- Research Institutes
- Medical Applications
- Manufacturing and Construction Industries
- Agriculture

7.0 NIGERIAN NUCLEAR SAFEGUARDS OBLIGATIONS

The Nigerian Nuclear Regulatory Authority (NNRA) through the Safeguards Division achieve its safeguards obligation through the following measures:

- i Development of laws, regulations and guidance document that will aid the implementation of a state's system of accounting for and control of nuclear material (SSAC), which ensure that the obligations of the Safeguards agreement and associated protocols and subsidiary arrangements are fully met;
- ii Conduct Inspections in nuclear facilities or where nuclear material are located;
- iii Provision of timely, correct and complete reports and declarations to the IAEA;
- iv Create awareness via trainings, seminars and workshops;
- v Facilitate/Provide support to the IAEA Inspectors during In-Field Activities to Nigeria.

8.0 DOMESTIC SAFEGUARDS ACTIVITIES IN NIGERIA

The NNRA is empowered by Act 19 of 1995 to carry out inspections including domestic Safeguards Inspection. The NNRA embarked on a nationwide pilot survey of Depleted Uranium used as shielding in 2013. Based on the results obtained from the survey, the Initial Declaration for the LOFs was made in 2014 and Safeguards Inspectors were mandated to conduct quarterly domestic inspection. Facilities visited during the domestic Safeguards Inspection include Hospitals, Research Centre as well as Manufacturing and Oil

and Gas Industries. During the inspections, source projectors and transport containers used in industrial radiography facilities, teletherapy heads are verified for the use of Depleted Uranium (DU) as shielding material as required in Article II of CSA.

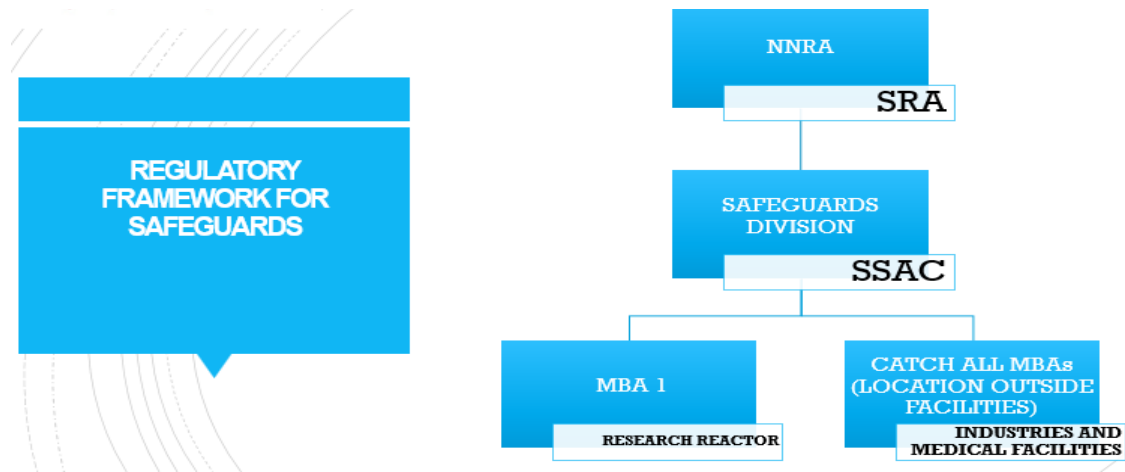


Fig 2:Image of Regulatory Infrastructure Nigeria safeguards in Nigeria

9.0 IAEA ANNUAL INSPECTION

The IAEA Physical Inventory Verification (PIV) Inspection is conducted annually to verify the presence of declared Nuclear Material. The Annual Inspection also involves Design Information Verification (DIV) and records at the Facility and at State level are been checked. The Inspections are conducted at the Material Balance Area (MBA) Nigerian Research Reactor (NiRR-1) facility and Catch all MBA (LOFs).



Fig 3.0 Mr Nodi Akelachi performing IAEA annual safeguards PIV/complementary access inspection in Nigeria research reactor and locations outside facilities(LOF)

10.0 CONTRIBUTIONS OF INTERNATIONAL PARTNERS REGIONAL PARTNERS IN STRENGTHENING SAFEGUARDS IMPLEMENTATION IN NIGERIA

International collaborations have been vital in bolstering Nigeria's nuclear security infrastructure. Key contributors include:

1. International Atomic Energy Agency (IAEA)

The IAEA provides a wide range of assistance, including, including:

- **Technical Assistance**: The IAEA offers technical support for the development and implementation of nuclear safeguards systems. This includes the provision of equipment, software, and expertise necessary for the effective accounting and control of nuclear materials.
- **Training and Capacity Building**: The IAEA conducts numerous training programs for Nigerian professionals in areas such as nuclear security, safety, and safeguards. These programs enhance the skills and knowledge of NNRA personnel, enabling them to effectively oversee nuclear activities in Nigeria.
- **Expert Missions**: The IAEA organizes expert missions to Nigeria to provide on-site technical advice and support. These missions assist in identifying and addressing specific challenges faced by Nigeria in implementing nuclear safeguards and security measures.



Fig 4: Ms Thelma Uche making contribution during the IAEA International I Training Course on the Authorization and Inspection of Radiation Safety and Nuclear Security for Medical Practices Lusaka, Zambia 19 to 30 June 2023

2. US Department of Energy (USDOE)

The USDOE has been a significant partner in enhancing Nigeria's nuclear security culture and capabilities.

Key initiatives include:

- Nuclear Security Culture Programs: The USDOE collaborates with Nigeria to promote a robust nuclear security culture among stakeholders. This includes training workshops, seminars, and the development of best practices for ensuring the secure handling of nuclear materials.

- **Nigeria Nuclear Material Accounting and Control (NMAC)**: The USDOE provides technical assistance in establishing and maintaining effective systems for the control and accounting of nuclear materials. This ensures that all nuclear materials are adequately tracked and protected from unauthorized access.

- **Emergency Preparedness and Response**: The USDOE supports Nigeria in developing and implementing emergency preparedness and response plans for nuclear and radiological incidents. This includes training exercises, the provision of equipment, and the development of response protocols .

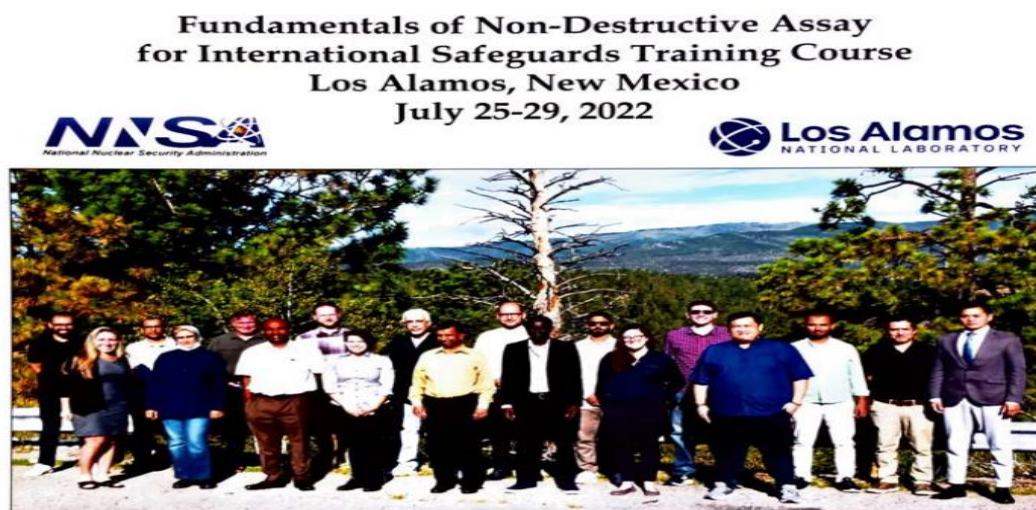


Fig 5. Mr Nodi at international training course on fundamental on Non-Destructive Assay at Los Alamos National laboratory, New Mexico, United States sponsored by the United States Government

3. International Nuclear Safeguards Engagement Program (INSEP)

INSEP focuses on capacity-building initiatives and knowledge transfer programs to enhance Nigeria's nuclear safeguards infrastructure. Key contributions include:

- **Capacity-Building Workshops**: INSEP organizes workshops and training sessions aimed at building the technical and regulatory capacity of Nigerian professionals. These workshops cover a wide range of topics, including nuclear material accounting, inspection procedures, and regulatory compliance amongst others.

- **Knowledge Transfer Programs**: INSEP facilitates the exchange of knowledge and best practices between Nigerian experts and their international counterparts. This helps Nigeria adopt advanced techniques and methodologies for implementing nuclear safeguards.

- **Collaborative Projects**: INSEP supports collaborative projects that enhance Nigeria's nuclear safeguards infrastructure. These projects often involve joint research and development initiatives, as well as the provision of technical resources and expertise.

4. National Nuclear Security Administration (NNSA)

The NNSA collaborates with Nigeria on projects aimed at enhancing physical protection measures and regulatory frameworks. Key areas of support include:

- **Physical Protection Upgrades**: The NNSA provides technical assistance and resources for upgrading the physical security of nuclear facilities in Nigeria. This includes the installation of advanced surveillance systems, access control mechanisms, and other security enhancements in high risks nuclear and radiological facilities.

- **Regulatory Framework Development**: The NNSA supports Nigeria in developing and implementing comprehensive regulatory frameworks for nuclear security. This includes assistance in drafting regulations, guidelines, and procedures that align with international standards.

- **Inspection and Enforcement**: The NNSA works with the NNRA to enhance its inspection and enforcement capabilities. This includes training inspectors, developing inspection protocols, and providing tools and technologies for effective regulatory oversight.

The Institute of Radiation Protection and Nuclear Safety (IRSN)

The Institute of Radiation Protection and Nuclear Safety (IRSN) has made significant contributions to helping Nigeria strengthen its nuclear regulatory functions in several key areas:

- i **Nuclear Security**: IRSN has supported Nigeria by providing expertise and resources to enhance the country's capabilities in protecting nuclear materials and facilities from theft, sabotage, and terrorism. This includes the development of security protocols, training programs for personnel.
- ii **Nuclear Safety**: IRSN has been instrumental in improving Nigeria's regulatory framework to ensure the safe operation of nuclear facilities. This involves conducting safety assessments, offering technical assistance, and facilitating the exchange of best practices in nuclear safety management. Their efforts help prevent accidents and ensure the protection of workers, the public, and the environment from radiation hazards.



Group photo participants at international training course on Implementing Nuclear Safeguards in practice organized by Institute for Radiological Protection and Nuclear Safety (IRSN) 27-31 May 2024, Paris, France

- iii **Nuclear Safeguards**: IRSN has assisted Nigeria in meeting her national and international obligations under treaties such as the Non-Proliferation Treaty (NPT). This includes support in establishing and maintaining effective systems for the accounting and control of nuclear materials, as well as the training of inspectors and other regulatory staff to ensure compliance with international safeguards agreements.



Fig 6:Mr Nnodi Akelachi presenting a paper as a guest lecturer on Nigeria nuclear safeguards implementation: Insight from the regulatory Authority at an international training organized by Institute for Radiation Protection and Nuclear Safety (IRSN)academy in Paris 27 May -1st June 2024

11.0 ANALYSIS OF STAKEHOLDERS CONTRIBUTIONS AND INITIATIVES

International partnerships have facilitated several capacity-building initiatives, collaborative projects, and knowledge transfer programs. These efforts have significantly enhanced Nigeria's nuclear security and safeguards infrastructure. Key initiatives include:

A. Technical Assistance

International partners provide state-of-the-art equipment and technologies for nuclear material accounting and control. This includes the provision of software for tracking nuclear materials, radiation detection equipment, and secure communication systems.

B. Training Programs

Specialized training programs are conducted to enhance the skills and knowledge of NNRA personnel. These programs cover various aspects of nuclear security, safety, and safeguards, including:

- i **Nuclear Material Accounting and Control:** Training on the establishment and maintenance of effective systems for tracking and controlling nuclear materials.
- ii **Inspection Procedures:** Training on conducting thorough and effective inspections of nuclear facilities to ensure compliance with regulatory requirements.
- iii **Emergency Response and Preparedness:** Training on developing and implementing emergency response plans for nuclear and radiological incidents.

C. Collaborative Projects

Collaborative projects between Nigeria and international partners aim to enhance the country's nuclear safeguards and security measures. Key projects include:

Regulatory Framework Development: Collaborative efforts to develop comprehensive for regulatory frameworks for safeguards implementation, including the drafting and review of regulations and guidelines.



Fig :7 Regional Workshop On Developing Safeguards Related Regulatory Document 2nd -4th March 2015 Voi Wild Lodge Kenya, Organized By USDOE/NNSA/INSEP

12.0 GAPS AND CHALLENGES

Despite significant progress, Nigeria faces several challenges in implementing nuclear safeguards:

- **Resource Constraints**

Limited financial and technical resources hinder the full implementation of advanced safeguards Implementation measures. This includes challenges in acquiring state-of-the-art equipment, training personnel, and maintaining effective regulatory oversight.

- **Capacity Building**

Ongoing need for training and education to keep pace on non-proliferation regime. This includes the need for continuous professional development and the establishment of training programs to enhance the skills and knowledge of NNRA personnel.

- **Regulatory Challenges**

Ensuring comprehensive and effective enforcement of regulatory measures remains a challenge. This includes difficulties in conducting thorough inspections, enforcing compliance with regulations, and addressing regulatory gaps

13.0 ACHIEVEMENTS

Nigeria has made significant strides in enhancing its nuclear safeguards and security through various initiatives:

Nuclear Safeguards

- a. The International Atomic Energy Agency (IAEA) in the year 2020 drew a broader conclusion on Safeguards activities and implementation in Nigeria for the first time;
- b. Nigeria has procured an Identifinder (HM-5) for domestic Nuclear Safeguards Inspection and there are plans to procure more;
- c. Nigeria is intensifying domestic Inspections through which more materials are expected to be discovered;
- d. Nigeria through the NNRA has brought facilities under location outside facility (LOF) under Safeguards Regulatory Control;
- e. Nigeria has successfully closed the HEU and opened the LEU Nuclear Material Accounting records in 2018



Fig 8: IAEA Regional Training Course On States System Of Accounting For And Control Of Nuclear Material 4-15 December 2023, Pretoria, South Africa Republic

14.0 FUTURE PLANS

To further strengthen its nuclear safeguards and security framework, Nigeria plans to undertake several initiatives:

- i **Enhanced Regulatory Framework:** Updating and refining existing regulations to address emerging nuclear safeguards challenges and align with international best practices.
- ii **Increased Funding and Resources:** Securing additional financial and technical resources to support the implementation of advanced nuclear safeguards measures.
- iii **Ongoing Capacity Building:** Expanding training and education programs to ensure that NNRA safeguards personnel are equipped with the latest knowledge and skills in nuclear safeguards.
- iv **Expansion of International Collaborations:** Strengthening existing partnerships and seeking new collaborations with international organizations to benefit from global expertise and resources.
- v **Public Awareness and Engagement:** Increasing public awareness about nuclear safeguards to foster a culture of vigilance and responsibility

15.0 CONCLUSION

Nigeria's regulatory framework, bolstered by international partnerships, is crucial for implementing effective non-proliferation measures. Through collaborations with organizations such as the IAEA, USDOE, INSEP, IRSN and NNSA amongst others, Nigeria is enhancing its nuclear safeguards implementation and contributing to global efforts to prevent nuclear weapons proliferation. Continued support and collaboration are essential to address the existing challenges and further strengthen Nigeria in meeting her national and international obligations in the peaceful application of nuclear energy.

16.0 ACKNOWLEDGMENTS

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17.0 NOMENCLATURE

NNRA - Nigerian Nuclear Regulatory Authority

AFCONE-African Commission on Nuclear Energy

IAEA - International Atomic Energy Energy

INSEP – International Nuclear Safeguards Engagement Program

USDOE- United States Department of Energy

NNSA – National Nuclear Security Administration

IRSN - Institute for Radiological Protection and Nuclear Safety

NSSB - Nuclear Safety, Security and Safeguards Bill

AP – Additional Protocol

CSA- Comprehensive Safeguards Agreement

MBA – Material Balance Area

SDP – State Declaration Portal

SSAC – States System of Accounting for and Control of Nuclear Material

PR3 – Protocol Reporter (3)

LOF's – Location Outside Facilities

PIV – Physical Inventory Verification

NiRR-1 - Nigerian Nuclear Research Reactor

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