



The Atom

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Nigeria Atomic Energy Commission

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Development of Infrastructure for Nuclear Power Plant in Nigeria

Nigeria has adopted the IAEA milestone approach in its Nuclear Power Plant development and has achieved the first Milestone in her journey towards NPP development in 2009 following the approval of the National Nuclear Power Roadmap by the National Executive Council (FEC) in 2007.

This was sequel to the approval of the national energy policy and the comprehensive report on nuclear power. The Nuclear Power Roadmap stipulated a 15-year timeline for NPP commissioning that demanded for a rapid nuclear infrastructure development.

Thus, the Nigeria Atomic Energy Commission (NAEC), which serves as the Nuclear Energy Programme Implementing Organization (NEPIO), in collaboration with the IAEA has been making concerted efforts in developing the necessary infrastructure that would facilitate the NPP development. This culminated into the first Integrated Nuclear Infrastructure Review (INIR) mission conducted in 2015 by the IAEA to assess the level of the Country's preparedness for the NPP. The INIR mission resulted into the development of the Integrated Work Plan (IWP) for the NPP infrastructure development by Nigeria and the IAEA in 2017.

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The Role of GIF towards National Food Security and Development

The Gamma Irradiation Facility (GIF) is one the premier facilities located at the Nuclear Technology Centre, Sheda. Its innovative design has significantly enhanced its versatility, and flexibility for irradiating a wide spectrum of products.

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NAEC Participation at the 2023 IAEA General Conference

The annual General Conference (GC) is the flagship conference of the International Atomic Energy Agency (IAEA). The conference provides the avenue where representatives of the IAEA Member States meet to consider and approve the IAEA's budget and to decide on issues raised by the Board of Governors as well as to discuss policy issues of the Agency.

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Editor's Note



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It is indeed a great honour and privilege to launch the first edition of the Atoms Newsletter, published by the Nigeria Atomic Energy Commission (NAEC). This Newsletter has been subject to delays due to unforeseen circumstances but as the saying goes, "better late than never". NAEC's goal is to "develop the ways and technical machinery to effectively explore, exploit and harness atomic energy for peaceful applications for sustainable national development". Since its reactivation in July, 2006, NAEC has embarked on the meticulous implementation of

Nigeria's Nuclear Energy Programme, all of which cannot be presented in one edition.

This first edition, will be allocated to events as well as projects embarked upon by the Commission. From projects completed and commissioned to various advocacy programmes as well as Technical Cooperation projects between NAEC and the International Atomic Energy Agency (IAEA). This edition will also provide briefs on NAEC's plan towards construction of its first nuclear power plant for electricity generation as well as the role of nuclear technology in food security for socioeconomic development.

As editor, I feel honoured to share and document the work done by the Commission and express my sincere gratitude to the editorial team, contributors and dedicated staff of the entire NAEC family. In the forthcoming editions, we promise to keep you all abreast on activities of the Commission in its quest to realize its mandate.

Kindly excuse whatever shortcomings noticed in this first edition as we intend to learn and correct them as we move forward.

Happy reading to you all.

Message from the Chairman/CEO



Prof. Yusuf Aminu Ahmed FNATE, MNIP
Chairman/CEO
Nigeria Atomic Energy Commission (NAEC).

I welcome you all to the first edition of our quarterly magazine, **The Atom** Newsletter.

The Nigeria Atomic Energy Commission (NAEC) was established by Act No. 46 of 1976 (CAP N91 LFN 2004) and activated in 2006 as the national focal agency charged with the responsibility for promotion of the development of

atomic energy and for all matters relating to the peaceful uses of atomic energy. NAEC is principally responsible for developing the framework and technical pathway to exploit and harness atomic energy for peaceful applications in all its ramifications for socio economic development of Nigeria in conformity with the policies of the Federal Government.

Specifically, the Commission is vested with the mandate to develop and implement the national programmes to deploy nuclear power plants for electricity generation in the country. In addition, it has the responsibility to harness expertise for peaceful applications of nuclear science and technology in food security and agriculture, medicine and human health, industry, water resources and environmental management.

As empowered by its law, NAEC is the National Liaison and Coordination Office for:

- International Atomic Energy Agency (IAEA),
- African Regional Cooperative Agreement for Research and Training related to Development of Nuclear Science and Technology (AFRA),
- Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO),
- Non-Proliferation Treaty (NPT),
- Treaty on the Prohibition of Nuclear Weapons (TPNW),
- United Nations Office on Nuclear Disarmament Verification.

Since my assumption of office at the Commission in 2021 as Chairman/CEO, my goal has been to actualise the mandate of the Commission as well as keeping critical stakeholders informed and updated on the activities of the Commission, especially the policy objectives of the Commission, which are:

- a) To streamline and coordinate R&D activities and applications of nuclear technology in agriculture, water resources management, human health, environment, minerals exploration and manufacturing among others
- b) To fast-track the process of development and deployment of nuclear power plants for electricity generation in Nigeria.
- c) To develop a comprehensive manpower programme which includes: introducing core training programmes in institutions of higher learning in Nigeria and creating opportunities for fellowships and advanced training in international organizations and advanced facilities in other countries.
- d) To develop the requisite legal framework for the deployment of nuclear power plants in Nigeria.
- e) To liaise with international organizations for the implementation of national programmes and domestication of ratified treaties and conventions.

This maiden edition of **The Atom** therefore focuses on various activities carried out by the Commission in year 2023. In this year 2024, the Newsletter will keep you all informed on the many important activities scheduled for the

About Us

The Nigeria Atomic Energy Commission (NAEC), created by Act 46 of 1976 (as amended by Cap N91 LFN, 2004), is the national focal agency charged with the responsibility for the promotion of the development of atomic energy and for all matters relating to the peaceful use of atomic energy. NAEC was, however, activated and became fully operational in July, 2006 under the aegis of the Federal Ministry of Science and Technology, by the appointment of its pioneer Director-General/Chief Executive Officer. In March 2011, Mr. President approved the reconstitution of NAEC, as a Commission to operate within the Presidency, by the appointment of the Chairman/Chief Executive Officer and six members in consonance with Section 4(1) of NAEC's enabling Act.

The Act of 1976 establishing the Commission mandated it to:

1. construct and maintain nuclear installations for purposes of generation of electricity;
2. produce, use and dispose of atomic energy and carry out research into matters connected with the peaceful applications of atomic energy;
3. manufacture, acquire, treat, store, transport and dispose of any radioactive substances, among others;
4. make arrangements with universities and other institutions or persons in Nigeria to conduct research into matters connected with atomic energy or radioactive substances;
5. prospect for and to mine radioactive materials;
6. educate and train persons in matters connected with atomic energy and radioactive substances; and
7. advise the Federal Government on issues relating to atomic



NAEC Goal:

To develop the ways and technical machinery to effectively explore, exploit and harness atomic energy for peaceful applications for sustainable national development.

Vision:

To lay an enduring foundation for the building of a world-class institution for the development and peaceful deployment of nuclear technology in all its ramifications for national development in conformity with international best practices.

Mission:

To develop a sustainable framework imbued with the fundamental elements of a high safety culture for the peaceful application of nuclear science and technology for the socio-economic development of Nigeria.

THE ORGANIZATIONAL MANDATE:

The Commission is principally responsible for developing the framework and technical pathway to exploit and harness atomic energy for peaceful applications in all its ramifications for socio economic development of Nigeria in conformity with the policies of the Federal Government. Specifically, the Commission is vested with the mandated to develop and implement the national programmes to deploy nuclear power plants for electricity generation in the country and deploy nuclear technology for peaceful applications in different sectors of the economy.

energy.

The Technical Support Organisations (TSO) under the aegis of the Commission are:

1. Centre for Energy Research and Development, (CERD) OAU, Ile-Ife
2. Centre for Energy Research and Training, (CERT) ABU, Zaria
3. Nuclear Technology Centre, (NTC) Sheda, Abuja
4. Centre for Nuclear Energy Studies, (CNES) UPH, Port Harcourt
5. Centre for Nuclear Energy Research and Development (CNERD), University of Maiduguri.
6. Centre for Nuclear Energy Studies and Training (CNEST) FUTO, Owerri
7. FGN-IAEA Marine Contamination and Coastal Field Monitoring Station (MCCFMS), Koluama II.

Programme of activities

National Nuclear Energy Programmes

Several key developmental activities, initiatives, and projects have been sustained and enhanced within the Commission to support and reinforce government's policy direction in national security, job creation, anti-corruption and diversification of the economy. These activities are encapsulated in four (4) National Nuclear Energy Programmes (NNEP) being implemented/coordinated by NAEC, namely:

- **Nuclear Power Programme** – to develop capacity to generate electricity from nuclear energy
- **Human Resources and Capacity Development Programme** – to develop a pool of indigenous nuclear professionals to enhance technology localization and/or domestication
- **Nuclear Research & Development Programme** – to develop R&D activities for capacity building and infrastructure development in nuclear technology, and
- **Nuclear Technology Applications Programme** – to develop capacity for the peaceful utilisation of atomic energy for socioeconomic development.



Cross Section of NAEC Staff.

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Development of Infrastructure for Nuclear Power Plant in Nigeria-Prof. Abdullahi Matti.

The Second Milestone will be achieved when Nigeria is ready to open bids for the construction of the NPP, while the third milestone is when construction has commenced with the pouring of the first concrete. Thus, the Nigeria IWP has been fashioned out to enable Nigeria develop the 19 infrastructure issues outlined by the IAEA. To date, NAEC has made significant stride in the infrastructure development gearing towards accomplishing milestone 2 of the IAEA milestone approach. Accordingly, the following are the major activities and programmes executed towards the IWP implementation.

- **NPP Site and Supporting Facilities:** NAEC undertook site selection process between 2009 to 2012, which resulted into selection of two suitable sites in Dodo Gbagi (Kogi State) and Itu in Akwa Ibom State. The sites were selected based on ranking criteria of the IAEA, which were based on site safety requirements of the IAEA encompassing natural and man-made hazards. The detailed site evaluation and site characterization hinged on external events safety evaluation is on-going.

In line with this, NAEC has signed a contract with the IAEA in 2023 to participate in a Coordinated Research Project (CRP)

aimed at studying the effects of weather induced hazards on the site and its installations, considering the upstream dams and river tributaries



- **Nuclear Safety, Security and Safeguards:** Considerable extend of safety and security infrastructure has been achieved by NAEC in collaboration with the Nigerian Nuclear Regulatory Authority. In this regard, the IAEA safety standards have been adopted in all phases of the NPP development. These include site safety, design safety, operational safety and general safety culture. The IAEA workshop and expert mission on leadership and safety culture was conducted in 2023 to further enhance the safety culture of NAEC and other stakeholders. IAEA assisted Nigeria in the physical security upgrades of its facilities and assisted in the provision of homeland security surveillance as well as in the training of our experts in nuclear security. In addition, Nigeria hosted the IAEA IPPAS mission in 2023 in order to strengthen the nation's capacity in security and physical protection of nuclear installations.
- **Management System:** a comprehensive Management System involving total quality management is necessary throughout the lifecycle development of NPP. Hence, NAEC, in collaboration with the IAEA conducted leadership and management system stakeholders' workshop in 2023 to establish comprehensive processes and procedures for NAEC management system. The IAEA conducted an Expert Mission in 2024 to review the Integrated Management System (IMS) documentation.
- **Legal Framework:** Given that the successful implementation of a Nuclear Power Programme is premised on an effective legal framework, the NAEC embarked on a review of the Nigeria Atomic Energy Act no. 46 of 1976 to ensure the establishment of a robust and comprehensive legal framework of an internationally acceptable standard, taking into cognizance our national obligations under various international legal instruments. These efforts culminated in a new national nuclear energy legislation with input from relevant national stakeholders and the IAEA. The Bill is presently being considered by the National Assembly for enactment.



Visit by NAEC team to National Control Centre, Oshogbo to ascertain grid appropriateness for introduction of Nuclear Power.

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The Role of GIF towards National Food Security and Development -Engr. Mustapha K. Tajudeen

Some of the major features are the 340kilocurie Cobalt-60 irradiation source, fully automated operations, laboratories to adequately support comprehensive research and development activities, The irradiation of food by Gamma Irradiation Plant enables the preservation of food and agricultural products by extending their shelf life. The GIF is also used for pest control research, sterilization of surgical equipment for healthcare delivery, packaging and improvement of mechanical, thermal and electrical properties of materials such as plastics. The facility has the capacity to irradiate over 20 metric tons of products daily. The production section is optimally configured for commercial activities. The facility has numerous potentials, and possesses the ability to attract both local and foreign entrepreneurs to establish manufacturing industries in pharmaceuticals, cosmetics and packaging as spin-offs.

The GIF boast of the following support laboratories:

- i. Physico-chemical laboratory
- ii. Dosimetry Laboratory
- iii. Two Food laboratories; one for wet products such as fish, seafood, meat and their products and fresh fruits, while the second is for dry products such as spices, vegetable and flour products.
- iv. Microbiological laboratory and culture room
- v. Food identification laboratory
- vi. Mutation breeding laboratory
- vii. Sterile insect technique (SIT) laboratory
- viii. Two plastic laboratories; one for induction moulding machines, while the other is for the measurement of properties of irradiated plastics and quality control
- ix. Photographic laboratory for fast development of films for desired photos for the purpose of the documentation and high-quality scientific presentations.

Some of the main research potentials of the facility include the following:

- i. Framework for irradiation of food and agricultural products, thereby reducing post-harvest losses and thus assuring food security and price stability.
- ii. Enhancement of agricultural yield through the production of high yielding and disease resistant varieties of crops and plants;
- iii. development of disease resistant crop variety to improve yield and enhance agricultural productivity;
- iv. developing framework for irradiation of medical devices, pharmaceutical and cosmetic products and packages for improved primary health care delivery; and improvement of quality to our cable and wire products, plastics, natural rubber, e.t.c, through radiation induced cross-linking and improvement of mechanical, electrical and thermal properties of plastics and vulcanization of natural rubber.



- **Grid Studies:** NPP requires very reliable and stable grid to evacuate the power generated. The national grid in its current state may not be able to provide the capability to evacuate the NPP generation. In order to ensure the preparedness of Transmission Company of Nigeria (TCN) to evacuate the NPP generation, therefore, NAEC is partnering with TCN in conducting comprehensive grid studies to establish the minimum requirements for the grid reliability and stability to evacuate the NPP power. A working visit to advanced NPP operating sites has been arranged in early 2024 to avail the TCN and NAEC engineers the experience in grid stability analysis for NPP integration. NAEC is also collaborating with the Nigerian Bulk Electricity Trading (NBET), Nigerian Electricity Regulatory Commission (NERC), and the Federal Ministry of Power to ensure synergy in the NPP implementation.
- **Human Resource Development:** the human resource requirement for an NPP is pervasive and thus, a comprehensive Human Resource Development Plan has been developed and is being reviewed by the IAEA in line with international standard. The plan encompasses recruitment plan, systematic training plan, succession plan and knowledge management plan. An IAEA expert mission will be conducted in 2024 to review the plan to enable the approval and publication of the plan.
- **Environmental Protection and Emergency Planning:** the construction and operation of NPP is hinged on strong environmental protection requirements established by both IAEA and national environmental protection laws. In order to fulfil this, NAEC has conducted capacity building workshop in 2022 on Environmental Impact Assessment (EIA) for NPP in collaboration with Ministry of Environment and other relevant stakeholders. In preparation for a comprehensive EIA needed for the feasibility studies on the NPP, an expert mission of the IAEA has been scheduled for early 2024 to evaluate the plan and processes NAEC is adopting in its EIA to conform with the requisite guidelines.



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Pursuance to the aforementioned objectives, the GIF has been utilized in the following services:

- i. Sprout inhabitation of onions, potatoes and yams;
- ii. Insect disinfestations of maize, beans, sorghum, millet, cocoa and kolanuts;
- iii. Reduction of microbial load in chilli pepper and ginger for local consumption and for export;
- iv. Microbial decontamination of meat, pork, poultry, fish, seafood (shrimps, lobsters and crabs) for local consumption and for export.
- v. Delay ripening in fruits (mangoes, bananas, plantains and tomatoes) for local consumption and for export;

The Commission is putting in place the relevant research and development framework for the following research themes.

- i. Plant breeding to boost food production through the production of high yielding and disease resistant crops and plants (e.g. roots and tubers such as yams, low cyanide cassava, etc.);
- ii. Sterile insect techniques in the eradication of pests that destroy farmland and adversely affects animal production;
- iii. Radio-sterilization of medical devices, pharmaceutical and cosmetic products and packages (e.g. syringes, catheter, swabs, sterile solutions, hypodermic needles, surgical blades, surgical gloves, etc.);
- iv. Cross-linking in polymers to improve mechanical, electrical and thermal properties of plastics (e.g. cable & wire products, plastic pipes for hot water in hotels and other household use, etc.) and vulcanization of natural rubber latex;

- v. Application in the Wood and Furniture Industry particularly in the production of particle-boards from sawdust and waste wood shavings as well as quarantine of wooden tiles for floors and ceilings for export; and
- vi. The plant also has facilities to perform requisite tests on irradiated food, food products and effect on constituents. Other tests include microbial decontamination level, sterility assurance, material testing and quality control.

ECONOMIC POTENTIALS OF GIF:

The expected economic potentials of the GIF are many. The presence of GIF at NAEC will open up a vista of investment opportunities in many sectors of the economy. Spin-off industries are expected in agriculture and agro – allied sector, food processing, pharmaceutical, plastic, rubber, and wood and furniture sectors with export potentials.

Another expected spin – off is the emergence of packaging industries to service the facility. Small and medium scale enterprises (SMEs) in particular can benefit immensely from partnership with the Gamma Irradiation Facility (GIF) in many ways. Appropriate packaging is expected to reduce post – harvest losses of agricultural products. It is also expected that the sterilization of medical equipment, pharmaceutical and cosmetics products and packages have the potentials to create SMEs.



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NAEC Participation at the 2023 IAEA General Conference

Nigeria's delegation to the Conference was led by the Permanent Secretary, Ministry of Foreign Affairs, Ambassador, Adamu Ibrahim Lamuwa. On the sidelines of the Conference, Nigeria's delegation held a number of bilateral meetings.

1. Bilateral Agreements between the USA and Nigeria Atomic Energy Commission (NAEC) represented by it's Chairman/CEO,

Prof. Yusuf A. Ahmed signed a Proliferation Resistance (PRO-X) of Nigeria's Research



Reactor-II (NIRR-II) on supporting Nigeria in the design, construction and commissioning process of Nigeria's Multi-Purpose Research Reactor.

2. Memorandum of Understanding (MoU) with the TOMSK, Polytechnic University, Russian Federation on manpower training. Prof. Yusuf A. Ahmed, Chairman/ CEO, NAEC signed on behalf of NAEC.



From R - L: Prof. Yusuf A. Ahmed, Chm/ CEO, NAEC, Prof. Abdulahi Mati, Director, NPPD, H.E. S D. Umar, Nigeria Ambassador to Austria, Dr. Vera Verkhoturova, Rep, TOMSK Polytechnic, Russia

3. Fourth Country Programme Framework (CPF) for 2024 – 2029



Prof. Yusuf Ahmed, Chairman of NAEC and Mr Hua Liu, IAEA Deputy Director General and Head of the Department of Technical Cooperation, signed Nigeria's Country Programme Framework (CPF) for the period of 2024–2029. The CPF is the frame of reference for the medium-term planning of technical cooperation between a Member State and the IAEA and identifies priority areas where the transfer of nuclear technology and technical cooperation resources will be directed to support national development goals. The 4th CPF covering the period 2024 – 2029 identifies 5 priority areas:

- i. Nuclear and radiation safety and security
- ii. Food and agriculture
- iii. Health and nutrition
- iv. Water and environment
- v. Energy planning and development

4. NAEC Seeks Collaboration with PAEC:



Nigeria and Pakistan held discussions on modalities for partnership between the two countries in the area of peaceful application of nuclear Science and technology.

Ali Raza Anwar, Head of Pakistan Atomic Energy Commission (PAEC) represented Pakistan while Permanent Secretary, Ministry of Foreign Affairs and Head of Nigeria's delegation to the IAEA 67th General Conference, Ambassador Ibrahim Adamu Lamuwa and Chairman NAEC, Prof. Yusuf Ahmed stood in for Nigeria.

NAEC and CNNC Seek Collaboration on Nuclear Science and Technology:

Nigeria Atomic Energy Commission (NAEC) and China National Nuclear Cooperation (CNNC) held bilateral talks in October, 2023 at Lagos to explore further areas of cooperation on the peaceful application of nuclear science and technology.

The talks came on the sidelines during the visit to Nigeria by the President of CNNC, Gu Jun at the official commissioning of the CNNC African Office in Lagos, Nigeria. Chinese Ambassador to

Recently commissioned projects by NAEC

The Neutronic Health Physics and Dosimetry Laboratory and Researchers Building



The Neutronic Health Physics and Dosimetry Laboratory Block and the Researcher's Building was commissioned by the immediate past Secretary to the Government of the Federation (SGF), Boss Mustapha at the Centre for Energy Research and Training CERT, Zaria.

The Laboratory will house the Internet Reactor and also carry out personal monitoring and dosimetry activities. The Centre is collaborating with University Hospitals across the country that have doses and radiation facilities on personal monitoring. Other activities of the facility will be to advise government on radiation mapping across the country

Nigeria, H.E. Cui Jianchun and Director Research and Nuclear Infrastructure Development (RNID, NAEC), Engr. Justine Salu who were part of the high level delegation also took time to visit the Dangote Refinery, the Deep Seaport, the Gas fired plant and the Langsun Electric Company all situated at the Lekki Free Zone, Lagos.



University of Health Science seeks collaboration with NAEC

The Vice Chancellor, David Umahi Federal University of Health Science (DUFUHS), Uburu, Ebonyi State, Prof. Jesse Uneke paid a working visit to the Commission in August 2023. The delegation was received by Chairman/CEO, NAEC, Prof Yusuf A. Ahmed and other Management staff of the Commission. Discussions centered on a wide range of issues which included; research and development, manpower training, education and training of students in nuclear science and technology etc.

Further discussions also explored how the University through NAEC can benefit from national, regional and inter- regional programmes of the IAEA via scientific visits, trainings and fellowships. The two institutions also agreed and set up a joint committee to develop a MoU.



IAEA Technical Cooperation with Nigeria: key benefits to the country's socioeconomic development

The IAEA's Technical Cooperation (TC) programme helps countries to use nuclear science and technology to address key development priorities in areas including health, agriculture, water, the environment and industry. The programme also helps countries to identify and meet future energy needs. It supports greater radiation safety and nuclear security, and provides legislative assistance.

The priority areas of IAEA Technical Cooperation with Nigeria are:

- Improved human health and nutrition
- Developing the food and agriculture sector
- Protecting water resources and the environment
- Improving nuclear radiation safety and security
- Strengthening energy supply and industry, and
- Research reactors

Improved human health and nutrition

There are persistent health problems of poor nutrition and communicable diseases with rising incidence of cancer and cardiac diseases posing new threat in Nigeria. Nuclear techniques provide unique capabilities in prevention and treatment of these diseases. Radiotherapy remains a major cost-effective means of treating cancer. Radiology is the key point for cancer diagnosis, staging, treatment planning, treatment monitoring and patient follow-up. Nuclear medicine procedures provide sound basis of managing cardiac patients. The IAEA has assisted Nigeria in education and training of medical personnel (Radio pharmacists, Oncologists, Medical Physicists and Nuclear Medicine Technologists) who are very critical in advancing cancer care. Medical equipment such as CTDI phantom and X-ray Multi-meter with test stand were donated to the University College Hospital (UCH) Ibadan while 6 pieces of RadEye G20-10 Gamma Survey Meter and 5 pieces of RadEye B20-ER, Alpha, Beta, Gamma Survey meter were donated to the National Hospital, Abuja.

Nigeria sees the IAEA Ray of Hope initiative as an important activity which can benefit from the overall cancer management.

Already, Nigeria has expressed her interest towards participating in the Ray of Hope programme. In the same manner, the IAEA has rolled out the Zoonotic Diseases Integrated Action (ZODIAC) project which is a response to the COVID-19 pandemic. The ZODIAC project is to get the international community to be better prepared in the event of another pandemic of similar nature. Nigeria has already established a framework for the ZODIAC implementation with a National ZODIAC team and a National Coordinator from the National Veterinary Research Institute (NVRI), Vom, Plateau State. The laboratory in the institute is the designated National ZODIAC Laboratory.

Furthermore, during the COVID-19 era, the IAEA procured some sets of COVID-19 test kits, reagents and other items vital for the quick identification of COVID-19. Several batches were shipped into the country and subsequently distributed to the Nigeria Centre for Disease Control (NCDC); the NVRI, Vom and the African Centre of Excellence for Neglected Tropical Diseases and Forensic Biotechnology (ACENTDFB), Ahmadu Bello University, Zaria to support national efforts in the fight against COVID-19.



Presentation of COVID-19 Diagnostic Kits to the Representative of the Chief Medical Director, Federal Medical Centre, Jabi Abuja

Developing the food and agriculture sector

A number of IAEA TC projects including those under AFRA have supported food and agriculture in Nigeria. To improve animal productivity in Nigeria's small farms, the IAEA under the projects RAF5090 and NIR5041, supported the use of nuclear and molecular techniques to detect and control parasitic and animal diseases. The project helped improve the capacities of the National Animal Production Research Institute (NAPRI) of the Ahmadu Bello University in Zaria through staff training, advisory services and the provision of analytical equipment. The activity saw a reduction in the mortality rate of small ruminants (such as goats and sheep) and an increase in farmers' livestock. The National Root Crops Research Institute (NRCRI) Umudike, through IAEA intervention under RAF5081, conducted a trial involving Integrated Nutrient Management and a yield of 490 cassava stem bundles/ha and fresh root yield of 49.61t/ha were obtained compared to yield of 336 cassava stem bundles/ha and 25.10 t/ha obtained from farmers' practice. NVRI had, under TC projects NIR5040 and RAF5073, undertaken projects on vaccine research and innovation, veterinary laboratory diagnostics, etc. Towards a qualitative and quantitative fruit yields in Nigeria, the IAEA contributed to combating the menace of fruit flies under RAF5074 through the National Horticultural Research Institute (NIHORT). The IAEA also contributed to the successful eradication of tsetse fly conducted by NVRI, Vom over 30 years starting in the late 70s using Sterile Insect Techniques (SIT) with Cobalt-60 and Cesium-137 used as the sources. SIT is a specific technique to control or eradicate tsetse fly by using gamma radiation.

Radiation processing

Globally, radiation processing has proved to be a very effective and efficient tool in several areas such as the irradiation of healthcare products, pharmaceuticals and food. The Nigerian government therefore established a GIF at the Nuclear Technology Centre in Sheda, Abuja, to provide such services and enable research in the country. The IAEA provided training for the facility's staff, as well as advisory support and analytical instruments to enhance effectiveness. With the improved capacities, quality assurance and control requirements for exporting products have been improved. Through its bulk irradiation capability, the facility has helped reduce large post-harvest losses and supported a tsetse and trypanosomiasis eradication campaign. Seeds are irradiated which introduces mutation from which plant breeders can select those plants with characteristics that best fits there needs. Field trials of mutation seeds have been carried out in Agricultural Research Institutes (ARIs) in Nigeria with good results.

Research reactor

Nigeria's first research reactor – NIRR-1 – was installed at the Centre for Energy Research and Training (CERT) Zaria, with IAEA supported training for its staff conducted at the Ahmadu Bello University in Zaria, Nigeria. The NIRR-1 was configured for education and training use, neutron activation analysis and some radioisotope production. However, growing demand for radioisotopes for medical therapeutic applications and new material development, as well as requirements for basic research to support the planned Nuclear Power Programme will require a high flux reactor. Nigeria now plans to acquire a new higher capacity research reactor to meet these needs. In November 2017, IAEA supported the planning and development of a new multipurpose research reactor. The IAEA technical cooperation programme will also consolidate and reposition current research reactor needs and utilization strategy, and will support capacity development for planning, development, utilization and maintenance of the reactors.

Protecting water resources and the environment

In water management, isotopic techniques can identify origin and dynamics of water resources, evaluate recharge and discharge of aquifers, determine water balance in reservoirs and define aquifer vulnerability to over-exploitation and pollution. Isotope techniques have been used for ground water studies in Sokoto and Chad basins under IAEA-TC projects. An isotopic mass spectrometer has been supplied to CERT by IAEA through Federal Ministry of Agriculture and Water Resources/CERT joint project. Under the implementation of TC Project RAF7019 titled "Adding the groundwater dimension to the understanding and management of shared water resources in the Sahel region", the IAEA provided hydrological field equipment to Nigeria Hydrological Services Agency (NIHSA). NIHSA has also taken delivery of laboratory consumables procured by the IAEA for TC project RAF7021 which is on "Enhancing, planning, management and sustainable utilization of water resources".

Education and Research

In Nigeria education and research in nuclear technology are anchored on the technical assistance of the IAEA. Starting in the late seventies more than 70 projects have been completed to date. The projects cover education and research, water resources management, human health, food and agriculture, etc. A large number of personnel have been trained and several

facilities/equipment provided with the assistance of the IAEA such as:

- 30 kW Nuclear Research Reactor at CERT
- 300,000 Ci Co-60 irradiation facility at SHESTCO
- 8 MeV Accelerator at CERD
- Several 14 MeV Neutron Generators
- Several neutron and gamma sealed sources

The IAEA support to Nigeria via the IAEA's TC programme, in recent years, focused on nuclear power; control of parasitic and transboundary animal diseases; urban air quality monitoring; the analysis of chemical contaminants in food; establishment of a national post-graduate programme in nuclear medicine; increase access to affordable, equitable, effective and sustainable radiation medicine services; improving livestock productivity; strengthening national capacity for nuclear instrumentation, repairs and maintenance; building national nuclear infrastructure and regulatory capacity for both the power reactor and multipurpose research reactor siting, design and construction, commissioning, operations and decommissioning, etc.

NAEC/IAEA Collaboration on Nuclear Technology Applications in Nigeria-Anyaegbu Chad

Being a Member State of IAEA, Nigeria has been benefitting from the IAEA TC Projects. These TC projects which are generally short and medium terms, cover the application of nuclear technology in the various sectors such as health, water resources, agriculture, security, emergency management and power. The scope of the TC projects includes training of indigenous personnel and acquisition/utilization of specialized nuclear technology facilities for the benefit of the local community and the nation. These TC projects are implemented through three key channels – National, Regional and Inter-regional in the various sectors of the economy.

a. Facilitating Import Duty Waivers and Clearing and Delivering of Shipments from the IAEA

Import Duty and Exemption Certificate (IDEC) are issued on items that are exempted from payment of duties, levies and other forms of taxation which are in accordance with the provisions of extant statutes and international agreements. List of existing items for fiscal incentives include goods obtained free as technical assistance or humanitarian purposes (e.g., international donations by the IAEA). Prior to the Federal Government automation of the IDEC processes, the manual processing involved lengthy bureaucratic processes with persistent follow-up requirements. These bureaucratic processes and other Nigerian peculiarities led to the inability of UNDP to follow-through their submissions for waiver as the consignee for IAEA shipments. Nigeria signed a revised supplementary agreement with UNDP which gave the UNDP the mandate to take full responsibility for processing IDEC on all shipments coming from the IAEA.

The persistent complaints from the project coordinators including the IAEA and the consequences of these delays on the IAEA TC project implementation in the country lead to the intervention of NAEC in resolving these challenges. A top-level intervention meeting through the Office of the SGF convened to discuss these challenges and identify the way forward and a further discussion with the IAEA led to the replacement of UNDP with NAEC as the "consignee" for all IAEA shipments. NAEC accepted the role for

sake of national interest on the expectation of quick clearance of shipments and non-payment of demurrage for goods.

The continued intervention of NAEC with the processing of import duty waivers for all shipments coming from the International Atomic Energy Agency (IAEA) has led to drastic reduction of backlogs of shipments to Nigeria from the IAEA. The implementation rate for Nigeria in the implementation of the IAEA projects in Nigeria in 2021 was 94.63% which is the highest in the country.

The following equipment have been cleared and delivered to the final beneficiaries:

S/N	Beneficiary	Equipment
1	Nuclear Technology Centre, Sheda	Gamma Irradiation Facility Spare Parts
2	Centre for Energy Research & Training, Zaria	Gamma Spectrometry System with HPGe Detector
3	Nuclear Technology Centre, Sheda	Portable Contamination Monitor with GM probe
4	Nigerian Nuclear Regulatory Authority Lagos	Reversing lifting solenoid for OB6 device
5	Nigeria Hydrological Services Agency (NIHSA)	Hydrological Field Equipment
6	National Root Crop Research Institute, Umudike	Laboratory Supplies for Cassava Research Programme
7	National Horticultural Research Institute (NIHORT)	Entomological Equipment & Supplies, fruit fly traps and attractants for Nigeria
8	University College Hospital, Ibadan	CTDI phantom (PURE CTDI)
9	Centre for Energy Research and Training, Zaria	Column Scanning System
10	Nuclear Technology Centre, Sheda	Geiger Mueller Counter for Alpha and Beta-Gamma measurement
11	Centre for Energy Research and Development, Ile-Ife	Spectrometer, Energy Dispersive X-Ray Fluorescence for environmental analysis
12	Nuclear Technology Centre, Sheda	PCB milling machine including software
13	Nuclear Technology Centre, Sheda	Alpha Spectrometry System (4 Chambers)
14	Centre for Energy Research and Development, Ile-Ife	Low volume air samplers; Large volume air particulate matter sampler 40-160 m3/h
15	University College Hospital, Ibadan	X-ray Multi-meter with test stand (RADCAL TOUCH AGT-P-AG, AGMS-DM+, 10X6-3CT, 8463D, 40V94D, AGTS+)
16	Nuclear Technology Center, Sheda	Total Reflection X-ray Fluorescence (TXRF) spectrometer
17	National Agency for Food and Drug Administration and Control (NAFDAC)	Laboratory Supplies
18	Nigerian Nuclear Regulatory Authority	HPGe Gamma Spectrometer System (P-type detector)
19	National Horticultural Research Institute (NIHORT)	Equipment for fruit fly management
20	National Veterinary Research Institute	Laboratory Supplies
21	Federal University Oye-Ekiti	Laboratory Supplies
22	National Animal Production Research Institute, Shika	Laboratory Supplies
23	National Hospital, Abuja	RadEye G20-10, Gamma Survey Meter, from 17 keV, measuring range up to 2 mSv/h, 200 mRem/h



Engr: Awwal Bissalla, Head, ICL (Left) and Chairman/CEO, NAEC (2nd From right) receiving some of the equipment from IAEA

b. Annual National Workshop for IAEA Project Counterparts on Enhancing Effectiveness and Efficiency of IAEA Technical Cooperation in Nigeria

One of the successes of the National Workshop for IAEA Project Counterparts is that it underscored the importance of a sustained sharing of experiences on the progress and challenges associated with project implementation on the applications of nuclear science and technology in the country. It helped to identify areas of improvement for optimal benefits. This has also prompted the willingness of NAEC to sustain the conduct of this national workshop on an annual basis. NAEC conducts this National Workshop for IAEA Project Counterparts to sustain the commitment of the Project Counterparts to an improved performance in their respective projects so that Nigeria continues to derive optimal benefits from the implementation of all the IAEA Technical Cooperation (TC) projects in the country. The focus of the national workshop is on the challenges, progress and improvements made in the various projects by adopting best practices. Participants come from institutes and agencies coordinating IAEA TC projects in the country namely: Nigeria Atomic Energy Commission (NAEC); Nigerian Nuclear Regulatory Authority (NNRA); Nigeria Geological Survey Agency (NGSA); Nigeria Hydrological Services Agency (NIHSA); Centre for Energy Research and Training (CERT); Ahmadu Bello University, Zaria; Centre for Energy Research and Development (CERD), Obafemi Awolowo University, Ile-Ife; National Hospital Abuja; University College Hospital (UCH), Ibadan; University of Port Harcourt, Rivers State; National Institute for Trypanosomiasis Research (NITR), Kaduna; Ahmadu Bello University Teaching Hospital (ABUTH), Zaria; Ministry of Health, Abuja; National Animal Production Research Institute (NAPRI), Zaria; National Horticultural Research Institute (NIHORT), Ibadan; National Root Crop Research Institute (NRCRI), Umudike, Abia State; Federal University, Oye-Ekiti; National Agency for Food, Drug Administration and Control, (NAFDAC); Centre for Marine Pollution Monitoring and Seafood Safety University of Port Harcourt; National Veterinary Research Institute (NVRI), Vom; African Centre of Excellence for Neglected Tropical Diseases and Forensic Biotechnology, (ACENTDFB), ABU Zaria, etc.



Cross section of the participants at IAEA Project Counterparts' workshop

c. Train-the-Trainers National Workshop on the Use of InTouch+ Platform of the International Atomic Energy Agency (IAEA)

In the new policy of the IAEA, all applications for trainings, fellowships, scientific visits, etc are to be processed only through the InTouch+ platform. Considering that most people are not



Group photograph of participants at the Train-the-Trainers National Workshop

conversant with the workings of the InTouch+, NAEC, being the national focal agency on nuclear matters and the National Liaison Office for IAEA in the country, organizes a train-the-trainers workshop with a view to getting all prospective applicants from all the relevant government institutions in the country to be acquainted with the workings of the InTouch+ platform. The InTouch+ is an IAEA web platform, embedded within NUCLEUS, which enables submission, review and approval of applications for events, including training courses, fellowships, scientific visits, meetings and sponsored participations, conferences, as well as registration to meetings of the Board of Governors and General Conference. Users of the InTouch+ platform can easily find technical cooperation events for which they are eligible, submit event application for further review by the IAEA or review participation requests by potential candidates in the case of Project Coordinators. The primary goal of the intermittent workshop is to ensure that at the end of every hands-on training exercise each of the participant would have acquired requisite knowledge and skills on the use of this platform and be adequately prepared to train other potential users of the InTouch+ platform in their respective agencies and institutions.



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National Outreach Programme on Nuclear Science and Technology for Public and Private Schools

As part of NAEC'S enlightenment programme on the National Nuclear Energy Programme, the NAEC conducted an outreach programme for secondary schools in the north-east and south-south geo-political zones on the peaceful applications of nuclear science and technology as well as career opportunities in the nuclear industry for young and aspiring scientists.

The objectives of the workshop were to:

- introduce an aggressive programme to 'catch-them-young' and providing a proper grounding for their understanding of the basic STEM subject and how it relates to nuclear Science and Engineering.
- provide understanding of the fundamentals and concepts inherent in nuclear energy applications at the secondary school educational level.
- stimulate interest among secondary school students to prepare them to study nuclear science and technology which would enable them pick up careers in the nuclear industry.

Three technical presentations were made in each centre

1. Nuclear Science & Applications
2. Nuclear technology & Applications
3. Job Opportunities in the Nuclear Industry

North East (Adamawa State)



Cross section of students at the programme

South-South



(Port-Harcourt, River State)



(Yenagoa, Bayelsa State)

Advocacy on peaceful application of nuclear science and technology

The implementation of the advocacy and Outreach programmes seek to involve people from villages to cities, local and state government, traditional and opinion leaders across the six geo-political zones. One of the programmes through which NAEC executes its mandates is the Nuclear Technology Applications Programme. The objective of the Nuclear Technology Applications Programme is to apply proven nuclear technology for the support of the socio-economic wellbeing of Nigerians which cuts across all socio-economic endeavors such as agriculture, health, industry, research and development. Some of the areas covered include:

1. Enlightenment on nuclear Policy implementation in the Fields of agriculture & water Resources in north-central Geopolitical zone of Nigeria



Participants at the Workshop at Keffi, Nasarawa State

2. Enlightenment on Nuclear Policy implementation in the field of Environment & Erosion Control, South East Geo- Political Zone in Isu LGA of Imo State.



3. Enlightenment on Nuclear Policy Implementation in the field of Mining and Mineral Resources in North- West Geo-Political Zone in Anka LGA, Zamfara State.



Participants at the workshop at Amada International Hotel, Maiduguri

Spotlight on Capacity Building

The Nigeria Atomic Energy Commission (NAEC) in conjunction with International Atomic Energy Agency (IAEA) developed a National Project titled **Strengthening National Capacity for Nuclear Instrumentation, Repairs and Maintenance**. The objective of the training is to provide a national institutional network and backbone for nuclear instrumentation for the sustainable and effective repairs and maintenance of nuclear equipment and devices. This project was approved by IAEA in 2018 and part of the output indicators are.

- Upgrade of nuclear instrumentation maintenance laboratory.
- Strengthened national capacity in the repair and maintenance of nuclear-based medical equipment and devices.

The project has assisted NAEC to equip its nuclear laboratory with the following ionizing radiation detectors.

- High Purity Germanium Detector
- Sodium Iodide Detectors
- Alpha and beta Spectroscopy Systems
- Total Reflection X-ray fluorescence (TRXF) Machine

The laboratories are for application in environmental ionizing radiation monitoring and elemental identification of sample. TXRF analyses samples from the environment (water, soil, dust, and sewage), medicine/biology (body fluids, drugs), industrial/technical applications (surface analysis), mineralogy (ores, rocks, minerals, fine arts/archaeological (pigments, painting) and forensic (gunshot residue, fingerprint, textile fibres. This analysis will determine the chemical composition of samples, determine the origin of some samples which can provide more evidence during investigation of crime. Analysis of sample of gunshot residues using TRXF can determine the angle of shooting and the range.

The fellowship activities are aimed at building capacity in developing custom made data acquisition system for nuclear application and to develop the technology to build radiation detectors. Furthermore, it addressed the need for adequate skills for repairs and maintenance of nuclear instrument (detector), biomedical equipment (X-ray Machines, Gamma Camera, CT scan, linear accelerators etc.) and other related devices.



Engr. Arome Kingsley Inyanda at the IAEA Nuclear Science and Instrumentation Laboratory, Seibersdorf, Vienna, Austria during the six months Research Fellowship on data acquisition system for nuclear applications.

Spotlight on NAEC Strategic Goals

GOAL I:

Develop responsive institutional and corporate framework as well as Monitoring & Evaluation (M&E) frameworks to enhance the fulfilment of the Commission's mandate in the 21st Century and going forward.

GOAL II:

Establish a sustainable human resource development programme for recruitment, training and retraining as well as retention of high calibre manpower required for implementing the use of atomic energy for national sustainable development.

GOAL III:

Develop nuclear education and research programmes that encourages gender parity for human resource, research, innovation and development in all spheres of peaceful applications of nuclear technology.

GOAL IV:

Develop Nuclear Power Plant with Suitable Capacity and Technology to Support Optimal Energy Mix for Electricity Generation in Nigeria.

GOAL V:

Develop framework for income generation for sustainability through the creation of Business Development Units (BDUs).

GOAL VI:

Strengthen partnership with national and international stakeholders as well as enhancing advocacy programmes.

GOAL VII:

Acquire new and boost existing nuclear infrastructure for non-power applications to enhance peaceful uses of atomic energy for socio-economic development of the Nation.

Upcoming Programmes

Up Coming Events for Q1 2024

S/N	TITLE	Date
1	Workshop on Development of Environmental Safety Documents for Selected Nuclear Sites	Q1
2	National Workshop on technology assessment, infrastructure development and deployment of Small Modular Reactor in Nigeria.	Q1
3	Training Workshop on Nuclear and Radiological leadership for safety and nuclear security.	Q1
4	Educational outreach programmes to Tertiary Institutions for career in Nuclear Science & Engineering in North- West.	Q1
5	Advocacy and Enlightenment on National Nuclear Energy program implementation and evaluation with stakeholders in North-Central	Q1
6	National Workshop on stakeholder participation in the designing and utilization needs of the Multipurpose Research Reactor.	Q1
7	National workshop to access and evaluate the level of implementation of integrated nuclear infrastructure requirement for nuclear power development in Nigeria	Q1
8	Technical meeting with stakeholders to assess resource capacities of some selected research institutions across Nigeria for implementation of National Nuclear Energy Programme.	Q1
9	NATIONAL WORKSHOP AND EXPERT MISSION ON THE ROLE AND RESPONSIBILITIES OF KEY ORGANIZATIONS DURING THE DEVELOPMENT OF NUCLEAR POWER PROGRAMME	Q2
10	Expert Mission to review Stakeholder Involvement Strategy	Q2
11	Expert Mission To review policy and strategy on radioactive waste management for Nuclear Power Plant	Q3
12	WS on selected issues of Site Safety Evaluation involving geography, demography, human-induced events, and hazard development.	Q3
13	National WS on Environmental Impact Assessment (EAI) for Nuclear Power Plant	Q4
14	Workshop on Conducting Grid Studies (including Grid-NPP Interaction), and Roles and Responsibilities of Key Stakeholders.	Q4
15	Expert Mission to review National HRD Plan	Q4

IAEA Expert Mission on Integrated management System

The Nigeria Atomic Energy Commission hosted an Expert Mission of the International Atomic Energy Agency (IAEA) from 05 – 08 February, 2024. The main objective of the workshop was to assist NAEC in developing its Integrated Management System (IMS), which will guide the Commissions' operations and provide appropriate leadership and comprehensive management guidance for the Nuclear Power Plant (NPP) project. The workshop was held at K-Class Hotel with various stakeholders in attendance including Nigeria Nuclear Regulatory Authority (NNRA), Office of the National Security Adviser (ONSA) and Office of the Secretary of the Government of the Federation (OSGF).

The Expert Mission involved presentations and hands-On exercises on the IMS plan and the core management processes required in phase 2 of the NPP development. At the end of the Expert Mission, recommendations were made on the establishment of the IMS team, the IMS governance framework and the required schedules to achieve the draft IMS manual.



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