A Review of Ghana's National Legal and Regulatory Framework for Nuclear Power and the way Forward

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ABSTRACT

Ghana's interest in nuclear power dates back to the 1950s and has continued under successive governments. Recently, the government of Ghana has renewed its commitment to establish a nuclear power programme and use nuclear power to drive economic transformation and development. Hence, Ghana has aligned its nuclear programme closely with the recommendations and guidelines of the International Atomic Energy Agency (IAEA), especially as outlined in the IAEA Milestones Approach. The Statute of the IAEA authorizes the IAEA to promote the safe and peaceful use of nuclear energy. The safe and peaceful use of nuclear energy in any given State can only be assured with the promulgation and implementation of an effective national nuclear legal framework and infrastructure. Over the past two decades, the IAEA's Office of Legal Affairs has provided assistance to Ghana in the development of its national nuclear legal infrastructures and training of professionals. The legislative framework for nuclear power generation has two main aspects: international and national legislative framework. At the international level, Ghana has ratified some basic international legal instruments, which, when implemented, will show Ghana's commitment to peaceful use and application of nuclear energy. At the national level, Ghana has enacted legislation to deal with radiation, waste, transport safety, environmental protection; among others, which, is relevant and is being taken into account in the development of its legal and regulatory infrastructure. In addition, Ghana has established an independent regulatory body, the Nuclear Regulatory Authority (NRA) to provide for the regulation and management of activities and practices for the peaceful use of nuclear material or energy, radioactive material or radiation; the protection of persons and the environment against the harmful effects of radiation hazards; to ensure the effective implementation of Ghana's international obligations, and for related matters. Also, Ghana has started the development of its Nuclear Power Program through the establishment of its nuclear infrastructure and the training of personnel to mount this program. The Nuclear Power Planning Committee (NPPC) comprising Stakeholder Institutions was established by the President of Ghana in 2008 for the formulation of the Nuclear Power Policy and development of the basic elements of nuclear infrastructure. Despite all this, more work lies ahead. Ghana will need long term commitment and planning, large scale financial and human capital investment, and effective implementation of its national legal framework, if its nuclear power programme is to succeed. Therefore, this study aims to review available international, national legal and regulatory frameworks and the extent to which these frameworks will enhance the establishment of a functional and sustainable nuclear power programme in Ghana.

Keywords: Nuclear Energy, Nuclear Power Programme, Legislative Framework, Regulatory Framework

1.0 INTRODUCTION

The Statute of the International Atomic Energy Agency (IAEA) authorizes the IAEA to promote the safe and peaceful uses of nuclear energy. The safe and peaceful use of nuclear energy in any given State can only be assured with the promulgation and implementation of an effective national nuclear legal infrastructure. The legislative framework for nuclear power generation has two main aspects; national and international legislative framework. At the national level, the existing legislative framework for radiation, waste, transport safety, environmental protection, etc, is relevant and is been taken into account in the legal and regulatory infrastructure development. Ghana though has started the development of its Nuclear Power Program through the establishment of its nuclear infrastructure and the training of personnel to mount this program. Nuclear Power Planning Committee (NPPC) involving Stakeholder Institutions was established by the President of Ghana in 2008 for the formulation of the Nuclear Power Policy and development of the basic elements of nuclear infrastructure. The Committee made recommendations on key issues to Government, including Economics of nuclear power, Legal, regulatory and legislative aspects on nuclear power, Environmental and siting aspects of nuclear Power, Selection of type of reactor, Nuclear fuel cycle including waste management, Role of government and private sector in the development of the programme, Additionally, after the Legislations dealing with establishing effectively independent regulatory authorities, with clear mandate on the responsibility for safety, security and safeguards. Ghana's emerging nuclear power programme is the culmination of nearly 60 years of socio-economic and political developments under successive governments. As far back as 1961, the Nkrumah government instituted a major atomic policy initiative, the Kwabenya Nuclear Reactor Project. Although the nuclear programme never took off as intended, for both political and economic reasons, the government of Ghana recently decided to renew its commitment to establish a nuclear power programme and use nuclear power to drive economic transformation and development. Ghana has demonstrated its commitment to responsible nuclear behavior and standards by ratifying relevant international nuclear instruments, entering into bilateral agreements with responsible nuclear partners, and joining major multilateral nuclear organisations. Ghana has ratified or acceded to several international treaties, conventions and protocols related to nuclear no-proliferation and nuclear safety and security as well as the civil liability regime. Since it joined the IAEA in 1960, Ghana has been a cooperative member of a number of international initiatives with the potential to enhance human resource

development, transfer of nuclear science and technology know-how, and the implementation of the nuclear power programme in the country. To comply with its obligation and benefit from privileges provided ounder the international instruments, Ghana has enacted several laws, formulated policies and worked to institutionalized them. These national laws and policies cover the core issues of nuclear non-proliferation and nuclear safety and security.The legislative framework for nuclear power generation in Ghana has two main aspects: national and international legislative framework. At the national level, there is existing legislative framework for radiation, waste, transport safety, and environmental protection; which is relevant and is being taken into account in the legal and regulatory infrastructure development. These include local land use controls, environmental matters (e.g. air and water quality and wildlife protection), the economic regulation of electric power utilities, the occupational health and safety of workers, general administrative procedures of governmental bodies, transport, the export and import of nuclear material, intellectual property rights, insurance and liability for nuclear damage, emergency management, criminal laws and taxation. At the international level, Ghana has ratified some basic international legal instruments, which, when implemented, will show Ghana's commitment to peaceful use and application of nuclear energy.

In addition, Ghana has enacted the Nuclear Regulatory Authority Act, 2015 (Act 895) which has established NRA to provide for the regulation and management of activities and practices for the peaceful use of nuclear material or energy, radioactive material or radiation, to provide for the protection of persons and the environment against the harmful effects of radiation hazards, to ensure the effective implementation of Ghana's international obligations, and for related matters. The NRA comprises three directorates and 10 Departments. Two of these departments – Nuclear Safety, Security and Safeguard; and, Emergency Preparedness and Response – have been taxed with overseeing the development of nuclear power-related regulations. The drafting of regulations by the NRA contributes to its mission of guaranteeing the implementation of the provisions of the NRA Act 895. Since 2017, 20 regulations relating to different categories were under development. These ranged from nuclear safeguards, siting of nuclear installations, nuclear power generation in Ghana and ration of a nuclear and radioactive waste management facility; to the education, training, qualification and certification of personnel of a nuclear installation. The regulations cover a wide range of factors that have to be taken into account in a nuclear power programme and as such represent an important step in its development. Apart from these regulations, the NRA is also preparing a number of 'guidance documents' that correspond to the general focus areas of the regulations. A number of stakeholders will play a part in the development of Ghana's nuclear power programme.

These consist of government ministries, nuclear regulatory bodies, key players from the energy sector and development partners. Ghana has taken significant steps to establish a viable and sustainable nuclear programme, but much work lies ahead. There will be need for long term commitment and planning; as well as large-scale financial and human capital investment, if the programme is to be successful. This paper discusses available international, national legal and regulatory frameworks and the extent to which these frameworks will enhance the establishment of a financial and sustainable nuclear programme in Ghana

2.0 ASSESSING LEGAL FRAMEWORK

This study reviewed the current legal framework state of the Ghana Nuclear Programme, and the way forward. In addition, to examine the available international legal and regulatory frameworks and the extent to which these frameworks will enhance the establishment of a functional and sustainable nuclear programme in Ghana.

The paper employed two comprehensive data collection methodological tools. The first source of data collection methodology was interviews and questionnaires conducted with randomly selected stakeholders of the nuclear programme in Ghana. Secondly, the paper also relied on qualitative research design by utilizing texts of existing primary and secondary sources of information on the nuclear programme in Ghana. These included international treaties, conventions and protocols; relevant domestic legislation and subsidiary legislation, and legislative instruments. In addition, the paper relied on information from textbooks, professional journals and periodicals, research papers, official reports, official government and policy papers, the internet and online library materials. All information and data were collated, coded, reviewed, analyzed and interpreted to clarify issues, to answer the relevant questions and finally provide the basis for recommendations and the way forward. The results of the review data were based on two studies done. Table 1 represent national legislative framework undertaken for the establishment of nuclear power program in Ghana and Table 2 represent international legislative framework that support the national laws for the nuclear power project. The protection of people and the environment in countries with nuclear installations relies on the existence of a solid regulatory framework that oversees the safety of these installations. The IAEA promotes and supports the establishment of comprehensive regulatory frameworks to ensure the safety of nuclear installations throughout their lifetime.

These regulatory frameworks consist of relevant legislation, regulations and guidance and a robust leadership and management programme for safety. It is essential to ensure that an operational and effectively independent regulatory body is established and maintained for the regulatory control of nuclear installations.

This body needs sufficient resources and suitably qualified and competent staff that are enabled to fulfil their regulatory responsibilities and functions. The IAEA's Safety Standards and the Code of Conduct on the Safety of Research Reactors lay out the international requirements and recommendations for enhancing existing or developing regulatory systems for the control of nuclear installations throughout their lifetime until they are released from regulatory control, and any subsequent period of institutional control. The Convention on Nuclear Safety also provides to its contracting parties a set of obligations, including those relative to their legislative and regulatory framework and regulatory bodies. To accomplished these two international regulatory frameworks as prerequisite for the use of nuclear technology, Ghana in 1960 signed on to IAEA status for peaceful use of nuclear for economic development. This led to the established of Ghana Atomic Energy commission in 1963. Subsequent to this, Ghana signed to the non-proliferation treaty and this allows her to utilize nuclear technology for peaceful purposes. The first president of the country cut the sod for the Ghana Nuclear Reactor Project (GNRP) in 1964, unfortunately this was abandoned after the 1966 coup d'état. However, since 1993 a number of legislative frameworks has been established that paved way for the establishment of nuclear power in Ghana. This includes the establishment of Radiation Protection Instrument, LI 1559, National Nuclear and Radiological Emergency Response Plans, Act 517, 1996, Nuclear Power Programme Organization, Regulatory Strategy, NPID-11521-STG-001, 2014 and Nuclear Regulatory Authority, Act 895, 2015. Additionally, the regulator provided a draft Safeguards Regulation, NRA SGR DV1/16, 2016, the establishment of Nuclear power institute (NPI) to provide a leading role in research and the Nuclear Power Ghana (NPG) which was set up to manage Ghana's first nuclear power project. NPG has been designated to be the eventual owner and operator of Ghana's first Nuclear Power Plant. Activities of the organisation began in 2018 when some staff of Volta River Authority (VRA), Bui Power Authority (BPA), and the Ghana Atomic Energy Commission (GAEC) were co-opted to form an initial core staff.

Table 1: Development of National Legal Framework

Laws	**Est Year**	**Agency**
GAEC Instrument, Act 204	1963	GOG
Radiation protection instrument, LI 1559	1993	GAEC
National Nuclear and Radiological Emergency Response Plans, Act 51	1996	NADMO/GAEC
Nuclear Power Programme Organization, Regulatory Strategy, NPID-11521-STG-001	2014	GAEC
NRA, Act 895	2015	GAEC
Draft Safeguards Regulation, NRA_SGR_DV1/16	2016	NRA
Nuclear Power Institute (NPI)	2016	NPI
U.S. Nuclear Regulatory Commission-Ghana Nuclear Regulatory Auth Action Plan, NPID-127540-TNT-005	2016	NPI
Nuclear power Ghana (NPG)	2018	NPG

Table 2: International legal framework ratified by Ghana

Laws/Treaties	**Year depos**	**Agency**	**Instrument**	**Year Entry into force**
Agreement on the Privileges and Immunit of the IAEA	1963	IAEA/GoG	Acceptance	1963
The Convention on Nuclear Safety (INFCIRC/449)	2011	IAEA/GoG	Ratification	2011
Joint Convention on the Safety of Spent F Management and the Safety of Radioactiv Waste Management (INFCIRC/546)	2011	IAEA/GoG	Accession	2011
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emerge (INFIRC/336)	2016	IAEA/GoG	Accession	2016
The Convention on the Early Notification Nuclear Accident (INFCIRC/335)	2016	IAEA/GoG	Accession	2016
Convention on the Physical Protection of Nuclear Material (INFCIRC/274)	2002	IAEA/GoG	Accession	2002
Convention for the Suppression of the Financing of Terrorism, UNSCR Resolution 1373	2001	IAEA/GoG	Accession	2001
Treaty on Non-Proliferation of nuclear weapons (INFCIRC/153),	1972			1972
Convention on the Physical Protection of Nuclear Material (GOV/INF/2005/10-GC (49)/INF/6).	2012	IAEA/GoG	Ratification	2016
Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500) and (INFCIRC/556) and (INFCIRC/567)	1963	IAEA/GoG	Ratification	1977
African Regional Co-operative Agreemen Research, Development and Training rela to Nuclear Science and Technology (AFR	2020	IAEA/GoG	Acceptance	2020

3.0 DISCUSSIONS

Ghana has demonstrated its commitment to responsible nuclear behavior and standards by ratifying relevant international nuclear instruments, entering bilateral agreements with responsible nuclear partners, and joining major multilateral organisations; as well as enacted national laws on nuclear power and established the relevant regulatory bodies. This section reviews the most important international, national and regulatory frameworks relevant to the Ghanaian context.

3.1 International Nuclear Instruments

To advance its nuclear programme, Ghana has ratified or acceded to several international treaties, conventions and protocols. The Convention on Nuclear Safety (INFCIRC/449), the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (INFCIRC/546) are instruments on nuclear safety and radiological protection, and seek to promote adherence to nuclear safety principles based on a common interest of the international community to achieve higher levels of safety. State Parties are obliged to submit reports on the implementation of the safety principles with arrangements for "peer review" at meetings.

The Convention on the Early Notification of a Nuclear Accident (INFCIRC/335) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (INFIRC/336) are conventions on Emergency Response and were adopted after the Chernobyl accident. They create a system for notifying the IAEA and neighbouring countries of a nuclear accident with potential transboundary consequences, and also set up a framework for prompt assistance and support for nuclear accidents or radiological emergencies.

The main legal instruments on nuclear security and physical protection are: Convention on the Physical Protection of Nuclear Material (INFCIRC/274) and Amendment to the Convention on the Physical Protection of Nuclear Material (GOV/INF/2005/10-GC (49)/INF/6). They aim to promote principles that are designed to prevent, detect and respond to criminal and other unauthorised acts involving or directed to nuclear or other radioactive material and associated facilities or activities. Other conventions include the Suppression of Unlawful Acts against the Safety of Maritime Navigation, Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms located on the Continental Shelf, International Convention for the Suppression of Terrorist Bombings, International Convention for the Suppression of the Financing of Terrorism, UNSCR Resolution 1373 on Prevention/Suppression of Financing and of Preparation of Terrorist Acts, and International Convention on the Suppression of Acts of Nuclear Terrorism. Legal instruments that empowers and requires that the IAEA ensures that safeguards and measures area applied to all nuclear materials in the territory, jurisdiction or control of

State, for the exclusive purpose of verifying that such materials are not diverted for nuclear weapons or other nuclear explosive devices are: the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on Non-Proliferation onf Nuclear Weapons (INFCIRC/153), Small Quantities Protocol (GOV/INF/276), Model Protocol Addition to the Agreement(s) between the State and IAEA for the application of Safeguards (INFCIRC/540), UNSC Resolution 1540 on Preventing theAcquisition of Weapons of Mass Destruction (Including Nuclear) by Terrorist/ Criminal Groups. Acquisition of Weapons of Mass Destruction (Including Nuclear) by Terrorist/ Criminal Groups.

However, two conventions are not yet in force: The Comprehensive Nuclear-Test-Ban Treaty and the Treaty on the Prohibition of Nuclear Weapons. Once these conventions enter into force, they will buttress the legal regime for non-proliferation and safeguards. Another relevant legal instrument is the Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA.

The Nuclear Liability Conventions ensure that there is no ambiguity as to who bears liability in the event of a nuclear incident and also makes provision for compensation for victims of nuclear damage. Nuclear damage includes transboundary damage caused by a nuclear incident at a nuclear installation, or in the course of transporting of nuclear materials to or from an installation. The Nuclear Liability Conventions include: The Paris Convention on Third Party Liability in the Field of Nuclear Energy, Brussels Convention Supplementary to the Paris Convention, Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500), the Joint Protocol Relating to the Application of the Vienna Convention (INFCIRC/402), the Paris Convention and the Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/556) and the Convention on Supplementary Compensation for Nuclear Damage (INFCIRC/567).

The Protocol to Amend the Paris Convention on Third Party Liability in the Field of Nuclear Energy, and the Protocol to Amend the Brussels Convention Supplementary to the Paris Convention seek to improve the compensation provisions in the Paris Convention on Third Party Liability in the Field of Nuclear Energy. These two conventions are yet to enter into force.

3.2 Ghanaian Nuclear Legal Framework

The Nuclear Regulatory Authority Act 2015 (Act 895) applies to all activities and practices involving the peaceful uses of radiation, nuclear and radioactive material conducted under the jurisdiction of Ghana. The Act establishes the Nuclear Regulatory Authority and provides for the regulation and management of activities and practices for the peaceful use of nuclear material or energy, radioactive material or radiation; to provide

peaceful use of nuclear material or energy, radioactive material or radiation; to provide for the protection of persons and the environment against the harmful effects of radiation hazards, to ensure the effective implementation of the Country's international obligations and to provide for other related matters. for the protection of persons and the environment against the harmful effects of radiation hazards, to ensure the effective implementation of the Country's international obligations and to provide for other related matters.

The Act deals with Nuclear Installations, Radioactive Waste Management, Transportation of Radioactive Materials and Decommissioning of Nuclear Facilities, and ensures the independence and separation of regulatory functions from those of other organisations concerned with the promotion and or utilization of nuclear energy. The Act addresses all relevant non-proliferation and safeguards undertakings of Ghana and clearly spells out the responsibilities and liabilities for the operation of nuclear facilities and the handling and safeguarding of nuclear materials; and establishes a system of licensing as well as the terms of licenses (i.e. suspension, modification and revocation of a license), a system of regulatory inspection and assessment to ascertain compliance with the applicable laws and regulations. The sector minister is empowered by the Act to make subsidiary legislation in the form of Legislative Instruments for the efficient and effective implementation of the Act. The Act is very comprehensive and covers all aspects of nuclear safety, security and safeguards. It also establishes an independent regulatory authority to regulate the industry and has put in place measures to ensure that the regulatory authority is independent and financially stable. This is in conformity with international legal requirements and best practices. Subsidiary legislation is yet to be passed as required by the law. The Environmental Protection Agency Act 1994 (Act 490) amends and consolidates all the laws relating to environmental protection, pesticides control and regulation, as well as related activities.

The Act establishes the Environmental Protection Agency, which is governed by a Board, as the Agency, mainly charged with the execution of the duties spelt out in the Act. The Act is generally silent on Nuclear Power or Nuclear waste. It rather deals with Industrial waste as well as other hazardous chemicals. It provides for a hazardous chemicals committee which has a representative of the Ghana Atomic Energy Commission as a member. The Act requires any person who wishes to undertake any activity which has or is likely to have an adverse effect on the environment to submit an environment impact assessment report. Apart from this requirement, there is no other compliance requirement that has to be met. However, the functions of the Agency and the Hazardous Committee both create an avenue through which issues on nuclear energy and nuclear waste can be dealt with pending an amendment of the EPA Act to cater for peculiar needs of the nuclear requirements of the nuclear industry.

In addition, the Act does not contain a comprehensive definition of key concepts such as pollution, hazardous substances, waste materials or substances and the environment. There is a need to include a clear and comprehensive definition of these concepts, and also amend the existing EPA Act to include nuclear energy and nuclear waste. Minerals and Mining Act 2006 (Act 703) consolidates all the laws relating to minerals and mining and also to cater for related purposes. The Act covers all minerals in its natural state in, under or upon land in Ghana, rivers, streams, water-courses throughout the Country. The Act also applies to radio-active minerals mined or discovered within the territory of Ghana.

The present scope of the Act is wide enough to cover the mining and milling of radio-active materials which may be mined locally to be processed as nuclear fuel or for other purposes. The Act at the moment need not be amended. National Disaster Management Organisation Act 1996 (Act 517) establishes a National Disaster Management Organization (NADMO) to be responsible for disaster management and other similar emergencies, to provide for the rehabilitation of persons affected by disaster and for related matters.

NADMO is mandated to prepare national disaster plans for preventing and mitigating the consequences of disasters. It is also to monitor, evaluate and update national disaster plans. NADMO is also tasked with ensuring that there are appropriate and adequate facilities for the provision of reliefs, rehabilitation and reconstruction after a disaster or any emergency incidence; and also responsible for coordinating local and international support for disaster or emergency control relief services and reconstruction. NADMO is also to ensure the establishment of adequate facilities, technical training and the institution of educational programmes to provide public awareness, warning systems and general preparedness of its staff and the general public; and to perform any other function that is incidental to disaster management and related matters NADMO is governed by the National Security Council which is responsible for determining its policies. It has the mandate to establish a national, regional and district management committees which carry out and implement the policies and functions of the organization at each level. NADMO is funded by moneys provided by parliament and by way of grants, donations and gifts. Hazardous and Electric Waste Control and Management Act 2016 (Act 917) provides for the control, management and disposal of hazardous waste, electrical and electronic waste for related purposes. The Act, among others, covers waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known, wastes of an explosive nature not subject to other legislation, wastes from production, formulation and use of

of photographic chemicals and processing materials; wastes resulting from surface treatment of metals and plastics and residues arising from industrial waste disposal operations. The main implementation organization is the EPA established under the Environmental Protection Agency Act, 1994 (Act 490). Though the Act contains provisions on the Control and management of hazardous wastes and other wastes, there is no specific mention of nuclear or radioactive waste substances. The Act makes it an offence to import, export, sell, purchase or deal in hazardous or other waste without lawful authorization from either the Minister or EPA . One criterion for granting such authorization is whether or not the State that desires to export the waste is a party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal or is a party to a bilateral, multilateral or regional agreement or arrangement regarding transboundary movement of hazardous waste or other wastes in accordance with Article 11 of the Basel Convention; The Act defines "wastes" to mean substances or objects, which are disposed of or are intended to be disposed of or are required to be disposed of and "waste electrical and electronic equipment" to mean electrical or electronic equipment that is waste, including all components, sub-assemblies and consumables which are part of the equipment at the time the equipment becomes waste. Looking at the scope of Act 917, it will appear that nuclear waste is best catered for by Act 895.

Energy Commission Act 1997 (Act 541) establishes the functions relating to the regulation, management, development and utilization of energy resources, provide for the granting of licenses for the transmission, wholesale supply, distribution and sale of electricity, among other things. The objects of the Commission are to regulate and manage the utilization of energy resources in Ghana and co-ordinate policies in relation to them. More particularly, the Commission shall, among other things: recommend national policies for the development and utilization of indigenous energy resources; advice the Minister on national policies for the efficient economical and safe supply of electricity and natural gas transmission, wholesale products considering the national economy; prepare, review and update periodically indicative national plans to ensure that reasonable demands for energy are met; secure a comprehensive data base for national decision making on the extent of development and utilization of energy resources available to the nation; receive and assess applications, and grant licenses under this Act to public utilities for the transmission, wholesale supply distribution, and sale of electricity and natural gas; establish and enforce, in consultation with the Public Utilities Regulatory Commission, standards of performance for public utilities engaged in the transmission, wholesale supply, distribution and sale of electricity and natural gas; and, promote and ensure uniform rules of practice for the transmission, wholesale supply , distribution and sale of electricity

products considering the national economy; and natural gas; and, promote and ensure uniform rules of practice for the transmission, wholesale supply, distribution and sale of electricity and natural gas. The NRA Act needs to be amended to ensure that the Energy Commission no longer plays a role in the licensing of electricity generation sources from nuclear energy resources.

Renewable Energy Act, 2011 (Act 832) provides for the development, management, utilization, sustainability and adequate supply of renewable energy for generation of heat and power and for related matters.The object of this Act is to provide for the development, management and utilization of renewable energy sources for the production of heat and power in an efficient and environmentally sustainable manner.The Act defines "renewable energy" to include energy obtained from non-depleting sources such as wind, solar, hydro, biomass, bio-fuel, landfill gas, sewage gas, geothermal energy, ocean energy and any other energy source designated in writing by the Minister. The Act provides a framework to support the development and utilization of renewable energy sources, an enabling environment to attract investment in renewable energy sources, the promotion for the use of renewable energy, the diversification of supplies to safeguard energy security; improved access to electricity through the use of renewable energy sources, the building of indigenous capacity in technology for renewable energy sources; public education on renewable energy production and utilization, and the regulation of the production and supply of wood fuel and bio-fuel.The Act also provides for requirements, qualifications and application for a license to engage in a commercial activity in the renewable energy industry. Even though there are ongoing arguments as to whether nuclear energy is a form or type of renewable energy, the Act, however, gives the Minister the discretion to designate any other energy source as a renewable energy source and this is one way or the other places nuclear energy directly or indirectly within the purview of this Act. In the event where a specific Act on nuclear energy does not make express provision on a subject or matter affecting nuclear energy, the Minister in exercise of his discretionary powers under the Act can make provision for same. The Act therefore does not need any amendment. Ghana Atomic Energy Commision Act, 2000 (Act 588) amends and consolidates the law relating to the establishment of the Atomic Energy Commission and for related matters in Ghana, and provides for establishment of the Energy Commission, functions of the Commission, committees of the Board, Funds and the general governance of nuclear energy in Ghana. The functions of the Commission include, among others: proposals to the Government for legislation in the field of nuclear radiation and radio-active waste management; to advise the Government on questions relating to nuclear energy, science and technology; to establish, for the purposes of research and in furtherance of its functions, institutes of the Commission and to exercise

of management of the institutes to encourage and promote the commercialization of research and development results through its Institutes; to supervise the carrying out of all requirements designed to secure the safety and health of nuclear radiation workers and the environment; to engage in research and development activities, as well as in the publication and dissemination of research findings and other useful technical information; to oversee and facilitate the development of human resources in the fields of nuclear science and technology, and to promote the training of scientific, technical and non-scientific personnel of the Commission; to maintain relations with the IAEA and other similar international and national organizations, and to collaborate and liaise with those organizations on matters of research and development of nuclear energy and nuclear technology. Under the Act, the Minister may, on the recommendation of the Commission, by legislative instrument, make regulations for the purpose of securing the safe operation of a nuclear installation under the supervision of the Commission and by any other organization; securing the safe transport of nuclear fuel, radio-active products or waste; regulating and controlling the collection, segregation, treatment, conditioning, storage and disposal of radio-active waste generated in facilities of the Commission and in the mining, milling, gas production and other uses of radio-active materials and sources; securing the maintenance of efficient systems for personnel and environmental monitoring and for medical surveillance and treatment of radiation related sickeness; harmonizing the interests of state agencies concerned with the utilization of radiation; and ensuring the operations relating to irradiating devices and radio-active materials are carried out without risk to public health and safety and that devices, plants, installations and facilities are designed, constructed, calibrated and operated in accordance with standards prescribed by the Minister. The Act is very instructive on nuclear energy in Ghana, setting up and Atomic Energy Commission in Ghana and provides expert knowledge on the nuclear power generation. Provision is also made for the safe keeping and transportation of radioactive materials as well as the safe disposal of radioactive waste. There is also a possible duplication of the provisions of the NRA Act. Collaboration between GAEC and NRA is therefore suggested. No amendment is however needed. Emergency Powers Act, 1994 (Act 472) provides for powers to be exercised in cases of state of emergency and for related matters. The Act states the circumstances under which a state of emergency may be declared to include a natural disaster and any situation in which any action is taken or is immediately threatened to be taken by any person or body of persons which, is calculated or likely to deprive the community of the essentials of life or renders necessary the taking of measures which are required for securing the public safety, the defence of Ghana and the maintenance of public order and of supplies and services essential to the life of the community. The Act provides immediate action in dire situations where necessary measures have to be

immediate action in dire situations where necessary measures have to be taken, or is required for securing the public safety, in the defence of the Republic and the maintenance of public order and of supplies and services essential to the life of the community. Furthermore, the Act makes provision for the removal of persons from emergency areas where the emergency relates only to a part of the country. The President in these emergency situations may be exercise these emergency powers through the issuance of Executive Instruments (EI) or Orders etc. These EIs or Orders may empower persons or authorities to take certain actions specified in the instruments. This Act, needs no amendment since it could be applied to an emergency situation arising from a nuclear disaster. Public Utilities Regulatory Commission, Act 1997, (Act 538) establishes the Public Utilities Regulatory Commission (PURC) as a multi-sectorial public utility regulator. Functions of the PURC among others is to provide guidelines for rates to be charged for the provision of utility services; examine and approve water and electricity rates; advise any person or authority in respect of any public utility; receive and investigate complaints and settle disputes between consumers and public utility. The Act deals largely with the administration of the Commission, providing for its governing body, staff, funding sources etc. and also deals with regulatory matters like standards of performance and rate setting for public utilities. Public Utilities Regulatory Commission Act, 2010 (ACT 800) As amended was amended in 2010, to include levies payable to on electricity and natural gas transmission services, to be part of the funding sources for the Commission. In my view, there is no need to amend the PURC Act to cater for a nuclear power programme. From the above review and analysis of the current laws of the country, it is important to note that the available framework is enough and very little amendments are required for the development of nuclear power plant program.

3.3 Ghanaian Nuclear Regulatory Framework

The regulatory framework established under Act 895 provides for the regulation of nuclear installations, establishing a licensing regime, safeguards and prohibitions, inspections, enforcement, liability for nuclear damage, among others The main approach adopted by the NRA is to set standards and requirements for the licensee and provide guidance by which the applicant will meet its license obligations. The NRA is responsible for the regulation of nuclear safety, security and safeguards, and also emergency preparedness and environmental considerations for nuclear and radiological related matters. The NRA was established in 2016; when, preparation for the introduction of nuclear power had started. Subsequently, it is developing regulations and guides; recruiting and developing the competency of its staff. The work of the NRA is guided by the IAEA Safety Series and Nuclear Security Series document. Meaning, it's work is

guided by the ten Fundamental Safety Principles provided for in the IAEA Fundamental Safety Principles document, and the twelve Essential Nuclear Security Elements provided for in the Objectives and Essential Elements of a State's Nuclear Security Regime document. The NRA follows the IAEA proposed 4-quadrant approach for the systematic training of its staff. Level I capture basic professional training in nuclear technology, nuclear security, safeguards and non-proliferation. Level II addresses technical competencies in nuclear safety, nuclear security, safeguards and non-proliferation; while Level III addresses the core functions of NRA work including inspections, review and assessment and development of regulatory tools, etc. The fourth level addresses management and leadership competencies. The above training requirements are conducted through a combination of both internal and external training programmes, including foreign training programmes. For local training, apart from in-house training of staff, the School of Nuclear & Allied Sciences (SNAS) of the University of Ghana offers training in various Level I, II and III topics. Considerable external foreign training support is provided by the IAEA and other multilateral organisations, bilateral partners, and other foreign regulatory bodies. Some of these include the Regulatory Cooperation Forum (RCF), Global Nuclear Safety and Security Network (GNSSN), the Forum on Nuclear Regulatory Bodies in Africa (FNRBA), the European Commission Instrument of Nuclear Safety (INSC), the United States Nuclear Regulatory Commission (US NRC), the Canadian Nuclear Safety Commission (CNSC), Moroccan Agency for Nuclear & Radiological Safety & Security (AMSSNUR) of Morocco, etc. In developing regulations for the nuclear power programme, the NRS adopts a hybrid approach of prescriptive and performance-based approaches. This approach is considered an optimal position between providing explicit regulatory requirements, that requires the licensee to follow a well-developed methodology, and generic requirements, that gives room for the licensee to innovate and use approaches that are well-founded and internationally accepted. The legal hierarchy of documents that govern the work of the NRA is presented in Figure 1.

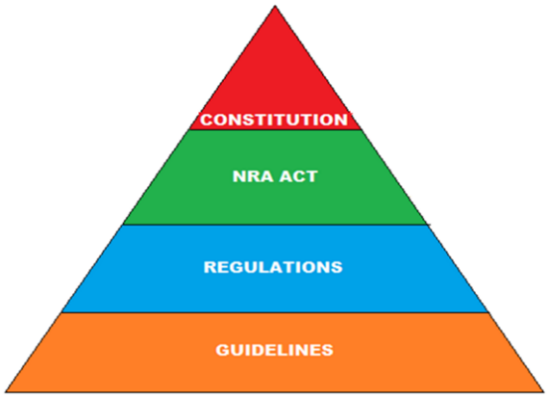

Figure 1: Ghana's Legal Hierarch

The NRA has experience with review and assessment for research reactors. Specifically, the NRA conducted a review and assessment for the change of the core of the Ghana Research Reactor -1 (GHARR-1) from highly enriched uranium to low enriched uranium. The NRA, however, does not have experience in conducting review and assessments for nuclear power plants.

The review and assessment process is a critical appraisal of a proposed reactor project design, with the objective of determining whether the information submitted by the prospective licensee demonstrates that the facility complies with safety and security objectives, throughout its lifetime. The process consists of examining the prospective operator's submissions on all aspects relating to the safety, security and safeguards of the facility. This includes considerations of both normal operation and under accidental conditions, and events including human errors that have the potential for causing exposure of workers, the public, or environment to radiological hazards.

Figure 2 presents a brief on the process that will lead to a series of regulatory decisions including granting an authorisation/license, which if appropriate, imposes conditions or limitations on a facility operator's subsequent activities; or the refusal of such an authorization or license.

Prepare programme of review and assessment	• This allows for streamlining activities during the review and assessment. With this, the NRA will be able to follow the development of facility, as applicable, from initial selection of site, through all activities until removal from regulatory control.
Acceptance review	• This is to ascertain if the document(s) submitted is complete and contains all necessary information to conduct an indepth review and assessment.
Conduct preliminary review	• Findings from this process allows for prioritizing review on the basis of potential implication on overall safety of the facility which inturn will support effectiveness of the Authority.
Systematic plan	• To provide assurance that all topics significant to safety will be covered and all operators of similar facilities are trated equally.
Conduct of review	• Subject matter experts assess information presented to ascertain its trueness/ appropriatness in meeting the requirements of the Authority

Figure 2: Brief description of review and assessment process

Authorisation by licensing broadly represents a graded approach to regulatory control based on levels of risk, or nature of the facility or activity. Authorisation is thus required by any licensee. It is the principal means by which the Authority can apply the legal and regulatory framework, and by which the responsibilities of an applicant are clearly spelt out. This is the practice used by the NRA for all radiological facilities within the country and the GHARR-1 facility. Building on the experience gained so far, steps are being developed for authorisation for nuclear power plants. For this case, authorisation is required to take the form of licensing. A license is given when the Authority has confirmed through review and assessment that a prospective licensee's activities and operations are going to be conducted in a manner that does not pose any unacceptable risk to people and or the environment. Licensing covers all stages of the lifetime of the nuclear power plant, including siting, construction, commissioning, operation, decommissioning and release from regulatory control.

Act 895 of 2015 makes provision for the NRA to undertake enforcement actions against any facility that is found to be in non-compliance with requirements. The objective of enforcement is to provide a high level of assurance that authorised parties comply with all requirements at all steps and stages of the lifetime of the facility, ultimately ensuring safety. There is an established enforcement policy for the NRA which is also applied in a graded approach. Enforcement actions within the policy include; verbal notification, written notification, imposition of additional regulatory requirements and conditions, written warnings, penalties and ultimately revocation of authorisation. Extreme situations may entail prosecution.

Figure 3: Steps for authorisation process/Licensing Life Cycle

4.0 CONCLUSION

In conclusion, Ghana has the necessary legislative and regulatory framework to ensure the success of its nuclear power programme. At the international level, Ghana has ratified relevant international nuclear instruments, entered into bilateral agreements with responsible nuclear partners, and joined major multilateral nuclear organisations; which, when properly implemented, will show Ghana's commitment to peaceful use and application of nuclear energy.

At the national level, Ghana has passed several national laws and formulated policies to cover the core issues of nuclear non-proliferation and nuclear safety and security, and has worked to institutionalized them. Also, it has existing legislation to cover radiation, waste, transport safety, environmental protection, among others; which is being taken into account in the development of its legal and regulatory infrastructure.

In addition, Ghana has established the NRA to provide for the regulation and management of activities and practices for the peaceful use of nuclear material or energy, radioactive material or radiation; to provide for the protection of persons and the environment against the harmful effects of radiation hazards; and, to ensure the effective implementation of Ghana's international obligations, and for related matters.

Despite Ghana's comprehensive legislative and regulatory framework, more work lies ahead. Ghana will need long term commitment and planning, large scale financial and human capital investment, effective implementation of its national legal framework, and amendment of some of its laws, if its nuclear power programme is to succeed.

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