

## LEGAL AND INSTITUTIONAL FRAMEWORKS ADDRESSING OCCUPATIONAL RADIATION AND PROTECTION OF WORKERS IN NUCLEAR POWER PLANTS AND OTHER RELATED WORK PLACES IN NIGERIA

By

Ogwezzy Michael. C (PhD)\*

### Abstract

*This paper foregrounds that in labour law and labour relations, the main focus of the law and policy drivers is to ensure occupational health and safety. This includes the promotion and maintenance of safe working environment ensuring capacity building and sound employee's health; improvement of working environment; development of work cultures and organizations to support health and safety in work places. Government makes laws that direct companies and employers to provide a safe working environment for their employees. This is intended to identify hazardous materials, conditions and practices at workplaces. Such laws will also assist employers and workers to reduce or eliminate the risks factors of their job. Nigeria over the years have enacted different legislations that provided for occupational safety measures for radiation protection in nuclear power plant industries. This paper examines the different legislation that makes provision for the Occupational Radiation Protection of Workers in Nuclear Power Plants in Nigeria. Though, the Constitution of the Federal Republic of Nigeria, 1999 in Section 17(3)(c), specifically provides that, the State shall direct its policy towards ensuring that the health, safety and welfare of all persons in employment are safeguarded and not endangered or abused. Major legislation enacted to provide for the safety and health of Nigerian workers generally and in Nuclear Power Plants in particular includes: the Factories Act 2004, Employees Compensation Act, 2010, Nigerian Minerals and Mining Act, 2007, Nigeria Atomic Energy Commission Act enacted 27 August, 1976, Nigerian Nuclear Safety and Radiation Act, 1995, National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, of 31 July, 2007, the Petroleum Industry Act, of 16 August, 2021. Other related laws that seek to give guidance to the implementation of occupational radiation protection of workers in Nigeria are: Nigeria Basic Ionising Radiation Regulations, 2003, Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006, Nigerian Radiation Safety in Nuclear Well Logging Regulation, 2008, the Nigerian Radiation Safety in Naturally Occurring Radioactive Materials (NORM) Management Regulations, 2008, The National Policy on Occupational Safety and Health, 2006 and the Nigerian Minerals and Mining Regulation 2011. The paper takes into consideration a review of the provisions of the major legislation that established Institutional Frameworks or bodies that implement and give directions as to the proper functioning of laws that addresses issues of safety*

*and protection of workers against the effects of radiation in Nuclear Power Plants in Nigeria and other related work places. For example, the Mines Inspectorate Department created by the Nigerian Minerals and Mining Regulation, 2011, the Board of the Nigeria Atomic Energy Commission and the Nigeria Nuclear Regulatory Authority, and the Governing Board established by the Nuclear Safety and Radiation Protection Act. These institutions assist in giving policy directions, execute policy directives and ensure the efficacies of these laws. This paper concludes that Nigeria has enacted laws that provided for institutions with mandates to address issues of Occupational Radiation Protection of Workers in Nuclear Power Plants in accordance with international best practices.*

**Keywords:** Legal, Framework, Occupational, Power, Nigeria.

## Introduction

This paper addresses the relevant legal and institutional frameworks on occupational radiation and protection of workers in Nuclear Power Plants in Nigeria. It is an established fact that people who work in nuclear power plants are exposed to different occupational hazards and the most obvious of them is radiation emitting from the plants. These radiation sources are deleterious to human health. Hence nations with potential for nuclear energy build ups and power stations have enacted laws and established institutions to implement these laws in a bid to ebb or reduce the effects of these radiations on the health of those working in these nuclear power stations. Ionisation radiation<sup>1</sup> exposure is the primary hazard that occur when working with nuclear substances, however, residual contamination, through exposure to particulate dusts, can also pose a serious health risk. This exposure can occur, for example, when residual radioactive contaminated particles, such as dusts and silica, are released into the air through the vibrations from the nuclear plant. Workers can also be exposed through occupational exposure <sup>2</sup>to contamination through chemical splash and liquid chemicals such as sulfuric acids and sodium hydroxide-all of which are an irritant and corrosive to skin tissue. Workers involved in nuclear research and testing, site inspections, reprocessing and general maintenance are also at risk. Where it is unavoidable for a worker to be exposed to contaminants, it is necessary that contamination is minimised through the correct use of personal protective equipment.<sup>3</sup>

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\*LL.B (Ibadan) B.L (Enugu) ML.D (DELSU) MASIO/LL.M (ZH/Switzerland) LL.M, Ph.D (Nigeria), Professor of Law, Head, Department of Public Law, Faculty of Law, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria. Tel: +2348035460865, Email address: ogwezzy@ust.edu.ng, michael.ogwezzy@yahoo.com

<sup>1</sup> "Ionizing radiation" is a sort of radiation capable of producing ion pairs in biological materials.

<sup>2</sup> "Occupational exposure" refers to all exposures of workers incurred in the course of their work.

<sup>3</sup>Manufacturing Chemist, "Choosing the Correct Personal Protective Equipment when Working in the Nuclear Industry", available online at

According to the International Labour Organisation (ILO) exposure to ionizing radiation can induce the death of cells on a scale that can be extensive enough to impair the function of the exposed tissue or organ. At whole-body doses approaching 1Gray (Gy) and above, acute health effects such as acute radiation syndrome may develop. The effect is more severe for a higher dose. Exposure to moderate levels can result in radiation sickness, which produces a range of symptoms.<sup>4</sup> Nausea and vomiting often begin within hours of exposure, followed by diarrhoea, headaches and fever.<sup>5</sup> After the first round of symptoms, there may be a brief period with no apparent illness, but this may be followed within weeks by new, more serious symptoms. At higher levels of radiation, all of these symptoms may be immediately apparent, along with widespread - and potentially fatal - damage to internal organs. Exposure to a radiation dose of 4 Gy will typically kill about half of all healthy adults. Again, exposure to radiation can also induce the non-lethal transformation of cells, which may still retain their capacity for cell division. The human body's immune system is very effective in detecting and destroying abnormal cells. However, there is a possibility that the non-lethal transformation of a cell could lead, after a latency period, to cancer in the individual exposed, if it is a somatic cell; or may lead to hereditary effects, if it is a germ cell. Such effects are assumed to be proportional to the dose received and have no threshold. The "detriment-adjusted nominal risk coefficient of dose", which includes the risks of all cancers and hereditary effects, is 5% per sievert (Sv).<sup>6</sup> Having noted these health effects of ionising radiation on human health, most nations including Nigeria enacted several laws to address the health risks associated with working in a nuclear power station and other occupations with radioactive sources.

### **Legal Frameworks Addressing Occupational Radiation and Protection in Nigeria**

Nigeria has different legislation dealing with issues of occupational radiation and protection of workers. By implication, there is no single law that addresses issues of occupational radiation rather the laws are in piecemeal. The relevant provisions of these laws as it relates to the subject matter of this paper which is Occupational Radiation Protection of Workers in Nuclear Power Plants in Nigeria will be examined. These laws are the Constitution of the Federal Republic of Nigeria, 1999. Other legislation enacted to provide for the safety and health of Nigerian workers generally and in Nuclear Power Plants in particular includes: the Factories Act, 2004, Employees Compensation Act, 2010, Nigerian Minerals and Mining Act, 2007, Nigeria Atomic Energy Commission Act enacted 27 August, 1976, Nigerian Nuclear Safety and Radiation Act, 1995, National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, of

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[https://www.manufacturingchemist.com/index.php/news/article\\_page/Choosing\\_the\\_correct\\_personal\\_protective\\_equipment\\_when\\_working\\_in\\_the\\_nuclear\\_industry/92018](https://www.manufacturingchemist.com/index.php/news/article_page/Choosing_the_correct_personal_protective_equipment_when_working_in_the_nuclear_industry/92018), access 10 July, 2022

<sup>4</sup>ILO, "Radiation safety and Protection of Workers in Nuclear and Radiological Emergency Operations", 4 October, 2013, available online at [https://www.ilo.org/global/topics/safety-and-health-at-work/news/WCMS\\_154370/lang-en/index.htm](https://www.ilo.org/global/topics/safety-and-health-at-work/news/WCMS_154370/lang-en/index.htm), accessed 10 July, 2022

<sup>5</sup> *Ibid*

<sup>6</sup> *Ibid*

31 July, 2007, the Petroleum Industry Act, of 16 August, 2021. Other related laws that seek to give guidance to the implementation of occupational radiation protection of workers in Nigeria are: Nigeria Basic Ionising Radiation Regulations, 2003, Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006, Nigerian Radiation Safety in Nuclear Well Logging Regulation, (NRSNWLR) 2008 and the Nigerian Minerals and Mining Regulation, 2011. These laws were reviewed and analysed for the purpose of determining their efficacy in addressing the health implications for people working in occupations that suffer exposures to ionising radiation or radiation sources.

### **Constitution of the Federal Republic of Nigeria, 1999**

Constitutional of the Federal Republic of Nigeria (CFRN) 1999 is the grundnorm of the Nigerian Legal order. It is the supreme law of the land and the principal legislation that governs the Nigerian state and all laws emanates from it. Section 17(3)(c), specifically provides that, the State shall direct its policy towards ensuring that the health, safety and welfare of all persons in employment are safeguarded and not endangered or abused.<sup>7</sup> This provision is omnibus as it addresses plethora of issues dealing with health, safety and welfare of all persons in employment. The provision also demands for safeguards and prevention of persons from being endangered and abused in the course of their employment. This includes workers in nuclear power installations and similar work environments in Nigeria. The Federal Government of Nigeria on Wednesday 16 September, 2020 approved a new national policy on occupational safety and health, called the National Policy on Occupational Safety 2020.<sup>8</sup> The new policy is aimed at ensuring that all workers are safe at their workplaces across the country. This Policy is derived from the grund norm of Nigerian Legal order, the CFRN which in section 17(3c) prescribes that the Nigerian State shall make laws and bye-laws for preservation of the health and well-being of workers in the workplaces; men and women at work and also from the ILO convention 155, which Nigeria has also domesticated.<sup>9</sup>

### **Factories Act, 2004**

The Factories Act Cap F1 Laws of the Federation of Nigeria 2004 was solely enacted for the protection of the occupational safety and health of Nigerian workers in all occupations. The Factories Act was first promulgated as Decree No. 16 of 1987 (now Factories Act Cap F1 LFN 2004). The Act is the primary legislation for the protection of the safety, health and welfare of workers. It has as its broad objective; to make elaborate provisions for the health, safety and welfare of the workers exposed to occupational hazards by taking measures to prevent accidents

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<sup>7</sup> Constitutional of the Federal Republic of Nigeria 1999, s 17(3)(c)

<sup>8</sup> "FEC Approves New National Policy on Occupational Safety 2020", Vanguard Newspaper, 17 September, 2020, available at <https://www.vanguardngr.com/2020/09/fec-approves-new-national-policy-on-occupational-safety-2020/>, accessed 21 July, 2022.

<sup>9</sup> *Ibid*

and injuries. The Factories Act in Part V, sections 45-50 deals with issues of *Health, safety and welfare (special provisions and regulations)*. Section 47 provides that “where in any factory workers are employed in any process involving excessive exposure to wet or to injurious or offensive substance, suitable protective clothing and appliances, including, where necessary, suitable gloves, footwear, goggles and head coverings, shall be provided and maintained for the use of such workers”. Section 48 further provides that, in the case of any of the processes specified in the Fourth Schedule to this Act,<sup>10</sup> suitable goggles or effective screens shall be provided to protect the eyes of the persons employed in the process.<sup>11</sup> Workers in nuclear power plants are covered by the provision of the factories Act as safety measures requiring protection from injurious and offensive substances like excessive exposure to the health effects of ionising radiation from such plants were guaranteed.<sup>12</sup>

Though, occupational exposure to ionizing radiation can occur in a range of industries, such as mining and milling; medical institutions; educational and research establishments; and nuclear fuel facilities. Adequate radiation protection of workers is essential for the safe and acceptable use of radiation, radioactive materials and nuclear energy in Nigeria.<sup>13</sup> This can be done by the use of personal protective equipment such as apron to protect against penetrating radiations, shielding gloves and sleeves, laboratory coats made of cotton or synthetic fibres and industrial suits, use of footwear to protect against radioactive contamination. Others are the use of respirators, use hoods, blouses and suits ventilated visors and helmets among others.<sup>14</sup> Section 45 of the Factory Act provides that, “in every factory in which, in connection with any process carried on there is given off any dust or fume or other impurity of such a character and to such extent as to be likely injurious or offensive to the persons employed, or any substantial quantity of dust of any kind, all practicable measures shall be taken to protect the persons employed against inhalation of the dust or fume or other impurity and to prevent its accumulating in any workroom, and in particular where the nature of the process makes it practicable, exhaust appliances shall be provided and maintained, as near as possible to the point of origin of the dust or fume or other impurity as to prevent it from polluting the air of any workroom. No stationary internal combustion engine shall be used unless provision is made for conducting the exhaust gases from the engine into the open air”.<sup>15</sup> This section 45 intends to cure the problems that arises from the effect of ionisation radiation exposure when

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<sup>10</sup> Fourth Schedule states that where in any factory electric arc welding is carried on, effective provisions shall be made, by screening or otherwise, to prevent persons employed (other than persons employed in the welding process) from being exposed to the electric arc flash.

<sup>11</sup> Factories Act Cap FI, LFN 2004, s 48

<sup>12</sup> *Ibid*, s 47

<sup>13</sup> IAEA, *Practical Radiation Technical Manual: Personal Protective Equipment*, (IAEA-PRTM-5, Vienna, April, 2004) The Foreword. Available online at [https://www-pub.iaea.org/MTCD/Publications/PDF/PRTM-5\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/PRTM-5_web.pdf), accessed 16 July, 2022

<sup>14</sup> *Ibid*, 17-63

<sup>15</sup> Factories Act Cap FI, LFN 2004, s 45(1)(2)



working with nuclear plants as that emit substances. This is because when residual contamination, occurs through exposure to particulate dusts, it can also pose a serious health risk.

### **Employee's Compensation Act, 2010**

The Employee's Compensation Act, 2010 was signed into law on 17 December, same year. It repeals the Workmen's Compensation Act of 1987, Cap. W6 Laws of the Federation of Nigeria, 2004 which contains some imminent flaws or gaps and makes comprehensive provisions for payment of compensation to employees who suffer from occupational diseases or sustain injuries arising from accident at workplace or in the course of employment. It is a social security or welfare scheme that provides comprehensive compensation to employees who suffer from occupational diseases or sustain injuries arising from accidents at workplace or in the course of employment.<sup>16</sup>

Though it is not a comprehensive legislation dealing with Radiation Exposure Compensation. Part I contains the objectives of the Act and it outlines the following as the main objectives. These are: provide for an open and fair system of guaranteed and adequate compensation for all employees or their dependants for any death, injury, disease or disability arising out of or in the course of employment, provide rehabilitation to employees with work-related disabilities, establish and maintain a solvent compensation fund managed in the interest of employees and employers; provide for fair and adequate assessments for employers; provide an appeal procedure that is simple, fair and accessible, with minimal delays; and combine efforts and resources of relevant stakeholders for the prevention of workplace disabilities, including the *enforcement of occupational safety and health standards*.<sup>17</sup> For the purpose of this paper the Act was enacted for the enforcement of occupational safety and health standards and made provisions for those who suffer any form of injury, harm or death resulting from the exposure to ionising radiation in any work place in Nigeria to be able to resort to this Act for claims by virtue of Part III, section 7 dealing with compensation for death, injury or disease. Section 9(1) further buttresses the fact that, where an employee suffers from an occupational disease and is disabled from earning full remuneration at the workplace; the death of an employee is caused by an occupational disease; compensation for mental stress compensation for occupational disease, the disease is shown to be due to the nature of any employment in which the employee was employed, whether under one or more employments; or an employee suffers from any occupational disease listed under this Act.<sup>18</sup> According to the United States Radiation Exposure Compensation Act, 2022, six common diseases suffered due to exposure from radiation sources include: primary cancer of the lung, fibrosis of the

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<sup>16</sup>Michael Dugeri, "The Employee's Compensation Act, 2010: Issues, Prospects and Challenges", June 2013, available online at [https://www.researchgate.net/publication/338402180\\_The\\_Employee's\\_Compensation\\_Act\\_2010\\_Issues\\_Prospects\\_and\\_Challenges](https://www.researchgate.net/publication/338402180_The_Employee's_Compensation_Act_2010_Issues_Prospects_and_Challenges), accessed 16 July, 2022

<sup>17</sup>Employee's Compensation Act, 2010, s 1(a)-(f)

<sup>18</sup>*Ibid*, s 9(1)

lung, pulmonary fibrosis, cor pulmonale related to fibrosis of the lung, silicosis, and pneumoconiosis.<sup>19</sup> According to Dugeri, the basis or justification for ‘compensation’ is the employer’s duty of care. The idea of compensation suggests that someone has suffered a wrong for which he has to be compensated monetarily. This implies that another person has a duty to prevent the occurrence of the wrong suffered. Payment of compensation by the employer to the employee is rooted in the accepted principle that the employer has a duty of care, a duty to protect the health, welfare and safety of workers at work. Where the worker sustains injuries, gets ill or dies in work-related circumstances, the employer is liable to pay compensation to the worker or to his dependents, in the event of death. The foregoing forms the underlying philosophy behind the enactment of the Employee’s Compensation Act, 2010.<sup>20</sup>

### **Nigerian Minerals and Mining Act, No 20 of 2007**

This Act repeals the Nigerian Mineral and Mining Act of No.34 of 1999.<sup>21</sup> It was enacted for the purposes of regulating all aspects of the exploration of solid minerals in Nigeria. The Act comprises of four (4) Chapters containing varying numbers of Parts that provide guidance to different aspects of solid mineral exploration in Nigeria. The thematic areas of the different Chapters are: Chapter 1-Minerals, prospecting, mining and quarrying; Chapter 2-Small scale mining; Chapter 3, -Possession and purchase of minerals; and Chapter 4-Environmental considerations and rights of host communities. This Act does not explicitly make provisions for the enforcement of occupational safety and health for practitioners in the field. The only section that remotely has a connection with occupational safety and health can be found in Part VIII of the Act. This Part gives guidance in the area of inquiry into accidents as a result of workplace exposure. It states the duty of the holder of the mining license to report the occurrence of the accident as soon as possible, as well as the accident investigation steps and penalties.<sup>22</sup> for example section 84 provides that the holder of mining lease or licence shall, if an accident occurs in any mine or in connection with the mining operations conducted under its lease, temporary tide or licence granted under the Act involving loss of life or serious injury to a person, report the accident

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<sup>19</sup>United States Department of Justice, The Radiation Exposure Compensation Act (“the Act” or “RECA”), 42 U.S.C. § 2210, **On June 7, 2022, the President signed into law the RECA Extension Act of 2022. Available online at** <https://www.justice.gov/civil/common/reca>, accessed, 16 July, 2022. Therefore, in cases involving the six illnesses, the Act’s exposure criteria can be satisfied by combining periods of employment that include mining, milling, and ore transporting. For millers and ore transporters (but not miners), the Act specifies two additional compensable diseases: primary renal cancer and chronic renal disease including nephritis and kidney tubal tissue injury. In cases involving these two illnesses, the Act’s exposure criteria can be satisfied by combining periods of employment that include only milling and ore transporting.

<sup>20</sup>Dugeri (n 12)

<sup>21</sup>Nigerian Minerals and Mining Act No. 20 of 29 March, 2007

<sup>22</sup>Nigerian/ILO, *Nigerian Country Profile on Occupational Safety and Health*, 2016, 16-17, available online at [https://www.ilo.org/wcmsp5/groups/public/---africa/---ro-abidjan/---ilo-abuja/documents/publication/wcms\\_552748.pdf](https://www.ilo.org/wcmsp5/groups/public/---africa/---ro-abidjan/---ilo-abuja/documents/publication/wcms_552748.pdf), accessed 16 July, 2022

as soon as possible, with full particulars of the accident to the nearest Police Station; or to the office of the Mines Inspectorate Department in the State in which the accident occurred.<sup>23</sup>

### **Nigeria Atomic Energy Commission Act, 1976**

The Nigeria Atomic Energy Commission (NAEC) came into existence through the enactment of Decree No. 46 of 27 August 1976 leading to the launching of the national nuclear programme. This Act<sup>24</sup> established the Nigerian Atomic Energy Commission. The commission is saddled with the responsibility to deal with all matters regarding the development and peaceful uses of atomic energy in Nigeria.<sup>25</sup> Section 11 dealing with Regulations which remotely applies to the issue of Occupational radiation and protection of worker. It provides that; the President may make regulations for: securing the safe operation of any nuclear installation operated by the Commission; securing the safe carriage of any nuclear fuel, radioactive products or waste; regulating and controlling the disposal of waste on or from any premises on which there is a nuclear installation; securing the maintenance of efficient system for detecting and recording the presence and intensity of any ionising radiation from anything discharged on or from such premises or from anything in the course of carriage to or from such premises.<sup>26</sup> Sub-sections (a) and (b) of the Act made reference to the word “safe” which is synonymous with “protection” as it relates to occupational radiation and protection of workers against exposure to nuclear sources in Nuclear Power Plants in Nigeria.

### **Nigerian Nuclear Safety and Radiation Act, 1995**

Nuclear Safety and Radiation Protection (NSRP) Act of 3<sup>rd</sup> August, 1995<sup>27</sup> established the Nigerian Nuclear Regulatory Authority (NNRA) in 1995. The function of this body includes the control and regulation of the use of radioactive substances, material, equipment, emitting and generating ionising radiation. The Act comprises of nine (9) Parts, with Section 25 of Part VII relating to the control of exposure to ionising radiation by workers. This section places obligation on the Authority (NNRA) to ensure that: no practice is adopted, unless its introduction produces net benefit and the dose equivalent to individual shall in no way exceed the established limits prescribed by the Authority. The direct wordings of the Act provides that, “the Authority shall, in the performance of its functions and for the protection of radiation workers and the general public, ensure that no practice is adopted, unless its introduction produces a positive net benefit; and the dose equivalent to individual, shall in no way exceed the established limits prescribed by the Authority”. Similarly, Section 26 stipulates the recording of emergency exposures to workers in

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<sup>23</sup> Nigerian Mineral and Mining Act, 2007, s 84(1)(a)(b)

<sup>24</sup> Nigerian Atomic Energy Commission Act, enacted 27 August, 1976, CAP. N90 LFN 2004, ss 1, 2(1)(a)-(e)

<sup>25</sup> *Ibid*, s 11(a)-(d)

<sup>26</sup> *Ibid*, s 11(a)-(d)

<sup>27</sup> Nuclear Safety and Radiation Protection Act of 3<sup>rd</sup> August, 1995, CAP N142, LFN 2004



this industry and states that every emergency or accidental exposure to radiation doses and accidental intake of radioactive materials shall be recorded together and clearly distinguished from normal exposure while Section 27 deals with the establishment of an intervention plan to deal with any foreseeable situation and the demonstration of the efficiency of the planned counter measures. Section 28 provides guidelines for the establishment of ideal working conditions for workers in the industry. The section states that the following classes of working conditions as occupation that are exposed to ionizing radiation: Working Condition “A”; and Working Condition “B”.<sup>28</sup> Working Condition “A” exists where the annual exposure is likely to exceed the prescribed dose equivalent limit as specified in the Code of Practice, in which case the workers assigned thereto shall- be classified as Type “A” Exposed Workers; and be subject to special health supervision and individual assessment by individual monitoring for external radiation and internal contamination as appropriate or by indirect methods.<sup>29</sup> Working Condition “B” exists where the annual exposure is not likely to exceed three tenths of the dose equivalent limit as specified in the Code of Practice, in which case the workers assigned thereto are classified as type “B” Exposed Workers and the dose equivalent assessment is achieved by area monitoring. No person under the age of 18 years shall be employed in any work performed under Working Condition “A” as is defined in subsection (2) of this section.<sup>30</sup>

### **National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, 2007**

National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, of 31 July, 2007<sup>31</sup> provides for the establishment of the National Environmental Standards and Regulations Enforcement Agency (NESREA) is charged with responsibility for the protection and development of the environment in Nigeria and other related matters. The Act has six (6) Parts as follows – Part I – Establishment of the Agency; Part II – Functions and powers of the Agency and Council; Part III – Structure of the Agency; Part IV – Staff of the Agency; Part V – Financial provisions; and Part VI – Miscellaneous provisions. The functions of the Agency were clearly outlined in Part II of the Act, prominent of which is to enforce compliance with laws, Policies and Standards on environmental matters in the country.<sup>32</sup>

Part V which though deals with financial matters appears more relevant to this paper. It provides and addresses issues related to the protection of *humans* which also comprises workers in the nuclear radiation industries. Section 20 deals with air quality and atmospheric pollution by setting specifications and standards to protect and enhance the quality of Nigeria’s air resources, so as to

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<sup>28</sup>Nuclear Safety and Radiation Protection Act of 3<sup>rd</sup> August, 1995, s 28(1)(a)-(b)

<sup>29</sup> *Ibid* s 28(2)

<sup>30</sup> *Ibid* s 28(3)

<sup>31</sup> National Environmental Standards and Regulations Enforcement Agency (Establishment) Act, of 31 July, 2007

<sup>32</sup>Nigerian/ILO, *Nigerian Country Profile on Occupational Safety and Health*, 2016, 19

promote the public health or welfare and the natural development and productive capacity of the nations' human... in particular; minimum essential air quality standards for human, animal, marine or plant health; the control of concentration of substances in the air which separately or in combination are likely to result in damage or deterioration of property or of human, animal, marine or plant health; the most appropriate means to prevent and combat various atmospheric pollution; control of atmospheric pollution originating from energy sources, including that produced by aircraft and other self-propelled vehicles, industries, *factories and power generating situations or facilities*; standards applicable to emissions from any new mobile or stationary source which in the Agency's judgement causes or contributes to air pollution which may reasonably be anticipated to endanger public health or welfare; and the use of appropriate means to reduce emission to permissible levels.<sup>33</sup> The term *factories and power generating stations or facilities* as used in this section of the NESREA Act, 2007 applies as well to nuclear power plants and similar stations that uses radioactive materials and emits radioactive substances as well that are harmful to human health.

### **Petroleum Industry Act, No.6 of 16 August, 2021**

The Petroleum Industry Act (PIA) No.6 was enacted on 16 August 2021.<sup>34</sup> The new law was assented and signed into law by the President of the Federal Republic of Nigeria to repeal the extant Petroleum Act 1969.<sup>35</sup> This Act contains salient provisions which is embodied in five (5) Chapters, 319 Sections, and eight (8) Schedules. It created an array of provisions and innovations that will affect the private, public sector and stakeholders in the oil and gas industry. The Act was enacted to provide for the legal, governance, the regulatory, and fiscal framework for the Nigerian Petroleum Industry, the establishment, and development of host communities and other related matters in the upstream, midstream and downstream sectors of the petroleum industry.<sup>36</sup> The Act deals with the gamut of issues related to the Petroleum Industry in Nigeria. Section 225 deals with radioactive materials<sup>37</sup> and it provides that, "the storage, application, transportation and other

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<sup>33</sup>NESREA Act 2007, s 20(1)(a)-(f). Sub sections 3 and 4 prescribes punishments for violators and it states that, a person who violates the regulations made pursuant to subsection (1) of this section commits an offence and shall on conviction, be liable to a fine not exceeding N200,000 or to imprisonment for a term not exceeding one year or to both such fine and imprisonment and an additional fine of N20,000 for every day the offence subsists. Where an offence under subsection (1) of this section is committed by a body corporate, it shall conviction be liable to a fine not exceeding N2,000,000 and an additional fine of N50,000 for every day the offence subsists.

<sup>34</sup> PIA, 2021

<sup>35</sup>Petroleum Act 1969, Cap P10, LFN 2004

<sup>36</sup>Mondaq, "Nigeria: Overview of the New Petroleum Industry Act 2021", Resolution Law Firm, 21 September, 2021, available online at <https://www.mondaq.com/nigeria/oil-gas-electricity/1113104/overview-of-the-new-petroleum-industry-act-2021>, accessed 15 July, 2022

<sup>37</sup>Radioactive substance means any substance, which contains one or more radionuclides whose activity cannot be disregarded for the purposes of radiation protection. Nuclear Safety and Radiation Protection Act (1995 No. 19) Nigeria Basic Ionizing Radiation Regulations 2003, Part I, Reg. 1, General Provisions and Interpretation.

petroleum operation of radioactive materials and other operation equipment generating ionising radiation in all aspects of oil and gas operation shall be in compliance with the Nuclear Safety and Radiation Protection Act and such other legislative provisions as may be applicable”.<sup>38</sup> Besides the provisions of sections 26-28 of NSRP Act 1995 *such other legislative provisions as may be applicable* in this context refers to all laws enacted, and are in force in Nigeria, that deals with issues of radioactive materials and its impact on occupational radiation, safety and health. Other are Occupational radiation protection in the workplaces involving exposure to naturally occurring radioactive material, radon and cosmic rays, Occupational radiation protection in industrial, research and educational facilities, nuclear power plants and nuclear fuel cycle facilities, emergency exposure situations and subsequent transition periods.

### **Nigeria Basic Ionising Radiation Regulations, No. 19 of 31 December 2003**

This Regulation provides guidance for the implementation of the Nigerian Nuclear Safety and Radiation Act, 1995. It deals with the prevention of excessive dose of exposure to sources of ionising radiation by workers who work in facilities utilising these substances.

Part II of the Regulation deals with General Provisions, Procedures and authorization of specified practices.<sup>39</sup> These are practices allowable by the NNRA or Authority on matters relating to the use of radioactive substances in workplaces. Regulation 4(1)(2) of the Regulation, provides that a radiation employer shall not carry out the use of electrical equipment intended to produce x-rays for the purpose of industrial radiography; the processing of products, research, or the exposure of persons for medical treatment, or authorisation of specified practices except with a prior authorisation granted by the Authority. Furthermore, the use of accelerators, except electron microscopes; radioactive sources and nuclear materials, authorisation may be granted by the Authority, from time to time, determine; granted with or without time limit; revoked in writing at any time; and in form of a registration, permit or license.<sup>40</sup> Under Regulation 20, the Regulation stipulates that attractive conditions of service for workers shall not obviate the responsibilities of any radiation employer or licensee, under these Regulations, with respect to the protection and safety of workers where there is the existence or the possibility of occupational exposure to radiation.<sup>41</sup> This Regulation emphasises the importance of protection and safety of workers as a paramount responsibility of the employer whenever there is the possibility of occupational exposure to radiation even when the employer has provided incentives and other attractive conditions of service to the workers. The succeeding Regulation 21 states that any personal

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<sup>38</sup> PIA, 2021, s 225

<sup>39</sup> Nuclear Safety and Radiation Protection Act (1995 No. 19) Nigeria Basic Ionizing Radiation Regulations 2003, Part II, General Provisions and Procedures and Authorization of Specified Practices. Regs 4(1)(2)(a)(i)-(iv)(b)(c) 2(a)-(d)

<sup>40</sup> *Ibid*

<sup>41</sup> *Ibid*, Reg. 20

protective material, device or equipment provided by any radiation employer or licensee shall comply with any provisions of appropriate labour laws in Nigeria that is applicable to such personal protective material, device or equipment.<sup>42</sup> This can be read together with sections 47-48 of the Factories Act, 2004 already cited that specified the nature of such protective devices and the appropriate work places where they are used.

Part III generally provides for arrangements for the management of radiation protection in the workplace. Part IV, on the other hand requires the provision of designated areas in workplaces making use of ionising radiation sources; dose monitoring; specific measures to prevent spread of contamination; and selection, maintenance and testing of equipment used for monitoring of exposure. Regulations 54-60 of Part V of this Regulation also stipulates the provision of medical surveillance services to employees exposed as well as keeping of health records for this group of workers. It also provides for the appointment of a Medical Adviser for organisations with the risk of ionising radiation exposure for the purposes of fitness certification.

### **Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006**

The Nigerian Radiation Safety in Nuclear Medicine Regulations, (NRSNMR) 2006 provides for the regulation of exposure in the use of radiation in Nuclear medicine in Nigeria. Part IV of this Law provides guidance for managing occupational exposure in the workplace primarily by stating radiation protection requirements, responsibilities and conditions of services as well as monitoring of exposure in the workplace, health surveillance and record keeping. Part VII provides for the regulation of potential exposure and existence of emergency plans in the workplace, while Part VIII states the responsibility of the license owner during the transportation of radioactive materials. Provisions are also contained in this Regulation for measures in place to penalise and discourage infractions.<sup>43</sup>

Part IV, Regulations 25-34 are very instructive, it deals with issues of occupational exposure with foci on radiation safety and protection requirements, responsibilities and conditions of service, classification of areas, local rules and supervision, protective equipment and tools, individual monitoring and exposure assessment, pregnant worker, monitoring the workplace, investigation levels, health surveillance and records.

The Regulations provides that workers shall follow applicable rules and procedures for protection and safety specified by the employer or licensee and should use properly the monitoring devices and the protective equipment and clothing, co-operate with respect to protection and safety and the operation of radiological health surveillance and dose assessment programmes. The regulation

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<sup>42</sup> *Ibid*, Reg. 21 see Factories Act Cap FI, LFN 2004, sections 47-48. Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006, Reg. 28

<sup>43</sup> Nigerian/ILO, *Nigerian Country Profile on Occupational Safety and Health*, 2016, 18

mandates workers to provide the employer with such information on their past and current work as is relevant to ensure effective and comprehensive protection and safety for themselves and others, and abstain from any wilful action that contravene the requirements of the Nigeria Basic Ionizing Radiation Regulations (NBIRR) 2003. Furthermore, they should accept such information, instruction and training concerning protection and safety as will enable them to conduct their work in accordance with the requirements of the NBIRR<sup>44</sup> and where they are able to identify circumstances that could adversely affect compliance with NBIRR, the workers should report such circumstances to the employer or licensee and such report shall be recorded by management and necessary action shall be taken.<sup>45</sup> Again exchange of information is necessary to facilitate proper protective measures and safety provisions where workers engaged in a work are involved with a radiation source that is not under the control of their employer.

Classification of areas under the NRSNMR for the purpose of avoiding occupational exposure are those areas such as the nuclear medicine department, rooms for preparation, storage and injection of the radiopharmaceuticals, area housing a patient to whom therapeutic amounts of activity have been given, room for temporary storage of radioactive waste, imaging rooms, (gamma camera room) and waiting areas. These rooms shall be classified as controlled or supervised areas and shall only be used for its specified work.<sup>46</sup> This is to avoid unnecessary exposure to workers and members of the public to radioactive substances being treated in those rooms. As a follow up to the classification of areas, employers shall in addition establish written local rules and procedures necessary to ensure adequate levels of protection and safety for workers and other persons who may be visitors to the work place where radioactive materials are treated.<sup>47</sup> The rules as a matter of fact, are meant to ensure that any work involving occupational exposure is adequately supervised by the employer and all reasonable steps must be taken to ensure that the rules, procedures, protective measures and safety provisions are observed.<sup>48</sup>

The NRSNMR, states that employers are to provide protective equipment and tools and shall ensure that workers are provided with suitable and adequate personal protective equipment such as: movable shields, bench top shields and shields for syringes and vials to be used when handling unsealed sources; protective clothing, gloves and tools for handling of sources to be used during the work with unsealed sources; and fume hoods, shielded containers for temporary segregation and storage of radioactive waste.<sup>49</sup> The whole essence of this requirement is to reduce or prevent

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<sup>44</sup> Nigerian Radiation Safety in Nuclear Medicine Regulations, 2006, Reg. 25(1)(a)-(d)

<sup>45</sup> *Ibid*, Reg. 25(2)

<sup>46</sup> *Ibid*, Reg. 26(1)-(6)

<sup>47</sup> *Ibid*, Reg. 27(1)(a)

<sup>48</sup> *Ibid*, Reg. 27(1)(d)

<sup>49</sup> *Ibid*, Reg. 28(1)(2)

exposures to radioactive substances or particulates that may constitute serious health hazards in nuclear power plants and other related workplaces in Nigeria.

### **Nigerian Radiation Safety in Nuclear Well Logging Regulation, 2008**

Nigerian Radiation Safety in Nuclear Well Logging Regulation, (NRSNWLR) 2008 was made pursuant to section 47 of the Nuclear Safety and Radiation Protection Act 1995. The objective of this Regulation is to set up the basic technical and organizational requirements to be complied with by all operators of nuclear well logging operations in Nigeria, in order to ensure the protection of human health and the environment from the hazards associated with ionizing radiation within and beyond the national borders of Nigeria.

It terms of its scope the NRSNWLR specifies the minimum requirements for radiation protection and safety for all users of ionizing radiation in nuclear well logging operations and further specified the radiation safety requirements for persons using licensed materials in these operations. The NRSNWLR applies to all existing ionizing radiation and nuclear Regulations, such as radioactive waste management Regulations and radioactive material transport Regulations.<sup>50</sup> Others are all sources of ionizing radiation with possible exemption prior to authorization by the Nigerian Nuclear Radiation Authority; facilities where sources of ionizing radiation are installed, used or stored; the operation of sources of ionizing radiation; the duties and responsibilities of the users, their internal safety organization and working procedures related to radiation protection; the monitoring of persons occupationally exposed (external, internal dosimeter) and of work places; medical examinations of persons occupationally exposed; radioactive sources or materials in storage or in transit; handling of wastes and radioactive release from the above uses; radiological emergencies or accidents; preparedness in cases of release of radioactive materials to the environment; import or export requirements; quality control of equipment and calibration of instruments, etcetera programmes for education, training and development; and those related to radiation injuries and medical preparedness.<sup>51</sup> Part II, Regulation 10 of the NRSNWLR mandates a Licensee who is responsible for setting up and implementing the technical and organizational measures that are needed for ensuring the protection and safety of sources for which they are authorized shall ensure that workers are adequately trained in radiation protection and safety, and the operating procedures, local rules and emergency plans appropriate to the specific types of equipment used within the organization; provide workers with personal dosimeter and appropriate health surveillance<sup>52</sup> and ensure that all equipment used for the practice is suitable for its intended and actual uses and is properly maintained, that workers be provided with appropriate survey

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<sup>50</sup> Nigerian Radiation Safety in Nuclear Well Logging Regulation, of 12 November, 2008, Reg. 4(a)

<sup>51</sup> *Ibid*, Reg. 4(b)-(o)

<sup>52</sup> *Ibid*, Reg. 10(1)(2)(g)(i)(ii)(h)



meters that are maintained in good working order and tested regularly.<sup>53</sup> The NRSNWLR requires a Licensee to carry out regular audits of normal well logging operations to ensure that a satisfactory standard of radiation safety is being maintained.<sup>54</sup> In Part III, Regulation 21 addresses issues regarding individual monitoring of workers. The provision requires that a Licensee<sup>55</sup> should assess the occupational exposure of all persons who may regularly work in controlled areas or receive significant occupational exposure and shall provide such persons with appropriate individual dosimeters<sup>56</sup> to assess their cumulative occupational radiation exposure. Furthermore, Regulation 28 cautions Licensees and stating that, they should not permit any individual to act as a Radiation Safety Officer or assist in the use of sources of radiation unless such individual wears a dosimeter such as an Optically Stimulated Luminescent Device (OSLD) or a Thermo luminescent Dosimeter (TLD) and each dosimeter shall be assigned to and worn by only one individual.<sup>57</sup> It is interesting to note that in order to ensure Security and Control of Radiation Sources, a Licensee shall ensure that an effective system for accounting radioactive sources which will be fully complied with by all workers and the system shall be capable of detecting losses quickly and during each logging or tracer application, the logging supervisor or other designated employee shall maintain direct surveillance of the operation to protect against unauthorized or unnecessary entry into a restricted area. Furthermore Storage of Nuclear Well Logging Source in sealed sources used in well logging activity shall be stored in secured exposure containers or source changers and these in turn shall be kept in suitable stores that it shall provide protection against fire and shall not contain or be located in proximity to flammable, corrosive, oxidizing materials, or explosives; the entrance door to the store shall be labeled clearly and durably with a radiation trefoil symbol with the words “Danger Radioactive Material” in an understandable language.<sup>58</sup>

As part of precautionary procedures in logging and subsurface tracer operations, the NRSNWLR requires all personnel handling radioactive materials to use protective gloves and other appropriate protective clothing and equipment and precautions shall be taken to avoid ingestion or inhalation of radioactive material. Furthermore a Licensee shall not intentionally inject radioactive material into any fresh water aquifers or any well unless such injection will not endanger the public health, safety and welfare or such will not result in any liquid or gases distributed to the public.<sup>59</sup> These

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<sup>53</sup> *Ibid*, Reg. 10(2)(i)(j)

<sup>54</sup> *Ibid*, Reg. 19

<sup>55</sup> *Ibid*, Part I, General Interpretation, Reg. 1, Licensee is the holder of a current licence granted for a practice or source who has recognized rights and duties for the practice or source, particularly in relation to protection and safety.

<sup>56</sup> *Ibid*, Part I, General Interpretation, Reg. 1, Dosimeter is the instrument used for measuring the absorbed dose of radiation.

<sup>57</sup> *Ibid*, Regs, 21, 28

<sup>58</sup> *Ibid*, Regs. 33(2)(h)(i) 34(e)(f)

<sup>59</sup> *Ibid*, Reg. 50(1)(2)

are precautionary measures intended to avoid dangers associated with occupational radiation exposure in nuclear industries or Well Logging operations and work places.

### **Nigerian Radiation Safety in Naturally Occurring Radioactive Materials (NORM) Management Regulations, 2008**

Sequel to the powers conferred on the President of Nigeria pursuant to section 47 of the Nuclear Safety and Radiation Protection Act 1995, the Nigerian Radiation Safety in Naturally Occurring Radioactive Materials (NORM) Management Regulations, 2008 was made by Nigerian Nuclear Regulatory Authority upon his approval.

The objective of this Regulation is to establish radiation protection, standards for the generation, possession, use, transfer, and disposal of Naturally Occurring Radioactive Materials in order to ensure the protection of human health and environment from the hazards associated with NORM in Nigeria. These regulations shall apply to any person who generates, possesses, uses, transfers, or disposes of NORM; address the introduction of NORM into products in which neither the NORM nor the radiation emitted from it is considered to be beneficial to the products; apply to the manufacture and distribution of products containing NORM in which the NORM or its emitted radiation is considered to be a beneficial attribute; not apply to radionuclides defined as source under the Nuclear Safety and Radiation Protection Act of 1995 and is understood that radioactive waste in any concentration regulated by the Nigerian Nuclear Regulatory.<sup>60</sup> Of relevant importance to the paper is Regulation 6 which deals with protection of workers during operations. The provision requires the licensee to conduct operations in compliance with the standards for radiation protection set out in the Nigeria Basic Ionizing Radiation Regulations 2003 except for the release of radioactivity in effluents, which is governed by Regulation 8 and other relevant Regulations. Regulation 8 addresses issues of Management and Transfer of Waste for Disposal and sub-regulation 3 states that transfers of waste containing NORM for disposal shall be made only to a person specifically authorized by the Authority to receive such waste.<sup>61</sup>

### **National Policy on Occupational Safety and Health, 2006**

The National Policy on Occupational Safety and Health, 2006, a guide to Occupational Safety and Health (OSH) in Nigeria is the government's approach for achieving a National development philosophy of building a united, self-reliant and egalitarian economy through minimising so far as is reasonably practicable, the causes and effects of hazards inherent in the working environment in response to her ratification of Convention 155 on Occupational Safety, Health and Working

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<sup>60</sup>Nigerian Radiation Safety in Naturally Occurring Radioactive Materials (NORM) Management Regulations, of 12 November, 2008, Part 1, General Objectives and Scope, Regs. 1-2

<sup>61</sup>*Ibid*, Regs. 6, 8(3)

Environment.<sup>62</sup> The Policy came into force in November, 2006 and it has the mandate among other things to: facilitate improvement of occupational safety and health performance by providing the framework for participative occupational safety and health protection of workers including the most vulnerable groups in all sectors of economic activities. The Policy makes it a duty to ensure harmonization of workers rights protection with regional and international standards in a private sector-led economic growth thus, focusing the role of the competent authority in facilitating an enabling environment and regulating various provisions for securing safety, health and welfare of workers in Nigerian workplaces. The several objectives to be achieved by the government relying on the policy framework are to: create a general framework for the improvement of working conditions and the working environment; prevent accidents and departures from health arising out of or in the course of work; ensure the provision of occupational safety and health services to workers in all sectors of economic activity.<sup>63</sup> The scope of the Policy covers both the formal and informal sectors of the economy; protection of all categories of workers from undue persecution, effective communication and cooperation amongst all stakeholders; prevention and control of hazards from all forms of occupational exposure; provision of health surveillance and emergency medical services; training in the area of occupational health and safety; and the gathering and storage of information pertaining to occupational safety and health amongst other area of focus.

The Policy empowered the Federal Ministry of Labour and Employment as the Statutory Authority. That is the “Competent Authority” that will be responsible for the implementation of the Policy across the country and stated clearly, the functions of the statutory authority in this regard. The Policy also identified the supportive duties of the Federal Ministry of Health in the area of occupational accidents, injuries and diseases data collation and submission and regulation of occupational health practice in the country.<sup>64</sup>

It also clarified the duties of the following stakeholders: employers, workers, manufacturers, transporters, OSH committees and the media towards the successful implementation of this Policy. The establishment of a National Commission on Occupational Safety and Health as a coordinating agency as well as the setting up of an Institute for Occupational Safety and Health amongst other strategies was designed to aid the robust implementation of the Policy. The review of the Policy by the Statutory Authority is meant to take place every three (3) years.<sup>65</sup>

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<sup>62</sup> Nigerian/ILO, *Nigerian Country Profile on Occupational Safety and Health*, 2016, 21-22

<sup>63</sup> *Ibid*

<sup>64</sup> *Ibid*

<sup>65</sup> *Ibid*

## **Institutional Frameworks Dealing with Occupational Radiation and Protection of Workers in Nigeria**

Legislative enactments and most importantly radiation safety laws has created some remarkable institutions that deals with the occupational radiation and protection of worker in Nigeria. These institutions shall be discussed hereunder.

### **Factories Appeal Board**

The Factories Act 2004 was solely enacted for the protection of the occupational safety and health of Nigerian workers in all occupations. The Act provides for the establishment of the Appeal Board. It is the responsibility of the Minister to appoint such persons as he thinks fit to constitute a Factories Appeal Board for the purpose of hearing and determining any appeal that may be submitted to it from an aggrieved person over the decision of the Director of Factories.<sup>66</sup> The Board, may, on hearing an appeal made to it by an aggrieved worker, confirm, vary or reverse the decision of the Director of Factories and the decision of the Board shall be final and not subject to any other appeal.<sup>67</sup> This Act applies to all workers in any registered factory in Nigeria in accordance to sections 2 and 3 of the Act including nuclear power plants. It is important to emphasis that the Minister may make regulations governing the procedure of the Board and, in the absence of any such regulations, the Board shall determine its own procedure.

### **The Nigeria Social Insurance Trust Fund Management Board**

Employees Compensation Act, 2010 established the Nigeria Social Insurance Trust Fund Management Board vide section 2(2). The powers of the Board were spelt out in sections 31 and 32 of the Act.

The Board has the mandate or power to implement the provisions of the Act and the Fund established in accordance with section 56.<sup>68</sup> Accordingly, it shall, as part of its powers and functions, formulate policies and strategies for assessment of compensation, rehabilitation and welfare of employees who sustain injuries or contact occupational diseases at the workplace or in the course of employment in Nigerian nuclear power plants and similar factories<sup>69</sup> and

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<sup>66</sup> Factories Act Cap FI, LFN 2004, s 5. The term “Minister” as used here refers Minister charged with responsibility for labour matters. See s 88, Interpretation, Cap M12.

<sup>67</sup> *Ibid*, s 6.

<sup>68</sup> Employee’s Compensation Act, 2010, s 2(2). Under Part VII dealing with Financial Provisions, section 56(1) provides that there is established the Employees’ Compensation Fund into which shall be credited all moneys, funds or contributions by employers for adequate compensation to employees or their dependents for any death, injury, disability or disease arising out of or in the course of employment. While, section 57 states that the Fund established under section 56 of this Act shall be managed by the Nigeria Social Insurance Trust Fund Management Board established under the Nigeria Social Insurance Trust Fund Act [1993 No. 73]

<sup>69</sup> *Ibid*, s 31(d)

cooperate with the National Council for Occupational Safety and Health for the prevention of occupational accidents and diseases and for the promotion of safety and health culture at workplaces in Nigeria.<sup>70</sup> The money in the Fund shall be applied or expended for the: payment of adequate compensation for all employees or their dependants for any injury, disease or disability arising out of or in the course of employment; provision of rehabilitation to employees with work-related disabilities; supporting activities and programmes on the prevention of occupational accidents and hazards and the promotion of occupational safety and health at workplaces in Nigeria.<sup>71</sup>

### **Nigeria Atomic Energy Commission**

Nigerian Atomic Energy Commission (NAEC) was established by the enactment of Act No. 46 of 1976 for the promotion and development of atomic Energy for peaceful applications but could not be activated to commence operations until April, 2006. Currently, NAEC is under the supervision of the Presidency to provide for a more effective coordination.<sup>72</sup> As a regulatory institution it is saddled with responsibility under section 10 of the Act establishing it to prevent nuclear damage that may result from anything including waste discharged on any premises occupied by the Commission or anything which in the course of carriage by or on behalf of the Commission to or from such premises.<sup>73</sup> This duty of protection is holistic because arduous responsibility is placed on the commission with regards to things placed on the premises of the commission and those under transportation within and outside the premises occupied by the commission or its agents. *Nuclear damage* as used in this statute applies to death of, or injury to persons or loss of, or damage to property which results from the radioactive properties or from a combination of such properties with the toxic, explosive or other hazardous properties of nuclear fuel or radioactive products or waste.<sup>74</sup> This provision is geared towards occupational protection of workers from radioactive and ionising radiation sources in Nigeria by the Commission through its regulatory activities.

### **Nigerian Minerals and Mining Regulations 2011**

The Nigerian Minerals and Mining Act was passed into law on 29 March, 2007 to repeal the Minerals and Mining Act, No. 34 of 1999. The purpose of the Act was to regulate the exploration

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<sup>70</sup>*Ibid*, s 32(f)

<sup>71</sup> *Ibid*, s 58(a)(b) & (d)

<sup>72</sup> Awwal Bisallah, "Progress and Challenges in the Establishment of a New NDC: The Case of Nigeria NDC", Nigerian National Data Centre for the CTBTO Nigeria Atomic Energy Commission Science and Technology Conference, Vienna, Austria 17<sup>th</sup> –20<sup>th</sup> June 2013.

<sup>73</sup> Nigerian Atomic Energy Commission Act, enacted 27 August, 1976, CAP. N90 LFN 2004. S 10

<sup>74</sup> *Ibid*, s 12

and exploitation of solid materials in Nigeria.<sup>75</sup> Section 21 of the Act enables the Minister of Mines and Steel Development to make Regulations in furtherance of the objectives of the Act.<sup>76</sup> This Act and the subsequent Ministerial Regulations did not address issues of Occupational Radiation and Protection of Workers in a Nuclear Power Plant but Part IV of the Regulation deals with “Mines Health and Safety”. Regulations 140 and 141 of the Nigerian Minerals and Mining Regulations 2011 addresses issues related to accidents, dangerous occurrences and diseases, records of accidents and occupational health services. Regulation 140 requires that a Mine Manager should keep a register of any accident, dangerous occurrences and diseases; incident report to be prepared by the Health, Safety and Environment manager; an extract from such register to be submitted to the Mines Inspectorate Department at the end of each quarter. He shall notify the Mines Inspectorate Department immediately of the outbreak of any contagious disease in a mine or mine settlement when any person employed in or at the mine contracts or dies of such disease. Such notification shall contain the particulars of the persons and of the illness so contracted.<sup>77</sup> Regulation 141 requires the Minister to request mining company to submit in its Mine plan, potential cases of health hazards to be encountered in its mining or exploration activities and in addition the proposed mitigation plans.<sup>78</sup> These measures are targeted at placing the Mine Managers on their guard regarding issues of health and safety in the mining industry.

### **Mines Inspectorate Department**

Mines Inspectorate Department (MID) was created by the Nigerian Minerals and Mining Regulation, 2011. Regulation 122(1) of the Regulations requires the MID to routinely inspect mining operations and exploration activities in order to ensure that mines operations or exploration activities are conducted in a safe and efficient manner; enforcing the provisions of the Act and the Regulations to ensure that mineral title holders comply with the provisions; ensuring that mineral title holders comply with minimum work obligations that may be imposed on them by the Ministry and to be administered by the Mines Inspectorate Department.<sup>79</sup> Work obligations include the duty of Mine Licence holders to ensure safe working conditions for their worker and the duty of the worker to abide by all safety standards expected of them during mining operations.

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<sup>75</sup>Adeoye Adefulu and Odujinrin & Adefulu, “Nigeria: An Overview of the Nigerian Minerals and Mining Act 2007”, 17 March, 2010, available at <https://www.mondaq.com/nigeria/mining/95916/an-overview-of-the-nigerian-minerals-and-mining-act-2007>, accessed 22 July, 2022.

<sup>76</sup>Nigerian Minerals and Mining Act was passed into law on 29 March, 2007, s 21. The 'Minister shall subject to the provisions of this Act make Regulations Regulation: in respect of any matter required to be prescribed by Regulations under this Act and generally for giving full effect to the provisions of this Act, including prescribing; amending or withdrawing any form that may be required-under this Act.

<sup>77</sup> Nigerian Minerals and Mining Regulations of 13 May, 2011, Reg. 140

<sup>78</sup> *Ibid*, Reg. 141

<sup>79</sup> *Ibid*, Reg. 122(1)(a)-(c)



The MID is to also examine and inquire into the condition and ventilation of any mine or any building used in or connected with exploration, mining or mineral processing operations and all matters relating to safety, welfare and health of persons employed in such mine or building; inspect and test any machinery, plant or equipment that is to be used in connection with exploration, mining or mineral processing operations. The duties of the department extends to inspecting the storage of explosives that is to be used in connection with exploration or mining operations; know what arrangements have been made to protect the host community and the public against the hazards associated with mining operations and storage of tailings; examine the arrangements for treatment of mine waste before it is finally disposed of, to minimize air and water pollution; examine the plans for dumping operation and the safety precautions to taken to avoid pollution of the environment or to minimize it.<sup>80</sup> These safety measures are expected to be determined by the MID in other to avoid occupational hazards during and after mining operations and ensure the safety of the miners and persons living in the surrounding or host communities. The MID is expected to addresses issues of exploration, mining and milling of radioactive ores and other ores associated with the presence of radioactive substances in accordance with section 4 of the Nuclear Safety and Radiation Protection Act, No. 19 of 1995.<sup>81</sup>

### **Nigeria Nuclear Regulatory Authority**

The Nigeria Nuclear Regulatory Authority (NNRA or Authority) and the Governing Board was established by the Nuclear Safety and Radiation Protection Act, No. 19 of 1995.

The NNRA is the national nuclear regulator; it became operational in 2001. It is empowered to licence and regulate the operations of the nuclear power industry and the use of radioactive sources. Its regulatory functions addresses issues regarding occupational radiation and protection of workers, safety and health in nuclear power plants in Nigeria.

Under Part II, Section 4 deals with the Functions and Powers of the Authority. It has the major responsibility of ensuring nuclear safety and radiological protection regulation in Nigeria. It regulates the possession and application of radioactive substances and devices emitting ionizing radiation; protect of life, health, property and the environment from the harmful effects of ionizing radiation, while allowing beneficial practices involving exposure to ionizing radiation. It deals with safe promotion of nuclear research and development, and the application of nuclear energy for peaceful purposes: perform all necessary functions to enable Nigeria meet its national and international safeguards and safety obligations in the application of nuclear energy and ionizing radiation. The Authority advises the Federal Government on nuclear security, safety and radiation protection matters relating to the regulation and introduction of radioactive sources, equipment or

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<sup>80</sup> *Ibid*, Reg. 122(2)(c)-(h)

<sup>81</sup> Nuclear Safety and Radiation Protection Act of 3<sup>rd</sup> August, 1995, s 4(2)(a)(b)

practices and of existing sources, equipment and practices involving exposure of workers and the general public to ionizing radiation and as appropriate, the exploration, mining and milling of radioactive ores and other ores associated with the presence of radioactive substances as appropriate. The Board is responsible for managing and superintending the affairs of the Authority, the overall policy and general administration and acts in the name of the Authority. It also formulates policies and guidelines for regulating nuclear safety and radiological protection and ensuring their implementation in Nigeria.<sup>82</sup>

## Conclusion

This paper concludes that Nigeria through legislative enactments has made several laws and Ministerial Regulations that addresses issues of occupational radiation and protection of workers against exposure to ionizing radiation in Nuclear Power Plants and related work places. There is the need to protect workers in industries involving naturally occurring radioactive materials, regulation and management of radon exposure in workplaces. The use of medical procedures utilizing ionizing radiation and the increase in number of occupationally exposed workers in medicine in Nigeria and globally. The legal and institutional frameworks established over the decades is a demonstration of Nigeria's commitment to tackling the issues of occupational radiation and protection of workers against all form exposure to ionizing radiation in Nuclear Power Plants and related work places. Nigeria in broad ways has done a lot in Occupational radiation protection in the workplaces that involves exposure to naturally occurring radioactive material, radon and cosmic rays and imbibed a lot of safety culture in occupational radiation protection. Finally besides legislative intervention, executive intervention by way of policy directives has been issued by Nigerian government to protect workers from the harmful effect of ionising radiation in work places generally. Nigeria has enacted laws in almost all aspects of occupational radiation protection and has ratified some international laws in this endeavour. What she needs is an effective coordination and cooperation agenda among her national regulatory authorities in efforts to enhance the country's occupational radiation protection and safety programmes for people working in nuclear power plants and related workplaces that produce radiation sources.

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<sup>82</sup>*Ibid*, s 5(a)(b)&(d)