**CHAPTER ONE**

**INTRODUCTION**

* 1. **Background of the Study**

The earth is radioactive due to natural sources and activities of man in the environment. There is a continuous bombardment of man and his environment by these (radionuclide) ionizing radiations (John and Zordan, 2001). Hence, the issue of environmental degradation and pollution in the 21st century is of global concern, because of its health impact and implications. The quest for oil field development and exploration in the Niger delta of Nigeria had led to various forms of activities that tend to perturb the fragile ecological, biophysical systems and the socio-economic and political structures of the region. Oil and gas industries in the Niger delta are a multifaceted industry that includes the construction, exploration, and production, downstream and marketing sectors. In most of these sectors, radioactive materials and radiation generators are used on a large scale. The application of these radioactive materials in both offshore and onshore oil and gas industries includes industrial radiography, automatically ionizing radiation gauge, well logging, use of radiotracers in pipes, mapping and evaluation of geological formation and the extraction of other natural hydrocarbon resources (Arogunjo *et al.,* 2004). The interest of the elemental composition and concentration of crude oil arose from the fact that almost all elements of the periodic table are found in crude petroleum and petroleum related products (Nakaimi, 1991) It is therefore imperative that crude oil and gas contain some level of natural radionuclide elements which will emits ionizing radiation when exposed to the environment.

The developments of the nuclear industry have been initiated by man, Who is therefore primanly preoccupied, and quite rightly so, by his own radiological protection. The philosophy, ideas and practical application of this radioprotection have been successfully set up, through the construction of an intemational consensus, by the International Commission on Radiological Protection. In this context where man is the target to be protected, the wider environment has only been taken into account in a restrictive manner, that is to say in as much that it provides a direct vector for the exposure of man. **As** an answer to the growing preoccupation with environmental radiological protection, the experts (those for the protection of man), equipped with the knowledge available, have emphasised man’s greater radiosensitivity as compared to the rest of living world. This argument has fed the ICRP recommendations which state that to protect man leads in an implicit manner to a sufficient protection of other living organisms (biota) (ICRP 1991), in any case on the population scale **(**Whicker and Bedford, 1995).

* 1. **Aim and Objectives of the study**

The aim is to study the Impact of oil and gas activities on the Environmental Radiation levels Exposure in Eruani refinery.

Specific objectives of the study are:

1. To provide information on the radiation levels in Eruani refinery and the resulting contribution of past nuclear operation carried out that may have being accumulated in the community.
2. The study will assesses the radiological impact on both the environment and the population of the nuclear Eruani refinery in Bayelsa state, Nigeria.
3. The study will also furnish baseline data on the background ionizing radiation (BIR) profile of the flow stations and the host community and add to existing research information on the radiological profile of oil facilities in the region.
4. The health implications on the personnel and residents of the host community will be examined.
   1. **Scope of the Study**

The scope is focused on the environmental radiation levels (Exposure) implications of processes that happen upstream in Eruani refinery, that is, on-site at the well production pad or field, a current focus of public health policy and community concern ([McKenzie](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6344296/" \l "R58) *[et al](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6344296/" \l "R58)*[., 2016](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6344296/" \l "R58)). Studies with an experimental design, with measurements of exposures or health outcomes, were considered. In addition, we included toxicological or animal studies directly assessing potential ecological or health-related impacts of environmental radiation activities or studies employing risk assessment models estimating a health-related outcome based on measured exposure data.

**1.4 Statement of the Problem**

This study has become very imperative due to the environmental radiation levels (Exposure) implications occasioned by hydrocarbon production in the Bayelsa state, Nigeria. There has been series of conflicts between the indigenous people of the region and the refinery operates therein over the years. The region claims that the activities of the refinery instead of improving have impoverished its people by causing a serious decline in their marine and agricultural resources, which constitute their economic main stay.

Because of environmental radiation Exposure, there is drastic decline in the region’s biodiversity and ecological resources, which are the main sources of their income and the people’s mode of survival (Kpeglo,2015). Also, there is an aspect of the health hazards posed to the inhabitants as a result of oil pollution of the environment, and hence there are environmental challenges as well as socio- economic problems created by adverse effects of oil mining, which has culminated into low agricultural productivity and poor farm yields sufficient enough to threaten the food security in Bayelsa state (Kpeglo,2015).

**1.5 Significance of the study**

Baseline data on the background radiation forms the basic requirement for any environment that may be prone to radioactive contamination (Jibiri and Bankole, 2016).A study to measure the background wing radiation in Eruani refinery in Bayelsa state has not seen carried out this now. Therefore, the present study will provide basic information on the exposure rate due to background ionizing radiation in Eruani refinery due to the equipment. Data from this study can also be used to assess the radiological health effects due to the background ionizing radiation . The study will be also provide data that can be used to plan, make and confirm decisions regarding possible radiation related health problems in the area.

**CHAPTER TWO**

**LITERATURE REVIEW**

Kuroda (1991) reported that this background radiation levels are from a combination of terrestrial (40K, 232Th, 226Ra) and cosmic radiation (muons, photons). He also reported that the level of radiation is fairly constant over the world, being 0.008- 0.015mRh-1. But China, Brazil and India have higher background ionizing radiation; this is primarily due to the high concentration of radioactive minerals (monazite & limonite) that contains high quantity of thorium, uranium and radium in the soil (Kathren, 1991). Avwiri and Ebeniro (1998) studied the external environmental radiation in an industrial area of Rivers state. They reported an average value of 0.14 mRh-1 of background ionizing level. The results indicated a slight elevation from the normal background radiation of 0.013 mRh-1. Akinloye *et al.* (2004) studied the indoor radiation exposure rates in some building in Ogbomoso, Nigeria and reported a value range of 1.57-1.89 μRh-1. They concluded that the values obtained are within the limits of 2.0-3.0 μRh-1 for areas of normal background radiation. The environmental radioactive level in Ikot Ekpene area of Akwa Ibom state of Nigeria has also been studied by Louis *et al.* (2005) and revealed an average activity level of 201.0±0.05 mBq and radiation level range of 0.007-0.015 mRh-1. On the effect of oil and gas activities on the radiation level of the environment, Stanislay and Elena (1998) studied the environmental impact of the offshore oil and gas facilities and revealed that production waters from oil and gas production contain naturally occurring radioactive elements (Uranium & thorium) and their daughter progeny (226Ra and 228Ra). There is also a report on radiation safety study of the use of radioactive sources and radiation producing machine for radiographic purposes in the Nigerian petroleum industry (Abison, 2001).

Arogunjo *et al.* (2004) studied the impact of oil and gas industry to the natural radioactivity distribution in Niger delta region of Nigeria and revealed that the mean

activity concentrations for 40K, 238U and 234Th radionuclide are 34.8±2.4, 16.2±3.7 and 24.4±4.7 Bqkg-1 respectively, with oil extraction activities areas having activities concentration values greater than areas without any known oil extraction activity in the region. Also, the Rail Road Commission of Texas (2007) (www.rrc.statetx.us) reported that naturally occurring radioactive materials (NORM) associated with oil and gas production originate in sub-surface formations which may contain radioactive materials like Uranium and thorium and their daughter products 226Ra and 228Ra. Avwiri *et al.* (2007) measured the terrestrial radiation levels around oil and gas facilities in Ughelli, Nigeria and revealed that the average radiation levels ranges between 12.00±0.1μRh-1 (5.33±0.35 μSv/week) to 22.00±2.1 μRh-1 (9.79±0.16 μSv/week) in the oil facility field and μRh-1 in the host communities. They concluded that thought the levels with the host communities are within the normal background level, the levels around these oil facilities are far above the normal background level of 0.013 mRh-1. According to the United State Environmental Protection Agency

(2006)(www.epa.gov/radi ation) field surveys have shown that petroleum pipe scale originating from oil production may have very high 226Ra concentration and on disposal exposes the environment to associated radioactive contamination. Ughelli and its environs are major onshore oil producing areas in the Niger delta

region of Nigeria with a population of about 0.432 million people (NPC Bulletin,2006). The area, which is one of the highest in oil and gas production onshore of the Niger delta, has over 160 oil and gas wells and five flare stations. It is crisscross with network of pipelines carrying either oil or gas to the flow stations from the different oil wells. In February 2001, there was a major oil spillage in well 13 and 19 of one of the fields in the area that lasted for four days. It is adjudged the largest oil spillage in the past 20 years in the onshore fields of Niger delta with partial clean up, no recovering and other migration measures on the affected soil and water body (UNDP, 2006). Since this incident, the awareness of the immediate and potential degradation of the water body and the environment by this spillage is on the increase and there have be various claims and counterclaims of loss of wild life and biodiversity, water pollution, loss of use of land affected by the spillage and increase in ionizing radiation levels of the environment by host communities. This study therefore is aimed at verifying the later claim. This is done by monitoring the radiation levels of the affected areas and the host communities for six years to ascertain the radiation level and distribution. The radiological health implications of the obtained values were carefully examined and necessary recommendations made.

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