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Radiological Impact Of Oil And Gas Activities In Some Oil Fields In Production Land Area In Nigeria

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Abstract: *Studies on the radiological impact of oil and gas exploration activities in some production land area in Nigeria insitu,, using two radiation meters (Digilert 50 and 100) synchronized and calibrated and a geographical positioning system (GPS). Readings were taken in nine different facilities in each of the oil and gas fields and their host communities. Measured radiation values in the oil field facilities ranged from 0.011+0.003mR/h in Evwreni camp site to 0.031+0.01mRm at the Otorogu gas plant. Mean field exposure equivalent dose rate in the oil field ranged from 0.016+0.006mRm (0.839+0.34mSvy) to 0.0213+0.008mRh (1.134+0.44mSvy) while in the host communities values ranged from 0.0115+0.003Mr/h (0.612+0.16Svy) in Evwreni community to 0.021+0.007mRh (1.117+0.37mSvy) in Otujeremi town and the control study area value been 0.009+0.002mR/h (0.479+0.11mSvy).The results show that Ughelli East, Kokori ,Eriemu, Evwreni ,Eriemu ,Oweh, Olomoro-Oleh oil and gas field radiation levels are still within the 1Svy maximum permissible limit recommend for the public and non-nuclear industrial environment by International Council on Radiological Protection (ICRP 1999).But Oturogu, Ughelli West, Afiesere and Uzere west and East oil and gas fields.Olomoro, Uzere and Emeragha communities radiation levels exceeded the maximum recommended values and other reported values in similar environment. Thisshow that the oil and field's environment and the host communities have been impacted radiological. Though these result obtained indicates no immediate health hazard, but will pose some long-time health side effects on the staff working in the facilities and residents of the host communities. Interim proactive measures are recommended while further detailed study is suggested to confirm likely hazards of exposure.*

Keywords; *Radiologicalimpact, oil and gas facilities, land Area, Delta State*.

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I. Introduction

Radiation play on important and sometimes vital role in our everyday lives. Every day each of u s is exposing to naturally occurring quantities of radiation. We are exposing to these radioactive materials through the air we breathe, the soil on which we walk, the water we drink, the food we eat even within our bodies (Ademola, 2008). Monitoring for radioactive materials is of primary importance for environment protection, but rapidand accurate methods for the assay of radioactivity are essentials (EL-B ahi, 2004).

Crude oil and other petroleum related products is a naturally occurring liquid mineral deposited beneath the earth surface. Its occurring liquid mineral deposited beneath the earth surface. Its occurrence is sometimes accompanied with the existence of natural gas. The oil, gas and associated gas are containedgenerally with radionuclide in the earth crust and drilling material. All these provide the source of radiation such as α, β,and ϒ radiation often found in the petroleum matrix (Laogun et al, 2006).

Gamma rays are known to be highly penetrating and are part products of the radioactive materials containing radon that may be ingested or inhaled into the human body, during repairs and maintenance of oil facilities. If inhaled the dust particles and aerosols containing radon may attach themselves to the lungs where gamma rays emitted in the decay may pose increase risk lung cancer, lung eye cataracts and mental imbalances to personnel's and host communities (laogun et. Al., 2006).

In recent times, researchers have found a strong correlation between radiation exposure and health hazard on workers in this environment eco-system (Avwiri, et.,al., 2007) which are attributed to the industries inputs raw materials, effluents discharged as in gas flare and output products.

Elena and Gracea (2004). Conduct environment monitoring of radioactivity in the surrounding of six oil fields in Bacau and Braila districts and reported that from radiological point of view, the situation does no pose any immediate concern. However, the high radium-226 content of oil formation waters could lead to environmental pollution.

Laogun, et.,al.,(2006) studied the variation in well-Heads gamma radiation levels at an oil field in Ologbo, Edo State and reported that values obtained are fairly higher than normal background level but are in agreement with the international Atomic Energy Agency's standard on background ionizing radiation level for such environment. Also, the Rail Road commission of Texas (RRC, 2007) reported that naturally occurring radioactive materials (NORMS) associated with oil and gas production originated in subsurface and contain radioactive materials like Uranium and Thorium and their daughter progenies (Ra-226 and Ra-228) Avwirii,et.,al., (2007) studied the terrestrial radiation around oil and gas facilities in Ughelli region of Nigeria and reported an average value range of 12.00±0.1μSv/wk) to 22.00≠2.1μRh^{-1} (9.79≠0.16) in the oil filed and 09.00≠1.0 to 11.00≠0.5μRh^{-1} in the host communities. They concluded that though the radiation values are within international standard and are in consonant with other reported values in the country, the BIR levels exceeded the normal background level.

EPA, (2009) on environmental, health and safety online, stated that the more radiation dose from oil and gas installation on a person or worker receives, the greater the chance of developing cancer, leukemia, eye cataracts, erythemia, hematological depression and incidence of chromosome aberrations. This may not appear until many years after the radiation dose is received (typically, 10-40 years).

The objectives of this study are therefore to assess the radiological impact on the environment and population of oil/gas industry that is non-nuclear industry. This study will also give precise and accurate information on the background ionzoning radiation (BIR) levels of these flow stations and their host communities in the Niger Delta State and add to the data on background radiation levels in oil facilities in the region. The health implications of the obtained results on the fields' workers and resident of the host communities will be examined.

II. Materials And Methods

The studied oil fields are within the Oil Mining lease 30 (OML 30) of the production land area of Niger Delta. An ***insitu*** approach of the background radiation levels measurement was preferred to enable samples maintain their original environmental characteristics. Two radiation meters, Digilert 50 and 100 nuclear radiation monitors (S.E International Inc. Summer town, USA), which contain a Geiger Muller tube, each capable of detecting α,β,ϒ and X-rays within the temperature range of -10 to 50^{0}c were used.

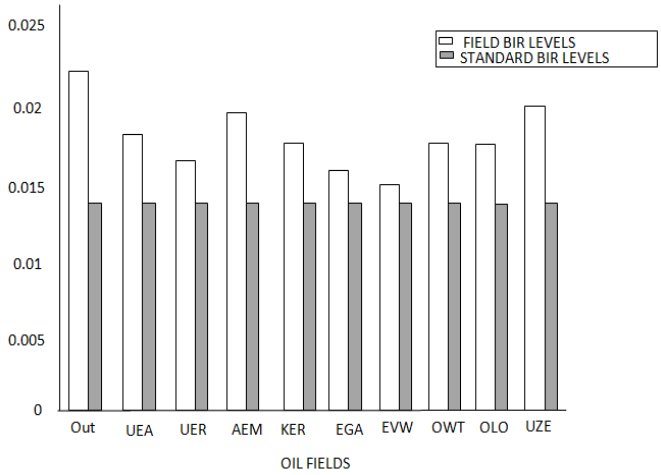
Prior to use, the two meter were synchronize by resetting them, The meters were then calibrated using a Cs-137 gamma source supplied and specified by International Atomic Energy Agency (IAEA) Vienna. Readings were taken on each operational scale at the time of the calibrations with check sources and repeated every 5 minutes. The standard errors detected were ≠8% and ±5% for digilert 50 and 100 respectively.

During field measurement, the tube of the radiation meters were held at a standard distance of 1.0m above the ground and placed at about 2.0m away from the facilities. The windows of the radiation meters were first oriented vertically downward and toward the oil/gas facility (Laogun, et.,al., 2006; Avwiri, et.,al.,2007). The geographical positioning system (GPS) reading for the particular facility location was recorded.

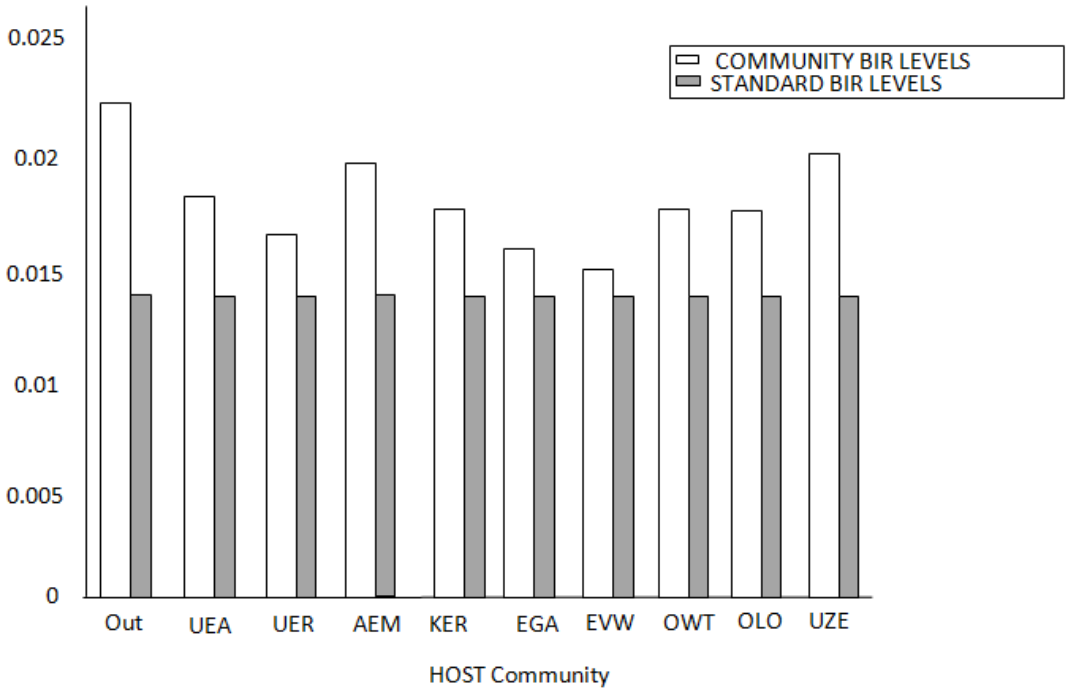
For optimum results, measurements were carried out between 1300 to 1600hours, Since the radiation meter have maximum response to environmental radiation within these hours (Akpabio, et.al. 2005)

At each facility, three readings were obtained simultaneously at 300secs each and their average values computed. Ina field, nine different facilities radiation levels were taken to ensure adequate coverage of the oil field facilities. Also the radiation level outside the oil and gas work environment i.e the host communities levels were evaluated.

III. Results And Discussions



COMPARISON OF OIL FIELDS BIR LEVEL



Comparison of Host Community BIR Level and Standard BIR Level

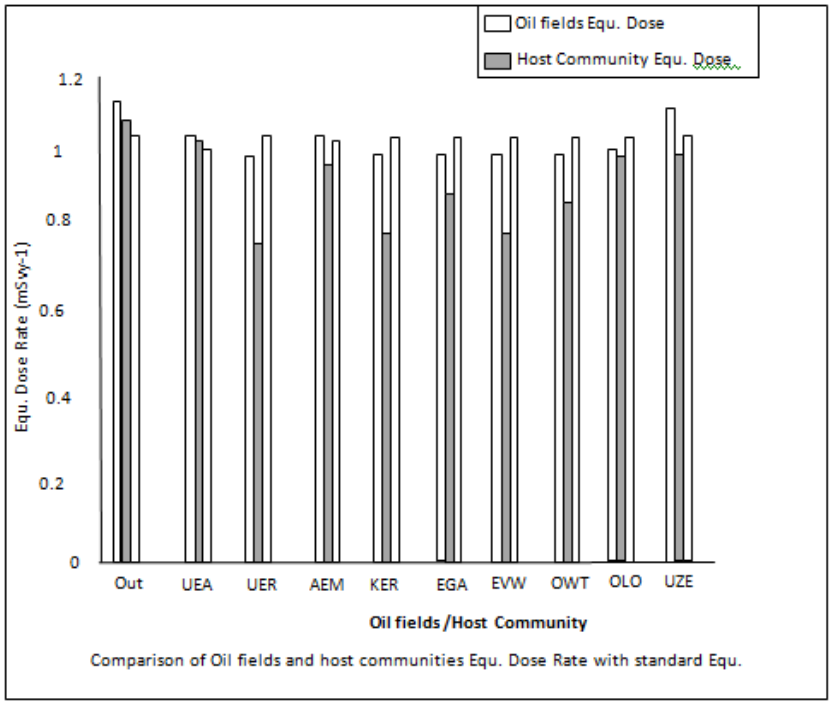


Table 1-10 show the results of the insitu measurement carried out in the tent studied oil and gas fields. The facilities insitu exposure rate in the fields ranged from $0.011\pm0.03mRh^{-1}$ at the campsite in Evwreni oil field to $0.031\pm0.01mRh^{-1}$ at the Otorogu gas plant in Otorogu oil and gas field. The high values obtained at the otorogu gas plat may not be unconnected with the high concentration of randon accompanying natural gas, which is in abundance in this environment.

The mean exposure rates/equivalent dose rates in the oil fields ranged from $0.016\pm0.006mRh^{-1}$ ($0.839\pm0.34mSvy^{-1}$) in Evwreni field to $0.0213\pm0.008mRh^{-1}$ ($1.134\pm 0.44mSvy^{-1}$) in Otorogu oil and gas field. The low level obtained at Evwreni oil and gas field could be attributed to the shutdown in operations at the oil

field. While the high radiation may be because of the development of new wells, turn around maintenance going on in some major facilities within these The results obtained shows that the mean exposure rates/equivalent dose rates in the oil fields ranged from 0.016±0.006mRh^{-1} (0.839±0.34mSvy^{-1} in Evwreni field to 0.0213±0.008 mRh^{-1} (1.134±0.44mSvy^{-1}) in Otorogu Oil and gas field. The low level obtained at Evwreni oil and gas field could br attributed to the shutdown in operations at the oil field. While the high radiation level; recorded at some of the oil and gas field. While the high radiation level recorded at some of the oil and gas field especially at Otorogu field may be because of the development of new wells, turn around maintenance going on in some major facilities within these oil and gas fields. The mean field radiation values obtained from the oil and gas field show that, Ughelli East, Kokori, Eriemu, Evwreni, Oweh, OlomoroOleh oil and gas fields are still within the 1.0mSvy^{-1} maximum permissible limit for non-nuclear work environment and the general public, recommended by European Council on Radiological protection (ICRP, 1999). This calls for a concern and detailed studies of oil fields to ascertain the level of radiological impact of these fields' workers, host communities and the immediate environment.

The exposure rates obtained in the host communities ranged 0115 ±0.003mRh^{-1} (0.62±0.16mSvy^{-1}) in 0.0115Evwreni community to 0.021±00.7mRh^{-1} (1.117±0.37mSvy^{-1}) in Otujeremitown. It was generally observed that the closer the facilities to the host community the higher the impact level, thus proximity plays an important roll in the radiation impact and distribution. These results obtained in the host communities show that Otujeremi and Ekakpamre communities equivalent dose rate exceeded the (ICRP, 1999)1.0mSvY^{-1} maximum permissible limit recommended,for the public. While Emeragha, OlomoronadUzere communities environment are radionuclide saturated with reference to the maximum limit, thus further accumulation may result to exceeding the permissible limit for the public, which may result in some health hazard in this environment. Table11 shows the comparison of the studied oil fields and host communities radiation data. The percentage deviation is least at Ughelli West Oil and gas field with a percentage difference of 0.30 and maximum at Ughelli East and gas field with a percentage difference of 39.10. This could also be attributed to the proximity of the oil and gas facilities to the host communities. The result obtained from the control site (a non-oil bearing communities with the same geological, hydrological and geomorphologic features with studied fields) is 0.009±0.002mRh^{-1}(0.479±0.11mSvy^{-1}), which show a great difference with the host communities BIR levels.

Fig.1 show the comparison of the mean oil and gas fields' radiation levels with the standard background radiation level of 0.013mRh^{-1} d by ICRP, 1999, The result shows that all the oil field examined exceeded the normal standard BIR level, with the maximum field examined exceeded by 63.8% while the minimum mean exposure field level exceeding by 23.1%. These values obtain are well above previously reported values in similar environment (Arogunjo et.al.,2004; Laogun, et al., 2006 Avwiri, et.al., 2007 Meindinyo and Agbalagba 2012)

Figure.2 shows the comparison of the host communities' average BIR levels with normal/standard background level of 0.013mRh^{-1} (ICRP, 1999). The results revealed that 70% of the host communities exposure rate exceeded the normal standard background radiation level, with the most impacted community (Otujeremi) being 161.5% of the standard background level. The control site (Non-oil bearing community) exposure rate is 69.2% of the standard background level. Examination of these three is 69.2% of the standard background level. Examination of these three categories show that the oil bearing host communities have been impact radioactively by the operation of the oil and gas industry and their facilities in these environment.

Equivalent dose rate is the measure of the amount of radionuclide's absorbed by the human body for a given period. To avoid any somatic, epidemiological and radiological health side –effect, ICRP, 1999 recommended and consequently set the maximum permissible limit for non-radionuclide industrial worker and the public as 1.0mSvy $^{-1}$. Figure 3 shows the comparison of the mean fields' equivalent dose rate, host community dose rate and ICRP, 1999 maximum permissible limit. The results revealed that 40% of the fields examined exceed the maximum permissible limit while 20% exceeded the limit in the host communities.

IV. Conclusion

The investigation on the radiological impact of oil and gas activities on field workers and host communities residents, in production land area of Delta State has been conducted. The overall results obtained show that the host communities and field workers may have been adverse imported ionizing with radiation that may be due to the oil activities in the environment.

These reported values indicate no immediate side effects, but may cause long-term health hazard to both the oil field workers and residents of the host communities according to EPA 2009, Agbalagba and Meindinyo

Since radiation exposure in these environment may constitutes health hazard on the long term, especially to personnel and host communities. Contaminated facilities, radionuclide's input materials and waste materials problems must therefore be adequately recognized and addressed in the oil and gas industries.

We therefore, recommended as follows:

- The oil gas operating companies in these areas should put in place means of reducing their radionuclide input.
- Both life and health insurance policies should be acquired for employees and contract staff working within the flow stations, to take care of their long-term health problems.
- Communities within oil and gas installation areas should have good, cheap and regular access to medical care.
- Communities within 500meters proximity to flows stations and other oil facilities should be relocated for the safety of their health.
- All oil and gas installations should meet all known international and ISO standard.
- There should be a regular monitoring of radiation levels in these environments.
- All government agencies responsible for the safety of the environment should enforce all the existing legislation on environment protection.

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