



Occupational Safety and Health Implications of the 2022 Gas Pipeline Eruption at Federal College of Education (Technical), Omoku

*¹Nwogbidi, K.C., ²Nwogbidi, S.I., ³Peter, E.O., & ⁴Tew, B.C.

¹Department of Biology, School of Science, Federal College of Education (Technical), Omoku, Rivers State

²Bursary Department, Federal College of Education (Technical), Omoku, Rivers State

³Audit Department, Federal College of Education (Technical), Omoku, Rivers State

⁴Department of Home Economics, Federal College of Education (Technical), Omoku, Rivers State

*Corresponding author email: kingsleynwogbidi@fctomoku.edu.ng.

Abstract

Occupational Safety and Health (OSH) in a work environment is focused on protecting worker's safety and health in the context of physical, mental and social wellbeing. This paper presents some occupational health and safety hazards associated with Federal College of Education (Technical) Omoku Campus II work environment consequent upon a gas leakage that occurred in 2022. An in-situ measurements of the levels of gases and volatile organic compounds was carried out using standard well calibrated instruments and equipment, the results indicate that the mean levels in parts per million (PPM) of the measured gas parameters at the Campus II work environment were higher than other sites and above regulatory limits, there were perceived impacts of bad air quality which were of major concern. The paper concludes with recommendations to all relevant authorities on the need for a proper OHS management system for all community's affect

Keywords: Air quality, Noise, Occupational Health and Safety, OHS management systems.

Introduction

Occupational Safety and Health (OSH) is a dynamic and integral aspect of contemporary workplace emphasizing the importance of maintaining a secured and healthy environment for employees (HSEbox, 2024). OSH is a systematic approach to ensuring worker's wellbeing by identifying, assessing and mitigating against accidents, illnesses and injuries arising from workplaces. Occupational Hazards can be due to chemical hazards, safety hazards, electricity, chemical, confined spaces, extreme temperatures, harmful bacteria, manual handling, occupational infections, workload hazards, radiation therapy, air /gas hazards etc. The introduction of noxious gases, solids and airborne biological agent's compromises air quality and their harmful effects lead to air pollution. There are natural and man-made (anthropogenic) sources of air pollution. The natural sources include wild forest fires, volcanic eruptions and complex atmospheric chemical processes such as the process that form ground level ozone. Anthropogenic activities that cause air pollution include burning of fossil fuels and biomass, agricultural practices, oil exploration, construction process and gaseous wastes. Natural sources of air pollution in Ogba/Ndoni/Egbema Local government area (ONELGA) of Rivers state are limited because of the gift of luxuriant vegetation, but anthropogenic sources are however numerous and indeed the crux of the matter. Industrial hygiene is the science of protecting man's health through the control of the work environment. Historically, there was little concern for protecting the health of workers. By and large, the basic objective of all the various Acts all over the world is that the workers' health shall be preserved by the employers. The followings throw some light into the means of recognition and evaluation of noise, heat stress and chemical agents.

Federal College of Education (Technical), Omoku is one of the Federal Colleges of Education (Technical) established to meet the challenges of national production of technology teachers to teach technical, vocational, science and business subjects/courses in vocational training centers, Secondary and Technical Colleges and is located in ONELGA, Rivers state Nigeria. It runs courses leading to the award of Nigeria Certificate in Education (NCE) and is in affiliation with some

Universities to run degree programs until last year that it has been granted the approval to award degree programs without affiliation to any University. In a study of air quality of Federal College of Education (Technical), Campus II Omoku, it was observed that Suspended Particulate Matter (SPM) in the campus's atmosphere ranged from $114 \mu\text{g}/\text{m}^3$ at DE MASTERS area axis to $198 \mu\text{g}/\text{m}^3$ in Ebogoro area axis. Carbon monoxide concentrations were highest in Omoku/Obrikom axis. Nitrogen dioxide concentration was highest in Obrikom ($187 \mu\text{g}/\text{m}^3$) and sulfur dioxide concentrations ranged from $19 \mu\text{g}/\text{m}^3$ in Obie.

Total hydrocarbon ranged from $178 \mu\text{g}/\text{m}^3$ in Obrikom to $292 \mu\text{g}/\text{m}^3$ in Omoku. Carbon dioxide ranged from 400 PPM in Ebogoro axis to 450 PPM in Okpurukpali axis. The most abundant of the VOCs is benzene and toluene. Ethylene was detected only in one station at concentration of $0.1 \mu\text{g}/\text{m}^3$ which was negligible. Low level detection of any BTEX is significant because of its volatility and reaction as it implies a momentary high dose of concentration. The most abundant of the metals was zinc which was present at above $3 \mu\text{g}/\text{m}^3$ in most of the study settlements. In remote settlements like Okposi and Ogbidi, some of the metals were not detected at all. In some instances, short term limits for pollutants exceeded WHO standards. The incidence of the gas eruption was so severe that it led to mass hysteria. This was because the eruption was visible as it accumulated on surfaces such as floors, office items such as tables, files, apparels and artifacts. A swipe on objects placed in open or poke on this nose stains the finger. People were emphatic that their daily dose of the Soot was certainly deleterious, hence the panic.

Air Quality Index (AQI)

The outcome of AQI assessment for the sampled Campus II areas indicated a moderate to unhealthy status particularly at dawn. The Ebogoro/Obrikom maintained a moderate to unhealthy status during the season. However, moderate to unhealthy status prevailed in Omoku throughout quality status during the dry season as it was above 70% unhealthy. The activities of NAOC/OANDO located in the area may have contributed to the poor air quality status.

Air Pollution Climatology of the Area

Combining weather parameters with emissions stoichiometry is a useful tool in estimating emission values without instrumental measurement. The propagation of air pollutants in terms of chemical reaction, dispersion, transport, deposition or removal taking place exclusively in the atmospheric medium on pollution is termed air pollution climatology. The area is characterized by humid, continuously rainy climate, high temperatures and air masses that are mostly maritime. The variables relevant to emissions behavior is the thermodynamic properties of the system embodied in the various categories of atmospheric stability.

The distribution of the classes of stability determines if emissions after release will remain in place, be dispersed vertically, horizontally or both. It can also determine how far and in what direction emissions will be flown. The capacity of the atmosphere to enhance the dilution of emissions is a significant solution to pollution apart from restraining or reducing the human contributory activities that release the emissions. When the local or regional atmospheric environment into which emissions are discharged is not dispersed or diluted, the ambient air will become more contaminated. The most significant atmospheric situations that influence the spreading, dilution and dispersion of concentrated pollutants in any locality are the surface wind force and the lower tropospheric stability conditions.

According to Ede et al. (2010); Ede et al. (2011); Ede AND Edokpa (2013); Edokpa AND Nwagbara (2017); Edokpa AND Ede, (2019), the dominance of low to moderate wind force in the Niger Delta atmospheric environment has made dilution moderate thereby creating a moderate to poor air quality status. Atmospheric stability influences the vertical displacement of air. The greater the degree of vertical mixing, the healthier is the quality of air. Atmospheric stability plays a dominant role in the build-up of air pollutants and significantly influences their dispersion, deposition and dilution (Almethen & Aldaithan, 2017; Edokpa & Nwagbara, 2017). In the Niger Delta environment, periods of lower diurnal air temperature values such as the night times are usually associated with stable atmospheric condition. This condition coupled with the high humidity encourages the growth of particulate thereby reduces visibility and increasing dry deposition (Hernandez et al., 2017).

Noise

Noise Sources and Effects

137 | Cite this article as:

Nwogbidi, K.C., Nwogbidi, S.I., Peter, E.O., & Tew, B.C. (2025). Occupational safety and health implications of the 2022 gas pipeline eruption at Federal College of Education (Technical), Omoku. *FNAS Journal of Basic and Environmental Research*, 2(4), 136-140. <https://doi.org/10.63561/jber.v2i4.1131>

Sources of noise in the petroleum industry are generally associated with flares, blowers and compressors and similar equipment (Botford, 2023).

Noise defined as “unwanted sound” is a form of vibration. The effects of noise on man include the following:

1. Psychological effects: Noise can startle, annoy and disrupt concentrations, sleep and relaxation.
2. Interference with speech communication.
3. Physiological effects: Noise induced loss of hearing, upsetting sense of balance, reduction of efficiency, constriction of blood vessels, raising blood pressure, nervousness’ etc. (Guidelines for Noise Exposure ,2022).

Table 1- Threshold limit values for non-impulsive noise adopted by the American Conference of Government Hygienist ACGIH.

Table duration per day (hours)	Permissible level DBA
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
0.75	107
0.50	110
0.25	115 max

Work Environment Risk Assessment/Hazard Analysis: September 2022 Gas Eruption/Leakage in Perspective.

This research was designed to examine the work environment risk assessment or hazard analysis arising from gas eruption or leakage that occurred within Federal College of Education Technical Omoku campus in September 2022. Empirical research design was used for the study. The sample was a representative proportion of the college community interacted with, the data generated is used to evaluate the level or degree of impact. The expected outcome of this research shall be used to know and ascertain the health status of staff (teaching and non-teaching) of Federal College of Education (Technical) Omoku in Campus II.

The purpose of this paper is to present some aspects of hazards people in the occupational environment can be exposed to in Federal College of Education (Technical) Omoku Campus II. It is readily recognized that it is not possible to examine all the different occupational hazards facing the campus, but it is possible to focus attention primarily on the relevant physical (noise, heat stress) and chemical (organic vapors, liquid, gaseous etc) agents in Campus II work environment to determine their existence and evaluate. The choice of heat stress and noise for example, becomes more important because most complaints and litigations brought about by local citizens in the Ebogoro and Obrikom oil producing areas of ONELGA have centered on these two factors. Thus, there may be good reasons to suspect a potential occupational hazard arising from this, the choice of this paper is also necessitated by some of the discussions in the previous challenges.

Heat Stress

General experiences show that extremes of temperature affect the amount of work that a worker can do and the manner in which he does it. The subjective sensations of heat, perceived as neutral, warm or hot depend primarily on skin temperature. Heat “discomfort” however, is the subjective evaluation of the thermal environment in terms of unpleasantness and depends not only on sensations of heat, but also on the level of physiological stress, which includes the following:

1. Heat stroke-severe headaches, rapid temperature rise, loss of consciousness.
2. Heat cramps-cramping of muscles of skeletal systems or intestines.
3. Heat exhaustion-weak pulse, dizziness, profuse sweating etc.

Survey Techniques

The general principles in evaluating the occupational environment of concern involves the recognition of the potential hazard and the possible areas or locations of such hazards. The recognition of the potential hazard includes the familiarization of the processes giving rise to such hazard. The recognition of the possible areas or locations of such hazard can be achieved through inventories, experiences and above all complaints received from the workers of FCET, Omoku.

Monitoring of noise is usually accomplished by the use of instruments. A complete array of instruments were available for measuring noise. Sound level meters, calibrators, frequency analyzers and other accessories available from suppliers, complete with instructions. The method employed in data collection was simple in-situ atmospheric air quality measurement with particular attention to parameters such as oxides of nitrogen, oxides of sulphur, suspended particulate matter 2.5 and 10.0, volatile organic compounds, wind speed, wind direction, relative humidity, carbon dioxide, carbon monoxide, methane and ozone. The most common purpose for sampling air at the workplace is to evaluate accurately the exposure of workers to one or more contaminants for determining compliance with regulations or commonly accepted standards. Other basic purposes of workplace air monitoring include evaluation of the risk of exposure from contaminants and assessment of the effectiveness of engineering control measures, process changes or personal protective devices.

Acceptability Criteria-Standards

In determining thermal stress criteria, several physiological strains are taken into consideration. Man, for example, regulates internal body temperature within narrow limits by physiological control of blood flow from sites of heat production in muscles and deep tissues to the cooler body surface where heat is dissipated.

Several psychological / physiological studies on heat stress have been investigated. These studies have formed part of the criteria used in establishing standards. It must however be born in mind that attempts to formulate indices of thermal stress have not been easy. In most cases, the criteria used in establishing such indices, seem to be based on environmental factors and work regimen. Several indices of thermal stress have been developed but because of the simplicity of one technique, the Wealth Bulb Globe Temperature (WBGT) Index has been adopted.

Effects of Chemical Agents

The hazards associated with breathing a gas or vapor usually depend on the solubility and vapor pressure of the substance that is airborne. These chemical agents may have adverse effects on health such as affecting target organs of the body (blood, nervous system, eyes, gastrointestinal system, cardiovascular system, kidneys, liver, respiratory system, etc.), or may have some undesired effect upon the ability of an individual to perform his or her normal work. Exposures even for brief periods to high concentration of the compounds can cause serious problems. The severity of hazard in FCET Omoku staff depend on several factors including the following:

- Proximity to Source of Pollution
- Type of Job Operation (Determines Exposure)
- Duration of Exposure
- Operating Temperature
- Ventilation Efficiency
- Evaporation Rate of Vapor Pressures
- Concentration of Vapor in Room in Workroom.
- Housekeeping.

Human Health Effects of Air Pollution in ONELGA

The effects of air pollution in Ogbaland is relatively not well documented. One of such works as carried out by some researchers detailed how congenital cleft deformity found in patients examined in a high volume hospital was associated with airborne hydrocarbon pollution in the area. Unfortunately, the incidence of air pollution has become worse with the establishment of more large-scale projects such as the two gas plants in the area. The development of illegal artisanal refining of crude oil across the Niger Delta region has added to the problem with severe repercussions for regional air quality.

Sadly, in a study by Rivers State Ministry of Environment in the past showed that, soot seen in Rivers State contain heavy metals, poly-cyclic aromatic hydrocarbons and respirable particulate (Rivers State Ministry of Environment, 2017, 2019). Through hospital records analysis, the study found a spike in respiratory, renal and dermatological conditions since soot started appearing in the area. The report further noted that the growing rate of increase in morbidity and mortality was far above the overall population growth rate and that the phenomenal increase in respiratory conditions in particular was conclusive indication of the effect (of the soot) as being responsible for the negative health conditions observed. The study also projected that with the present quality of air in area, thousands of people will be subjected to cancerous conditions in the future. Estimates from human health risk analysis for PAHS, TPH, BTEX and heavy metals concentrations measured

in Rivers State showed that thousands of people are expected to suffer cancerous and non-cancerous effects from the suspended particulate matter / soot in the atmosphere.

For instance, Benzo (a) pyrene, a compound of PAHS is directly linked to prostate cancer. The analyzed data showed that substance is found in the soot can induce oxidative stress, DNA damage and cell death processes resulting in increased risk of cancer and cancer related diseases.

Conclusion

Nigeria having joined the race for advancement and industrialization through petroleum exploration, exploitation and refining. This race is relatively not new in Nigeria but the petroleum industry with all its advanced technologies and safety precautions is relatively old elsewhere. Therefore, the oil industry in Nigeria has impacted in great measure the health and happiness of his work people in its power.

Recommendations

- There should be regular monitoring of the air quality status of the investigated areas if a healthy air status is to be achieved.
- The oil industries in Ogba/ Egbema/ Ndoni should not only pursue petroleum pollution control because of recent pressures exerted on it by the public and the government but shall also show concern for occupational hazard as part of the overall environmental problems facing the industry.
- Public and governmental pressure exertions for occupational safety in the oil industry are not too distant to what staff of Federal College of Education Technical, Campus II Omoku requires.
- There is need for concerted efforts by all stakeholders to ensure that air pollution is reduced to the barest minimum so as to forestall OSH in and around Federal College of Education (Technical), Omoku, ONELGA, Rivers State, Nigeria.

References

- Almethen, O. M., & Aldaithan, Z. S. (2017). The state of atmospheric stability and instability effects on air quality. *The International Journal of Engineering and Science*, 6(4), 74–79.
- Botford, J. H. (2023). Noise measurement and acceptability criteria. In *The industrial environment—Its evaluation and control*. U.S. Department of Health, Education, and Welfare, Public Health Service, National Institute for Occupational Safety and Health (NIOSH).
- Ede, P. N., Edokpa, O. D., & Ayodeji, O. (2011). Aspect of air quality status of Bonny Island, Nigeria attributed to an LNG plant. *Energy and Environment*, 22(7), 891–909.
- Ede, P. N., Obunwa, C. C., & Nlerumchi, S. C. (2010). Air quality studies around some local palm oil mill plants at the northern fringes of the Niger Delta area, Nigeria. *Journal of the Chemical Society of Nigeria*, 35(2), 6–10.
- Edokpa, O. D., & Ede, P. N. (2013). Challenges of associated gas flaring and emission propagation in Nigeria. *Academia Arena*, 5(4), 28–35.
- Edokpa, O. D., & Ede, P. N. (2019). Preliminary air quality index estimates of particulates concentration in Port Harcourt during soot incidents. *International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET)*, 5(5), 25–29.
- Edokpa, O. D., & Nwagbara, M. O. (2017). Atmospheric stability pattern over Port-Harcourt, Nigeria. *Journal of Atmospheric Pollution*, 5(1), 7–19.
- Guidelines for noise exposure. (2022). *Sound and Vibration*, 4, 21.
- Hernandez, G., Berry, T. A., Wallis, S. L., & Poyner, D. (2017). Temperature and humidity effects on particulate matter concentrations in a sub-tropical climate during winter. *International proceedings of chemical, biological and environmental engineering*, 102(8), 41–49.
- HSEbox. (2024). Occupational health and safety. Technical University in Zvolen.
- Rivers State Ministry of Environment. (2017). Report on particulate matter (soot) analysis on some parts of Port-Harcourt (p. 16). Government of Rivers State, Nigeria.
- Rivers State Ministry of Environment. (2019). A study of airborne particulates “black soot” in Port-Harcourt and its environs (p. 139). Government of Rivers State, Nigeria.