

**RIVERS STATE UNIVERSITY,  
PORT HARCOURT**



**ENVIRONMENTAL POLLUTION HAZARDS,  
LIKE MAN, ANIMALS ARE ALSO AT RISK:  
THE ANIMAL SCIENTIST PERSPECTIVE.**

**AN INAUGURAL LECTURE**

By

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RAS, MNSAP, MNIA, MASAN, FCASN, B.Sc. (ANIMAL SCIENCE) U.N.N.,  
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**Professor of Animal Science**  
(Poultry Production And Management)

**SERIES NO. 56**

**Wednesday 30th May, 2018**



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*Dedicated*

TO



**ELDER (PA) CORNELIUS IBITOMIE HART**

(MY CENTENARIAN)

FATHER OF GRAND BONNY KINGDOM,

*AND MY MOTHER,*

**LATE MADAME CECILIA BROWN**

OF BUOYE OMUSO BROWN HOUSE OF FINIMA,

AND

TO ALL WHO LOVE ANIMALS.

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The Vice Chancellor,  
Deputy Vice Chancellor,  
Registrar and other Principal Officers,  
Deans of Faculties,  
Directors of Institutes,  
Distinguished Professors and Eminent Scholars,  
Heads of Department,  
Other Members of Senate,  
Distinguished Guests and Family Members,  
Staff and Students of RSU,  
Ladies and Gentlemen

## 1.0. PREAMBLE

I am indeed grateful to God Almighty who has made today, a day of reality for me to present my inaugural lecture. My desire to study started from childhood, from Primary School to the University level where I was encouraged by my father. My love for Agriculture, in particular, animals made me choose Animal Science as a course of study, with special interest in Poultry Production and Management. Since the environments in which animals are raised are of paramount importance for effective economics of production, my PhD study took me to the area of Environmental Management. This brought a lot of argument for those who thought Environmental Management had no

relevance in Animal Production. I thought those people should have known that just like man lives and strives to survive in his environment, so do animals of other species including poultry.

Vice Chancellor, Sir, I stand here to declare loud and clear that Environmental Management as a discipline, has everything to do with Animal Production. So whether you raise your livestock on land, or sea or air, you are interacting with the environment. Just like man suffers from various forms of environmental pollution, so do animals.

Unfortunately those who refused to understand this fought my professorial promotion for years, but to God be the glory, I prevailed over them. Today I am glad to say that as a Registered Animal Scientist, my knowledge of Environmental Management has paid off in enabling me become a Fellow of the College of Animal Science of Nigeria, (FCASN) and attain the full membership of the following professional bodies - the Nigerian Institute of Animal Science (NIAS), Nigerian Society of Animal Production (NSAP), Animal Science Association of Nigeria (ASAN).

It is known that man and animals belong to the kingdom “*Animalia*” and exhibit same characteristics in terms of physical, biochemical and physiological qualities that lead to growth, production and reproduction. However, we know that man is the apex of God's creation and can relate to Him spiritually, while animals cannot. Furthermore, my work has established the fact that when the external environment is polluted in several ways, through the air, land and water, animals suffer the same risks as man, depending in the severity and intensity. From my knowledge of Environmental Management, I now appreciate the Animal/Environment Interaction which makes for better animal productivity.

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cried and rejoiced with me. I appreciate our four (4) lovely children; Omieibi, Ibiene, Tekena and Belema, who bore with me even when academics took me out of the home.

To my colleagues at University of Port Harcourt, Prof. (Mrs.) M.O. Ironkwe, Dr. (Mrs.) L.A.F. Akinola, Dr. (Mrs.) F.O. Ajayi and others, I appreciate you. I thank all my friends and well-wishers who stood by me and encouraged me. May God bless you all, Amen.

I appreciate particularly Rev (Prof.) & Rev. (Mrs) Mosy Madugba, Mr. & Mrs. P. Somiari, Mrs. E. Nwibani, Bishop and Rev. (Mrs.) W.T. Iwo, Engr & Mrs .A. Ogbuigwe, Hon. Justice .O. Daniel-kalio, Prof. (Mrs) E.E. Orlu, Dr.(Mrs). Emylia Jaja, Ms. Lucretia Barber, Dr.(Mrs) N.J. Emelike, Mrs. M.J. Igben, Mrs. Data Akobo, Mr. & Mrs. Gogo Uranta, Mr. Romeo Briggs, Mr.E.I. Davies, Mrs. N.I. Amadi, Mr. M.V. Opuwari of ITC and others. God bless you all. To all who are present in this hall today to be part of this inaugural lecture, I want to specially appreciate you. Thank you so much and God bless.

## 2.0 INTRODUCTION

### 2.1. Animal Science As A Profession / Discipline:

In relation to the domestication of animals, Adam was the first recognized Animal Scientist/Husbandman, who named all the animals that were with him in the Garden of Eden after God created them. He enjoyed their companionship until Eve was created to complement him. The Patriarchs in the bible- Abraham, Isaac, Jacob and others were all Animal Scientists/Husbandmen of their types, raising domestic animals like cattle, camels, oxen, donkeys, sheep, goats and poultry for their use as food, sacrifice, income, companionship, for work, beast of burden etc. You will also recall the story of Noah and the animals in the ark. Jesus rode on a donkey into Jerusalem. Let me stop so far.

Another name for Animal Science is Animal Husbandry. It is a branch of Agriculture. It is defined as the art and science of rearing farm animals for human use. Animal husbandry includes feeding, breeding, housing, healthcare, processing and marketing of domestic animals for human benefits.

Farm animals include all types of livestock (cattle, sheep, goats, horses, pigs, camels and donkeys), poultry (chickens, turkeys, ducks, geese, guinea fowls, quails, pigeons and ostriches), and micro-livestock (grasscutters, rabbits, snails, guinea pigs, honey bees and squirrels and common pets (dogs and cats)

## 2.2 Career Opportunities in Animal Science

*Career opportunities in Animal Science include, though not limited to the following areas:*

- ❖ Breeding and Genetics
- ❖ Poultry Farming
- ❖ Livestock Farming
- ❖ Hatchery Engineering
- ❖ Animal Health (Vet care)
- ❖ Marketing and Distribution
- ❖ Meat Processing Engineering
- ❖ Quarantine Programmes
- ❖ Feed Milling.
- ❖ Pasture and Range Management
- ❖ Laboratory Analysis (Experimentation)
- ❖ Extension Agency (Reaching out to Farmers)
- ❖ Animal /Poultry Educational Research in Universities.

## 3.0 TYPES OF ANIMAL HUSBANDRY

### 3.1. Subsistence Animal Husbandry:

This is where a farmer keeps a few farm animals in the traditional way where they roam and fend for themselves using family labour, sometimes with supplementary feed and shelter at night. Once in a while the farmer can sell one or two to meet his financial needs. No machinery is involved and no adequate farm records are kept.

I appreciate my Spiritual fathers and mothers who tarried in prayers for me in my trying moments. I particularly appreciate the General Superintendent- Rev. S.O. Akinola, the District Superintendents- Dr. D.S. Cookey-Gam, who is also my Parish Pastor and Doctor and Mr. Osaki Alalibo and their lovely families, the entire Pastorate and Elders of Glorious Covenant Ministry, the Body of Deacons and Deaconesses, the noble Women's Fellowship under the able leadership of Deaconess Blessing Daniel Kalio and her team, the Fellowship and Service arms, the Ministry Intercessory Team, the Teachers and Children of the Children's Department to which I belong, May the Lord bless you all.

To my brethren in the Scripture Union, SULAFF, Haggai Institute, Old Girls Association Archdeacon Crowther Memorial Girls School, Elemenwo, University of Nigeria, Nsukka Alumni Association and members of the Unitech Women Association. I appreciate you all. I am grateful to you all

I thank God for my parents, my father, Elder (Pa) Cornelius Ibitomie Hart. (a Centenarian) and my late mother, Madam Cecilia Apiafi Brown of blessed memory who trained me to love academics, to my siblings, relations and their spouses, I thank you all. To my in-laws (Dennis Amakiri LongJohn Family of Ogoloma and Fubara Erekokaye Family of Bolo), I thank you for your support and encouragement.

To my immediate nuclear family, I want to specifically appreciate and acknowledge my darling husband- Rev. Tonye Dagogo Amakiri, who did not let my marriage to him stop my academic pursuits. In fact, my 2<sup>nd</sup> and 3<sup>rd</sup> degrees were obtained in his house as a wife. May I use this opportunity to advice every husband in this audience to please encourage his wife for when it is well with her, it is well with you as her husband. My dear husband of almost 39 years of marriage, may God continue to bless you in Jesus name, Amen. You stood by me,



I am grateful to my colleagues in the Faculty of Agriculture, the Dean and other colleagues, and those in the Department of Animal Science (Head of Department, and other Colleagues). I appreciate your support for me over the years when I served as the longest serving Head of Department. My special thanks to Prof. A. Monsi, who was not only my academic mentor, but also my major supervisor for both second and third degrees. My other colleagues in the Department are acknowledged, Prof S. Wekhe, Prof. S.F. Amakiri; Prof. U.I. Oji, Prof. J.M. Olomu, Prof. J.P Alawa, Dr. O.J. Owen (present Head of Department), Dr. (Mrs.) Vivian Oleforuh –Okoleh, Dr. N.C Johnson, Dr. H.H Gunn, Mr. I.J Nte, Mr. H. Ideozu, Mr. B. Oriji in the laboratory, Mrs. Diseph Okonny in the farm and others, God bless you all.

My Faculty colleagues –Prof. H. Ukoima, (present Dean), Prof. B.I Isife, Prof. S.Y. Giami (former Dean), Dr. (Mrs.) A.I Nwonuala, Dr. (Mrs) U. Orji, Dr. (Mrs.) D.I. Ekine, Prof. U.U. Gabriel, Prof. T.A.T Wahua, Prof. E.E. Opuwaribo, Dr. A.D.I George, Dr. B.E Ekeke, Prof. (Mrs.) Onome Davies, Prof. S. Deekae, Dr. C. Osakwe and others, I appreciate you all for your support.

I am grateful to the President, Prof. I.F. Adu, the Registrar, Prof. E. Iyayi and all members of the Nigerian Institute of Animal Science. I appreciate the President, Prof. A.O. Ani, and members of the Nigerian Society for Animal Production (NSAP), and President Dr. Taiwo Adeoye and members of Animal Science Association of Nigeria (ASAN), and fellow members of the Fellow, College of Animal Science of Nigeria (FCASN), ASAN Rivers State Chapter, President, Mr. H.C. Okere, Secretary, Mr. Friday Osuagwu and others, I salute you.

To my graduate and undergraduate students who sharpened my research abilities, both past and present, I appreciate you all. Your interaction with me helped me.

### 3.2. Commercial Animal Husbandry:

Large areas of land are needed, while large numbers of animals are reared using skilled and unskilled hired labour. Special strategies have to be planned for successful marketing and distribution. A huge capital investment is involved and sourcing of loans may be necessary. In commercial animal husbandry, the use of machines such as debeaker, egg candler, incubator, milking machine etc. are necessary. Farmers specialize in one species of animals or the other and farm records are adequately kept.

### 3.3 Importance of Farm Animals

Farm animals play significant roles in human development. The important functions of farm animals are as follows:-

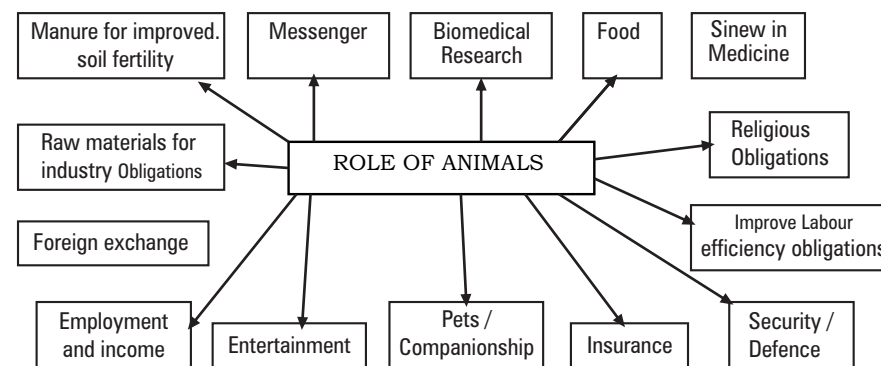


Fig 1: Overview of the Importance of Farm Animals

- ❖ **Provision of food:** e.g. meat, milk and eggs provide proteins and other nutrients beneficial for good health, growth and mental development of man
- ❖ **Source of Manure:** Faeces, urine and droppings from farm animals are used to improve soil fertility for crops and forages. Manure can also be used to grow earthworms and maggots.
- ❖ **Source of Income:** Live animals and their products e.g. meat, milk, eggs, hides and skins, wool, pelt etc are sold as sources of income.
- ❖ **Generation of employment opportunities:** Jobs are created through productive engagement in Animal husbandry e.g feed milling, farm animal breeding and management, processing, value addition, marketing etc.
- ❖ **Source of power:** Bulls and bullocks are used to till the land for crop production. Horses, camels and donkeys are used for threshing grains and extraction of vegetable oils. Dried and wet manure are sources of fuel and biogas for cooking.
- ❖ **Means of transportation:** Horses, camels and donkeys are used to carry loads and transport humans especially in arid (desert) areas.
- ❖ **Provision of raw materials:** Agro-based industries make use of hides and skins for the tanning industry, milk for dairy products, eggs for confectionary, bones for bone meal, feathers for making pillows, cushions, and mattresses etc. Animal skins are used to make drums, horns and feathers are made into ornaments.
- ❖ **Entertainments, sports and games:** Horses, chickens and dogs can be used for entertainment. Cocks are also used in cockfights.

## 14.0 ACKNOWLEDGMENT

“To God be the glory, great things He Has done”.

I must first of all thank the Almighty God who has made it possible for me to present this inaugural lecture today. It was all by His grace and mercies for all that He has done for me and my family.

I thank the Vice Chancellor, Prof. Blessing Chimezie Didia for granting me the opportunity to prove my professorship today. I am also grateful to the Deputy Vice Chancellor, Prof. B.M Oruwari, and the former Deputy Vice Chancellor, Prof. Howells Hart, the former Registrar, Mrs. Daba C. Odimabo, the current Registrar, Mrs. Victoria T. Jamabo, the former Librarian, Dame Prof. (Mrs.) Blessing Ahiauzu and the current one Mrs Jennifer Igwela, the Bursar, Mr. Kennedy Abraham, Prof I.K.E. Ekweozor. I thank you all for your support.

I also acknowledge the support and encouragement from these men- Emeritus Prof. D.M.J Fubara, Emeritus Prof. A.I. Ahiauzu, Emeritus Prof. S. Odi-Owei, Emeritus Prof .S.C. Achinewhu, Prof. Placid Njoku, ex-President of the Nigerian Institute of Animal Science (NIAS), and Sir, G.T.G Toby, Former Deputy Governor, Rivers State and Prof B.B. Fakae (former Vice Chancellor).

I am grateful to the Amanyanabo of Grand Bonny- King Edward Asimini William Dappa Pepple III J.P, Perekule XI, Late Chief Yibo Brown, former Paramount ruler of Buoye-Omuso Brown House of Finima and Chief Reginald Abbey Hart, the Chief of Hart House of Grand Bonny. I appreciate their financial, moral support and encouragement.

My colleagues at Senate, I appreciate you all, your encouragement for me when I was going through my trying times for my professorship.

### 13.0 RECOMMENDATION

Vice Chancellor, Sir, since animals are affected by environmental pollution, just like man, they stand the risks of health challenges through inhalation, food and water. Animals cannot carry placards and shout over soot cover in Port Harcourt or oil spill problems like the Ogonis or gas flaring pollution like the Egbemas, then it behoves us as animal farmers, reputed Animal Scientists, Government Agencies (Federal, State and Local Government Agricultural/Livestock Agencies) to protect our animals by:

- ❖ Creating a conducive environment through proper and adequate housing
- ❖ Proper feeding regimes
- ❖ Proper livestock regulation policies by the Nigerian Institute of Animal Science (NIAS) and other bodies.
- ❖ Sustained Government Policies for livestock development and sustain ability.
- ❖ Providing a cleaner environment through reduction in air (soot, gas flaring), land (contaminated pastures) and water (oil spills and heavy metals) pollution.
- ❖ Provision of funds/capital for farmers to cater for their livestock by way of soft loans with low interest rates etc.

- ❖ **Source of insurance:** Livestock and poultry offer insurance to crop failure in a mixed farming system.
- ❖ **For festival activities:** Animals are used in ceremonies and special occasions; e.g. rams are slaughtered during Muslim feasts, dogs are sacrificed along Ogun festivals, pigeons are released into the air during celebration of special events or National Independence Day, for games and weddings.
- ❖ **As messengers:** In the olden days, pigeons and dogs are often used to deliver messages during wars and at peace times.
- ❖ **For security and protection:** Dogs are used to watch and guard homes and farms, for protection of lives and property. Bees and geese are also used as security. Cats ward off rodents in stores, poultry farms and homes.
- ❖ **As bride price:** Goats, sheep, cattle, camels, donkeys and horses are used as part of bride price in some communities.
- ❖ **For companionship:** Animals provide companionship as pets e.g. dogs, rabbits and cats
- ❖ **Source of foreign exchange:** Live animals and their products can be exported to earn foreign exchange.
- ❖ **For research purpose:** Animals are used for field and laboratory researches e.g. rabbits, poultry, guinea pig, rats etc.
- ❖ **As a gift:** Persons considered as very important (VIPs) are presented with gifts of live animals e.g. cattle, horses etc.
- ❖ **In medicine:** Honey from bees is used to treat wounds, sinews from animals are used during surgery.



- ❖ **For circumcision:** Traditionally, snail fluid is used during circumcision.

#### 4.0 PROBLEMS OF ANIMAL HUSBANDRY/LIVESTOCK INDUSTRY IN NIGERIA

1. **Inadequate Finance:** Most livestock farmers are poor and cannot purchase modern machines and implements; hence they cannot operate large animal farms. High interest rate on loans and other administrative bottlenecks make access to credit facilities difficult. Inadequate finance may also prevent marketing of animal products
2. **Poor land tenure system:** Traditionally, land is shared among family members leading to land fragmentation. It is therefore difficult to acquire large hectares of land for animal production.
3. **Unfavorable climatic condition:** Excessive rainfall leads to high humidity, thereby leading to rapid multiplication of livestock pathogens. High temperatures cause heat stress; which may result into abortion, drop in egg and milk production. Wind aids the spread of animal diseases.
4. **Disease infection:** Spontaneous incidence of disease outbreaks cause sickness and death of farm animals, e.g. avian influenza (bird flu) causes death of birds in large numbers, leading to large financial losses to farmers. Also, the African swine fever in pigs and rinderpest in cattle lead to great loss of livestock.
5. **High cost of feeds:** For ruminant animals e.g. cattle, sheep and goats that subsist on pasture (forages), feed cost may not be very significant, unlike, the monogastric animals e.g. poultry and pigs which feed on concentrate feeds-mash/grains. About

effects of the harsh, hostile environment on his domestic animals under his control, to the best of his ability as a dedicated farmer.

The second point of the animal's impact on the environment is seen in the following ways:

Through production of greenhouse gases-  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ , and fluorinated gases. The largest  $\text{CH}_4$  source emitter in the world is from livestock and manure emissions combined, via manure storage and enteric fermentation, which is methane produced in the digestive tract of an animal. Some farmers abroad however use methane digester to convert the methane into another source of energy. Also the offensive smell (odour) from the animal waste (manure) is an environmental hazard to the environment. When manure and other agricultural wastes are washed into surface body waters e.g. rivers, lakes, ponds, they contaminate and pollute the water, causing water pollution.

## 12.0 CONCLUSION

Vice Chancellor, Sir, from the foregoing my findings have shown that inhaling gaseous emissions from crude oil burning caused adverse effects on the broiler chickens studied implying that gas flaring truly has adverse health implications, not only to man but animals as well. I wish to conclude by reiterating that every animal is affected by the environment it finds itself. This impact is in two ways namely:-

1. Environmental impact on the animal through air, land and water pollution.
2. The animal's impact on the environment.

The first point has been exhaustively discussed in this lecture, as it has been observed that pollutants from the air (via inhalation of noxious gases), the land (via ingestion of contaminated pasture grasses) and the water (via drinking contaminated water) affect animals negatively. All these affect the growth of animals from the embryo/egg stage to adulthood, giving rise to runts with stunted growth rates. In terms of production (either meat, eggs, milk, or wool etc.), environmental pollution through these three major routes also affect animal productivity, making them not to reach their full genetic potentials.

In terms of reproduction, environmental pollution affects animals with obvious decrease in fertility, semen volume, sperm density, sperm motility and increase in embryonic mortality and sperm abnormality.

Physiologically, animals in a polluted surrounding also suffer from damages to their organs, (lungs, liver, heart, kidneys), blood, enzymes, hormones, metabolism and thermoregulation. The negative impacts of the environment on animals are many and varied. However, it is man's responsibility to protect and ameliorate the

60-70% of cost of production goes to feed. Many poor farmers cannot afford this.

6. **High pest infestation:** Pests transmit disease from one animal to another. They reduce the quality and quantity of animals and their products, causing economic loss to the farmer, as animals would not grow well (runts), their skins are destroyed (ectoparasites-lice, fleas, ticks). Large amount of money is spent on treatment and pest eradication.
7. **Low level of technical know-how:** There is low acceptance of new methods of production because of low technical know-how of livestock farmers which lowers production.
8. **Socio-cultural constraints:** Religious beliefs, norms and taboos of some people may limit production of certain farm animals e.g. Muslims and Jews do not eat pork for religious reasons. Some communities in Nigeria don't also eat snails.
9. **Inconsistency in government policies and political instability:** Banning and unbanning of livestock production inputs affects planning of livestock business. High tariffs and double taxation on importation of livestock inputs such as battery cages, drugs, grains, day old chicks, vaccines etc. discourage livestock production. Unstable government and policy reversals cause problems to Animal husbandry.
10. **Poor research and training:** Most research and training institutes are poorly funded by government. In Nigeria, a few research institutes have been established such as National Animal Production Research Institute (NAPRI), Zaria, National Veterinary Research Institute (NVRI), Vom, International Livestock Research Institute, (ILRI) Ibadan, The Nigerian Institute of Animal Science (NIAS) is also making

efforts to establish research institutes in some Universities in the six geo-political zones, subject to available funding.

11. **Lack of infrastructural development in the rural areas:** Bad roads, lack of markets, poor social amenities etc impact negatively on livestock improvements.
12. **Disposal of manure and dead animals:** Manure can become unsightly and emit foul odour causing pollution especially in urban areas. Disposal of dead animals either by burying or incineration can also possess environmental pollution hazards.

## 5.0 SOLUTIONS TO THE PROBLEMS OF ANIMAL AGRICULTURE

1. Loans should be provided for animal agriculture to allow for the mature period of the project, interest rate on loans should be low.
2. High quality parent stock, proper housing and healthcare as well as processing and storage facilities should be provided. This depends on accessibility to capital.
3. Feed constitutes the major input to animal production. Feeds should be provided in terms of quantity and quality at the appropriate time.
4. Livestock production knowledge and experience is necessary in terms of training to improve the literacy of the animal handlers for effective production.
5. Research institutes should be able to predict, detect and investigate animal disease incidence. When diseases develop spontaneously, they should be promptly controlled. Research institutes should be adequately funded by government.

- ❖ Effects of mash versus pelleted feeding on broiler chicken performance –Amakiri et al, 2013.
- ❖ Performance characteristics of weaner rabbits fed wet and dried brewers grains-Amakiri and Owen, 2013
- ❖ Responses of broiler chicks performance to dietary vitamin E supplementation-Amakiri and Owen, 2014.
- ❖ Serum and carcass evaluation of broiler birds fed different levels of sodium chloride (common salt) in diet- Akinola and Amakiri, 2017.
- ❖ Effects of Graded levels of cholecalciferol (Vit. D3) on the haematological characteristics, serum enzymes, and bone mineralization of broilers in the hot humid Southern Nigeria- Okafor et al, 2018.

## 11.2 Management and Air Quality Monitoring

- ❖ Bamboo hutches as a replacement for wire mesh cages in rabbit production in Nigeria –Owen et al, 2008
- ❖ Broiler chicken growth rate in three different nocturnal lighting regimes - Amakiri et al, 2011
- ❖ Effects of sex differences in performance and carcass characteristics of broiler chickens - Amakiri et al, 2013
- ❖ Air quality and macro-meteorological monitoring of gaseous pollutant flame emissions from burning crude petroleum in a poultry house. Amakiri et al, 2009 etc.

## 11.0 SOME OTHER WORKS BY THE PRESENTER AND OTHER RESEARCHERS

These are in the areas of:

### 11.1 Poultry and Rabbit Nutrition

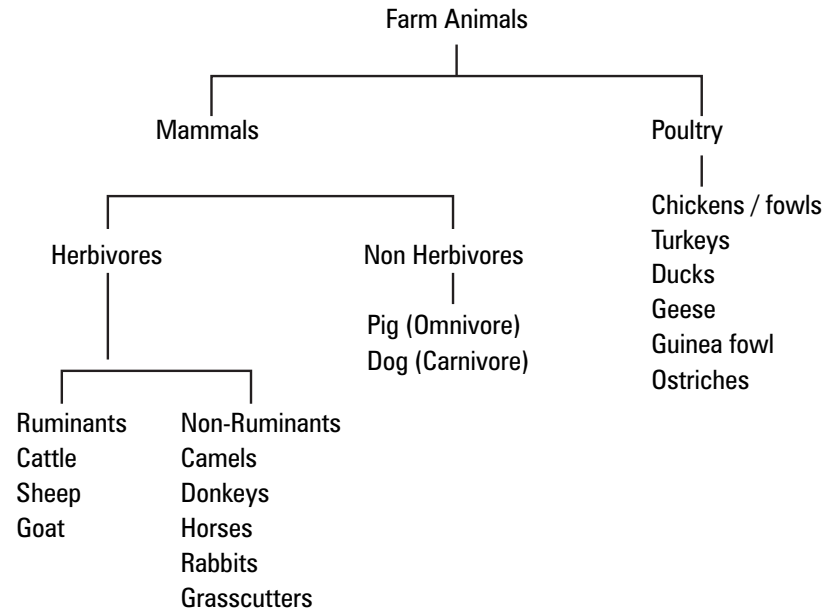
- ❖ Use of graded levels of dietary Nutrafos 3, a feed additive for laying hens- Monsi and Amakiri, 1988.
- ❖ Effect of supplementary dietary palm oil and graded levels of protein on broiler performance- Oruwari et al, 1997.
- ❖ Responses of broiler chickens to graded levels of brewers dried yeast –Amakiri et al, 1998.
- ❖ Extruded, roasted and untreated full-fat soybeans in broiler diets-Oruwari et al, 1998.
- ❖ Responses of broiler chicks to graded levels of dietary sodium chloride (common salt)- Amakiri et al, 1999
- ❖ Effect of Pitudiz (feed additive) on the performance of broiler chickens in the humid tropics –Kalio and Amakiri, 2005.
- ❖ The biological and economic effects of introducing poultry wastes in rabbit diets - Owen et al 2008.
- ❖ Sugar lowering effects of bitter leaf meal (*vernonia amygdalina*) in experimental finisher chickens-Owen et al, 2011.
- ❖ Comparative study of nutritional value of two pasture grasses using weaner rabbits- Amakiri et al, 2011.
- ❖ Assessment of the performance and haematological indices of broiler birds administered prebiotic and probiotic feed additive –Amakiri et al, 2012.

6. Animals that are acceptable to a culture should be raised. It might not be lucrative to raise pigs in areas where people are predominantly Muslims or Jews.
7. Extension workers should be trained and encouraged to disseminate information. Farmers should be able to read labels on drugs, feed and they should record activities on the farm.
8. Corporate bodies and rich individuals should be encouraged to fund research in Animal Husbandry. This will improve the activities of the researchers. Training of handlers should be carried out periodically.
9. Infrastructure in rural areas should be improved upon. Roads, culverts, recreations, electricity, hospitals, portable water etc should be provided. These will also encourage youths to remain in rural areas and therefore engage in animal production.

## 6.0 CLASSIFICATION OF FARM ANIMALS

Farm animals are divided into 2 major classes namely – Mammals and birds (Figure 2). The mammals can be ruminants or non-ruminants. All birds are non-ruminants. **Ruminants (polygastrics)** are herbivorous animals with complex stomach. They have four stomach compartments namely: rumen (80% of stomach); reticulum (5% of stomach); omasum (7% of stomach) and abomasum (8% of stomach, the true stomach where actual digestion occurs).



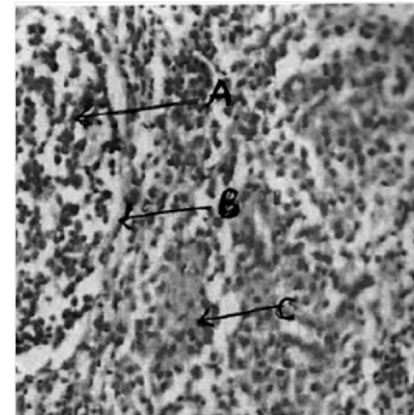


**Figure 2:** Classification of Farm Animals

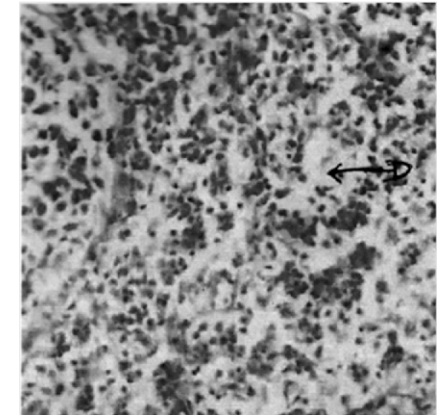
Some farm ruminants include cattle, sheep, and goats. The horse, donkey and other equine family members are herbivores though not ruminants since they do not possess complex stomachs. They fall under the category of **non-ruminants**. Non-ruminants are animals with simple stomach and are usually referred to as monogastrics (having one stomach). They cannot on their own produce enzymes that digest cellulose and do not chew the cud. Other farm animals which are non-ruminants or monogastrics are rabbits, pigs, and poultry.

## PHOTOMICROGRAPHY OF HISTOLOGY OF THE KIDNEY

### PLATE 7

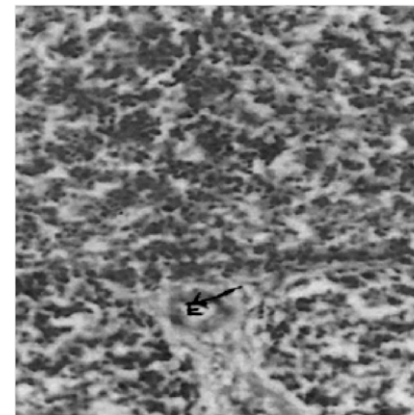


Normal liver cells  
 A = Normal glomerulus  
 B = Norman Bowman's capsule  
 C = Normal Tubules

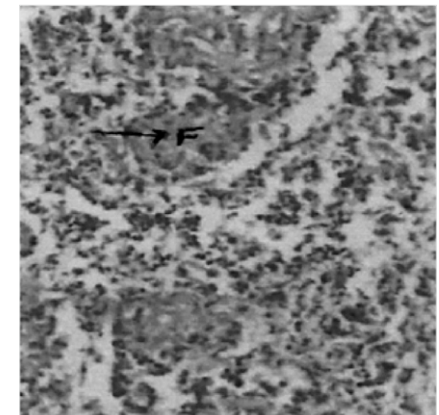


D = Increased interstitial spaces between the tubules

### PLATE 8



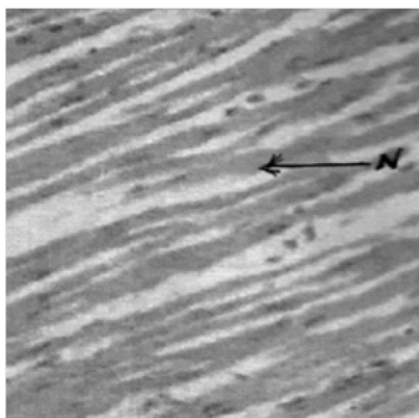
E = Thickened tubules



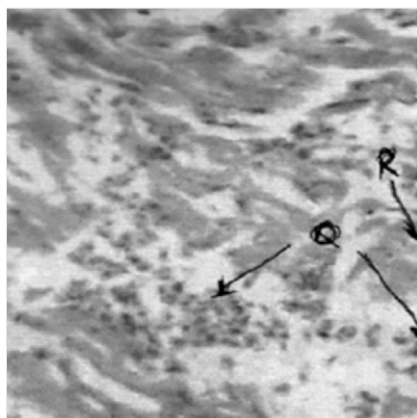
F = inflamed tubules

## PHOTOMICROGRAPHY OF HISTOLOGY OF THE HEART

### PLATE 5

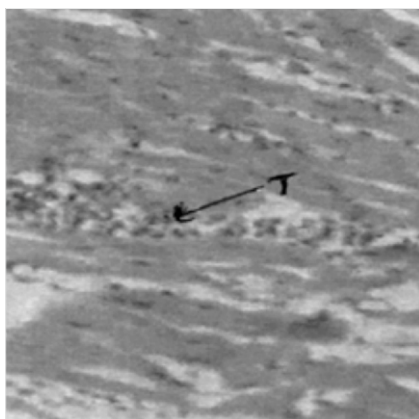


Normal Myocardial cells  
N = Normal interdigitating (syncline) myocardial bundles

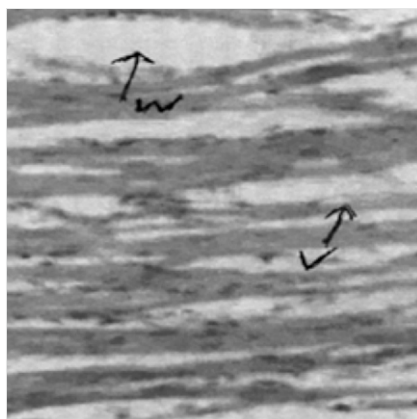


Q = Multifocal dense inflammation  
R = Irregular disposed myocardial fibre bundles

### PLATE 6



T = Focal dense inflammation



V = Atrophy of myocardial fibres  
W = Increased interstitial spaces

## 7.0 POULTRY

Vice Chancellor Sir, much of my research has been on poultry. Before proceeding to the core discourse of this day, I believe it will be pertinent to highlight some basic facts about poultry and its production.

Poultry production is the management of domestic birds mainly for economic and nutritional purposes. The term poultry is used for all domestic birds reared for their meat, eggs or both and in some cases for cock fighting, religious rituals, show or games. Poultry includes such birds as the domestic fowl (*gallus gallus*), common duck (*Anas platyrhynchos*), ostrich (*Struthio spp.*), peafowl (*Pavo spp.*), pheasant,

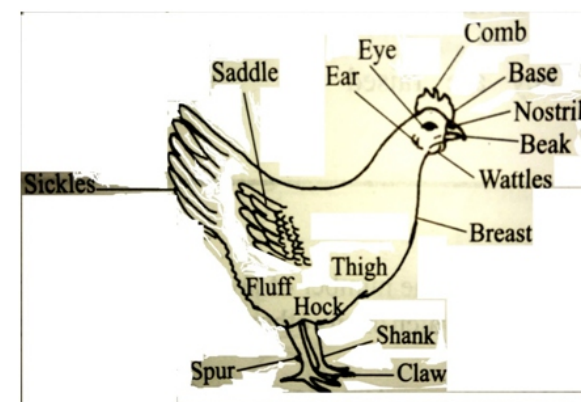


Figure 3: Parts of a domestic fowl

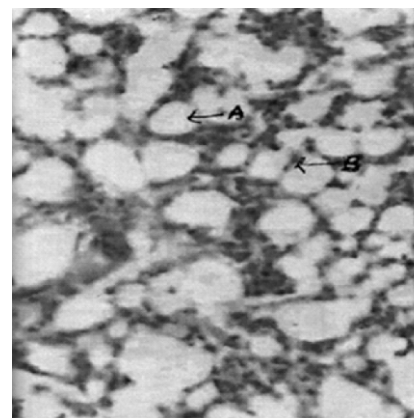
goose (*Anser anser*), guinea fowl (*Numida spp.*), pigeons (*Columba livia*) turkey (*Meleagris gallopavo*) and quail (*Cortunix cortunix japonica*). Of all these, the domestic fowl or chicken is the most popular today, raised virtually worldwide, followed by ducks, geese and turkeys.

## 7.1 Types and Breeds of Chickens

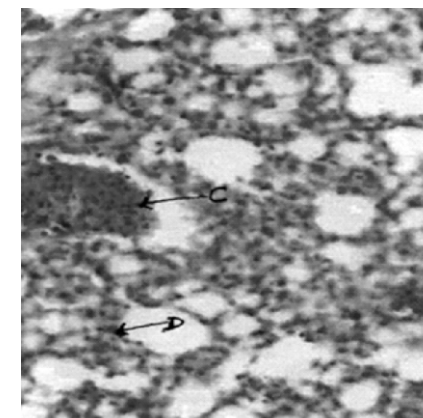
Many different breeds and varieties of the domestic chicken are raised in Nigeria, they are however classified into three major types namely:

1. **Egg type:** They are often called layers since they are reared mainly for egg production. They are light breeds and are non-broody. Examples include the Leghorn, Ancona and Minorca which are Mediterranean Breeds. They are small in size and are very good, prolific layers. Mature cockerels and hens weigh about 2.7kg and 1.8 kg respectively.
2. **Meat Type:** These are heavy breeds, generally known as broilers, reared for meat production. They grow rapidly and attain market weight at about 8-10 weeks of age. Depending on their size and age, they can be classified as fryers or roasters. Examples of the meat type chickens are Cornish, Plymouth rock, Orpington and Jersey black giant. Mature cockerels weigh between 3.9-5.0kg. They are not normally economical egg producers and are not particularly heat tolerant.
3. **Dual purpose type:** The birds in this category can be used either for eggs or meat production. Examples are Rhode Island Red (RIR), New Hampshire and Light Sussex. Our local native chicken also falls into this class. Cockerels and hens of mature RIR and Light Sussex weigh about 3.6kg and 2.7kg respectively. The RIR hens are good layers as well as good meat producers.

## PHOTOMICROGRAPHY OF HISTOLOGY OF THE LUNGS PLATE 3

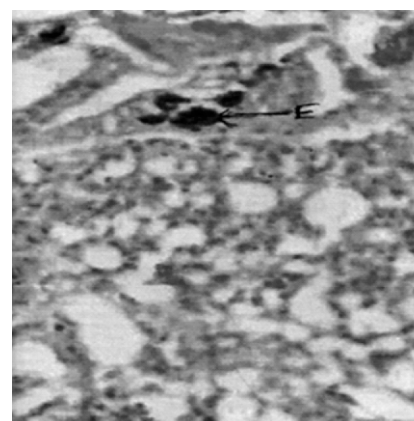


Normal lung cells  
A = Alveolar Air Space  
B = Thin Alveolar Wall Cell

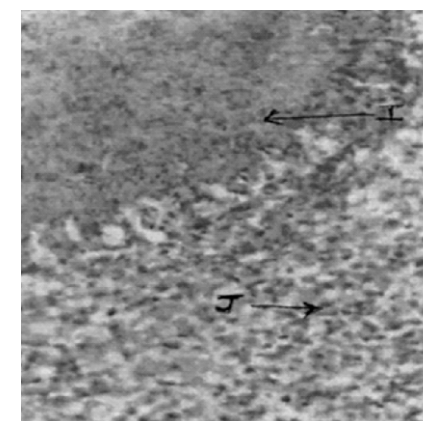


C = Increased inflammatory cell  
(neutrophil infiltrate causing D below)  
D = Thickening of the alveolar walls

## PLATE 4



E = Large carbon deposits (Anthracosis)  
the wall of the airway  
(bronchi/bronchiole)

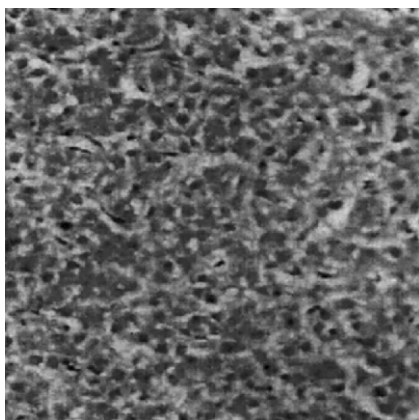


I = Intense inflammatory tumor mass  
J = Extensive inflammatory cell  
(neutrophil) infiltrate

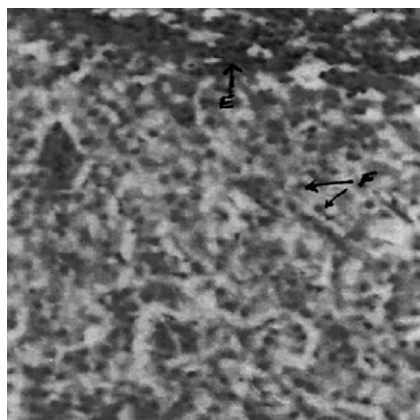


## PHOTOMICROGRAPHY OF HISTOLOGY OF THE LIVER

### PLATE 1



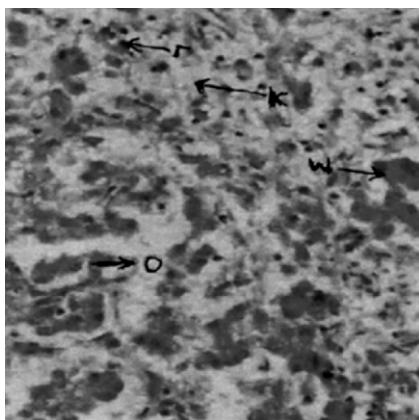
Normal liver cells



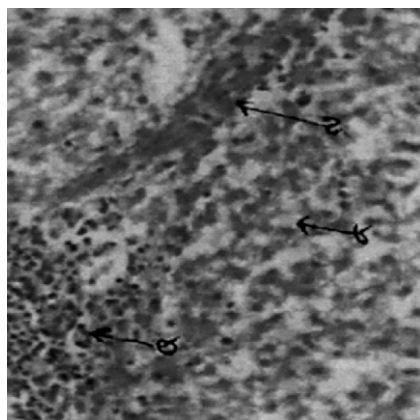
E= Denser Neutrophil inflammatory cell infiltrate

F= Reduced size of nuclei (early necrosis)

### PLATE 2



K = Liver cell loss necrosis marked by  
L = Inflammatory cell infiltrate  
M = Surviving normal liver cells  
O = Marked widening of liver sinusoids



Q = Inflammatory cell infiltrate  
R = Cytoplasmic vacuolation  
S = Spindle-shaped fibrous tissue

## 7.2 Advantages of Poultry Production

*Some advantages of poultry production over other farm animals are:*

1. **Source of farm income:** The poultry is a major source of farm income and to some extent a commodity of international commerce compared with products of other animals.
2. **Less land space:** Poultry requires less land space than other animals. Lands not suitable for other agricultural purposes such as crop or larger animal production can be used for poultry. Poultry can be raised by both urban (at your back yards) and rural dwellers.
3. **Less cost outlay:** When compared with the production of other farm animals, poultry production involves small cost in terms of animals, infrastructural and capital outlay. For example, chickens eat less per unit of protein produced.
4. **Higher productivity:** It has comparatively higher level productivity and short generation interval.
5. **Employment opportunities:** Poultry production can increase local employment opportunities for our teeming unemployed youth.
6. **Poultry manure:** Poultry can supply the manure for fertilizer and methane gas (used for both domestic and industrial purposes). Many poultry farmers in Nigeria now make a very reasonable profit (income from the sale of poultry manure). Chicken manure can be used to fertilize fish ponds.



7. **For festival and other activities:** Poultry can be used to meet social and traditional obligations. During funerals, propitiation of the gods, and other cultural rituals, the domestic chicken is the most popular sacrificial animal. Herbalists and native medicine men always demand white feathered or frizzled type of local chicken to offer to their deities. Christians, Muslims and people of other religions invariably use poultry during their festivals.
8. **As gifts:** Chickens serve as gift animals especially among the very poor who cannot afford larger animals.
9. **Good sanitarians:** The domestic fowls are great sanitarians. As they scavenge around the compound, they clear all forms of particles, debris, insects, weeds and waste, which tend to pollute the environment.

### 7.3 The Poultry Industry In Nigeria

Vice Chancellor, Sir, the poultry industry is one of the most important facets of animal agriculture in Nigeria. In developed countries such as the UK, USA, Brazil, China, factors that accelerated the growth of the poultry industry include:

- ❖ Development of reliable and commercial hatchery companies for production of day old chicks;
- ❖ Advances in poultry nutrition that permits intensive management on large scales.
- ❖ Technological advances which allow for partial or complete automation in management.
- ❖ Improvement in disease prevention and control measures.

**Table 9.** Histopathological report on broiler organs (Slides)

Treatment	Liver	Lung	Heart	Kidney
4m	Section shows liver tissue displaying minimal architectural and hepatic changes such as inflammatory cell infiltrate and early necrosis.	Section shows lung tissue displaying fibro collagenous materials with pseudostratified epithelium with mild inflammatory cells	Section of the heart shows myocytes punctuated by dilated vascular cells, hypertrophy, fatty degeneration and chronic inflammation of cells.	Section of kidney resembles lymphoid or splenic tissue showing increased interstitial spaces between tubules.
8m	Liver tissues shows mild to moderate tissue necrosis and processes	Lung section shows dilated air space with mild fibrosis and edema of the stroma and inflammatory processes, with large carbon deposits (anthracosis)	Heart tissue shows skeletal muscle with hyalinized vascular channels and aggregates on inflammatory cells	Sections of kidney are similar to lymphoid tissue showing monotonously alike cells and moderately dilated vessels with thick walls
12m	Section of the liver shows massive necrosis and fibrosis with infiltration by chronic inflammatory cells	Section shows dilated air spaces with islands of anthracosis (black carbon deposits) and inflammatory cells	Section of the heart shows edematous skeletal muscles with areas of haemorrhagic necrosis punctuated by inflammatory cells	Section of kidney looks like lymphoid tissue with monotonously thickened cell walls
Control (no flame)	Liver section shows normal hexagonal architecture with few areas of fibro-collagenous deposits	Lung tissue shows numerous normal alveolar air spaces with thin alveolar walls and vascular channels	Heart sections show normal myocytes with thickening myocardial bundles and vascular channels	Kidney section looks like lymphoid tissue with normal glomerulus, Bowman's capsules and tubules. No renal tissue is seen

#### 10.3.4 Post Mortem and Toxicological Evaluation

Post mortem examination of the birds from the treatment groups showed varying degrees of abnormalities. For instance, there were indications of gross morphological alterations in the visceral organs, evidence of necrosis and congestion in the lungs, liver cirrhosis, and kidney enlargement. Furthermore, the heart was slightly enlarged, flabby and haemorrhagic, there appeared to be congestion and internal haemorrhage in the small intestine while the abdominal cavity was partly gelatinous. All visceral organs and intestine of birds in the control group appeared macro and microscopically normal.

The toxicological aspects involved examining the organs at the cellular level to ascertain the impact crude oil petroleum fumes had on the birds (histopathology) of the organs (liver, lungs, heart and kidney). A histopathological report on the chickens used for the study is presented in Table 9. However, a better appreciation and understanding of what transpired within the animal is shown in the various photomicrography of the organs (Plates 1- 8).

Of all the organs examined, the lungs were worst hit, as there was inflammation and thickening of the alveolar walls as well as presence of large carbon deposits (anthracosis) in the bronchi/bronchioles. Since what were produced in the fumes were SPM (soot) and other aerosols, inhalation of soot would cause damage to the lungs, just like what we are experiencing now. There are various studies which have reported diminished pulmonary function that was associated with duration of exposure to inhalation of noxious gases from crude oil burning.

In Nigeria, commercial poultry production actually witnessed a tremendous boom between the 1970's and early 1980's. Use of improved breeds which were imported from developed countries (exotic breeds), and improved feed production helped in this boom.

However the boom in Nigeria's poultry industry could not be sustained for various reasons which include:

- ❖ Unstable government due to incessant military coups
- ❖ Continuous changes in and conflicting agricultural policies.
- ❖ Inability of animal scientists, breeders, nutritionists, etc. to develop indigenous breeds adaptable to our native environments.
- ❖ High cost of feed, due to high cost of feed ingredients such as maize, fish meal, soybean meal etc.
- ❖ High prevalence of some endemic diseases, such as bird flu, Newcastle disease, coccidiosis, etc., which cause huge economic losses to farmers.
- ❖ Lack of capital from government to establish large commercial farms.
- ❖ Lack of standardized markets in Nigeria for poultry and its products.
- ❖ Lack of technical know-how and skills to manage large commercial poultry enterprises in terms of breeding, feeding, management, disease control and marketing.

## 8.0 ENVIRONMENT / ANIMAL INTERACTION

Vice Chancellor Sir, every animal, including poultry, has a genetic make-up which interacts with the environment to express its full potentials. In chicken production these include among other factors, feeding, management, climate, mating methods, and health status. Thus the phenotype of the chicken, example body conformation is a function of the genetic composition of the bird and the environment it is exposed to.

No matter how superior a chicken's genetic potential is, if the environment is not friendly, it will not grow, produce, or reproduce well. This is why the exotic breeds with high superior genetic makeup imported from abroad do not thrive well in our harsh, hostile tropical environment which is characterized by high temperatures, poor feeding, breeding, disease burden/load and environmental pollution.

### 8.1 Animal Biometeorology- Livestock Ecology

Animal ecology is the study of the reciprocal relationship between animals and their environment. Wild animals are said to be in complete equilibrium with their environment which consists of some physical characteristics of the atmosphere, vegetation competition among themselves and diseases.

Domestic animals have left their natural environment and are either in ranches like cattle or in complete confinement like chickens.

So, what is the environment? Vice Chancellor, Sir, the environment in which an animal is reared is defined as non-genetic factors which may influence it from conception to death. These factors include climate, nutrition, management, maternal influence, social status, hygiene and state of health of the animals. Simply put, the environment is the sum total of

Although there appeared to be elevation in SGOT and ALP in birds closest to the crude oil burning source, such increase was not statistically different ( $P>0.05$ ) from the levels observed in other birds irrespective of their locations. High levels of plasma enzymes have been associated to prolonged collapse of the circulatory system due to shock and deprivation of fresh blood supplying oxygen and nutrients (oxidative stress). The organ most hit is the liver since it is mainly responsible for the metabolism of toxins.

### 10.3.3 Hormones

Hormones are chemical substances produced and secreted into the blood stream by an organ or tissues, and have a specific effect on a target tissue. Hormones act in conjunction with the nervous system to maintain the internal chemical conditions necessary for cellular functions and to allow the body to respond to emergency demands (Prosser, 1973). In this study the hormones measured were Growth hormone, Thyroxine and Adrenaline. It was observed that growth hormone, thyroxine and adrenaline levels increased with increasing flame distances though not significantly.

**Table 8:** Effect of Crude Petroleum Flame on Blood Hormone Levels in Broiler Chickens (Mean  $\pm$  SEM)

Treatment	Growth Hormone (ng/dl)	Thyroxine (ng/dl)	Adrenaline (ng/dl)
4m	2.5 $\pm$ 0.5	48.0 $\pm$ 2.0	3.2 $\pm$ 0.2
8m	2.7 $\pm$ 0.6	50.0 $\pm$ 2.0	3.7 $\pm$ 0.3
12m	3.2 $\pm$ 0.7	51.0 $\pm$ 2.0	4.1 $\pm$ 0.3
Control)	2.8 $\pm$ 0.7	50.0 $\pm$ 1.0	3.5 $\pm$ 0.2

\*Non-significant difference between means ( $P>0.05$ )

**Table 6:** Effect of Crude Petroleum Flame on Blood Constituents of Broiler Chickens (Mean  $\pm$  SEM)

Treatment	Hb (g/dl)	PCV (%)	White Blood Cell ( $10^9 \text{ ml}^{-1}$ )	Neutrophils (%)	Lymphocytes (%)
4m	7.4 $\pm$ 0.4	22.1 $\pm$ 1.1	2.3 $\pm$ 0.3	70.4 $\pm$ 2.0 <sup>ab</sup>	31.0 $\pm$ 2.0 <sup>b</sup>
8m	7.1 $\pm$ 0.2	21.1 $\pm$ 0.6	2.1 $\pm$ 0.3	73.0 $\pm$ 1.0 <sup>a</sup>	29.0 $\pm$ 2.0 <sup>b</sup>
12m	7.3 $\pm$ 0.4	21.9 $\pm$ 1.1	2.2 $\pm$ 0.3	68.0 $\pm$ 3.0 <sup>b</sup>	32.0 $\pm$ 3.0 <sup>b</sup>
Control	7.4 $\pm$ 0.2	21.0 $\pm$ 0.5	2.2 $\pm$ 0.3	55.0 $\pm$ 5.0 <sup>c</sup>	45.0 $\pm$ 5.0 <sup>a</sup>

\*Means  $\pm$  SEM with different superscripts differ significantly at ( $P < 0.05$ ).

### 10.3.2 Serum Enzymes

Enzymes are specific biologically synthesized proteins that catalyse biochemical reactions without undergoing changes in composition. Tissue damage or necrosis resulting from injury or disease is generally accompanied by increases in the levels of several plasma enzymes. The serum enzymes monitored in my study included the serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT) and alkaline phosphatase (ALP). The result of my findings is depicted in Table 7.

**Table 7:** Effect of Crude Petroleum Flame on Blood Enzyme Levels in Broiler Chickens (Mean  $\pm$  SEM)

Treatment	SGOT (iμ/l)	SGPT (iμ/l)	ALP (iμ/l)
4m	153.0 $\pm$ 22.0	18.0 $\pm$ 6.0	1512.0 $\pm$ 324.0
8m	127.0 $\pm$ 13.0	13.0 $\pm$ 3.0	1184.0 $\pm$ 285.0
12m	138.0 $\pm$ 14.0	12.0 $\pm$ 5.0	1305.0 $\pm$ 308.0
Control	145.0 $\pm$ 11.0	22.0 $\pm$ 9.0	1371.0 $\pm$ 288.0

\*Non-significant difference between means ( $P > 0.05$ )

the surroundings which includes all physical, non-physical, living and non-living, chemical and biological components that determine the existence, development, growth and survival of an organism (Cunningham et al, 2003, Muoghalu, 2004 and Ezemonye, 2013).

## 8.2 Physical Environment and Animal Production in the Tropics

Various elements of the local natural environment do influence animal production. These elements contribute to problems of animal production through their interactions. Animals have some physiological mechanisms at their disposal to meet the challenges imposed by changes in their environment. The climatic variables that affect animal production include: ambient temperature, air humidity, rainfall, air movement (air velocity) or wind speed, solar radiation (intensity), barometric pressure and ionization. Of all, the most important factors with direct effects on animals are the ambient temperature, relative humidity and air movement. In the Tropics, climatic factors affect animal production in two basic ways:

- By directly affecting growth, development and production of the animals
- By affecting indirectly the growth and quality of feedstuffs, incidence of diseases and parasites, labour efficiency and various other production parameters.

### 8.3 Temperature and Animal Production

The most important climatic element that affects the physiological functions of an animal is temperature. For proper functioning of the body, the body temperature must be constant, varying only slightly, as both hypothermia (cold stress) and hyperthermia (heat stress) are harmful to the animal. Below normal temperatures are less damaging to the biochemical integrity of organisms than above normal temperatures. Temperature does not only limit the distribution of animals but also determines their activity. An animal's main task, thus, is to maintain its internal environmental temperature. The animal's body generates heat by metabolic processes and dissipates it by respiration. Every animal has a particular range of environmental temperature to which it is adapted and in which it is able to function most effectively. This temperature range is termed “comfort zone”, and varies widely from species to species. Animals kept at temperatures below or about their comfort zones increase or decrease their metabolic rate to keep themselves warm by shivering or to assist in heat dissipation by panting. Animal responses to heat show forth as:

- ❖ Increased blood flow through vasodilation of the blood vessels near the surface.
- ❖ Initiation of sweating.
- ❖ Increased, though shallow respiration (panting).
- ❖ Changes in hormone activity
- ❖ Changes in behavior patterns
- ❖ Increased use of water. e.g. water intake increases
- ❖ Wallowing (for pigs)
- ❖ Increased body T°

**Table 5:** Effect of crude petroleum flame on organ weights of broiler chickens (Mean  $\pm$  SEM)

Treatment	Liver (g)	Lungs (g)	Heart (g)	Kidney (g)
4m	55.2 $\pm$ 2.2	11.3 $\pm$ 0.6 <sup>b</sup>	9.6 $\pm$ 0.5	2.3 $\pm$ 0.4
8m	55.1 $\pm$ 4.1	11.65 $\pm$ 0.4 <sup>b</sup>	7.9 $\pm$ 0.4	2.4 $\pm$ 0.3
12m	56.3 $\pm$ 5.4	14.8 $\pm$ 1.2 <sup>a</sup>	9.5 $\pm$ 0.6	2.9 $\pm$ 0.4
Control	48.1 $\pm$ 2.7	16.1 $\pm$ 1.3 <sup>a</sup>	8.6 $\pm$ 0.8	2.7 $\pm$ 0.3

\*Means in the same column followed by different superscripts are significantly different (P<0.05).

However, birds that were at 12m away from the flame source and those in the control group had significantly heavier lungs than those at 4m and 8m away from the source. A better understanding of what could have caused this would be explained in the histopathology of the various organs.

### 10.3 Effect on the Physiology of the Chickens

**The physiological** aspects covered impacts of the noxious gases produced by burning crude oil on the blood (haematology), enzymes and hormones.

#### 10.3.1 Haematology

Blood constituents of the chickens varied (P<0.001) in the neutrophils and lymphocytes levels (Table 6). This affirms the report of Uchegbu (1998) that inhalation of noxious gases such as CO, SO<sub>2</sub> and H<sub>2</sub>S affects the blood chemistry. The disparity in the neutrophil and lymphocyte levels between treated and untreated birds could be associated with incidence of noxious gas inhalation which had resulted in inflammation of the organs as observed during the post mortem evaluation of the experimental birds.



## 10.1 Effect on Growth Performance of Broilers

In the area of **performance characteristics**, exposure of the birds to gaseous emissions from the crude oil burning in this study did not reveal any significant variation ( $P>0.05$ ) in final body weight, daily feed intake, feed conversion ratio and mortality in treated and untreated birds (Table 4). However, black soot (carbon) colourations of the feathers, asphyxiation, panting and coughing were observed in the treated groups (Ede *et al.*, 2007; Amakiri *et al.*, 2008, and Amakiri and Owen, 2010).

**Table 4:** Effect of crude oil gaseous emissions on growth performance of broilers chickens (Mean  $\pm$  SEM)

Distance to crude oil flame (m)	Bodyweight (g)	Daily body weight gain (g)	Daily feed intake (g)	FCR	Mortality (%)
4	2300 $\pm$ 21.0	40.18 $\pm$ 0.05	107.7 $\pm$ 1.20	2.68 $\pm$ 0.14	0.13 $\pm$ 0.06
8	2330 $\pm$ 21.0	40.71 $\pm$ 0.06	107.92 $\pm$ 1.19	2.65 $\pm$ 0.12	0.04 $\pm$ 0.04
12	2400 $\pm$ 21.6	41.96 $\pm$ 0.06	114.58 $\pm$ 1.26	2.73 $\pm$ 0.15	0.21 $\pm$ 0.08
Control	2400 $\pm$ 21.6	41.96 $\pm$ 0.06	112.50 $\pm$ 1.18	2.68 $\pm$ 0.18	0.04 $\pm$ 0.04

\*Means were not significantly

## 10.2 Effect On Organ Weights

After eight weeks of exposure to the fumes, some birds were slaughtered and the liver, lungs, heart and kidney were excised and weighed.

Results of the organ weights are presented in Table 5. There were no significant differences between the liver, heart, and kidney weights of birds exposed to crude petroleum flame and the control.

- ❖ Changes in the use of body water
- ❖ Changes in state of hydration

In situations where these measures fail to maintain equilibrium in the animal's heat regulation mechanism, serious complications such as diarrhea, general weakness, staggering, convulsion and finally death due to hyperthermia could occur.

## 9.0 ENVIRONMENTAL POLLUTION AND DEGRADATION IN THE NIGER DELTA

### 9.1. The Niger Delta Region / Environment

Vice Chancellor, Sir, most of my research works were carried out in the Niger Delta, therefore, I am obliged to say something about the Niger Delta region, a blessed area that now wants to become a curse. Only a few people in this audience may not be indigenes of this area, and perhaps may not appreciate the pains and agonies of this blessed region as a result of oil and gas exploration and exploitation. The cries about crude oil spills, gas flaring and recently black soot over the city of Port Harcourt and its environs have reached to the high heavens, desiring God's divine intervention. Animals, plants in fact all creatures in the Niger Delta are not spared the agonies and pains of environmental pollution due to this blessing of crude oil too.

**So, where and what is the Niger Delta region, and what are the peculiarities about it?**

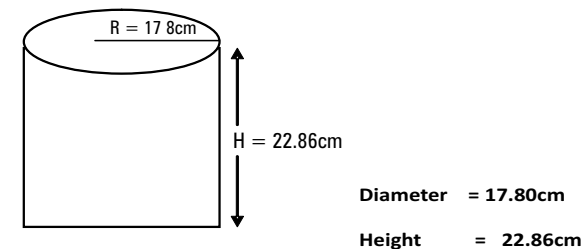
The Niger Delta is situated in the southern part of Nigeria and is bordered to the East by the Republic of Cameroon and to the South by the Atlantic Ocean. According to Ukpong (2009), the

Niger Delta stretches from the Benin River estuary for about 450km eastward and terminates at the mouth of Imo River estuary. A total of 21 estuaries open and discharge into the sea through this delta. The region occupies a surface area of about 112,110sqkm and represents about 12% of Nigeria's total surface area (Cyrus, 2017). (Figure 4)



**Figure 4:** Map of Nigeria showing the Niger Delta

The Niger Delta region falls within the tropical rain forest zone. About 2,370sqkm of the Niger Delta area consists of rivers, creeks, and estuaries, while stagnant swamp covers about 8,600sqkm. The delta with mangrove swamps spanning about 1,900sqkm has the largest mangrove swamps in Africa. The ecosystem of the area is highly diverse and supports numerous species of terrestrial and aquatic flora and fauna and human life (Ajao, 1994). The region has emerged as one of the most ecologically sensitive region in Nigeria. Resources (Oil and Gas) from the region are the main source of revenue for the



**Fig. 6:** Design metal burner that was used to burn the crude oil to produce the flame

Broiler chicks were randomly allotted into experimental pens at varying distances (4m, 8m and 12m) from the metal burner used to burn the crude oil. They were exposed to the gaseous emissions for eight weeks. The control birds were housed outside the treatment area.

Gaseous emissions were monitored within the poultry house before and during the study. My findings revealed that there was an appreciable increase in the air pollutants in the poultry house due to the crude oil burning (Table 3).

**Table 3:** Gaseous emissions within the poultry house

Periods covered	Gaseous emissions						
	NO <sub>2</sub> mg/m <sup>3</sup>	SO <sub>2</sub> mg/m <sup>3</sup>	H <sub>2</sub> S mg/m <sup>3</sup>	CH <sub>4</sub> mg/m <sup>3</sup>	CO mg/m <sup>3</sup>	VOC mg/m <sup>3</sup>	Pm10 mg/m <sup>3</sup>
Before study	0.01	ND	ND	0.30	ND	ND	33.5
Brooding phase (2 <sup>nd</sup> week of study)	0.03	1.03	0.70	0.67	1.40	0.61	121.75
Finishing phase (7 <sup>th</sup> week of study)	0.01	0.63	0.69	0.66	0.81	1.74	161.20

NO<sub>2</sub> – Nitrogen dioxide; SO<sub>2</sub> – Sulphur dioxide; H<sub>2</sub>S – Hydrogen Sulphide; CH<sub>4</sub> – Methane;  
CO – Carbon monoxide; VOC– Volatile Organic Carbon; Pm10 – Suspended Particulate Matter 10

## 10.0 ENVIRONMENTAL POLLUTION HAZARDS, LIKE MAN, ANIMALS ARE ALSO AT RISK: MY CONTRIBUTION TO KNOWLEDGE

Vice Chancellor, Sir, as an Animal Scientist cum Environmentalist, my research work has spanned from Animal Production, with particular reference to Poultry Production, to areas of Environmental Management (simulating crude oil burning as in natural gas flares in a poultry house). Incidentally Sir, what was observed in November 2016 over the Port Harcourt City and its environs as black soot cover, I had already observed as far back as 2005 in the cause of carrying out my PhD research work and in supervision of some of my postgraduate students (Amakiri *et al.*, 2008, 2009, 2010, and 2012).

This novel work which was carried out at the Poultry Unit of the University's Teaching and Research Farm and had the layout as indicated in Figure 5.

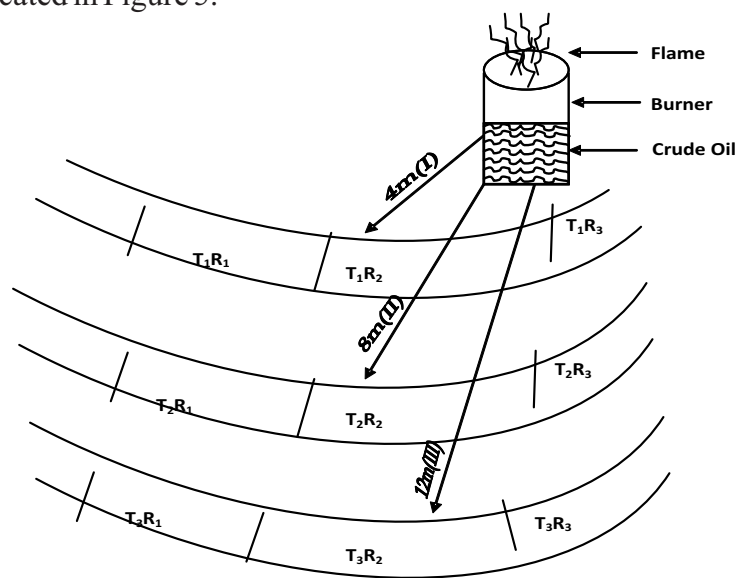


Fig. 5: Poultry pen layout showing the distances from the flame point

Nigerian State, accounting for about 97% of the country's total export (CREDC, 2017)

The region is divided into four ecological zones namely;

- (a) Coastal and inland zone
- (b) Mangrove swamp forest zone,
- (c) Fresh water zone
- (d) Lowland rain forest zone.

The Niger Delta is often described as the Delta of the Niger River, emptying directly into the Gulf of Guinea portion of the Atlantic Ocean in Nigeria (Michael, 2013). The region is politically delineated into nine states (six in the south-south geo- political zone, one in south west zone and two in south east zone). The states are Edo, Bayelsa, Akwa-Ibom, Delta, Cross River and Rivers (South-South zone), Ondo (South West zone), and Abia and Imo (South-East zone). The Niger Delta region is one of the most known wetland regions on the globe. Three main reasons as opined by Akankali (2017), why the Niger Delta region is well known are:

1. It is one of the 3rd largest wetland regions in the world.
2. It is a region that is highly and richly endowed with one of the world's largest oil and gas resources in the world.
3. It is one of the most devastated and polluted aquatic/wetland environments globally.

The United Nations Environment Programme (UNEP, 2011) Report on "Environmental Assessment of Ogoniland" is one example of an empirically established case of extreme environmental degradation and pollution of the Niger Delta environment. UNEP's report declared this. "The findings in the report underline the fact that there are significant numbers



of locations within the region, serious threats to human and animal health from contaminated drinking water to concerns over the viability and productivity of ecosystems. In addition, the pollution has perhaps gone further and penetrated deeper than many may have previously supposed”.

All over the region, there are series of heavily polluted sites especially from crude oil and gas flaring activities, including illegal (artisanal) refining of crude oil, which is giving us the soot problem currently.

## 9.2 Environmental Pollution

Man, in a bid to improve his life has continued to encourage the increase and diversification of industrialization as well as increase in human population around the industrialized cities and centres. Wastes produced by such industrialization have continued to be a source of nuisance to man in the form of air, water and soil pollution. Environmental pollution has, thus, become a problem, which importance can no longer be ignored. The problems of pollution have risen to such an extent that man is concerned and worried about them, hence the realization that unless something is done quickly, he too will become a victim of his own excesses.

Ogban (2009) defined environmental pollution as an undesirable change in physical, chemical or biological characteristics of soil, air or water quality that are harmful to humans, animals and other lives, individual process, living conditions and cultural assets or cause wastage of our raw material resources. Ekweozor, (1985) noted that the environment is said to be polluted when there is alteration in its composition or condition directly or indirectly as a result of the activities of man, such that it becomes less suitable for the

which have been found to be more susceptible than the white mangroves (Dick, 1986; Ankley *et al.*, 1994).

## 9.4 Sources of Environmental Pollution on Animals

Just like man is affected by a polluted environment through the air, soil and water, so are animals. They are affected in the following ways;

- ❖ Through feeding on crude oil contaminated grasses (pastures), grains, tubers etc.
- ❖ Through drinking contaminated surface water from wells, streams, ponds etc.
- ❖ Through ingesting heavy metals via the soil and pastures- lead mercury, cadmium, while grazing
- ❖ Through inhalation of noxious gases-CO<sub>2</sub>, CO, CH<sub>4</sub>, H<sub>2</sub>S, SO<sub>2</sub>, SPM (soot, aerosols etc.).
- ❖ Through inhalation of tropospheric ozone molecules near the ground, which cause damage to the lung tissue of animals.

### 9.3.3 Water Pollution

Crude oil pollution effects in aquatic environments (fresh water or marine) are destructive. There have been reports of oil spills over surface water bodies –oceans, seas, rivers, streams, lakes and ponds in the Niger Delta. There are also incidences of seepage of crude oil into underground water sources, run-offs from dump sites, sewage, decayed vegetation sites, farms sites into surface water bodies through nitrate poisoning from livestock wastes, seepages (leacheates) from dump sites etc. into underground water sources. These result in massive destruction of the ecosystem where marine and estuarine organisms such as mollusks, crustaceans, echinoderms, polychaetes, coelenterates and hydroids are killed (GESAMP, 1980; Ekweozor, 1985). Many of these species (notably oysters, lobsters, shrimps, scallops, periwinkles and crabs) constitute natural fisheries resources. Another group of marine life affected by oil pollution is the fishes - fish juveniles, eggs and benthic feeders (Ekweozor, 1989). They are smothered and suffocated as their oxygen source is cut off. Seabirds which depend on fish for food are usually adversely affected by oil pollution effects. This is also true of marine mammals like whales, seals and sea turtles, (Smail, 1971; Lanssen, 1972). Eggs laid by sea birds are also vulnerable to toxic hydrocarbon contamination. Oil toxicity also causes a reduction in reproductive ability, abnormal behavior, interference with thermoregulation, and the alteration of prey/predator relationships (Ken-Dal et al, 1978).

Oil pollution also has been reported to cause drastic reduction in aquatic faunal density and diversity (Sanders *et al.*, 1980; Dauvin, 1982; Katyal and Satake, 1993). Mangroves are also affected by crude oil pollution especially the red mangroves

uses for which it would have been suitable in its natural state. The natural water, soil and air quality of the Niger Delta ecosystem have been negatively distorted due to environmental pollution (oil spills and gas flaring) attributed to oil exploration and exploitation activities of the multinational oil companies, such as Shell SPDC, Chevron Texaco, Exxon Mobil, Agip and Liquefied Natural Gas (LNG).

## 9.3 Contribution of Crude Oil in Environmental Pollution

As stated earlier, crude oil is a great natural resource in the Niger Delta, however its exploration has immensely contributed to environmental pollution as observed in air pollution (atmospheric), land and/or soil (terrestrial), water (aquatic), biota (living organisms-fauna and flora).

### 9.3.1 Air Pollution

When crude oil is burnt or gas is flared, noxious gases such as sulphur dioxide ( $\text{SO}_2$ ), nitrogen oxides ( $\text{NO}_2$ ), hydrogen sulphide ( $\text{H}_2\text{S}$ ), carbon monoxide ( $\text{CO}$ ) and methane ( $\text{CH}_4$ ) are released into the atmosphere. Other particles released into the air include volatile organic carbon (VOC), and suspended particulate matter (SPM) (smoke, dust, fumes, soot and aerosols). In some instances, radioactive and heavy metals may be associated with these air contaminants. Sulphur dioxide ( $\text{SO}_2$ ),  $\text{NO}_2$  and carbon dioxide ( $\text{CO}_2$ ) form weak acids with water vapour in the atmosphere, which corrode pipelines, cause acidification of soils and produce global warming effects. When inhaled by man and animals, these noxious gases cause respiratory disorders causing damage to their organs and tissues. These substances at varying concentra-

tions (Tables 1 and 2) can elicit undesirable effects to humans, animals, the environment and properties. Naturally at low levels, these are considered harmless.

**Table 1:** Standards for flame emissions monitoring

Flame emissions	Detection range/limit	Equipment used
1. Nitrogen dioxide (NO <sub>2</sub> )	0-20ppm, 0.1ppm Resolution	Multi RAE plus (PGM 50) Plus Multigas monitor
2. Sulphur dioxide (SO <sub>2</sub> )	0-20ppm, 0.1ppm resolution	Multi RAE plus (PGM 50) Plus Multigas monitor
3. Hydrogen sulphide (H <sub>2</sub> S)	0-100ppm, 1ppm resolution	Defender Multigas detection model D2 -2000
4. Methane (CH <sub>4</sub> )	0-100% LEL, i.e. 0-5% CH <sub>4</sub> 0.01%	Defender Multigas detection model D2 -2000, Uses catalytic
5. Carbon monoxide (CO)	1999ppm, 1ppm Limit of detection	ELE Analox sensor gas monitor model GC 401
6. Volatile organic carbon (VOC)	(1) 0-200ppm, 0.1ppm resolution (2) 200-2000ppm, 1ppm resolution	Multi RAE plus (PGM 50) Plus Multigas monitor
7. Suspended particulate Matter (SPM)	33ug with 0.1ug sensitivity	Aerosol mass monitor
8. Radiation	400-700mm	ELE quantum radiation Measuring unit

Source: Air quality monitoring manual C.T.I. Odu. (1972)

Other sources of air pollution apart from crude oil are greenhouse gases (CH<sub>4</sub>, CO<sub>2</sub>, N<sub>2</sub>O), Chlorinated gases, illegal (artisanal) refining of crude oil (“kpofire”, causing soot problem), bush burning for agricultural purposes and combustion at dumpsites, slaughter sites (burning of tyres to roast slaughtered animals in abattoirs).

**Table 2.** Nigerian ambient air quality standard/tolerance limits for gaseous pollutants

Pollutants	Average Time (min)	Long term Limits (mg m <sup>-3</sup> )	Short term Limits (mg m <sup>-3</sup> )
1. Nitrogen dioxide (NO <sub>2</sub> )	30	0.085	0.058
2. Sulphur dioxide (SO <sub>2</sub> )	30	0.5	0.5
3. Hydrogen sulphide (H <sub>2</sub> S)	30	0.008	0.008
4. Methane (CH <sub>4</sub> )	30	0.5	1.0
5. Carbon monoxide (CO)	30	1.0	5.0
6. Volatile organic carbon	30	0.08	0.008
7. Suspended particulate Matter (SPM)	30	0.15	0.5

Source: FEPA, 1991

### 9.3.2 Land/Soil Pollution

Crude oil serves as a source of land/soil pollution through oil spillage thereby contaminating pastures, farmlands, vegetation. Such soil pollution produces scorching effects which destroy soil microorganisms and adversely affect cultivated crops, and other vegetation. These soils take considerable time to recover especially when proper remediation procedures are not employed (Isichei and Sanford, 1976; Isirimah *et al.*, 1989).