DETERMINATION OF AMMONIA CONCENTRATION IN DAIRY CATTLE HOUSE

BY

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DEPARTMENT OF AGRICULTURAL ENGINEERING,
FEDERAL UNIVERSITY OF TECHNOLOGY,
MINNA ,NIGER STATE.

NOVEMBER, 2006.

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A PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL ENGINEERING, IN FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG.) DEGREE IN AGRICULTURAL ENGINEERING,

FEDERAL UNIVERSITY OF TECHNOLOGY,

MINNA , NIGER STATE.

NOVEMBER, 2006.

DECLARATION

I hereby declare that this project is a record of a research work that was undertaken and written by me. It has not been presented before for any degree, diploma or certificate at any University or Institution. Information derived from personal communication, published and unpublished works of others were duly referenced in the text.

Okunle. .... 17/11/2006 ....
Owolabi, Y. Adekunle   Date

CERTIFICATION

This Project entitled "Determination of Ammonia Concentration in Dairy Cattle House" by Owolabi, Yemi Adekunle meets the regulations governing the award of Bachelor of Engineering (B.ENG) of the Federal University of Technology, Minna, and it is approved for its contribution to scientific knowledge and literary presentation.

-- 16/11/06

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DEDICATION

This Project Work is dedicated to My Parent CHIEF & Mrs M. A. OWOLABI. .May the Almighty God give them long life so that they can reap the fruit of their Labour (Amen).

ACKNOWLEDGEMENTS

My sincere gratitude goes to the Almighty God for His Mercy and assistance throughout the course of my Studies and for His Promises to see me through the Course of my Life in this University. So may it be!

My road to the University would not have been a reality if not for the assistance of so many people. I give praises to Almighty God for touching the heart of these people to rise to my need and made my University Education a reality.

Firstly, I am indebted to my Project Supervisor, DR. E. A. Alabadan for his guidance and technical advice in the write-up. The same gratitude goes to my H. O. D., DR (MRS.) Z. D. Osunde, Prof. A. Ajisegiri, and Dr. M. G. Yisa, my level adviser in person of Dr. O. Chukwu, Engr. Solomon Dauda and other Lecturers in the Department. Also to Engr. P. N. Ndoke of Civil Engineering Department for their contributions towards my success during the Programme.

Secondly, I am sincerely grateful for the immense contribution of my parents Chief and Mrs. M. A. Owolabi for their moral, financial and spiritual support. The same gratitude goes to Engr. Shola Adewumi, HRH Olosi of OSI, Prof. Ajisegiri, Mr. and Mrs. Shola Ajayi, Mr. and Mrs. Rotimi Atolagbe and others.

My Special gratitude goes to my Uncles, Brothers, and Sister who in one way or the other have contributed either directly or indirectly to the success of my University Education both financially and morally they are Mr. Oladele Owolabi, Sir Willy Owolabi, Mr. Oluayo Owolabi, Miss Odunola

Owolabi, Mr. Taiye Owolabi, Miss Kehinde Owolabi, Miss Toyin Owolabi (F. U. T. Minna), Mr. Oladele Atolagbe, Miss Temitope Owolabi, Mr. Wale Fatigun and Jumoke.

Also my sincere gratitude goes to my friends and junior one in one Institution or the other for their moral and Spiritual support. They are:- Mr. Nurudeen Ahmed, Olayode Dupe, Olayode Wale, Oluleye Kayode, and all the 1997 Graduates of Government Secondary School Omu-Aran.

This acknowledgement will not complete if I fail to appreciate all the entire members of Anglican Students' Fellowship of F.U.T Minna, for their Spiritual Support before and after the course of my study. May Almighty God continue to bless them all (Amen).

Lastly, my sincere appreciation go to my Special friend in person of Obasi Claudius [Ronaldo] and my friend in the University for their assistance during the compilation of this Report, they are:- Oladimeji Kareem, Balogun M. Ahmed, Akano Rotimi, Wale Sule, Joy, Akinyemi Banjo, Suleiman Yemi,Zubaru Abdulganiyu. Also to Miss Olagunju Atinuke, James Kolade John,Tunde Jimoh,s Bakare Hammeed, all my friends in Mechanical, Civil, Electrical, Chemical and most especially people of Agricultural Engineering Department. My appreciation goes to my Project mate in person of Ogunfunmilayo Abiodun. God in His infinite mercy will continue to guide and guard each and every one of us and make our future very bright.

ABSTRACT

The presence of gases in animal houses may create health problems among workers as well as depressed health status of the animals. This project determines the concentration of Ammonia gas in Dairy Cattle House using Maizube Farm as a Case Study. In the experimental analysis carried out using a colorimetric method of analysis with the use of RAE gas detection instrument, three reagents were used during the analysis, ammonia, hydrogen sulphide, sulphur dioxide. The results of the test carried out with the sampling distances indicate that concentration of hydrogen sulphide, sulphur dioxide are low in the dairy house used for the analysis, but the concentration of ammonia gas in the dairy cattle house shows some concentration which is still high for the occupational threshold level for ammonia during an eight hour day is generally recognized as 25ppm; for short time exposure is 15minutes.

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CHAPTER ONE

1.0 INTRODUCTION:

The problem of pollution in animal houses is as old as the factor of any pollution to man. The concentrations of all these gases are mostly governed by some factors.

Concentration of gases is an inevitable consequence of most animal houses through their activities. The concentration of these gases in animal house depends on the types of animal and the nature of feeds taking by the animals.

The presence of gases in animal houses may create health problems among workers as well as depressed health status of the animals. For example acute respiratory illness has been reported as common among Cattle confinement workers. Frequent symptoms are cough, phlegm and sputum, itchy threat etc. Since measures to reduce the contamination of gases in animal houses are urgent, there is a need to improve our knowledge of how different parameters affect the concentration of these gases in the building.

An important objective for the climatization research at the Department of Agricultural Biosystems and Technology (JBT) has been to investigate in which ways different parameters affect the mass balance of different air pollutants in animal houses. The highest concentration of air pollutants, such as ammonia (NH_3) dust, suphur dioxide etc normally occurs in animal houses. For this reason, this Project will mainly discuss pollutant of these gases in dairy Cow building.

The Project will deal only with the measurement of the concentration of the following gases like ammonia, hydrogen sulphide, and sulphur doxide in dairy house.

Knowledge is also still poor about how ventilation technique affects the spreading and concentration of contagious matters, which can affect the dairy houses.

The tropical environment clearly has important effects on animals but there are wide differences among individuals. So that selection and adaptation can greatly improve climatic tolerance. Within recent years sufficient scientific evidence and practical experience have accumulated to make it clear that efficient animals are sufficiently protected and properly managed.

The concentration of gases in animal houses occurs mostly due to heat stress in animals, which is manifested by increased respiration rate, panting, excessive salivation, restlessness, prostration, or heat stroke and in the animal are not cooled, death may follow. Animals that are over crowded in pens or in transit, and deprived of air movement are especially vulnerable.

1.1 Problem Statement:

The determination of the concentration of gases in dairy cattle house has coincided with rising community interest in environmental issues. To ensure the environmental sustainability of the individual farms, it is important to carefully manage environmental concerns. The degradation takes place under two different conditions in terms of oxygen requirement; aerobic and anaerobic conditions. The breakdown of sulphide, also breakdown of nitrogen containing compounds produces ammonia at the same time some odorous compound such as volatile fatty acid, alcohols might also produced through the breakdown of other compounds. Aerobic degradation can be expected to break nitrogen-containing compounds down into odorous compound containing nitrogen. Anaerobic degradation can be expected to produce sulphide contain odorous compound.

Reducing the moisture content in the litter will inhibit anaerobic bacterial activity and reduce the formation of other odorous gases. Problem of ventilation result in the concentration of all the gases in dairy houses.

1.2 Aim/Objective:

The aim of the Project is to determine the concentration of gases in dairy cattle house (Case Study of Maizube Farm Niger State).

The Objectives:-

To evaluate the concentration of ammonia emission and further to study the effect of emitted ammonia to their exposure time.

Also to simulate the concentrated release of contagious gases in dairy house and to determine how concentration at dairy cattle building is affected by the location of the source gases. Ventilation rate of the dairy house is briefly discussed.

1.3 Scope of Work:

This Project is intended to carry out the following investigation of the concentration of the following gases;

1. Ammonia.
2. Hydrogen sulphide.
3. Sulphur dioxide.

In this Project, Maizube Farm Minna is taken as a Case Study with the particular breed of dairy known as Holstern, which are imported down from South Africa. The Holstern breed of dairy has high Milk production, which produces about 25 litres of Milk per day.

CHAPTER TWO

LITERATURE REVIEW:

2.0 Air Pollution:

Air Pollution may be defined as any atmospheric condition in which certain substance are present in such concentration that they produce undesirable effects on man, animal and his environment (Treshow and Anderson, 1991). Air pollution can be classified into Natural and Anthropagenia types.

Natural Air Pollution includes wind blown dust, gases, smoke etc., while Anthropogenic Air Pollution includes product of waste such as NO_X, CO_X, SO_X e.t c.

2.1 Effects of Air Pollution on Human Health:

Sulphur dioxide (SO_2) gives rise irrigative reactions which cause pulmonary blood vessels (capillaries) to dilate and exude fluid. This leads to tissue fluid accumulation and swelling (edema). Bronchial spasms and shortness of breath. In a chronic situation the gas contributes to and aggravates lung diseases like chronic bronchitis, pulmonary fibrosis via irritation to diseased pulmonary function and increasing stress on the heart.

Nitrogen dioxide (NO_2) at concentrations higher than acceptable level is responsible for respiratory tract edema due to cell membrane disruption. In chronic cases. It causes cell membrane damage and acid-induced irritation leading to or contributing to diminished pulmonary function and right-heart stress.

2.2 Effects of Air pollution on Plants and Animals

The air pollutants most responsible for plant damage are sulphur dioxide and acids derived from the oxides of both sulphur and nitrogen. Plants that are susceptible to these kinds of pollutants include vegetables, fruits and other kinds of agricultural crops, grasses, shrubs, tree, and commercial flowers. For example, sulphur dioxide at levels above permissible causes bleached spots on leaf, chlorosis, suppression of growth, early abscission and reduced yields in crops such as barley. Pumpk in alfalfa, cotton, wheat, tettuce, apple and oat. Alfalfa, barley and cotton are known to be sensitive to sulphur dioxide at a concentration as low as 0.3ppm. nitrogen dioxide at concentrations above optimal causes brown spots on leaf and suppression of growth in sunflower, mustard, tobacco and pinto bean. Pinto bean is sensitive to nitrogen dioxide at a concentration as low as 3ppm.

The effects of acid rain on wildlife can be far-reaching. If a population of one plant or animal is adversely affected by acid rain, animals that feed on that organism may also suffer. Ultimately, an entire ecosystem any become endangered. Some species that live in water are very sensitive to acidity, some less so. Freshwater clams and mayfly young, for instance, begin dying when he water pH reaches 6.0. Frogs can generally survive more acidic water but if their supply of may flies is destroyed by acid rain, frog populations may also decline. Fish eggs of most species stop hatching at a pH of 5.0. below a pH of 4.5, water is nearly sterile, unable to support any wildlife.

2.3 Factors Affecting the Generation and Concentration of Gases:

The Scope of the Project is on Ammonia, Hydrogen Sulphide and sulpurdioxide gases.

2.3.1 Ammonia Gas:

Ammonia is produced by decomposition of nitrogenous compounds in the manure and the waste product of the animals. The release of ammonia is affected by several factors. The most important factors are.

a. **The role of sizes of exposed surface:-** The release of ammonia increase with increasing sizes of those surfaces that are covered by faeces and urine. Building planning that minimizes exposed surface may therefore be one way to abate ammonia releases.

b. **Manure Handling:-** An International Survey of air pollution in cattle house shown a wide range of concentration depending on the type of manure handling used. The Survey indicates that the type of manure handling is the decisive factors for the release and concentration of ammonia. The lowest values of ammonia release have been found in system using conveyors for manure removal and in particular system where manure is dried on the conveyors. System with bedding and deep pit manure storage gave the highest values in the Survey.

c. **Airflow Rate and Air Movement:-** Several Investigations have proved that the release of ammonia will increase with increase airflow rate. The reasons for this are:-

1. Pressure difference between ammonia in the manure and in the air increases, which enhances the forces to evaporate ammonia from the manure.

2. If air velocities increases around exposed surfaces with faeces and urine, then the mass transfer coefficient for ammonia from the surface will also increase.

d. **Humidity:-** This is the amount of moisture content present in air or atmosphere. The release of gases from dairy cattle is affected by the moisture content of the bedding. The release decreases at decreasing moisture content.

e. **Temperature and pH-value:-** Increase in air temperature also affect the release of gases in dairy cattle houses. Air temperature above the animal lower temperature demand should therefore be avoided in the building.

f. **Diet:-** Diet composition may also impact on ammonia production in farm and there health in several ways.

Approximately 18 percent of the feed content of nitrogen is releases into the atmosphere as ammonia. Therefore, diets with high protein levels may have a direct affect upon the development of contact dermatis because of the increase in nitrogen content on the manure.

Other dietary constituents can have an adverse effect on litter quality, either by causing increased water intake, which leads to wetter faeces, or by making the faeces sticky. High levels of dietary sodium, chloride or potassium all cause an increase in water intake.

Finally, high dietary fat levels and in particular fat sources of poor digestibility make the faeces greasy with fat that has not been digested or absorbed, making the litter stick to the skin more easily and making the skin more prone to lesions caused by the ammonia

g. **Health:-** The dairy cattle health status is another factors to consider. When there are outbreaks of diarrhea resulting from intestinal disorders may cause litter deterioration.

The problem is more severe at high densities because the litter may easily become wet as a result of larger deposits of fecal content, spilled water and inadequate ventilation.

2.3.2 Best Management Practices to Maintain Low Ammonia Level:

i. Using of diets that reduce the level of urea and proteins.

ii. Maintaining densities based on the ventilation capacity of the building.

iii. Using litter material with high water-holding capacity.

vi. Minimizing over drinking.

2.3.3 Cattle and Characteristics:

Cattle can be classified using generic classification and levels of functional traits, breeds can be grouped into these functional types:-

i. British Beef:- British-originated breeds and combinations used for beef production only.

ii. Continental Beef:- Continental European breeds and derivatives developed exclusively for beef production.

iii. Dual Purpose:- Breeds selected for both beef and dairy production in their native area, mostly continental European and combination of beef and dairy breeds. Dual-purpose breeds are used only for beef in the United States.

iv. Dairy:- Originating in Western Europe and selected in the United States for dairy purposes only, with beef production as a by product. Dairy for beef production are used primarily to create early – maturing, high-milking females without increasing muscle. dairy influence, particularly the smaller breeds, also should maintain or possibly increase fertility, if body condition is maintained.

2.3.4 Common Dairy Cattle are Holstein and Jersey:-

Holstein:- Which have characteristic of very high body size and extremely high milk potential. The Age at puberty is early with medium hot climate adaptability and has a medium fleshing ability. Muscle expression low. Holstein dairy cattle use as the Case Study at Maizube Farm in Niger State was imported from South Africa, which have the ability of producing 25 litres of Milk per day.

2.4 Airflow Influence on Odour Ammonia Concentrations and Emissions:

The airflow rate showed as expected a significant influence on concentration of odour, ammonia etc, in air. The concentration of the gases decline with the ventilation rate of the farmhouse. Experiment carried out showed that no influence of the ventilation rate could be seen on dust concentration.

Generally, temperature and humidity in a particular environment may lead to change of odorant emission e.g by affecting the volatilization or by affecting the activity of microorganisms producing odorous compounds.

Also, reducing the moisture content reduces the odour production in manure and this affect may be explained by less anaerobic conditions at low moisture level.Water spillage will seriously affect litter moisture content.

2.4.1 Principle of Odour Generation:

Decomposing waste product such as manure, urine, faeces causes odours in dairy cattle buildings. This degeneration takes place under two different condition in terms of oxygen requirement aerobic and anaerobic condition. As biological degeneration of organic material progresses, odourous compound are produced in liquid and solid phases. The volatilization rate of these odorous compounds controlled by the concentration difference between liquid/solid and gas phases.

Ventilation rate and temperature significantly influence the concentration in the gas phase. The higher the ventilation rate the higher the volatilization rates and vice-versa. Due to the high levels of odourous compound in the dairy house, the volatilization process becomes a dominant factor in the generation of atmosphere odour emission.

2.5 Ammonia and Rearer's Health: Monitoring good air quality in dairy cattle houses is important for the productivity, health and welfare, a rearer's personal health comes first.

Unfortunately, in our industry, air quality for personal well being does not receive the attention it should. Human respiratory hazards in cattle houses are not limited to ammonia. Other hazards in hydrogen sulphide, which is the greatest concern with deep pit manure storage system; dust; bio-aerosols including bacteria, fungi, mold; viruses, or fragments of these organism; and dust, fumes; or vapour associated with pesticides, disinfectants and litter treatments.

Ammonia, which constitutes the most pollutant in cattle houses, affects the rearers when exposed to multiple generation of it. As little as 4ppm of ammonia may cause eye irritation and 25ppm, mild tissue irritation in some individuals. The occupational threshold level for ammonia during an eight-hour day is generally recognized as 25ppm; for short-term exposure (15 minutes) the threshold is 35ppm. An ammonia concentration of 300ppm is immediately dangerous to life and greater than 2.500ppm can prove lethal.

Whyte (1993) reported an increase in susceptibility of the respiratory system to airborne. Pathogens when combined with ammonia concentration below the occupation exposure limit of 25ppm.

2.5.1 Method to Reduce Risk of Concentration of Ammonia:

1. **Increasing the Ventilation Rates:-** Ventilation is the primary means of controlling air and litter quality during rearing. Between dairy cattle houses there should be good ventilation rate, particularly during cold weather, ammonia levels can be dangerously high.

   It is extremely important to ventilate the building before working in this environment.

2. **Maintain Desirable Litter Moisture:-** There is a linear relationship between litter moisture and ammonia release in the 15 to 40 percent range. To minimize litter moisture content manages ventilation and cooling

system and maintaining, uniform dairy cattle density and adequate litter depth.

3. **Prevent Water Seepage into Houses:-** Correct outside drainage problems that allow surface water seepage in houses and re-dirt houses to prevent wetting the liter base with moisture from the house.

4. **Clean Out Houses:-** If condition permit, a partial or total clean out of the litter, particularly going into colder weather.

5. **Use litter treatments:-** Although the duration of ammonia control limited, a number of litter treatments, when used appropriately, offer effective ammonia suppression in dairy cattle house.

6. **Implement Laboursaving technologies:-** Proper husbandry and care of dairy cattle is essential. However, consider implementing technologies such as computer controllers, which improve labour efficiency and reduce the hours spent working in houses.

7. **Wear Respiratory Protection:-** Proper respiratory protection equipment is the most effective way to reduce inhalation of ammonia. Selection of appropriate equipment to limit the intake of other pollutants such as dust will aid in reducing the additive and synergistic affects of the multiple respiratory health risk in dairy cattle house environment.

The cost of implementing these strategies to reduce your exposure to ammonia and other pollutants in dairy cattle house is a small price to pay for your personal health.

2.5.2 Method of Controlling Odours:

Odours can be controlled using these three methods:-

i. At the source.

ii. Between the sources and the receiver.

iii. At the receiver.

The most effective way of controlling odour is at the source. The control of odours can be achieved by managing the odour generating processes or removing odour from air before it is releases.

Windbreak walls help to disperse odour and provide a means for controlling odour and dust emission between the source and the receiver.

Controls at the receiver only warrant consideration where other approaches fail. Air conditioning for receptor houses is an example of a control approach. However, this may be expensive if there are many houses to treat.

2.5.3 Good Practice, Design and Management:

The most effective way of minimizing odour or concentration of gases impacts is by minimizing the odour generated at the source. Provision or construction of optimum ventilation and controlling temperature.

Good practice, design and management should always be considered before other odour control strategies are implemented.

- **Managing Waste Product:-**Odour and dust levels from dairy cattle house depend on the moisture content of the Farm house. Cattle house with a moisture content between 15 percent and 30 percent is relatively dry and friable.

2.5.4 Equipment for Measuring Pollutant

Various equipments are available for the measurement and detection of a wide variety of dangerous atmosphere contaminants and conditions such as combustible gas and accumulations, oxygen deficiencies, and toxic gases such as carbon monoxide, hydrogen sulphide, carbon dioxide and many and other commonly encountered atmospheric hazards.

2.6 Brief History of Equipment:

Gas detection tubes were first developed at Harvard University in early 1900's for measuring carbon monoxide. Early tubes were designed mainly for confined space entry, such as in the mining industry, where carbon monoxide and hydrogen sulphide are the main toxic gases. Since then, a large number of tubes have been developed for a broad range of chemicals.

With the coming of OSHA regulations in the work place in the 1970's, these compounds have expanded from mostly inorganic, acutely toxic compounds to include a large of organic compounds whose health effect tends to be more long term.

A few important factors limited the occurancy of early tube/hand pump system. First, the tubes had no pre-calibrated markings. Some tubes were read, using a colour comparism chart, which depended on the user's interpretation of the colour. Other tubes came with and external scale that was slid into position by the user. This introduced potential error in the position of the scale, but more importantly did not allow for variations in the length of stains produced by different batches of the same tubes. Modern tubes avoid such errors by having calibrations performed on each batch, which are then marked directly on the tube.

A second error sources was in the volume of air sampled. Early pumps were variations of rubber squeezed bulb that gave poor reproducibility in the amount of compression and were added to the bulbs to ensure a uniform compression and thus a fixed volume. These types of pumps are now called bellows pumps and are familiar to many in the form of the dragger and MSA hand-pumps.

Air sampling can also be performed using piston pumps, which latch, into a precisely defined position to fix the volume. These pumps pull a strong vacuum initially and this create substantially higher flow rate than bellow pumps.

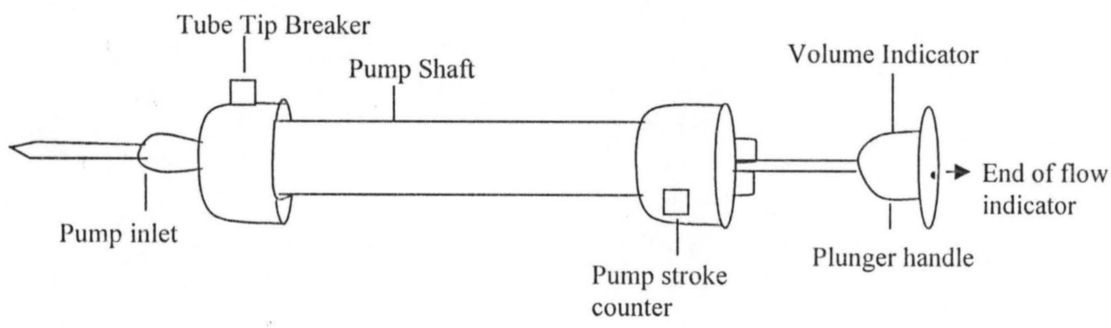

Fig. 1: RAE Hand Pump

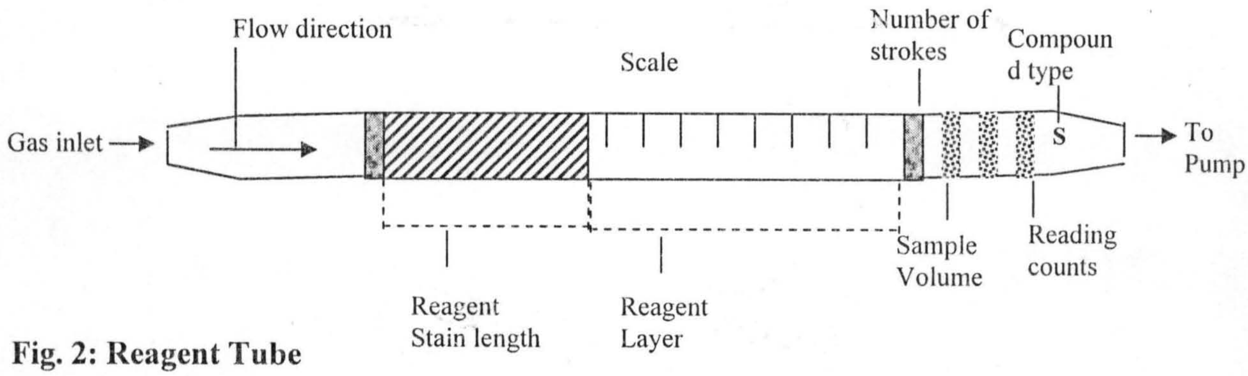

Fig. 2: Reagent Tube

2.6.2 Types of Equipments for Measuring Air Pollutant Concentration:

Given below is a list of equipments that can be used in detecting and measuring the amount of air pollutant in an air.

i. **LP-1200 Hand Pump and Gas Detection Tubes:-** The LP-1200 is a piston type hand pump that draws a fixed volume of gas, selected at either 50ml or 100ml by rotating the handle. A tight vacuum seal is formed by a greased plunger gasket. The tapered rubber inlet accommodates a range of tube diameters for different types of tubes. The inlet filter prevents glass pieces and dust from entering the shaft. An end-of-flow indicator in the handle turns white when the gas sampling is complete. A pump stroke counter is rotate to keep track of the number of stroke completed.

ii. **Toxi RAE Pid (PGM-30):-** The TOXI RAE PID is light (180g) and so compact that it comfortably fits in a shirt pocket. TOXI RAE PID features include a full range of 0-2,000ppm Voc, with resolution down to plus or minus 0.1ppm.

iii. **Drae (PGM-6000):-** This is a robust pocket sized, personal, 1 or 2 gas monitor for measuring combustible gases (percent LEL) plus a choice of O_2, C_O or H_2S sensors for the measurements of these specific hazards.

iv. **QRAE (PGM-50Q):-** This is a high performance, economical, compact, 4-gas monitor designed specifically for confined space entry, QRAE are equipped with sensors for the defection of oxygen, percent LEL, combustible gas, and carbon monoxide and hydrogen sulphide.

v. **Multi RAE 1R (PGM-54):-** This is an extremely flexible one to five-sensor instrument for use in door air quality, industrial hygiene, and other monitoring applications.

vi. **Sentry RAE (PGM-501):-** This is a multi sensor area monitorable to include photo ionization detector (PID) for port per-million measurements of volatile organic components (V_0C_5) as well as LEL, 0_2 and up to two electrochemical toxic sensors for measurement of specific substances such as C_0 and H_2S.

vii. **Area RAE (PGM-5020):-** Area RAE detectors are rugged, weather proof one to five sensor multi gas instrument that can run over 24 hours at a time: Sensors available for Area RAE detectors include oxygen, H2S, S02, N0, N02.

viii. **CD RAE (PGM-8000):-** This is a robust, low maintenance, and sensitive portable gas monitor for VOCs with ionization potentials (IP) up to 11.sev.

2.6.3 Data Sheets of Various Pollutants Measured:-

Sulphur dioxide $S0_2$:- The temperature range for the tube measuring $S0_2$ is 0-36°c and the relative humidity should be between 5-90%RH.

Colour change:- Blue-green →Yellow.

Hydrogen Sulphide H_2S:- The temperature range for the tube measuring H_2S is 0-35°c and the relative humidity should be at 5%RH.

Colour change:- Pale Orange → Pink.

Ammonia NH_3:The temperature range for the tube measuring NH_3 is 0-35^{0}C and the relative humidity should be at 5%RH.

2.6.4 W. H. O. Guidelines on Air Pollution:- The new WHO Air quality Guidelines helps to protect worker health, to eliminate or reduce to a minimum concentrations of air pollutant both indoors and outdoors, to make risks management decisions and to guide farms in setting standards and development of the animal growth and planning.

The global annual death rate due to air pollution is estimated at more than 2.7 million, with 900,000 in the cities and 1.8 million in rural settings while 800 thousand are produce from farmhouses.

Indoor air pollution from biomass fuel burning, particularly in rural households is extorting the largest death told.

Pure air compress oxygen (21%) and Nitrogen (78%) and a number of rare gases of which organ is the most plentiful.

TABLE 2.0:WHO Guide values(1999) for common pollutants.

Pollutant	Amount of ambient air concentration (Ng/ms)	Guideline value (Ng/ms)	Concentration at which effect on health start to be observed	Exposure time
30_2	5 – 400	500	1000	10 minutes
		125	250	24 hours
		50	100	1 year
C0	50 - 7000	100,000		15 minutes
		60,000		30 minutes
		30,000	Not applicable	1 hour
		10,000		8 hours
Lead	0.01 – 2.0	0.5	Not applicable	1 hour
		200		1 hour
$N0_2$	10 – 150	40	365 – 565	1 year
0_3	10 - 100	120	Not applicable	8 hours
NH_3	10-200	250	200-250	8 hours

(www.airpollution/pch/airindex)

2.7 Air Pollution Standards:- Ideally, controls over individual sources of pollution should be set at level where the cost of increasing or decreasing control are both positive. However, while the concept of balancing the costs and benefits of pollution control, and hence determining the type or degree of technical or other controls to be applied is very attractive.

Standards may relate either to air pollution concentrations or to the emissions of wastes and may be determined nationally, regionally or locally (Wood, 1988). It is possible to classifying the various types of standard as:-

1. Environmental Quality Standards.
2. Source Emission Standard.
3. Area Emission Standards.

Environmental Quality Standards:- Refers to limit of ambient environmental quality that cannot be exceeded without infringing statutory law. (Wood, 1988). It is apparent that if an area has pollution level higher than the environmental quality standard, then no new emissions in that area should be permitted and strenuous action should be taken to reduce existing emissions. In other words, no new sources should be constructed. In practice, a mixture of both stringent anticipatory technical controls and land use planning controls are normally employed to attempt to attain and maintain air quality standards.

The use of air quality standards, of course, implies on extensive monitoring system to record ambient concentrations on a regular basis (Wood, 1988).

Source Emission Standard:- These refers to a numerical limit to the amount of a particular pollutant, which may be discharged from a specific source, (Wood, 1988). Source emission standards, which are very widely used much be determined in terms of concentration of (1) pollutant permits volume of air, weight of pollutant per ton of product, weight of emission per ton of raw material, (2) Weight of emission per unit time, percentage removal of emission etc. (Wood, 1988).

Area Emission Standards:-Relate to the total emissions from a given area of land (i.e a collection of sources) (Wood, 1988). One variant is emission density zoning. In which maximum legal rate of emission of air a pollutant from any given area is limited by the size of area.

Another variant is emission allocation in which a maximum legal emission rate is assigned to a large area (often the area controlled by a local jurisdiction) with provisions for sanctions, such as construction ban, to ensure the area's allocation is not exceeded (Wood, 1988).

CHAPTER THREE

MATERIALS AND METHODS:

The method adopted in the analysis of the samples is a colorimetric method, whereby a gas sample is pulled through a glass tube containing a reagent, and the reaction between the gas and solid reagent forms a colour that is related to the concentration of the gas. The concentration is read from the length of the colour strain in the reagent. The glass tubes containing the reagent are known as gas detectors tubes and are fitted into the sample pump.

3.1 Procedures:

Procedures for taking measurements for each of the gases concentration were essentially the same, which is as follows:-

1. The Pump to be used was first tested for leaks by inserting unopened tube snugly into the inlet of aspirating pump. The plunger was pulled one stroke and after two minutes, the plunger dot was rotated away from the pump shaft alignment mark as it was observed that the plunger returned to within 3mm of its original position, which indicated that there were no leaks.
2. Both ends of a new detection tube were broken using the tip breaker on the side of the pump.

3. In the case where a pre-tube was provided, the pre-tube was connected to the measurement tube using a rubber connector in the direction indicated on the tube.

4. The measurement tube was inserted securely into a rubber pump inlet with the tube arrow pointing towards the pump.

5. The desired sample volume was selected and the red dot on the plunger was aligned with the red dot on the pump shaft. The handle was pulled quickly until it latched at half or full stroke (50ml or 100ml). Immediately this was done, the person taking the time takes it simultaneously until the sampling time required was reached (i.e. when the end-of-flow indicator on the handler of he pump turned to its full brightness.

6. The corresponding reading was taken by observing the length of strain or change of colouration on the pre-calibrated gas detection tube for each gas.

7. For additional pump strokes, the handle was rotated ¼ turn clockwise or counter clockwise and pushed back fully without removing the tube from the pump. The step 5 was repeated again.

8. Readings were taken at intervals taking 10 meters interval to each reading. The pollutants tested for are as follows:-

a. Ammonia.

b. sulphur dioxide.

c. Hydrogen sulphide.

Measurement Condition:-

- Temperature of the environment when the reading was taken:-

First reading:- Temperature of 32°C

Second reading:- Temperature of 31°C

- The Height of measurement is 1m from ground level.

CHAPTER FOUR

RESULTS AND DISCUSSION:

4.0 Results:-

The Results obtained form MAIZUBE FARM for each gas tested is given below:-

Table1: The Results obtained form the first reading (Temperature 32^0C)

Sampling Distance (m)	Sampling Time (min)	NH_3 Concentration (ppm)
10	10:23 – 10:28am	20
20	10:29 – 10:32am	18
30	10:33 – 10:36am	17
40	10:37 – 10:40am	14
50	10:41 – 10:44am	12
60	10:45 – 10:48am	10
70	10:49 – 10:52am	9
80	10:53 – 10:56am	8
90	10:57 – 11:00am	6
100	11:01 – 11:04am	5

TABLE 2: The Results obtained form the second reading (Temperature of 31^{0}C)

Sampling Distance (M)	Sampling Time (min)	NH_3 Concentration (ppm)
10	4:00 - 3:03pm	16
20	4:04 - 4:07pm	14
30	4:08 - 4:11pm	13
40	4:12 - 4:15pm	12
50	4:16 – 4:19pm	10
60	4:20 – 4:23pm	8
70	4:24 - 4:27pm	7
80	4:28 – 4:31pm	5
90	4:32 – 4:35pm	3
100	4:36 – 4:39pm	2

For sulpur dioxide, no colour changes was observed on the tubes throughout the duration of analysis.

Also for hydrogen sulphide, colour changes were not observed.

Table 3. Source data points.

Private	Distance (m)	Concentration (ppm)
1	10	16
2	20	14
3	30	13
4	40	12
5	50	10
6	60	8
7	70	7
8	80	5
9	90	3
10	100	2

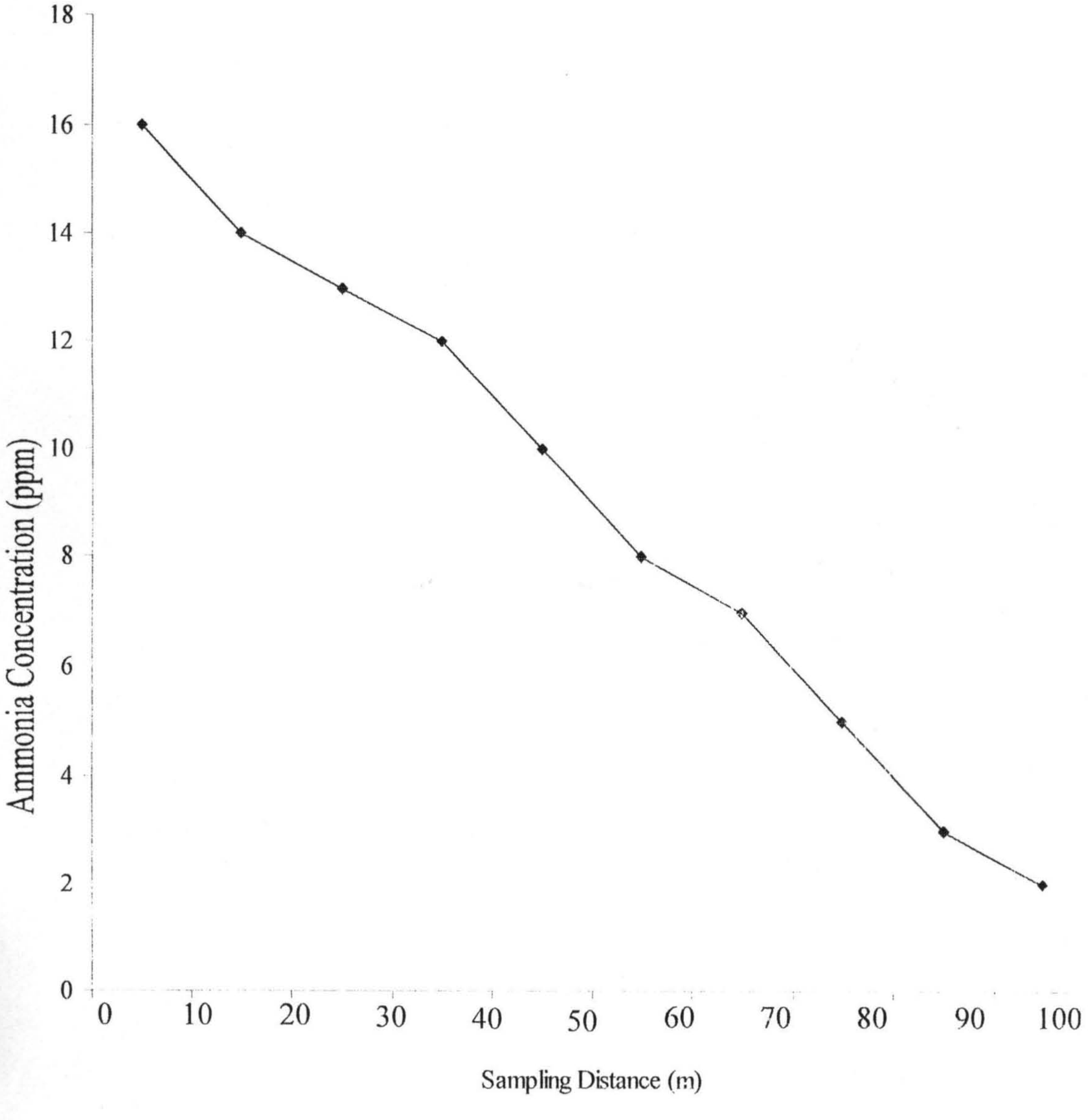

Fig 3: Graph of Ammonia Concentration against Sampling Distance in A Dairy Cattle House

Table .4. Source data points.

Private	Distance (m)	Concentration (ppm)
1	10	20
2	20	18
3	30	17
4	40	14
5	50	12
6	60	10
7	70	9
8	80	8
9	90	6
10	100	5

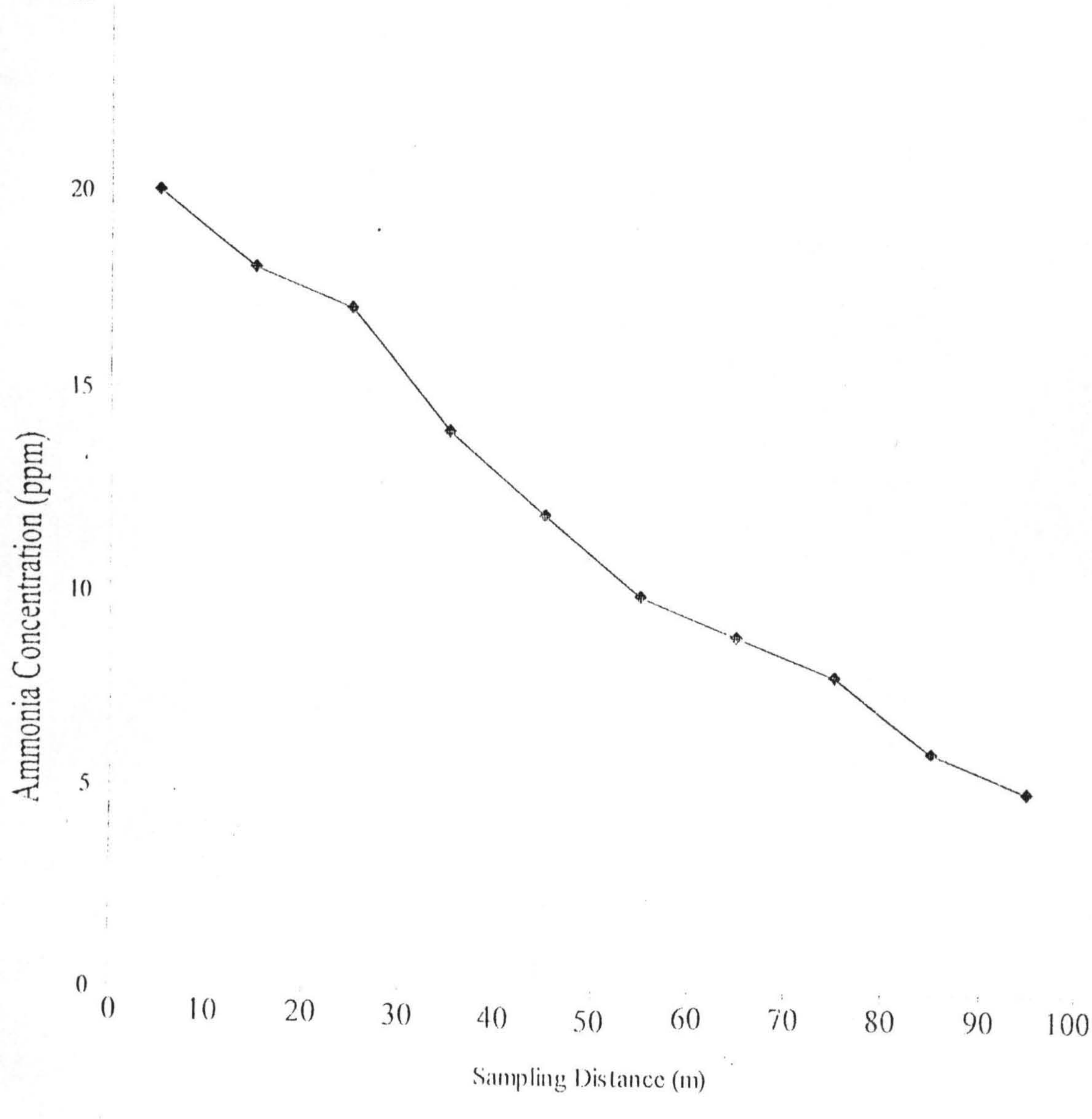

Fig 4: Graph of Ammonia Concentration Against Sampling Distance in A Dairy Cattle House

4.1 Discussions of Results:

The results obtained from the analysis reveals that there were no reading for pollutant like sulphur dioxide and hydrogen sulphide, this indicates that these pollutants or gases are not commonly detected in cattle houses. Also the generation of odour is proportional to the number of animals i.e. cattle. , and the activity in the building.

The ammonia gases, which was found in the practical work verified that location of air inlets and outlets, airflow rate and time interval between manuring will affect the release and concentration of ammonia. The release and concentration of ammonia gas can be controlled through different methods i.e. handling method of manure, ventilation effectiveness of the farmhouse.

Also the ammonia concentration in farmhouses causes health problems to the rearer and also to the animal, which should be taken into consideration.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Conclusions:

From the data obtained and analysed for dairy cattle house at MAIZUBE farm Minna, it can be concluded that the classes of pollutions that are majorly found in dairy cattle house is Ammonia.

The graphs also been obtained form the concentrations of ammonia gases in the farm and their corresponding mathematical models were also developed. This result is as a result of the material handling and method of litter handling used in the farm.

5.1 Recommendations:

In order to forestall further increase in the concentration of Ammonia gas in the dairy cattle house, concerted efforts must be made in the design and management of the farm.

1. The ventilation rate of the farm building must be put into consideration. Good ventilation rate should be encouraged and minimum number of cattle should be place at a particular building.
2. Proper Cleaning of the litter in the farmhouse should be encouraged.
3. The type of diet composition should be in right proportion for the dairy cattle to maintain proper dietary constituent.
4. Wearing of respiratory protection must be encouraged within the farm to help to reduce respiratory health risk.

REFERENCES

Anderson M (1995): Ammonia volatilization from Cow and Pig manure. Report No. 98. Department of Agricultural Biosystem and Technology, Swedish University of Agricultural Science Lund.

Gustafson G. (1988): Air and Heat Balances of Animal House. Report No. 59 Department of Farm Buildings. Swedish University of Agricultural Science, Lund.

Gustafson G. (1993): Tracer Gas Technique as a Method to Determine Ventilation Effectiveness and Distribution of Air Contaminants in Animal House. Report No. 84 Department of Farm Buildings. Swedish University of Agricultural Science, Lund .

RAE System (2002): Handbook of Gas Detection Tubes and Sampling Pumps, Second Edition. Pp (1 – 30).

Whyte, (1993): Report on respiratory s ystem to air borne.

WHO (2000): Air Quality Guidelin es for Europe, Capenhagen Denmark.

Wood. C. (1998): Plannin g Pollution Prevention, First Edition. Redwood Burn Limited, Wiltshire , Great Britain. Pp (1 – 20).