

Research article

ENVIRONMENTAL IMPACTS OF SWINE PRODUCTION IN RESIDENTIAL AREAS OF IBADAN, NIGERIA

Olagbami, W. V* . and Sangodoyin, A.Y.

Department of Agricultural & Environmental Engineering, University of Ibadan, Nigeria.

E-mail: victoriawemimo@yahoo.com

Abstract

Many people in residential areas are now engaging in swine production due to its economic importance without considering the environmental and public health impacts. Swine production is associated with intense odour, noise, dust, fly breeding, rat infestation of premises, pollution of surface and groundwater and sometimes conflicts with neighbours. This study attempts to assess and quantify these effects of swine production in Ibadan, a highly urbanized Nigerian city. The study was conducted in some residential areas in Ibadan where swine operations are being practiced intensively. Water samples were collected from wells in the neighbourhood and were analyzed for pH, TDS, NO₃, Fe, Pb, DO, BOD, COD, SO₄, alkalinity, total hardness, Cl and coliforms. The results were compared with the WHO drinking water standards. Also, odour intensity and noise levels generated around swine facilities were examined. The noise levels were compared with the noise exposure limits of Nigeria's Environmental Protection Agency. Findings showed that the average values for some water parameters were impacted due to swine production. The odour intensity level was strong while the odour character had choky and rotten egg-like smell. This could be due to the emissions of hydrogen sulphide and ammonia from swine manure. The noise levels ranged between 83.0 -99.2dBA which when compared with standards has exceeded the limits. Typical cases of headache, nose irritation, nausea, mood disturbances and typhoid were reported in the study area. The study therefore concluded that swine production in residential areas had effects on the residents of the study area. Residents of the study area should treat their wells to curb the effects of water quality impact from swine production. **Copyright © ASETR, all rights reserved.**

Keywords: environmental and public health, alkalinity, TDS, NO₃, Fe, Pb, DO, BOD,

Introduction

Most people now engage in swine production due to its economic values. The concern is that it is done mostly in residential areas. The interaction between agricultural production and the environment cannot be

overemphasized due to the negative impacts. Specifically, pollution problems associated with agricultural production are often different from those in other industrial sectors as more wastes are generated in the agricultural sector (Cloutier et al, 2003). According to Weersink et al (1998), the impact of agricultural production on the environment is different from other industrial sectors due to the amount of non-point source pollution and the large number of heterogeneous farms.

Aillery et al (2005) identified waste products such as manure urine and bedding materials as the major sources of environmental risk or degradation from swine farms. Basically, the major impacts of swine production on the environment can be grouped into air, noise and water pollution.

*Author for correspondence.

Agricultural wastes have been identified as one of the major source of groundwater pollution and to a more restricted scope, well water pollution. George (1987) linked $\text{NO}_3\text{-N}$ problems in New Zealand groundwater to concentrated livestock and manure usage. In some parts of Europe, pig manure concentration was linked to leaching of nitrogen (as nitrate) and phosphorus (as phosphate) to ground and surface water (Ogink and Aarnink, 2004). In such cases, nitrate concentrations in groundwater sometimes exceed the 50mg/l threshold that is set by the European Nitrate directive.

Odorous emissions are generated in intense swine production. Dust particles which originate from faeces and feed, can adsorb and concentrate odorants in swine facilities. The inhalation of gases can also cause respiratory and cardiovascular diseases in farm workers and neighbours.

Hearing loss is the most significant health problem associated with noise pollution. The noise levels within a swine confinement building will vary gradually throughout the day, with the levels increasing greatly during the feeding, due to an increase in animal activity and the dry feeding systems. On swine farms, noise levels may easily exceed 95 decibels during feeding and bleeding of hogs (Ricky, 1995).

With a view to evaluate the impacts of swine production on the environment and the attendant hazards, a study was undertaken in parts of Ibadan, a major city of Nigeria. The study objectives included among other things: (i) an assessment of the groundwater quality in the vicinity of swine facilities (ii) the investigation of noise levels in swine production and (iii) an assessment of the odour intensity associated with swine production. The study was concluded with recommendation of measures to abate the impacts.

The Study Area

The study was carried out in Ibadan, the capital of Oyo State in Nigeria. Ibadan lies in the Southwestern part of the country between latitudes of $7^{\circ}23'47''\text{N}$ of the Equator and $3^{\circ}55'0''\text{E}$ of the Greenwich Meridian. Ibadan covers an area of about 12km^2 and altitude of about 218 m above sea level (Awodoyin and Olubode, 2009). Ibadan has a population of 1,338,659 according to the 2006 census. Ibadan has a tropical wet and dry climate with a lengthy wet season and relatively constant temperatures throughout the year. Based on existing demographic consideration and land use characteristics, Ibadan is divided into 3 major residential zones as follows:

- (i) high-density residential district with a density of over 300 persons per hectare. Wards in this zone include Mapo, Oje, Beere and Yemetu.
- (ii) medium-density residential district with a density of 100- 300 persons per hectare. Wards in this zone include Ojoo, Agbowo, Sango and Mokola.
- (iii) low-density residential district with less than 100 persons per hectare and encompasses such wards as Bodija, Jericho, Ashi and Idi-Ishin.

Ibadan represents a typical industrial and agricultural setting of which swine production is a popular practice and is mostly raised by small-scale farms in villages and medium to large scale farm in the medium and high-density residential district. The research was conducted in two piggery farms located at Ajia and Wofun area of Egbeda Local Government. One of the farms is self-owned while the other is a multiple-owned farm settlement. The main factors that informed the choice of the farms were number of pigs, method of manure disposal, nearness of wells to the piggery confinement buildings and number of years of swine production.

Experimental Techniques

Questionnaire administration, informal interview, jury assessment of odour intensity level, investigation of noise level effects, water sampling and analysis formed the bedrock of information acquisition on the subject. Four water samples were collected from two wells in the study area with two water samples from each well. The two wells are used for drinking and domestic purposes. The water samples were analysed for physical, chemical and bacteriological properties. Parameters were determined according to Standard Methods (APHA, 1998) using reagents and equipment such as Atomic Absorption Spectrometer, incubator, electronic counter, pH meter and oven.

The assessment of odour intensity and character was conducted with cooperation of some residents and workers who were formally interviewed. Three juries were selected and positioned at different locations to assess the odour intensity levels. Numerical values corresponding to each jury assessment of the odour intensity were recorded at each position respectively. A mean value (the intensity) for the three juries at each position was calculated and the grand mean (a single value for the odour intensity) was computed as follows:

$$\text{Mean of each position } (y_1, \dots, y_3) = \frac{x_1 + x_2 + x_3}{n} \dots\dots\dots(1)$$

x_1, \dots, x_3 = numerical values corresponding to the odour intensity.

n = numbers of jury.

$$\text{Grand mean} = \frac{Y_1 + Y_2 + Y_3}{K} \dots\dots\dots(2)$$

k = number of positions

Hours and years of exposure to noise levels and activities in the piggery units that generate high noise levels were assessed with an informal interview of workers at the swine confinement building. Already generated noise levels assessment information and data in some swine farms using a sound level meter was assessed from Alege (2011).

Drinking water standards were used to compare the average values of the various parameters determined in the water samples. The average maximum noise levels generated in swine farms from a previous study (Alege, 2011) was compared with the noise exposure limits of Nigeria's Environmental Protection Agency.

Results and Discussions

Swine operation effects on groundwater

In general, the groundwater quality in the vicinity of swine farm under investigation was adversely affected by seepage from swine manure (Table 1). This was confirmed by large increases in total viable counts and total coliform counts. The wells are an obvious health risks, especially to the residents. It appears that part of the danger involved in seepage to groundwater of swine effluent and waste was high colour and the unpleasant taste. The progressive movement of leachate into groundwater was confirmed by high total dissolved solids, total solids concentration and chemical oxygen demand. The groundwater sources in the study area need to undergo treatment processes such as screening, filtration, aeration and chlorination.

Table 1: Average Values of the Water Parameters in Wells around Swine Farms

Parameters	Well A	Well B
pH	6.8	6.6
Dissolved Oxygen	2.6	2.3
Biological Oxygen Demand	115	455
Chemical Oxygen Demand	360	805
Total Solids	1855.0	2320.0
Total Dissolved Solids	352.5	767.5

Colour (NTU)	6	6
Taste	Objectionable	Objectionable
Alkalinity	0.60	1.30
Total Hardness	77.50	85.75
Ammonium	ND	ND
Nitrate	1.50	2.50
Sulphate	0.60	0.90
Lead	0.01	0.03
Cadmium	ND	ND
Iron	0.30	0.50
Arsenic	ND	ND
Mercury	ND	ND
Sodium	75	90
Potassium	25	20
Calcium	70	82.5
Chlorine	18	22.0
Total Viable Count (cfu/g)	3.5×10^6	3.7×10^6
Total Coliform Count (cfu/g)	1.2×10^4	3.4×10^4

All parameters in mg/l excepted where stated.

Odour Assessment in Swine Farms

The nuisance potential of a swine farm is to some extent decided by whims of farm neighbours. Odour conflicts are most frequent with operations near housing developments. Table 2 shows the odour intensity level as assessed by the jury. It could be deduced that odour intensity reduces as distant increases. Residents close to the swine farm experienced very strong odour level. The manure is not properly managed thus increasing the odour intensity level due to anaerobic decomposition. In the study area, it was observed that some residents could not ascertain the intensity of odour levels because of their acquaintance with some of the swine operators while some residents identified the odour character as choky and rotten-egg like smell. The choky nature of the odour and the rotten-egg smell could be attributed to the presence of ammonia and hydrogen sulphide gas respectively. The resulting odour intensity and odour character trigger health effects such as nausea among the residents of the study area.

Noise Levels in Swine Confinement Units

In a swine confinement building, it has been observed in different studies that noise levels are generated during feeding, breast-feeding, bleeding of hogs and intrusion of visitors into the swine farm. Table 3, extracted from Alege (2011) shows the average maximum noise levels from different swine farms. The average noise levels ranged between 83.0 and 99.2dBA. Noise levels of 95 -105dBA has also been reported in a related study conducted by Ricky (1995). The range 83.0 -97.4dBA fall within the FEPA's Noise Exposure Limits while values above 97.4dBA has exceeded the limit. Hearing impairment or any other noise pollution effects like disruption of sleep were confirmed by some residents close to the swine farms.

Table 2: Odour Intensity Assessment

Position	July 1	July 2	July 3	Average	Grand mean
1	5	4	6	5	4.0
2	4	5	4	4.33	
3	4	2	2	2.67	

*Extremely Strong = 6

Very Strong =5

Strong =4

Weak =2

*Position 3≥2≥1

Table 3: Average Values of the Maximum Noise Levels Generated in Six Farms

	UIT& RF	IAR&T	MPBORA	BARRYTS	UIT&RF2	UIT&RF3
Day 1	89.9	93.9	83.0	89.4	98.3	96.0
Day 2	89.6	94.7	99.2	86.8	94.0	97.3
Day 3	95.4	98.2	98.6	95.9	93.5	97.4

Source: Alege (2011)

Impacts of Swine Operations on Public Health

Previous investigations have revealed that health hazards associated with livestock operations are normally higher than would exist in the absence of these operations, (Sangodoyin and Olorunfemi,1996). In the study area, some residents confirm that the presence of large and small scale swine facilities negatively affect the quality of life, public health, property values and the local economy while some show their awareness hiding under the umbrella of religious belief.

In the study area, health effects on swine farm residents were reported (Table 4). Typical cases include headache (16%), nose irritation (30%) and nausea (24%). These arise from a combination of toxicological effects of volatile organic compounds, direct irritation of the nose and throat and emotional factors. Close to 30% of the respondents experienced discomfort due to the noise generated from swine facility. Complaints made by 20% of the residents of the study area in the age range of 60 – 70 years were increased levels of mood disorders including anxiety, depression and sleep disturbances.

Table 4: Health Symptoms Related to Closeness to Swine Farms

Health Symptom	% Occurrence
Nose irritation	30
Nausea	24
Head ache	16
Mood disorders	4
Sleep disturbances	16
Typhoid	10

Conclusion

There was evidence of groundwater contamination from swine operations. Health symptoms related to swine operations cannot be overlooked. Swine operations could also lead to noise and air pollution and complaints from neighbours. It is obvious that the environmental impacts of swine production in residential areas could not be abated without the intervention of environmental agencies and government.

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