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Environmental Impact Auditing of Food Processing Industry in Nigeria: The Case of Climate and Air Quality

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Abstract

In developing countries it is common to cite industries without carrying out environmental impact assessment. This is the case of the two industries audited in this study. Therefore, it becomes necessary to audit food processing industries in Nigeria to determine their impact on the environment. This will go a long way towards a cleaner and healthier environment. In this study the impacts of food processing industries on climate and air quality of their environments were reported. The need for environmental impact auditing and the importance of impact auditing as a project management tool were highlighted. The method adopted is the investigative survey research approach (ISRA). The effects of air pollution on man, plants and animals, aquatic organisms, and materials that man cherishes were reported. It was concluded that the food processing industries do have positive and negative impacts on their environments and recommendations towards alleviating negative impacts on the were made.

Keywords: *Baseline data, screening data, cleaner and healthier environment, investigative survey research approach, air pollution.*

Introduction

The last two decades marked the emergence, rapid proliferation, growth and development of food processing industries (both foreign and indigenous) in Nigeria. This is due to increasing demand for processed foods particularly in urban areas. The raw materials for the processed food industries are mainly agricultural, from where finished products such as beverages, edible oils, sugars and other sweeteners, drinks (both alcoholic and non-alcoholic), fish and meat products emerge. Food processing as an industry was introduced into Nigeria by the United African Company (UAC) in 1923 (Ojo 1998). Today, food industries in the country are so many that they could be sub-divided into thirteen (13) categories. These are flour and grain; soft drinks and carbonated water; breweries; starch and miscellaneous food products; meat, poultry and fish; tea, coffee and other beverages; fruit juices; animal feed; sugar; distilleries and blending of spirits; cocoa, chocolates and sugar confectioneries; agricultural and food chemicals and industrial packaging (Ojo 1998). Food processing projects involve the processing and packaging of meat products, fish and shell fish, dairy products, fruits and vegetables, grains and beverages production. It includes refinement, preservation, and improvement of product; storage, handling, packaging and canning. The processing may involve receiving and storing raw or partially processed plant, animal or other food materials, processing the raw materials into finished products, and packaging and storing the finished products.

The processing industries exist in our environment and are the main generators of wastes. Since the existing environment within

which they operate is the only one we have, and shared by both the consumers, and operators of other sectors of the economy, there is the need therefore, to ensure the preservation of the environment in as natural and as ecologically balanced a state as possible for the use of all. This must and should be made to be the motivating factor during the design, construction and operation of all industrial set up. Industrial waste is a major source of environmental pollution.

Environmental pollution is viewed as any condition or situation in which any substance or combination of substances present in the ecological system is detrimental to the health of man, plant or animal or affects the welfare of man now or at a later time .The food industries must be aware of the contents of the wastes they generate with the view to making them environment friendly .This is more so when it is realized that waste from food industries has the potential of polluting the environment in all the three possible states – solid, liquid and gas.

Environmental Auditing is a management tool that systematically, periodically and objectively reviews performance of existing projects, organizations, management and equipment with the aim to safeguard the environment (FEPA 1995; Chukwu 2005). It is one of the technical activities which characterize the Nigerian environmental impact assessment procedure developed by the Federal Environmental Protection Agency (FEPA) in 1995. It involves a periodic assessment of the positive and negative impacts of a project. As a post-commissioning activity, environmental auditing is the organization and analysis of environmental monitoring data in order to establish the record of change associated with a project. It also enables the comparison of actual and predicted impacts in order to determine the effectiveness of the impact assessment and management practices and procedures. When used in this way, it is called impact monitoring (Partidario 1996). Impact monitoring is the activity undertaken to identify variation in environmental parameters which can be attributed with confidence to the presence of a project or other course of action. Its role is to identify project-induced change and it can assist in the management of environmental effects by observing the extent of change and the degree of mitigation which is necessary (FEPA 1995; Sadler 1996).

The Need for Environmental Auditing

It is never possible in advance to predict all the environmental impacts of a development project with complete certainty or accuracy. Moreover, no situation is static or incapable of improvement. What is needed, therefore, is regular environmental audit or review of projects after their implementation. This involves the systematic examination of the consequences for the environment of the projects; and the continuing identification of means of reducing adverse impacts. This is increasingly becoming a part of sound environmental management in many countries and a part of normal management practice in many commercial enterprises (Olesen *et al*. 1996).

Environmental Auditing as a Project Management Tool

Environmental auditing process comprises a systematic, documented, periodic and objective evaluation of how well projects, organizations, management and equipment are performing. The aim (EEC 1993) is to safeguard the environment by: identifying the defects of an establishment (either a single plant or enterprise or an entire organization) whether of design, technology, operations, management or maintenance that are contributing to environmental pollution and degradation; facilitating management control of environmental practices; assessing compliance with industrial policies (including the meeting of regulatory requirements and relevant standards); increasing awareness of the establishment's environmental performance; and identifying the scope for improvement and prioritizing preventive and remedial actions.

Setting priorities for an action is an essential part of an environmental auditing. Indeed, action is implied in the definition of environmental auditing as a management tool.

It is therefore important in any auditing programme that management is committed to correcting defects that are identified. Environmental auditing also has another practical benefit. By identifying those actions which are as a matter of priority necessary to improve the environmental performance of the establishment, auditing provides a solid basis for calculating the cost and benefits of such action (Uchendu 1994). Approached in these ways, an environmental auditing is indeed a genuine management tool which can easily be integrated by managers into their normal management systems. In a policy context in which environmental requirements and standards will become steadily more demanding, environmental auditing is an essential ingredient of good management.

Materials and Method

Description of the Study Areas

The two industries coded A and B are located in Jos and Ikeja, Nigeria respectively. Jos is a city in the middle belt of Nigeria and capital of Plateau State. It is on Lat. 9º 52′ N and Long. 8º 54′ E. Jos is about 1,250 m above sea level on the Delimi River. The average monthly temperatures range between 21ºC and 25ºC. The monthly rainfall ranges from 200 mm to 325 mm between May and September; and 2.5 mm to 85 mm for the months of January through April and October through December (Roder 2004). Ikeja is a town in the South-West of Nigeria and capital of Lagos State. Ikeja is on Lat.6º 30′ S and Long.3º 30′ W .It is located in Lagos Mainland. Ikeja is about 305 m above sea level. The average monthly temperatures range between 22.3ºC and 32.2ºC. The annual average rainfall is 1,507 mm (Chukwu 2005).

Design of the Study

The study design was based on investigative survey research approach (ISRA) (Chukwu 1994). The ISRA for obtaining data entails the schedule of a series of visits to the food processing industries of interest. The tasks accomplished during such visits include the following: inspection and witnessing processing operations; taking relevant measurements; collection of solid and liquid wastes for laboratory analysis; interviewing relevant and competent staff of the industries and residents of the industrial areas and administering questionnaires to them; and administering and completion of structured questionnaires from available records kept by the industries. Two types of data were sought for in each of the industrial projects visited. These are qualitative and quantitative in nature and were based on: observations, measure-ments, computations, existing records, information from structured questionnaires, expert opinions, and authoritative publications.

Description of the Questionnaire

The questionnaire for this study was in two parts. Part 1 contains the screening/preliminary assessments of the natural (physical) environment. It seeks information on potential environmental impacts. It entails the isolation of the elements and sub-elements of the environment upon which the activities of the food processing industries may have severe or significant impact(s). The key environmental element screened in this study is climate and air quality with its sub-elements which are wind, precipitation/humidity, temperature and air quality. Part 2 sought information about the baseline environment. The baseline environment was the environment without the food processing industry. The purpose was to elicit information from the industry and residents of the industrial area on the environment without the plant, so that all significant direct and induced environmental impacts attributable to the food processing industries would be known. The questionnaire was analyzed in a composite table containing the baseline and screening data from the food processing industries. The monthly rainfall data were summed to get the annual rainfall for the industrial environments. Graphs of annual rainfall were plotted for the industrial environments to depict the variation in rainfall

15 years before and 15 years after the establishment of the food processing industries under study.

Assessment of Impacts

At the selected industries, baseline data on the natural environment were collected when available. These are data that describe the conditions and circumstances of the industrial environment prior to the setting up of the industry. Also, screening tests or assessments on the existing industrial environment were carried out through measurements, computations, interviews, and use of structured questionnaires. Screening tests or evaluations give information or data on the conditions and circumstances of the existing industrial environment. It is a form of situation report on the environment. Therefore assessment of impact involves the evaluation of potential environmental impact through the application of screening tests to isolate the element (e.g. climate and air quality) and sub-element (e.g. precipitation/humidity) of the environment upon which there may be a severe or important impact. The natural environmental element considered for both baseline data and screening assessment is climate and air quality.

Results and Discussion

The baseline data and screening assessment data for climate and air quality of industries A and B are presented in Tables 1 and 2, respectively. The results of the baseline studies and the screening assessments on climate and air quality (Tables 1 and 2) were used to adjudge whether an impact has occurred due to the establishment of the industries – A and B. The climate and air qualities for the two industrial environments are discussed simultaneously to enhance comparative analyses of the environmental parameters studied.

Climate and Air Quality

The impediment to wind flow due to the height of the plant and offices of industry A (Table 1) has contributed to hotter environment for the residents of the area. This was not the case before the establishment of the industry. The lowest and highest temperatures recorded at the industrial area prior to the establishment of the plant were 10ºC and 30ºC, respectively at certain seasons of the year (Table 1). In the case of industry B, the lowest and highest temperatures recorded prior to the establishment of the plant were 26ºC and 34ºC, respectively (Table 2). The minimum and maximum temperatures recorded now are respectively 12ºC and 35ºC for industry A (Table 1) and 28ºC and 36ºC for industry B (Table 2). The consequences of such a modest increase in temperature may be devastating. Problems that may develop include a rise in sea levels that will completely inundate a number of low-lying island cities and flood many coastal cities in Nigeria such as Lagos, Port Harcourt, and Warri. Many plant and animal species will probably be driven into extinction; agriculture will be severely disrupted in many states, and the frequency of droughts will likely increase. It is also a source of discomfort among industrial workers and residents of the industrial areas.

However, it may be pointed out that the increase in temperature may not be due to the activities of the two industries alone as the issue of global warming is quite general. Most of the radiant energy which the atmosphere and the earth receive from the sun in the form of short-wave radiation (ultra-violet and visible radiation) is reflected directly or re-emitted from the atmosphere or the surface of the earth as longer wave infrared radiation. Part of the longer wave infrared emitted is absorbed by gases, aerosols and particles in the earth's atmosphere, thereby increasing the temperature of the atmosphere. This phenomenon is termed global warming (Zimmerman 2004; Chukwu 2005).

The presence of A and B industries has led to a modest increase in environmental temperature due probably to emission of hot gases during processing operations, dust from traffic and quarrying, emissions from vehicles bringing in raw materials/conveying away finished products and emissions from burning

of waste materials. The air pollutants associated with industry A are smoke, dust, and heat (Table 1) while those of industry B are smoke, dust, exhaust gases (SO_2, NO_2, and CO_2), heat, particulates and flash ash (Table 2). These emissions led to degradation of air quality, primarily in the immediate environment and can result to acute and chronic physiological effects on human beings. Effects of air pollutants on plants, aquatic lives and climate have also been reported by many researchers (Kupchella and Hyland 1993; Chukwu 2005).

Effects of air pollution on human health

Sulphur dioxide (SO_2) (a by-product of processing activities, Tables 1 and 2) gives rise to irritative 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 leading to decreased pulmonary function and increasing stress on the heart (Kupchella and Hyland 1993; Zimmerman 2004; Chukwu 2005).

Nitrogen dioxide (NO_2), a by-product of processing activities, 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 (Schindler *et al*. 1985).

Dust and dusty environment are generated by the food processing industries (Tables 1 and 2). Inhalation of large doses of dust or accumulation of small doses of dust over a prolonged period may eventually help to bring about structural impairment and loss of lung function. Dust in the lungs causes a response in which fibrous tissue is deposited around dust particles, creating “macules”. The fibrotic reaction eventually decreases the function of the lungs; this in turn puts stress on the heart (Kupchella and Hyland 1993; Chukwu 2005).

Effects of air pollution on plants and animals

The air pollutants (Tables 1 and 2) most responsible for plant damage are sulphur dioxide and acids derived from the oxides of both sulphur and nitrogen. Schindler *et al*. (1985) reported the effects of these pollutants on plants and animals. Plants that are susceptible to these kinds of pollutants include vegetables, fruits, and other kinds of agricultural crops, grasses, shrubs, trees, 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, pumpkin, alfalfa, cotton, wheat, lettuce, 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 (Chukwu 2005).

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 may 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 the water pH reaches 6.0. Frogs can generally survive more acidic water, but if their supply of mayflies 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. Land animals dependent on aquatic organisms are also affected. It has been reported (Chukwu 2005) that populations of snails living in or near water polluted by acid rain are declining in some regions.

Table 1: Assessment of Climate and Air Quality of Industry A.

Sub-element	Baseline data	Screening data	Impact
Wind			
(a) directions	North – South	North – South	–
(b) speeds	moderate	moderate	–
(c) unusual conditions of wind flow	seasonal storm	seasonal storm	–
(d) height of structure(s)	NA	>24m (industrial building) 7–9m (offices)	obstructs ventilation
(e) modification of local wind behavior	NA	No effect	–
Precipitation/humidity			
(a) local rainfall	1,558.9mm	1533.5mm	See Figure1
(b) unusual conditions of rainfall	seasonal floods	seasonal floods	–
Temperature			
(a) lowest	10ºC	12 –14ºC	marginal increase in
(b) highest	28 – 30ºC	30 – 35ºC	temperature
Air quality		smoke/dust/heat//exhaust	Environmental
pollutants	smoke/dust	gases e.g. CO_2,SO_2, NO_2	pollution

Table 2: Assessment of climate and air quality of industry B.

Sub-element	Baseline data	Screening data	Impact
Wind			
(a) directions	North – South	North – South	–
(b) speeds	moderate	moderate	–
(c) unusual conditions of wind flow	Nil	Nil	–
(d) height of structure(s)	N	NS	–
(e) modification of local wind behaviour	NA	No effect	–
Precipitation/humidity			
(a) local rainfall	1,865.2mm	1636.5mm	See Figure 2
(b) unusual conditions of rainfall	seasonal floods	acid rains/seasonal floods	reduced soil fertility affects buildings
Temperature			
(a) lowest	26ºC	28 -29ºC	marginal increase
(b) highest	34ºC	34 – 36ºC	in temperature
Air quality	smoke/dust	smoke/dust/heat/noise/	Environmental
(a) pollutants		exhaust gases (SO_2, CO_2, NO_2)/flash ash	pollution
(b) odour	Nil	pleasant confectionery aroma	adds fragrance to the environment
(c) intensity of odour	NA	modest	–
(d) duration of odour	NA	during production long	–

In The Netherlands songbirds are finding fewer snails to eat. The eggs these birds lay have weakened shells because the birds are receiving less calcium from snail shells (Hart 2003).

Acid pollution, however, has one surprising effect that may be beneficial. Sulphates in the upper atmosphere reflect some sunlight out into space, and thus tend to slow down global warming. It is believed that acid pollution may have delayed the onset of warming by several decades in the middle of the 20th century. The susceptibility of plants to pollutants is influenced by such variables as temperature, wind, light intensity, soil fertility and relative humidity. High soil moisture and atmospheric humidity actually intensify the damage.

Effects of air pollution on lakes and aquatic communities

Sulphur dioxide and nitrogen dioxide are two of the important gaseous pollutants identified in this study (Tables 1 and 2) whose end products are respectively sulphuric acid and nitric acid when they dissolve in rain water. As a result, acid rain precipitation occurs. An obvious mechanism by which acid rain influences aquatic systems is that involving pH itself. Living things have optimal pH levels and pH limits (tolerance limits). Departure from near-optimal pH means sub-optimal reproduction, growth, and survival. Acid rain can change the pH of lakes directly and through the soil acids it mobilizes as it runs over and through soil on its way to streams and lakes (Hart 2003). In aquatic systems, acidification can also cause toxic metals (e.g. aluminum and mercury) to be leached from sediment in a lakebed, for example, and from soil as acid water percolates through it. Schindler *et al*. (1985) reported dramatic changes in the food web of a poorly buffered, small lake in Ontario. They noted that there was elimination of key organisms at pH values as high as 5.8, changes in the phytoplankton species, cessation of reproduction, disappearance of bottom-dwelling crustaceans, and the appearance of filamentous algae (such as had been reported in dying lakes in high-acid-deposition areas). They concluded that the changes were caused by changes in acidity and not by secondary effects such as aluminum toxicity.

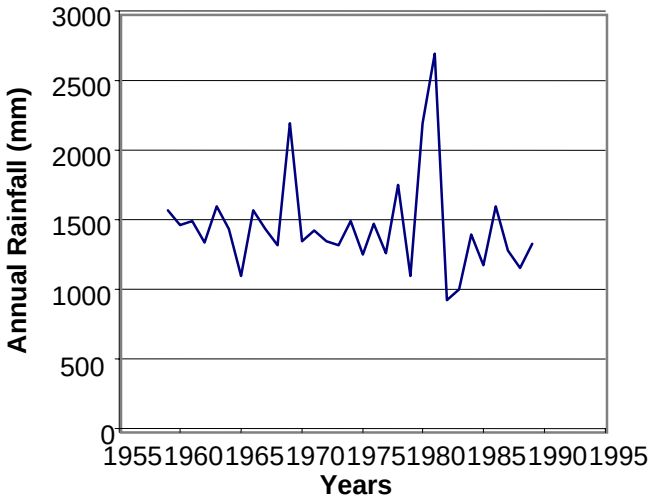

Fig.1. Variation in annual rainfall before and after establishment of industry A.

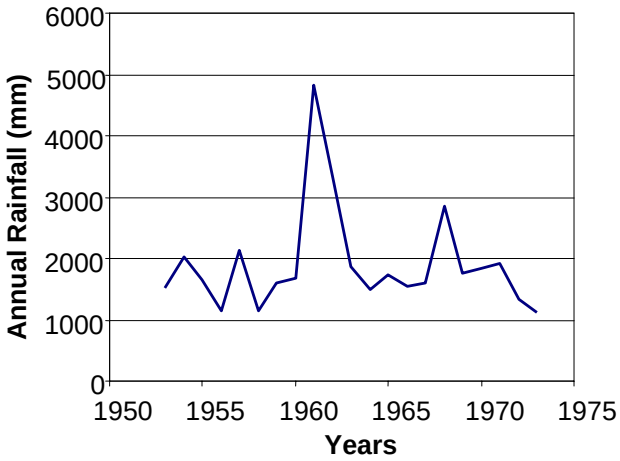

Fig.2. Variation of annual rainfall before and after establishment of industry B.

Effects of Air Pollution on Climate

Impairment of visibility is perhaps the most noticeable effect of particulate matter. Smoke and haze (Tables 1 and 2) distort visual range, the colour of the sky, and the ability to see stars at night. In socio-economic terms, reduced visibility has considerable impact on air travel and property values. Sulphur dioxide and nitrogen dioxide are involved in reactions that yield haze-generating fine particles in the

atmosphere. The reactions and the hazes they form are influenced a great deal by meteorological conditions including wind, rain, sunlight, temperature, and humidity. These pollutants that reduce visibility may also affect climate via reduction of net solar radiation and enhanced cloud and fog formation. The variation of annual rainfall for Jos and Ikeja as shown in Figures 1 and 2 respectively could be linked partly to the industries located in these cities. The figures present the annual rainfall history of the two cities 15 years before and 15 years after the industries. The average rainfall for Jos before and after the establishment of industry A was 1,558.9mm and 1,533.5mm, respectively (FDMS, Lagos 1997). For Ikeja, the average rainfall before and after establishment of industry B were 1,865.2mm and 1,636.5mm, respectively (FDMS, Lagos 1997). In both cases it would be observed that the industries do have effect on rainfall amount. Actually, industrial emissions affect microclimate via reduced cloud formation as a result of net reduction in solar radiation (Zimmerman 2004).

Biological and Ecological Effects of an Increase in Carbon Dioxide Concentration

Carbon dioxide is one of the exhaust gases of food processing operations (Tables 1 and 2). An increase in the atmospheric carbon dioxide concentration can greatly affect living things. Green plants grow better when the air around them is enriched with carbon dioxide. Thus a worldwide increase in carbon dioxide might increase annual net vegetation production if no other environmental factor interfered to limit the growth. The increasing CO_2 concentration in the atmosphere could have other indirect effects. If the climate were to warm, some kinds of vegetation would increase and others would decrease. The effects of changes in weather patterns, including rainfall could become complicated and difficult to predict. Increased CO_2 in the atmosphere contributes to global warming via the greenhouse effect (Hart 2003; Zimmerman 2004; Chukwu 2005).

Effects of Air Pollution on Materials

One of the off-shoots of the Nasco plant is a quarrying site. Dust and other emissions from on-site activities are likely to spread sufficiently to affect homes and other properties around the site. Dust and emissions from vehicles carrying materials, particularly quarried rock and aggregates generate dust nuisance in communities along their routes. Dust from quarrying itself affects communities and farm fields in the immediate vicinity of sites. It is significant within 500 m of site where it seriously affects orchards and houses. Acid rain and the dry deposition of acidic particles damage buildings, statues, automobiles, and other structures made of stone, metal, or any other material exposed to weather for long periods. The corrosive damage can be expensive and, in cities with very historic buildings, tragic. Both the Parthenon in Athens, Greece, and the Taj Mahal in Agra, India, are deteriorating due to acid pollution (Kupchella and Hyland 1993).

Conclusions

The two industries do have both positive and negative impacts on the environment. The positive impacts are more of social services to their immediate community and jobs creation for the Nigerian people. But of greater significance to this study are the negative impacts of the selected industries on climate and air quality. Acid rain resulting from unrestrained discharge of gaseous pollutants has impacted negatively on quality of life of man, aquatic life, flora and fauna as well as materials that man cherishes.

In order to protect the environment from the adverse effects of food processing industries, a number of mitigation measures and management options that should be implemented are hereby recommended. For all the identified negative environmental impacts, it is recommended that utilization of the best available technology; payment of optimal liability compensation to local communities and institutionalization of adequate abatement measures be adopted. The manufacturing

processes should be designed to maximize recycling potential and minimize the generation of residuals. For example, new low and non-waste technologies (already in use in developed countries) which can reduce environmental impacts are to be adopted.

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References

Chukwu, O. 1994. Technical Evaluation of Rice Threshers in Use in Niger State, Nigeria. M. Eng. Project, Dept. of Agric. Engineering, University of Nigeria, Nsukka, Nigeria.

Chukwu, O. 2005. Development of Predictive Models for Evaluating Environmental Impact of the Food Processing Industry: Case Studies of Nasco Foods Nigeria Limited and Cadbury Nigeria Plc. Ph.D Thesis, Dept. of Agric. Engineering, FUT, Minna, Nigeria.

EEC. 1993. Eco-Management and Adult Scheme (EMAS), Official J. European Communities, L 168/1-8, 10 July 1993, Brussels, Belgium.

FDMS. 1997. Monthly Rainfall at Ikeja and Jos, Nigeria. Federal Department of Meteorological Services, Lagos, Nigeria.

FEPA. 1995. Environmental Impact Assessment Sectoral Guidelines-Manufacturing Industries, Federal Environmental Protection Agency, EIA Secretariat, Abuja, Nigeria.

Hart, J. 2003. Acid Rain. Microsoft Encarta Reference Library.

Kupchella, C.E.; and Hyland, M.C. 1993. Environmental Science: Living within the System of Nature. Prentice-Hall International, Inc., Kentucky, USA.

Ojo, O.O. 1998. Quantitative and Qualitative Analysis of Wastes from Nigeria's Brewery Industry, M. Eng Project, Dept. of Agric. Engineering, FUT, Minna, Nigeria.

Olesen, J., Wenzel, H., Hein, L. and Andreasen, M.M. 1996. Design for Environment, Danish Environmental Protection Agency and Confederation of Danish Industries, Copenhagen, Denmark.

Partidario, M. 1996. Strategic Environmental Assessment: Key issues emerging from recent Practice. Environ Impact Assess Rev. 16: 31-57, Elsevier Science Inc., England.

Roder, W. 2004. Jos City. Microsoft Encarta Reference Library. Microsoft Corporation.

Sadler, B.V. 1996. Strategic Environmental Assessment: Status, Challenges and Future Directions, Report 53. Hull, Canadian Environmental Assessment, Agency and International Association for Impact Assessment, Quebec, Canada.

Schindler, D.W.; Mills, K.H.; Malley, D.F.; Findlay, D.L.; Shearer, J.A.; Davies, I.J.; Turner, M.A.; Linsey, G.A.; and Cruikshank, D.R. 1985. Long-term ecosystem stress: the effects of years of experimental acidification on a small lake. Science 228: 1395-6, Ontario, Canada.

Uchendu, V.C. 1994. Policy and Strategy Revisited, Kuru: NIPSS, Sec. No. 16, Jos, Nigeria.

Zimmerman, M. 2004. Environment. Microsoft Encarta Reference Library.