LECTURE 1: DEVELOPMENT AND THE ENVIRONMENT: AN OVERVIEW

i. Introduction

This short paper is meant to introduce the participants at this workshop to the main theme of the workshop namely Environmental Impact Assessment. The paper gives an overview of the interrelationships between development and the environment and establishes the need for a harmonious relationship between development and the environment for the continued survival of man on this planet.

ii. On Development and the Environment

The World Environment conference that took place in Stockholm in 1972 drew world attention to the inextricable links between development and the environment. Incidentally, that conference took place at the height of the drought in the West Africa Sahel that caused so much human misery and death in that part of the African Continent. Since 1972, the twin issues of economic development and environmental protection have engaged the attention of scientists and non-scientists alike especially in the developed world.

It is necessary at this point to briefly define some of the key concepts that are used in the discussion and debate on the relationship between development and the environment. These are (i) development (ii) environment (iii) technology, (iv) ecology and (v) ecosystem amongst others.

Development is usually used as a synonym for economic development. Development is now generally regarded as more than economic growth as denoted by an increase in a country's gross national product or per capita income. Development is a multi-dimensional phenomenon that

centres on man's well-being. This is because there could be an increase in a country's gross national product or per capita income without a concomitant improvement in the well-being and quality of life of the citizens. In recent years, the United Nations Development Programme (UNDP) has introduced the Human Development Index (HDI) for the international comparison of economic development in different countries. This index is a composite index consisting of three key elements of human life namely longevity, knowledge and decent living standards.

Environment can be defined as the surrounding external conditions within which man or any organism for that matter lives. Man depends on the resources in the environment to provide for his sustenance and meet his basic needs such as air, food, water, shelter and clothing. However, in the process of obtaining and using these environmental resources man may pollute or damage the environment and so reduce the capacity of the environment to further provide the resources that he needs.

Technology can be regarded as the skills or techniques required by man to explore, exploit and process or transform environmental resources into usable goods and services. The application of technology thus fosters human well-being directly but it also indirectly undermines human well-being because of its adverse effect on the environment.

Ecology in a broad sense is the study of the biosphere, the biologically active portion of the earth occupying the interfaces between the atmosphere, the lithosphere and the hydrosphere. Ecology is basically the scientific study of the mutual relationship of organisms to their environment.

An ecological system or ecosystem is an area of nature made up of living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living parts. Thus, an ecosystem consists of an organic community and its physical environment

or habitat with which it interacts. The reciprocity between the living and non-living parts of the ecosystem is the fundamental basis of the science of ecology.

The relationship between man and nature has been dominated by economic rather that ecological considerations particularly since the Industrial Revolution. It was felt there were no limits to man's economic growth as long as he is able to fashion the necessary technology to exploit and process environmental resources for his use. It was only in the last few decades that man realized that there could be limits to economic growth set by the negative impacts of the application of technology in the pursuance of economic growth. In addition, it is now generally realized that uncontrolled population growth may also hinder further economic growth. High population growth rate increases the demand for goods and services which have to be supplied from the resources of the environment at the risk of over exploitation.

Human impacts on the environment are therefore determined by the nature or characteristics of the environment, the needs of the people and the way the environmental resources are exploited to satisfy these needs. Human needs depend on the characteristics of the population such as the number, distribution, density and level of socio-economic development. Man's ability to satisfy his needs from environmental resources depends on his perception and knowledge of these environmental resources and his skill and technology to actually exploit these resources, process and use them.

For most of the period that man has inhabited this planet, his numbers have been small and his technological were very limited and localized and were usually subject to repair by natural regenerative processes. The enormous increases in world population since 1800 A.D., and the rapid development of the man's technological capabilities since the Industrial Revolution have enabled man to dominate nature and radically modify natural conditions at the earth's surface.

The damages done to the environment are now beyond what the regenerative power of nature can repair thus creating environmental problems and reducing the ability of the natural environment to support man on this planet. It is these developmental management and protection to ensure sustainable development and the continued existence of man on this planet.

iii. Impact of Human Activities on the Environment

Before we elaborate on the issues of environmental management and sustainable development, let us briefly consider the major forms of human activities and the way they affect the environment. Every human activity affects the environment in one way or another either directly or indirectly. The activity may affect one or more elements of the environment or the nature of the interactions within and between these elements. Let us illustrate this with the examples of agriculture, mining and urbanization, infrastructural development.

Agriculture normally involves land clearing by which the natural vegetation is removed and the land ploughed in preparation for planting. If land clearing is not properly handled, it can result in soil erosion, deforestation and desertification. The objective in agriculture is to increase the yield of the cultivated crops. Thus, plants which may compete with cultivated crops are regarded as weeds and eliminated. Similarly, animals, birds and insects which inhibit the production of the cultivated crops are regarded as pests while herbicides are used to get rid of weeds. Fertilizers are applied to the soil to improve its productivity while water is artificially applied in water deficient areas or during water deficient periods. The application of these inputs interfere with the bio-geochemical cycles within the ecosystem as well as the hydrological cycle creating within the ecosystem as well as the hydrological cycle creating such environmental problems as water pollution, eutrophication of water bodies and soil salination. In animal husbandry,

overgrazing creates problems of soil erosion and soil dessication while lumbering leads to deforestation if not properly controlled and accompanied by tree planting. Deforestation in turn leads to land degradation, soil erosion and flooding. Selective logging as is common in many developing countries reduces the floristic diversity and structural complexity of the forest. The faunal population of forest is also affected by lumbering operations which destroy or greatly modify the habitats of the wild animals while some of them are wounded or killed during logging operations.

It has been estimated that about 350, 000 ha of forests and savanna woodland are deforestated every year in Nigeria through such activities as farming, lumbering, bush burning, fire, wood collection and infrastructural and urban development. Thus, Nigeria which in 1897 had 60 million ha of forests and woodlands now has only 10 million ha of forests and woodland under reserves.

Apart from urban development, mining perhaps has the greatest negative impact on the environment. Mining not only destroys the landscape, it pollutes the land, water and air. Mining activity involves many operations including exploration, extraction of the mineral, its processing and transportation. Each of these leaves its impact on the landscape and adversely influences the ecology of the environment. For instance, tin mining on the Jos Plateau and oil exploration in the Niger Delta have modified the vegetation and physical landscape of these areas. Rivers have been polluted and several farmlands have been destroyed particularly in the Niger delta. Oil pollution has destroyed the ecosystems and the aquatic life in many parts of the delta. Mining is a technology-intensive operation and is therefore very destructive of the environment.

Urbanization represents man’s greatest impact of the environment. In cities, fields, farm and forest are replaced by stone, brick, concrete and asphalt. There is a large concentration of people,

vehicles, buildings and other modern artifacts. A virtually new ecosystem – the urban ecosystem – is thus created. This essentially man-made ecosystem is characterized by complex interactions and feedbacks between natural environmental processes and various human activities which alter the earth's surface and the chemistry of the atmosphere. Thus, the natural pathways of energy and matter in the environment are altered to create new ones. During the process of urban development, the vegetation is cleared, swamps are reclaimed, the terrain is generally graded, the natural drainage system is modified while new artificial ones are constructed to improve drainage in built-up areas and evacuate storm water. The thermal, hydrologic and aerodynamic properties of the earth's surface are thus altered giving rise to the creation of a distinct urban climate and hydrology in built-up areas.

The impervious urban surfaces encourage flooding while infiltration is discouraged. The relative lack of infiltration of rainwater combines with man-modified drainage systems result in flooding as peak discharges are increased while the lag time between rainfall and channel run-off is reduced. Industrial and domestic wastes are discharged into urban water courses with adverse effect on water quality and aesthetic quality of the surrounding area.

Land surface processes and characteristics resulting from urban development modify climate in the following major ways:

i. They alter the radiative properties of the surface and hence the pattern of energy exchanges between the earth's surface and lower atmosphere.

ii. They affect the hydrological properties of the surface and hence the pattern of moisture exchanges at the earth/atmosphere boundary zone.

iii. They alter the aerodynamic properties of the surface and hence the pattern of air flow and momentum exchange between the earth's surface and the atmosphere.

iv. They alter the chemistry of the atmosphere through input of gaseous and particulate pollutants which have implication for the energy balance of the earth's surface and the atmosphere.

The emission of various green-house gases by human activities has been help responsible for the recent increases in average global temperature, the so-called global warming. Available empirical data shows that the earth's temperature has increased by between 0.3 and 1.1^0C since 1900 because of the greenhouse effect of man-produced CO_2, methane, nitrous oxides and chloro-fluorocarbons. In 1880's before the Industrial Revolution, levels of CO_2 in the atmosphere were between 285 and 290 pm. These levels rose to 300 pm and 355 pm respectively in 1957 and 1980. It has been estimated that if the present rate of increase continues atmospheric CO_2 levels will be 450 pm by 2050, a development that can increase house gases such as methane, nitrous oxides and chlorofluorocarbon have been increasing. These gases particularly the last also have the ability to destroy the stratospheric ozone layer which protects life on this planet from the harmful effects of ultra violet cause a shift in the been suggested that intense global warming may cause a shift in the rain-produced weather systems as well as a rise in sea level as result of melting of polar glaciers and thermal expansion of sea water. Thus, global warming may increase the incidence of droughts and flood as well as cause the inundations of coastal areas by rising sea level.

iv. The way out

The various environmental problems arising from the impact of human activities on the environment are manifestations of the disharmony between development and the environment and they threaten to destroy the basis of development itself. The natural environment is man's life-support system that must be wisely utilized and protected. This brings us to the notion of

sustainable development earlier mentioned. According to the report of the World Commission on Environment and Development (WCED) title, Our Common Future, sustainable development is a process in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable development therefore seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future.

Following from the above, it is believed that development must be guided by ecological principles whereby the regenerative powers of nature will be enhanced and the carrying capacity of the environment will not be exceeded. In other words, there should be conscious management of the environment including the protection of the environment against the onslaught of man and his technology.

Environmental Impact Assessment is designed to assess in advance the likely impact of a development project on the environment before a project is executed. If the impact of a planned project is going to have a serious negative impact on the environment, the project may be discarded in favour of an alternative that is more environment-friendly or greatly modified to reduce its negative impact on the environment. Environmental Impact Assessment is now being used in developed countries as an instrument of public policy in deciding not only the type of development projects that may be executed but also the locations of such projects.

In recent years, because of climate fluctuations and the reality of man's impact on climate through emission of greenhouse gases amongst other and the possibility of future climate change modeling. There are two types of climate impact assessment. There is the assessment of the impact of climate variability and there is the assessment of the impact of climate variability and

there is the assessment of the impact of climate change. The first examines the impact of real time climatic fluctuations on the society and the economy. The second is futuristic being concerned with estimating or forecasting possible impact of predicted change of climate whether caused by natural processes or induced by human activities, on the society, economy and the ecosystem.

The first type of climate impact studied is empirical as it is based on the identification and analyses of effects that are occurring or have occurred as a result of variability of climate from year to year or season to season. The second type of climate impact studies is on the other hand theoretical being based on modeling the possible impacts of predicted change in climate. The two types of climate impact studies are essentially complementary. Studies of impacts of climatic variability are useful analogues of potential future effects of longer-term climate change.

v. Conclusion

Environmental problems are manifestation of disharmony between human activities and the environment. When human population was small and his technological ability limited, his activities inflicted little damage on the environment and such damages were repaired by the regenerative power of nature. But as population increased and became concentrated in urban areas and as man's technological capabilities increased, man was bale to temporarily 'dominate' nature but at an increasing cost to his well-being and survival. Environmental problems of various types and intensities have emerged to threaten his well-being and the natural environment which serves as his life-support system. Man then realizes that development cannot be sustained if the environment is not protected and managed. There are ecological limits to economic growth. Sustainable development and environmental protection and management are now the major issues facing mankind. Environmental impact assessment which is the theme of

this workshop is one major way of achieving sustainable development and protecting the environment for posterity.

E.I.A Principles and Basic Concepts

Environment

Environment means different things to different people. However for the purpose of discussion E.I.A. Environment means:

(i) air, Land and H_2O

(ii) pH, animal life and man

(iii) the socio-cultural conditions that influence the life of man or a community

(iv) any building, structure, machine or other devices made by man

(v) any Solid, liquid, gas, odour, sound, vibration, radiation resulting directly or indirectly from activities of man.

(vi) the combination or interrelationship between any two or more of the above factors.

LECTURE 2

DEFINITION OF ENVIRONMENTAL IMPACT

By definition, an “environmental impact” is any alteration of environmental conditions or creation of a new set of environmental conditions, adverse, or beneficial, caused or induced by the action or set of actions under consideration. The attention given to environmental conditions, as referred to here, will vary according to the nature, scale, and location of the proposed action (or actions). Those attributes which are most apparently affected will be given priority of attention, including such effects as are on the resource base such as land, water quality and quantity, air quality, public services and energy supply plus other areas which might be environmentally critical. For example, a threat on the nesting grounds of an endangered species will be far more significant than that of a similar threat on a species which is abundant. Also, the impact of a high noise level for instance will be more significant in a residential area than in an industrial area.

Impacts can be generally labeled as either primary or secondary. A way of describing the distinction in the labeling is that “inputs” generally result in primary impacts, while project “outputs” result generally in secondary impacts. It is generally easier to analyze and quantify primary impacts, while secondary impacts are usually not very easy to quantify. It is even possible that secondary impacts may, in fact exhibit a higher significance than primary impacts. A good example is when a primary impact may only be a differential in the vegetable composition of a species, but the secondary effect may result in a significant reduction in an endangered or rare species of wildlife.

“Primary impacts” are always, directly attributed to the proposed action. For example, in trench excavation, a primary impact will result when the soil materials removed from the

environment would damage certain communities of plant or wildlife species. Likewise in a facility construction, such as a sewage treatment works or dam, the environmental impacts due to the construction and operation of the facility and land use changes at the facility site all will be labeled as primary impacts.

"Secondary impacts" are usually changes that are indirect or induced. These always include the resultant investments and the pattern of changes in the social and economic kinetics initiated or stimulated by the proposed project. If a project involves the construction of a facility, the secondary impact would include those aspects of the environmental effects that are related to induced changes in the pattern of land use, population density, and related impacts on air and water quality or other natural resources. In addition, any unanticipated increase in growth rate or standard in the community will be considered. The importance of secondary impacts on the bio-physical environment cannot be over emphasized. For instance, the removal of existing vegetation cover may result in excessive erosion of the soil which eventually may lead to excessive sedimentation in the receiving stream; a reduction in the amount of sunlight penetrating the water results leading to a reduction in dissolved oxygen, which ultimately will have a very serious negative effect on the water quality and the aquatic community.

4. EVOLUTION OF E.I.A CONCEPT

E.I.A is conceptually noted in the theory of environmentalism, whose origin according to Coates (1923); Mikesse (1974); Herbert and Johnston (1978); dates back to the 19^{th} century. Environmentalism has two major ideological themes, both of which have led to emergence of E.I.A either directly or indirectly. These two ideological themes are eco-centricism and technocentricism (O'Riordan, 1981).

The eco-centric ideology attempts to accommodate man as part of nature although in its original formulation, eco-centricism precluded man from interfering with nature based on the presumption that man acted only to disrupt if not to destroy the natural ecosystem or natural order (Faniran, 1988). Attempts by O'Riordan (1981) to explain eco-centricism led to the formulation of the bioethnic and self-reliant community themes. While the bio-ethnic theme is more or less the same as the nature – moralist philosophy of Muir and Leopold (1940), the latter theme has been adopted by numerous utopians. Advocates of bio-ethnicism support the protection of "natural eco-system" for man's amenity values, that is, nature's pleasantness as perceived by man.

The second theme of environmentalism is that of technocentricism. This philosophy, according to O'Riordan and Turner (1983), is essentially anthropocentric in origin and practice. This philosophy is hinged on the presumed ability of human beings to explore, study, understand and control the physical, biological and social processes of the bio-physical environment for the present and future benefit of man. Technocentricism has a good following among economists and engineers.

However, events in the last few decades have led to a partial marriage of the main tenets of the technocentric and eco-centric ideologies. Consequently, environmental management and resource conservation practices have been accepted by environmental designers, planners, engineers, geographers, economists, and policy makers. It is this acceptance that has largely led to the emergence of E.I.A, which is a progeny of the tenets of environmental management.

The E.I.A was formally introduced to project management with the passage of the United States National Environmental Protection Agency (USNEPA) Act of 1970. Being the precursor of other E.I.A legislations that led to the formal introduction of E.I.A, an overview of the

USNEPA provisions becomes pertinent before some E.I.A concepts and methods are reviewed for better understanding of their implications for E.I.A process in Nigeria.

5. STAGES INVOLVED IN E.I.A PROCESS

Table 1 outlines the major stages involved in E.I.A as well as the area of focus of each state, including contextual issues as well as concerns. Environmental impact assessment procedure, its application and the utilization of its results place environmental information and values at the heart of project planning and review. Similarly, E.I.A does not always resolve the divergence of interests among the numerous public and private parties involved in the development process.

Consequently, therefore, a typical development project environment with E.I.A is not the same as a development project environment without. The project environment for this study is represented schematically by figure 2. There are three major influences, viz – human, ecological and institutional. The human interests are those of the people in the project areas / communities, while the ecological interests could either be site specific or extent to larger areas apart from the inter-generational nature of some ecological impacts. The institutional dimension involves the River Basin Development Authority that constructed and manages the dam / irrigation projects. Guiding such an agency are legal and policy statements.

Within this general environment the key elements (or factors) in the project operate and interest with one another. These are the dam / reservoir, the technology used (i.e the irrigation itself), the farmlands and farming systems, and the project farmers, and their cultural and socio-economic background.

If E.I.A process were to be integrated with the project environment as discussed above, then the schema shown in figure 3 represents the nature and character of key actors, variables and relationships.

The framework indicates strong lineages between man (including all his interests) and values. The interests and values strongly influence the perceptions of a proposed action and its effects, the prediction, measurement and evaluation of which is the environmental impact. The nature and scale of the impact determines the mitigative or control measures as well as management policy and strategy to be employed, once a decision has been taken on the project and its implementation and commissioning.

6. PERCEPTION AND E.I.A

The evaluation of alternatives and selection of preferred alternatives is partly dependent on the perception of the project itself, and of the alternatives suggested.

Environmental management therefore involves the perception of environmental attributes over time. Perception is defined as the ability of the mind to comprehend objectives, situations or events through the senses of sight, hearing, smell and touch (Fielding, 1974).

This implies that it is a process through which people select, organize and interpret or attach meaning to events or activities occurring in the environment. It is therefore, a subjective process, since people with different socio-cultural and economic attributes may perceive the same environment differently, based on the particular aspects of the situation they choose to selectively absorb, how they organize this information, and the form in which they comprehend and interpret the situation.

A number of factors influence how man processes the perceptual inputs and transform them into outputs. According to Figure 4, the factors could be categorized into three namely – perceptual inputs, perceptual throughput and perceptual outputs. Perceptual inputs include all stimuli present in the environment including biotic and abiotic objects, events, information and conversion etc.

The processes of selecting, organizing and interpreting the environmental inputs or stimuli constitute the perceptual throughput. While it is known that all individuals pass through the same perceptual throughput process, they differ in the way and manner in which they select, organize and interpret stimuli, consequent upon their own personality predispositions, expectations and biases. Also, situational factors as well as the nature and characteristics of each stimulus influence the perceptual throughput process (Sekaran, 1989, op.cit.)

The third main factor in perception is the perceptual output. Perceptual outputs comprise all that emanate from the perceptual throughput process. Thus factors such as human attitudes, feelings, opinion, values and behaviours are all perceptual outputs.

According to Whyte (1977), man's perception of the environment is considered so fundamental to environmental management, that it becomes the main point of departure for any analysis of main environment studies. A thorough understanding of the direction and level of environmental perception vis-à-vis the stimuli (e.g irrigation project of interest), by the public is a pre-requisite for enhancing policy options and decision making. Hence, E.I.A places great emphasis on the views and perceptions of the local people in the project areas.

This study is hinged on the state of the environment and the consequences for human interests and values of all the various dimensions of the introduction of modern large-scale irrigation projects in the Sudano-Sahelian zone. The models shown as Figures 2.2, 2.3 and 2.4

summarize how the various ideas and concepts discussed above relate to the design and execution of this study. According to Boyden (1979) models of this nature have several functions; they provide a basis for the organization of variables; they play essential roles in the integration of variables; they play essential roles in the integrative process by ensuring that germane components are not glossed over in analysis or in considering the future implications of possible options, and finally, they facilitate the communication of ideas and hypotheses concerning inter-relationships within and between human ecosystems.

7. THE PRACTICE AND PROCEDURE OF E.I.A

In practice, the E.I.A process has been categorized into seven distinct but inter-related activities as follows (see Munn, 1975).

Activity 1:	Description of the proposed action and all alternative locations.
Activity 2:	The second step which is the identification of potential impacts consists of a number of actions to identify (i) all the different activities (of the action) which may interact with the surrounding environment; and (ii) the potential impacts resulting from each aspect of the development.
Activity 3:	This step which is the prediction of impacts, involves the provision of data about the nature, distribution and degree of impacts, as well as a description of the environmental and human factors that will be altered.
Activity 4:	This is the step whereby an evaluation and interception of predicted impacts would be accomplished.
Activity 5:	Proposition of appropriate mitigating measure
Activity 6:	Organization and presentation of the information and data obtained in steps 1

	through 5 above.
Activity 7:	Recommendations On Whether Or Not To Accept A Proposal As Well As Conditions Of Approval, In Final Output Which Is Known As E.I.A Report / Environmental Impact Statement (EIS).

Since the 1970s E.I.A practitioners have developed a number of methods for each of the above activities. Generally, the methods used are as indicated on Table 2. Although E.I.A legislation and procedure emerged from the United States of America, other countries have had to tailor the legal, institutional and procedural contexts of E.I.A to suit their own peculiar situations. Table 3 provides an overview of the legal and institutional frameworks within which E.I.A is practised in the U.S.A., Canada, South Korea, Malaysia and Brazil.

The U.S. approach is quite open and comprehensive apart from deriving its power through the legislative means. This is also the situation in Canada. In all the countries cited on Table 3, the project proponents have the responsibility for preparing EIS, although the scope of such EIS varies from one country to the other. While the EIS in the U.S. is very elaborate and detailed, the same cannot be said of EIS in Malaysia and South Korea. In fact, the Brazilian law does not specify the scope of EIS. In Brazil, submission of EIS to the agency responsible for implementing E.I.A is not normally required. This is unlike the situation in the U.S., Canada, Malaysia and South Korea.

In all the five countries, E.I.A guidelines are available to project proponents on request. While public participation is mandatory in the U.S. and Canada, it is not mandatory in the other countries. Again, appeals against the rulings of E.I.A agencies in Canada and the U.S.A. are frequent, unlike the case of Brazil, Malaysia and South Korea. Monitoring of projects subject to

E.I.A is carried out in all the countries by the respective E.I.A agencies, although such responsibility is shared with other relevant agencies.

10. DIFFICULTIES FACING ENVIRONMENTAL MANAGEMENT

1. The complexity and interrelatedness of environmental problems and solution.
2. The infancy of the environmental planning and management field.
3. The frequent omission or discounting of environmental goods and services during conventional value analysis.
4. Life style changes, which are often required to resolve environmental conflicts, are difficult to accomplish.
5. Environmental goals often appear to conflict with other community development goals.
6. The difficulty in establishing environmental priorities and defining tradeoffs.
7. The lack of commitment of resources to environmental quality control programs (making management efficiency a compelling issue).
8. A general lack of sufficient and accurate information for proper decision making.

Consequently, heightened public awareness of environmental hazard in the developed countries soon exposed the limited nature and the inadequacies of these various approaches. It was argued that these approaches did not consider the inter-connected nature of ecological and socio-economic systems. For instance, in order to solve an environmental problem such as lake pollution, it is important to realize that the problem has two major inter-connected components. These are:

1. The natural / human environment component (e.g effect of chemicals on fish and the consequent reduction of the fisherman's income); and

2. The institutional / environment component, that is, the various interests affecting, acting upon and being affected by the pollution or degradation problem (e.g polluters, pollutes and regulatory agencies).

It becomes clear that no environmental problem could be fully considered and solved satisfactorily without taking cognizance of these two components as well as anticipating their probable changes and how to deal with them. This dilemma led McHarg (1969) to propose that environmental processes be explicitly considered in the planning process. This idea, according to O'Riordan and Turner (1983) turned out to be the forerunner of E.I.A. Figure 3 is indicative of the numerous actors and complexity of environmental. The concept and practice of environmental impact assessment, commonly referred to by the acronym E.I.A, formally emerged first in America in 1970, as part of the United States' National Environmental Policy Act (USEPA) PL 91-190 (U.S. Government Printer, 1970). E.I.A is defined as a "systematic process of the identification, prediction, evaluation and presentation of the probable as well as possible consequences of a proposed action at a stage in the decision making process where serious environmental damage can either be minimized or avoided" (Clark, 1986; Canter, 1986).

E.I.A is now widely recognized as a strategy for mitigating environmental pollution and degradation, as well as promoting resource conservation and rational decision-making in developmental efforts. Since the 1970's, many countries have embarked upon both pre-project auditing exercises either statutorily or voluntarily, with a view to improving the decision-making process with particular emphasis on dams, reservoirs, irrigation and road projects. Example of countries that have statutory E.I.A requirements apart from the U.S.A., are Canada, the United Kingdom, applied in any political or ecological zone, it is important to identify the sensitive environmental, political, technological and socio-economic factors or circumstances on the basis

of which appropriate philosophy, procedure and institutional framework for E.I.A can be developed.

CONCLUSION

From the fore-going, it is apparent that a number of scientific and behavioral approaches have been used in the quest for good environmental quality and resources conservation. Today, the E.I.A process is the most preferred, but most other approaches are still being used to supplement the E.I.A and environmental auditing process.

LECTURE 3

ENVIRONMENTAL IMPACT ASSESSMENT (E.I.A) – METHODS AND APPLICATIONS

Introduction

Since the initial spate of methods and techniques published in the USA after the USNEPA Act (1970) was enacted, a new series have emerged, some of which are refinements of existing methods, while others take different approaches. Consequently, in Environmental Impact Assessment (E.I.A), most are referred to variously as “techniques”, “methods”, or “methodologies”. In this paper, the term E.I.A “method”, is being adopted.

Definition

Methods in the E.I.A context, according to Canter, (1986), are simply mechanisms whereby information is collected, evaluated and displayed for the purpose of decision-making. Techniques provide some of the data which are organized according to the logic of a particular method.

Plan of the Paper

The paper consists of three main parts. Part One is an overview of E.I.A activities or tasks, while the next section discusses some methods for carrying out such tasks. The final part is the conclusion.

Overview of Types of E.I.A Tasks or Activities

In most E.I.A studies, methods have been developed for each or a combination of the following tasks or activities:

(i) Scoping;

(ii) Impact Identification;

(iii) Impact Prediction;

(iv) Impact Evaluation

Each of these activities are briefly explained before the methods used to determine theme are discussed.

Scoping

Scoping can be defined as a very early exercise in an E.I.A in which an attempt is made to identify the attributes or components of the environment for which there is public (including professional) concerns and upon the E.I.A should be focused (See Beanlands and Duinker, 1983).

Impact Identification

This is usually done at the early stage of an E.I.A study. Knowledge about the various types of changes and impacts which could occur can be used to identify potential impacts for new projects or activities. Impacts can be both beneficial as well as adverse.

Impact Prediction

This is the most technical of all E.I.A activities in view of the need for accuracy. Generally, prediction of most project impacts can be based on the following:

(a) A qualitative approach which relies on general knowledge of the impacts of similar projects or specific results of comprehensive studies of similar projects.

(b) A quantitative approach based on the use of simple mass balance and environmental dilution calculations; and

(c) A quantitative approach based on the use of mathematical or conceptional models for multiple environmental factors (See Canter, 1986). Usually, combinations of the three are used. It is important that impact prediction be well focused. Thus, the following questions must be answered.

(a) what variable is to be subject to impact?

(b) what is the magnitude of that impact (for example) number of people to be re-settled).

(c) what is the geographical extent of the impact?

(d) what is the time scale of the impact?

Again, any serious prediction should be accompanied by information on the following issues:

(a) what is the probability of the impact occurring?

(b) What is the significance of the impact?

(c) How much certainty or confidence may be placed in the prediction, based upon the quality and quantity of environmental information used to formulate the prediction?

Impact Evaluation

Impact evaluation is simply the interpretation of the predicted impacts. Decisions based on this activity include whether or not to approve a proposed a project, whether or not to prepare an environmental impact statement, and the necessity for identification and inclusion of mitigation measures.

Apart from rigorous analytical methods, sound professional judgement is perhaps the key to good impact evaluation. Table 1 provides a summary of the common methods used for E.I.A studies.

An Overview of Impact Assessment Methods

Checklists

Checklists are usually lists of environmental and socio-economic factors which may be affected by specific types of projects or actions (e.g. dam and oil pipeline construction). Some development actions such as "land clearing", "Excavation", which may give rise to impacts are included. Schaeman (1976) and the U.S. department of Housing are Urban Development (1975), developed the early versions of checklists. An example of a simple checklist is shown in Appendix I.

In 1981, the U.S. Agency for International Development (USAID) developed the questionnaire checklist. The method was designed for the assessment of rural development projects in developing countries. The questions constitute rough impact measures for all relevant environmental variables. The features of a proposed project are reviewed in terms of these questions and a decision is made concerning whether the project could possibly have significant environmental impacts.

The generic categories covered in the USAID questionnaire checklist are:

(i) Disease vectors;

(ii) Terrestrial ecosystem;

(iii) Aquatic ecosystem;

Table 1: LIST OF SOME E.I.A METHODS

Activity	Methods
1. Description of Proposed Action	Qualitative and Descriptive
2. Identification of potential	Checklists (e.g. simple list of parameters, descriptive,

impact	scaled- checklists and weighted checklist) Matrices (e.g. Leopold matrix) Networks (e.g. Sorensen's network) Cross-impact matrices (e.g. Ross) Map overlays (e.g. McHarg) Opinion Surveys Public Meetings and other participatory techniques
3. Prediction	Trend extrapolation Delphi Metaphors, Simulations and analogies Scenario writing Modeling
4. Evaluation	Trade-off Analysis Sensitivity Analysis Subjective impact ranking Ranking Procedures for alternatives within each impact category. Weighting procedures (e.g. Battlelle's Environmental Evaluation System). Risk assessment).
5. Organization and Presentation	Graphs, tables, Write-ups, and other audio visuals.

Source: Olokesusi, Femi (1992) “Framework for Environmental Impact Assessment in Nigeria; Case Study of Large-Scale Irrigation Projects in the Sudano-Sahelian Zone”. Unpublished Thesis submitted to the University of Ibadan, Ibadan.

(iv) Public Health;

(v) Economic; and

(vi) Social (see Appendix II)

Lecture 4

LIMITATIONS AND APPLICATIONS OF E.I.A IN NIGERIA

Introduction

Since the introduction of E.I.A, the socio-economic, cultural and technological bias of E.I.A methodology adopted each country that has adopted the E.I.A process has become apparent. In view of this, it is considered necessary to outline an E.I.A methodology that is appropriate for the Nigerian environment. The main features of

(a) the poor technological base;

(b) low level of socio-economic development;

(c) poor and largely illiterate rural populations;

(d) elitist approach to development planning; and

(e) diverse social and cultural attributes and organizations.

In view of these, we suggest the following stages or aspects for appropriate E.I.A methodology in Nigeria:

1. Authorization to proceed with E.I.A study
2. Reconnaissance visit and survey
3. Field and survey investigation
4. Data analysis
5. Impact projection
6. Impact prediction and evaluation
7. Environmental impact statement review
8. Decision making
9. Enforcement and monitoring
10. Post – construction auditing

11. Right of appeal

Authorization to proceed with E.I.A Study

A project proponent must be required by law to tender a letter of intent to the Division of Environmental Impact assessment together with the details of the proposed project. Procedurally, when project is not expected to be subject to either E.I.A or screening, the proposal ought to be sent to the relevant E.I.A for approval (see Figure 1). On the other hand, if the project brief is not quite explicit or the project is suspected as a possible source of environmental and human problems, then it ought to be subjected to the screening process. If after the screening process no detailed assessment is required, the proposal ought to be sent to the relevant DEIA for approval.

If the project, after screening requires a full assessment by its nature and scope, then the process outlined shall be applied, after which the project EIS shall be reviewed in public by a review Panel. A maximum of 30 days is suggested for a decision to be made public in respect of a project subjected to the screening process, while 60 days is suggested for projects requiring full EIS.

The authorization to conduct an E.I.A and prepare a report would have to be sent to the project proponent by the Federal or State Division of Environmental Impact assessment on receipt of this notice, the project proponent would form an E.I.A study team made up of both in-house staff and hired consultants. Therefore, this study team ought to contact the appropriate Federal, State and Local Government authorities and private sector organizations to collect relevant base maps of study area(s), the Guide book on E.I.A, and other secondary data such as reports of E.I.A on similar studies done elsewhere. The study team would then have to formulate a workplan.

It is expected that the study team for an E.I.A would include qualified and experienced persons on the fields of Geography, Economics, Urban and Regional Planning, Engineering, Geology,

Agriculture, Anthropology, Mass Communication, Computer Science, Bio-Chemical and Physical Sciences and Public Health.

Reconnaissance Visit and Survey

It should be mandatory that the study team visit the proposed project area(s) and meet with the community leaders, representatives of socio-cultural groups, Town Planning Authority Staff, State and Federal Environmental Protection Agency Staff, State and Local Government staff, and members of the public. During such meetings, the E.I.A project team leader is expected to discuss the following among others:

(a) Purpose of the team's visit;

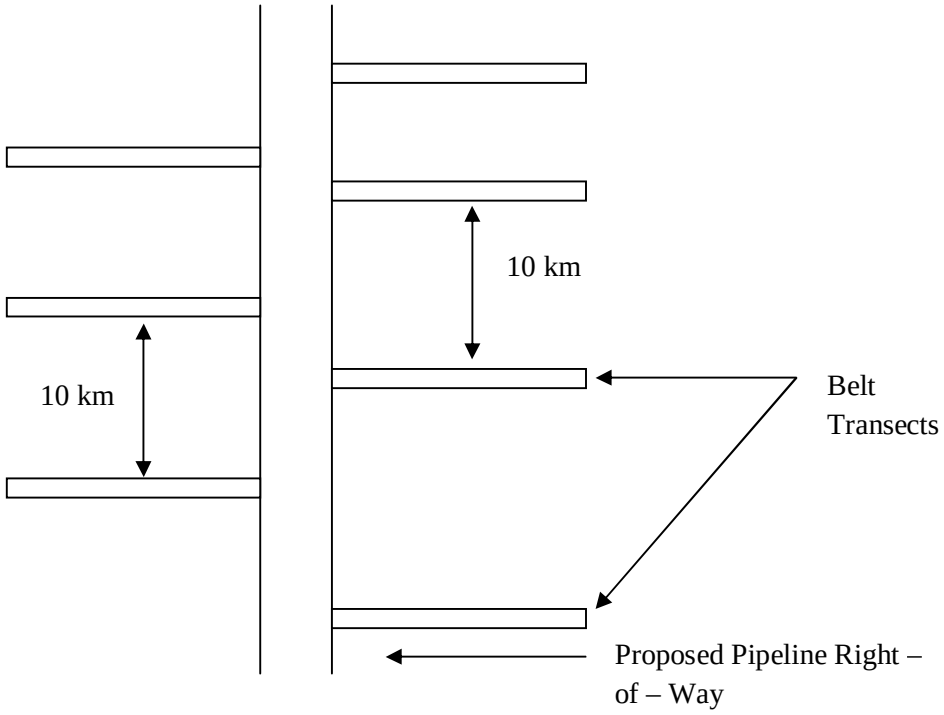
(b) Highlights of the proposed project (e.g. purpose, land required and displacement of persons, etc.);

(c) Outline of study process;

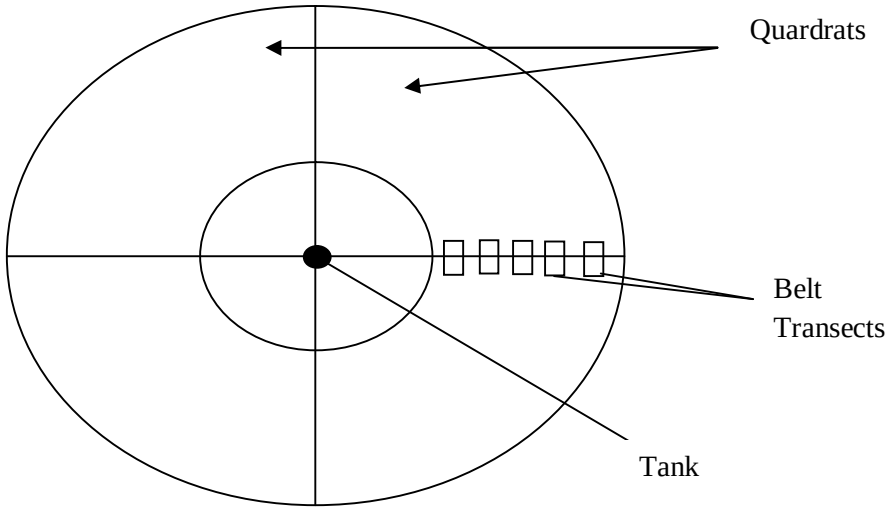
(d) Permission to carry out the study, especially questionnaire survey and field investigations;

(e) Modalities for involving community members in item (d) above including review of the study's report and other decision-making and project activities. A notable example is the formation of the Community Project Advisory Committee.

Figure 1. Sampling Procedure For Vegetation Studies



(a) Along The Corridor



(b) Around The Tank Depots

A project office would have to be opened in each proposed project area.

Field and Site Investigations

The operations to be carried out by the study team with the active collaboration of the Advisory committee are two-fold:

1. Questionnaire administration; and
2. Technical field investigations.

Ideally, all residents ought to respond to the survey questionnaires, but this is only feasible in very small communities. Therefore, a sample of suitable size from the total population is suggested. The questionnaire should elicit information on the following among others:

a. Demographic characteristics;
b. Social status;
c. Membership of socio-cultural groups and social organizations;
d. Perceived local problems, needs and general concerns;
e. Infrastructure;
f. Land ownership and land rights;
g. Existing land uses;
h. Transportation;
i. Economic activities;
j. Existing laws and standards relevant to study;
k. Expectations in respect of proposed projects;
l. Aspects of the proposed project that are satisfactory / not satisfactory to them;
m. Possible areas of involvement in project; and
n. Other issues.

Simultaneously, while the questionnaire administration is in progress, we expect the field investigation of environmental conditions to be executed. Such investigations ought to cover resources like land, water, air, flora and fauna as well as climatic and geological attributes of the project area. The objective should be to establish baseline data and information for future monitoring of the environmental impacts of the proposed project, apart from the prediction of the project's impact.

Data Analysis

The data collected by the survey questionnaire ought to be analyzed preferable in the format described in one of the preceding lectures. In other words, the data collected ought to be weighed and categorized accordingly, and a list of concerns prepared. Whatever weights are obtained from the weighting process need to be supplemented with expert knowledge especially based on technical data collected through direct measurements in the field. The results of the field investigations need to be presented in a simple non-too-technical manner, as members of the general public must be able to have access to the E.I.A report and pass comments.

Impact Project

Having carried out the initial analyses of the questionnaire and field investigations, the study team would then project the socio-economic resources needed or expected changes and the bio-physical changes expected to result from the implementation of the project; for impact prediction and evaluation purposes.

Mathematical models, Delphi technique and other appropriate techniques could be used for projecting these changes among others:

a. Total population (for villages, towns and Local Government Areas, and by age and gender);
b. Economic factors such as business or trade volume, employment by type, personal income;
c. Infrastructural demands for housing, water, roads, schools, and postal facilities;
d. Land required in hectares by type and period;
e. Health care facilities and disease by type;
f. Public costs and revenues by type and net fiscal balances by area;
g. Siltation and eutrophication rates;
h. Loss of fauna and flora;
i. Loss of environmental quality as measured by changes in quality of solid waste and air pollutants generated among others; and
j. Non-technical considerations. However, such considerations should be weighty enough to justify the medication.

The Environmental Impact Statement and Review Process

The report that would emanate from the above activities is the Environmental Impact Statement (EIS). It should be pointed out that if five alternative sites are being contemplated, all the activities reported in this section must be carried out for each site and the total scores of the 5 prospective sites must be compared, along with qualitative descriptions.

The EIS is then subjected to a review process (see Figure 1) by an EIS Review Panel. An EIS Review panel is a body of experts formed as and when necessary, to review the environmental and human impacts of a specific project and its alternative and to evaluate the

significance of the impacts that might result from implementing the project. The E.I.A Division of the Federal Environmental Protection Agency or the State Environmental Protection Commission concerned would have to nominate members of the panel and provide all logistical and other support services. Panel members should be drawn from the Division of E.I.A concerned, Community Project Advisory Committee, Local Town Planning Authority, Socio-cultural Organisations, labour organizations, and technical experts. The review should be carried out based on specific terms of reference issued to the review panel by the DEIA. Legal representation by any affected body or individual is also preferred.

Decision-Making

At the end of the review process, a detailed report is expected to be prepared by the Review panel and submitted to the Approving Authority for decision. There could be four types of decisions, namely:

a. Proceed without modification to proposal;
b. Proceed with some modification to proposal and subject to certain conditions being met;
c. EIS not satisfactory, hence a new EIS is required for more information; and
d. Do not proceed.

In respect of projects for which further information is required, a new E.I.A study is expected to be completed and its statement submitted for another review. For those projects that are approved and constructed (or implemented), they ought o be subjected to regular periodic monitoring and auditing. The view of the affected people in the project area must be sought at each monitoring and auditing exercise.

Enforcement and Monitoring

Legal backing is required to make E.I.A mandatory for certain projects, as suggested later in this chapter. The Federal and / or State DEIA should work out the modalities for the enforcement of the legal provisions for E.I.A. However, assistance from other government agencies, non-governmental agencies and the general public is required to complement their efforts.

Also, project managers ought to be required to forward periodic monitoring data to the Environmental Protection Agencies for auditing purposes.

Post-Project Construction / Implementation Auditing

This is a process that should provide systematic, periodic and objective evaluation of how well human and environmental organization and equipment are performing. This is with a view to realizing the project goals and objectives as well as assessing compliance with mitigation measures for adverse human and environmental impacts.

The E.I.A as well as the project management, the Community Project Advisory Committee, socio-cultural organizations and the public ought to be involved.

Auditing is quite important to the weighting process and methodology developed in this study. This is because of its utility in improving the predictive ability of E.I.A techniques and methods and in increasing knowledge on the effects of particular development types in specific environmental settings.

Rights of Appeal against an E.I.A Decision

Under the expected E.I.A legislation, reasons for all decisions taken must be provided in writing and parties should have statutory right to abduce evidence and cross-examine witnesses.

Failure to abide by well-established rules of natural justice should subject FEPA or its state counterparts to the judicial review proceedings before a High Court of Law in the country.

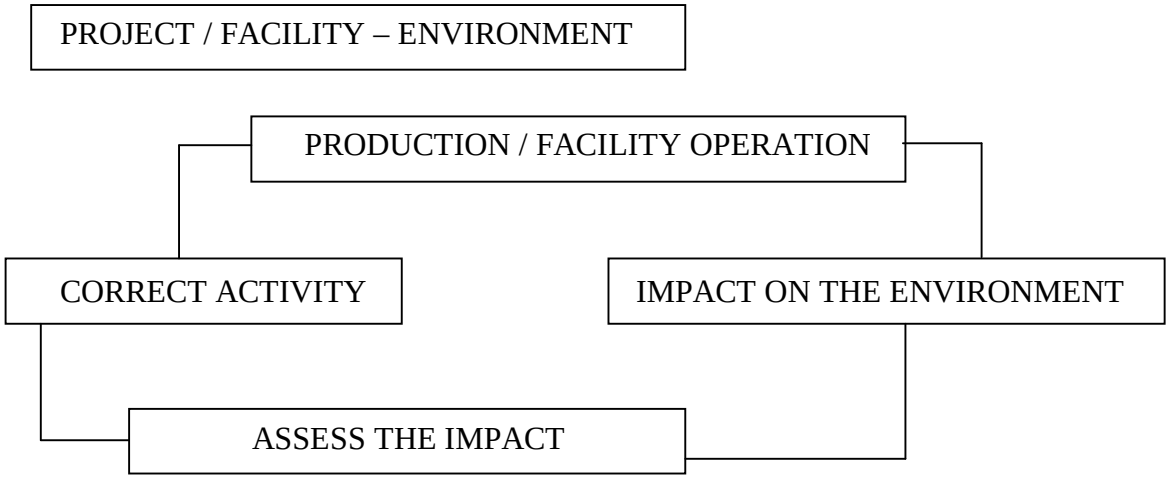
LECTURE 5

AN APPROACH TO ENVIRONMENTAL AUDITING

Introduction and Objectives of Environmental Auditing

In E.I.A parlance, environmental "audit" is usually referred to as an account of the environmental consequences of operational developments. That is "after-the-fact" evaluation (see Figure 1). The data set used for audits are derived from monitoring programmes, and are used to identify and evaluate the effects of a project on the human and natural environments.

Fig. 1: ENVIRONMENTAL AUDITING SCHEME



The major value of auditing is as a management tool, which provides timely information on environmental performance in relation to goals and objectives. Also auditing provides independent verification that production/project systems are in place, to ensure continued compliance with the legislation(s) in force.

i. Provides timely information on environmental performance in relation to goals and objectives.

ii. Provides independent verification that project is in place to ensure continued compliance with the legislation(s) in force.

A related advantage is reduced exposure to litigation and regulatory risk. Furthermore, environmental auditing has the following equally important benefits:

- Increasing awareness of environmental policies and responsibilities;
- Providing an opportunity for management to give credit for good environmental performance;
- Identifying potential cost savings, for example those which might arise from waste minimization;
- Providing an opportunity to determine the accuracy of E.I.A predictions earlier made;
- Providing an up-to-date environmental data base, which can be drawn on when making decisions in relation to plant/project modifications, etc. or for use in emergencies;
- Evaluating training programme and providing information for use in training staff.

Overview of the Approach

It must be emphasized that the requirements for environmental auditing could vary from one company/agency to another, depending on factors such as location, size, number, resources, type of employee and legislative requirements. Consequently, the basic principles and the general approach are common to all situations, the description of which follows:

- Developing an understanding of the plant's internal management systems and controls;
- Assessing the strengths and weaknesses of project;
- Gathering audit evidence through assessment and verification;
- Evaluating audit findings;

- Discussing findings with facility management;
- Preparing audit findings for the close out meeting;
- Preparing the draft audit report followed by the final version;
- Completing the action plan (by the audited facility); and
- Ensuring that the action plan has been implemented. This is accomplished by the Corporate Environmental Services Staff including the Manager regular and special visits to plant (see Figure 2)

Of vital importance to the audit process is the preparation of an audit process, response plans and the follow-up activities described in Figure 3.

The preparation and implementation of the action plan are essential for an effective audit programme.

Audit Types

International experience has shown the existence of about seven distinct types of environmental audit. These include the external environment, occupational health, industrial hygiene, emergency response, acquisition, divestiture and closure.

Audit Team

Under normal circumstances the audit team should consist of the following at the minimum:

(a) A production/project manager or a site manager from a similar site (as Team Leader);

(b) A qualified environmental health specialist (as experienced system Auditor and team Secretary);

(c) An Environmental and Safety Manager either from within and/or a similar site;

(d) A bio-chemical specialist;

(e) An Environmental Engineer having special knowledge of the operations under consideration;

(f) A Sociologist or Town Planner having special knowledge of the plant/project location and the citizenry.

Other e.g. FEPA staff or Staff from its state counterpart, could be invited to join the team, depending on available resources. It is quite important to invite experts from outside, to participate in the auditing process. This gives a good measure of legitimacy to the report thereafter produced.

Figure 2
BASIC STEPS OF AN ENVIRONMENTAL AUDIT

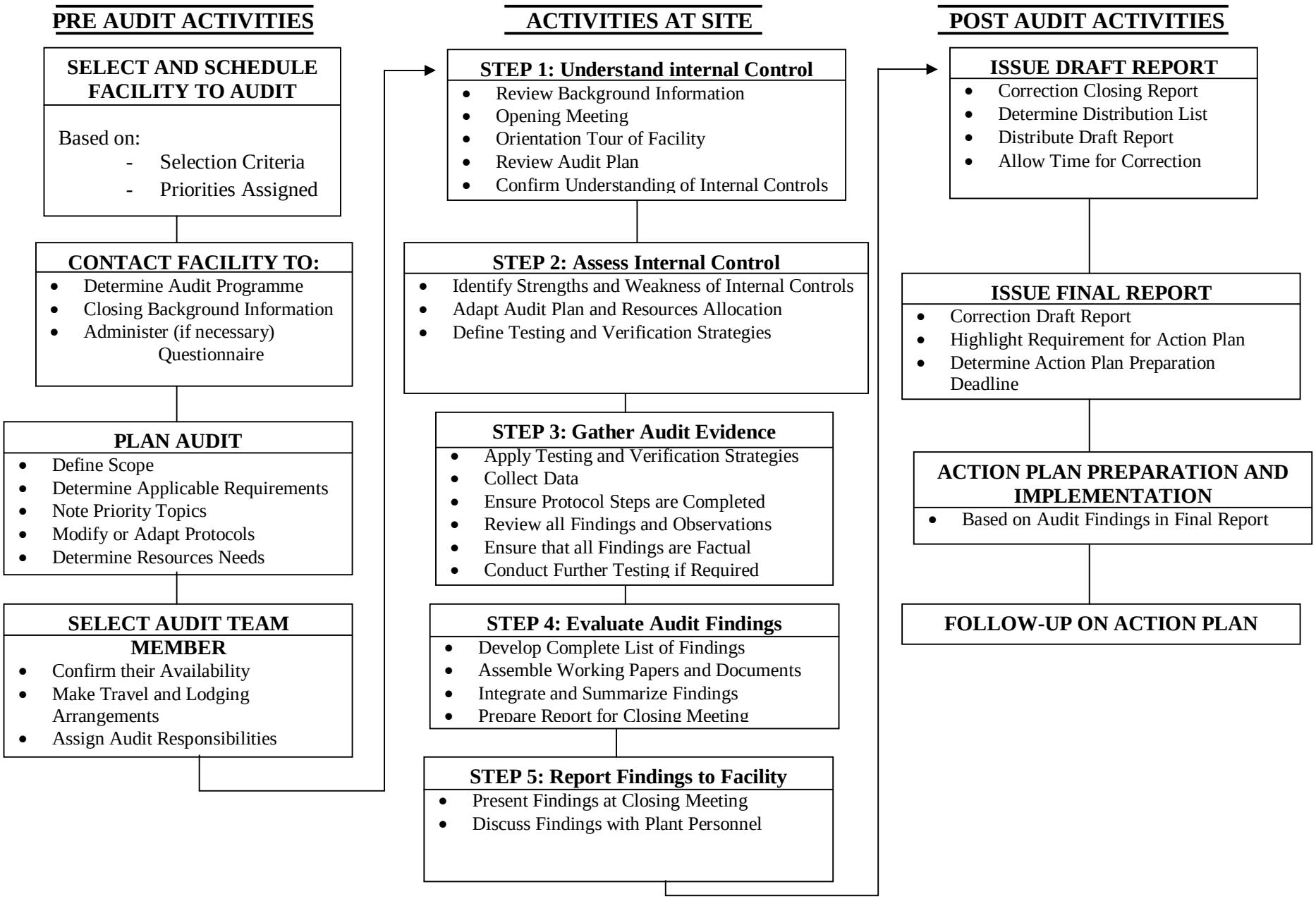
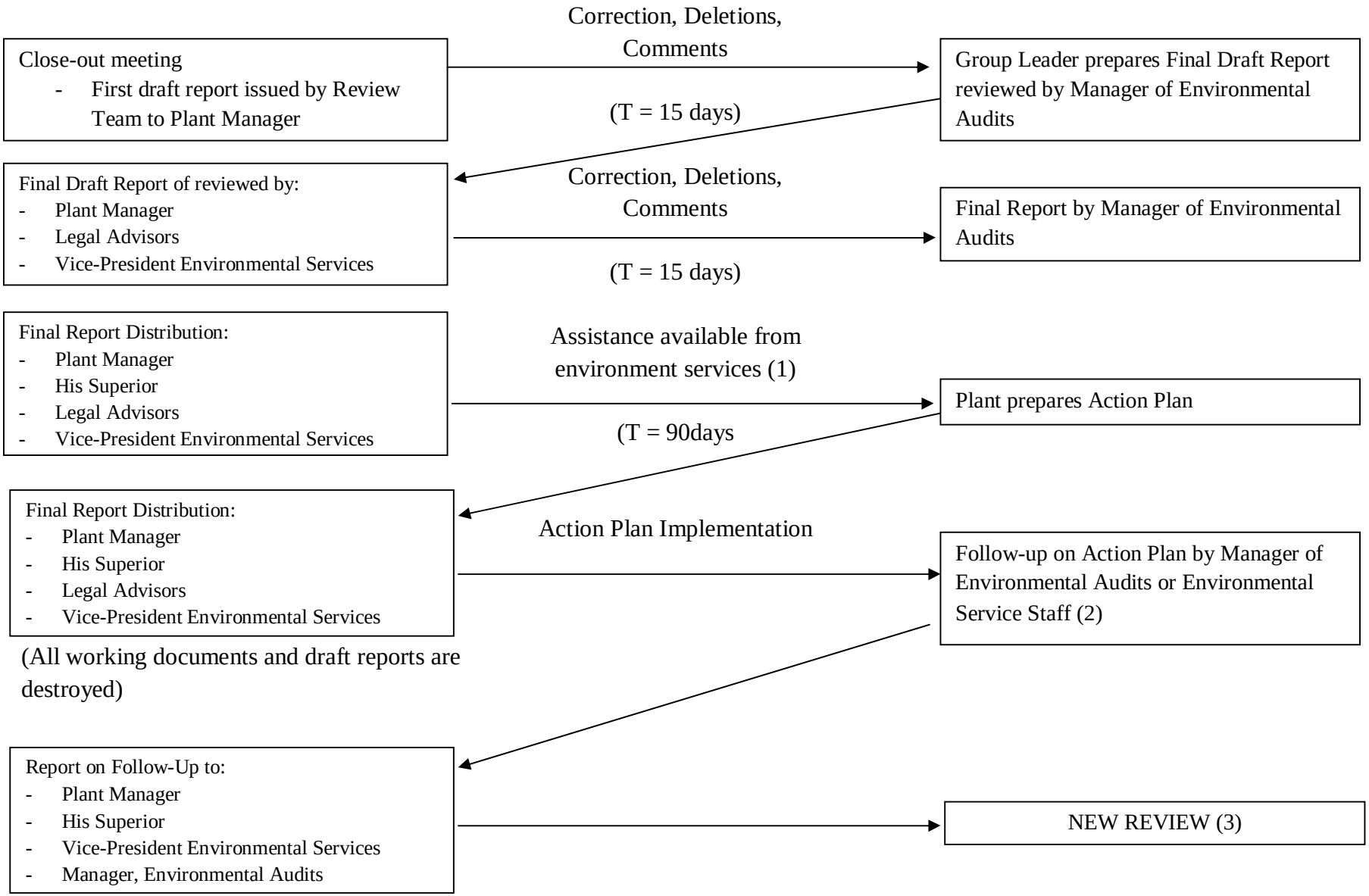


Figure 3
POST REVIEW ACTIVITIES



Scheduling of Audits

While there is no generally agreed time frame for audit scheduling, it is not out of place to suggest an audit exercise once in 3 -4 years. However, certain factors could lead to an increase in frequency of auditing. Such factors include

- new or modified legislation;
- the size of the facility;
- the processes carried out and the characteristics of the chemicals and raw materials used and the volumes stored.
- the employee exposure to in-plant chemicals and process by products.
- the emission effluent and waste volumes and characteristics;
- the sensitivity of the environment surrounding the facility;
- the nature of the receiving environment; and
- the proximity of public residences to the plant.

Conclusion

As part of its mandate, the Federal Environmental Protection Agency has been carrying out some form of environmental audits of industrial establishments. It has been suggested by FEPA that auditing should be schedules agree to between it and the project management.

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