NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: ESM 431

COURSE TITLE: ENVIRONMENTAL HEALTH AND SAFETY

MAIN COURSE

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MODULE 1 ENVIRONMENTAL MANAGEMENT

UNIT 1 OUR PLANET

CONTENTS

1.0 INTRODUCTION

In order to have an understanding of the concept of environmental health, one must understand: what the environment is, which normal processes occur in the environment, how man affects his environment and how the various effects of all the activities of man on his environment ultimately affect him.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the concept environment
- explain some of the natural processes that keep the earth stable
- enumerate some of the activities of man currently degrading the planet.

3.0 MAIN CONTENT

3.1 Natural Processes that Keep the Earth Stable

Most people think the environment is something "out there" that doesn't affect them. The environment is where we live and consists of all the living and non-living things around us.

Pruss-Ustun and Corvalan define the environment as all the physical, chemical and biological factors external to a person, and all the related behaviours. The non-living (physical) part of the environment includes air, water, soil, minerals and climatic factors such as temperature and humidity. The living part consists of all micro-organisms, plants and animals (man inclusive). Everything we need to live is ultimately provided by our planet and its natural life support systems. If the environment is unable to provide those life support services, then man will suffer.

3.2 Some Benefits of the Environment to Human Health

1. Stable climate - A stable and comfortable climate is essential for human development

2. Protection from ultra-violet radiation: Our atmosphere, specifically the ozone layer, protects life against the most harmful ultraviolet light from the sun. Ultraviolet light can damage DNA in plants and animals. It is a cause of skin cancers, crop damage and can harm sea creatures.

3. Provision of fresh water - All the water we have on the earth now is all the water we have ever had. Most of the earth's water is in the oceans (97%) or locked away as ice. Freshwater is mostly stored underground as groundwater (0.6%) and a very small proportion (0.01%) is in lakes, streams and rivers. Nature provides fresh water continuously, as rain or snow, as melt-water from glaciers, and by releasing clear filtered water from springs. We tap into natural underground reservoirs of water which have been filtered through porous rocks when we get water from wells.

4. Provision of breath-able air - Wind disperses pollution. Rain washes pollutants out of the air. Plants can trap and filter out pollutants. When plants photosynthesis (make sugar from carbon dioxide and water) they release oxygen. All of these help to ensure that animals of all kinds can breathe clean and fresh air.

5. Food webs - Food webs are the complex inter-relations of plants and animals which rely on each other for food. The start of it all is photosynthesis. Green algae and plants create their own stored food by using the energy from sunlight to turn carbon dioxide and water into simple sugars. This is the basis of every live on the planet, as animals eat the plants or each other, and living organisms eat other dead organisms.

6. Fertile soils - In most land-based food webs, plants also need fertile soil, which is provided through the weathering of rocks, the rotting of dead organisms, and the presence of microscopic living organisms which bind the soil together.

7. Food - We depend on nature for our food. There are about 270,000 plant species yet only 7,000 (less than 1%) have been used for food by humans.

8. Fuel - We use a lot of fuel including hydrocarbons e.g. coal, gas and oil as sources of energy. These sources are not renewable. Other sources of energy include wind and sunlight which are renewable.

9. Raw materials - We use raw materials for building, clothing, tools, equipment, dyes and books.

10. Medicines - Plants and animals also provide us with medicines such as birth control drugs, antibiotics, cancer drugs, cardiac drugs, anti-malaria and analgesics.

11. Water recycling, disposal and clean up - Natural cycles such as the carbon cycle, water cycle, nitrogen cycle and phosphorus cycle play a part in neutralising and filtering waste and pollution. Over time natural substances broke down, are digested or eaten by micro-organisms, worked on by water or light, rotted and absorbed in the planet cycles which move carbon, water and many other materials around.

12. Soil - Soil is crucial to agriculture, the production of many raw materials (from plants and animals) and to the food webs which keep so many of the planet cycles functioning. Soil also plays an important role in storing water and slowing down the speed with which it flows back to the sea.

13. Biodiversity - The Convention for Biodiversity (CBD) (1992) defines biological diversity or biodiversity as the term given to the variety of life on earth and the natural patterns it forms. The biodiversity seen on earth today is the result of billions of years of evolution, natural processes and, increasingly, human influence. It forms the web of life of which we are part and which we fully depend on. Thus, individual species and varieties provide us with resources: food, raw materials and medicines.

3.3 Man's Effect on his Environment

Man has however had an effect which has degraded the environment and is affecting his own health.

1. Climate

One major way in which man impacts the climate is through adding greenhouse gases to the atmosphere. The greenhouse effect is a natural phenomenon, keeping the Earth warm and helping to support life. We are adding greenhouse gases such as carbon dioxide released when fossil fuels are burnt for energy, methane (formed when plant and animal remains rot without oxygen being present – in rice fields, the stomachs of cows, rubbish dumps etc, water vapour**,** chlorofluorocarbons(CFCs), halogenated fluorocarbons (HFCs) and other 'halogenated' gases (used as solvents, in dry cleaning, as refrigerants, in car air-conditioning systems, as insulators in electrical applications), nitrous oxide (also formed when fossil fuels are burnt, e.g. by cars), ground-level ozone (a by-product formed when other types of air pollution react with sunlight).

This has resulted in more heat being trapped and the warming of the Earth. Apart from adding more greenhouse gases to the atmosphere, we are making it harder for nature's cycles to remove them. Carbon dioxide is used by plants and when the plants die and decompose, it can be stored in the soil. Forests are being cut down and soils farmed so hard that they cannot store as much carbon. This is leading to a wide variety of changes in the climate, including more extreme weather like droughts, floods, and severe storms. We are also impacting on the climate by cutting down forests – which changes the pattern of rainfall.

Essential climatic terms

a. Global warming

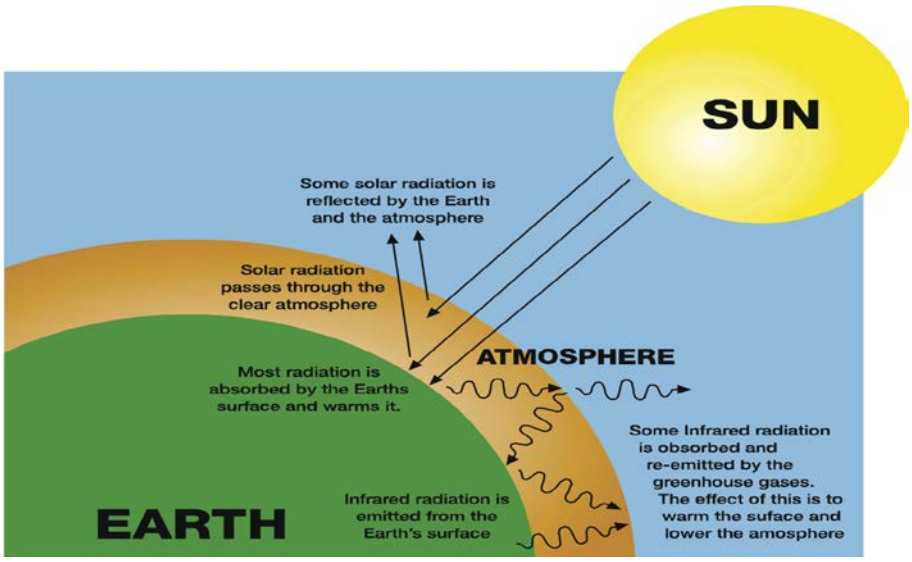

Fig. 1.1: Effect of Solar Radiation on the Earth
Source: IEMA Environmental awareness trainers Manual

The increased greenhouse gases in the atmosphere caused by man's activities, causes more heat to be trapped on the Earth. This is causing overall temperatures to rise. The average surface temperature has increased by between 0.3 and 0.7 ºC over the last century. The Earth is warming faster than at any time in the past 10,000 years resulting in a retreat of snow cover, glaciers and ice sheets, a 40% drop in the amount of Arctic ice since the 1970s and a thawing of the whole western Siberian sub-Arctic region for the first time since its formation, 11,000 years ago.

b. Climate change

The Earth is warming, and as a result the climate and sea levels are changing. What the weather will be like in the future is hard to predict, but it is likely to be more extreme (with more frequent severe storms, flash floods, heat waves and droughts, tsunamis, reactivation of volcanoes). The pattern of temperature and rain around the world will shift and people will need to adapt to different agriculture, and different ways of living their lives. Plants and animals will also be affected, migrating at different times of the year, to places which no longer have the same weather they would have expected.

c. Protection from radiation

The ozone layer has been severely damaged and has become very thin over some parts of the planet. The cause is the release of man-made chemicals like Chloro-Flouro-Carbons (CFCs), Halogenated Flouro Carbons (HFCs) and other 'halogenated' chemicals, which drift up to the upper atmosphere and destroy the ozone layer.

2. Fresh water

Man is polluting lakes, rivers and the underground natural reservoirs known as ground water. Once polluted, it is extremely hard to clean up. Secondly, we are diverting and using water often in a very wasteful way smaking it unavailable downstream, where it would otherwise have been expected. Thirdly, we are draining marshes, cutting down forests and stopping rivers from using natural flood plains. This means that water passes through an area much faster than it would have done previously, rather than being stored up and gradually emerging later in the season.

3. Breathable air

Man is polluting the air and creating pollutants which do not occur naturally. In cities, levels of air pollution often go above safe levels. Even in the countryside, where pollution ought to be low; high levels of pollution is still found as pollutants from fumes, exhausts and other human activities are carried by the wind from the cities to the countryside.

4. Food webs

The physical destruction of habitats (forests, lakes and so on) adversely affects other creatures which depend on those habitats for food or shelter. As such, creatures which depend on them for food suffer. Logging, draining, building, mining, quarrying and plowing for farming are some of the ways that we disrupt food webs.

5. Fertile soils

By taking away the covering and protection provided by plants, soil is left uncovered and can be washed or blown away. If the plants which grow in an area are removed each year, then the soil can become poor and thin, as the nutrients and organic matter are not replaced. The microscopic life of the soil is reduced, and the soil becomes less fertile and prone to erosion.

6. Food

Although 7,000 species of plants have been used for food by humans over our history, today we use fewer than 20 species for most of our food. This makes our own food supplies very vulnerable to changes - because of the lack of variety - if there is a big problem with one source of food, we have very few species to fall back on. On the other hand, rural communities in more than 60 countries get much of their protein from wild animal meat and fish. This makes them vulnerable if that source of protein shrinks, because of the reasons above.

The most important wild source of protein, globally, is fish. Nearly 70% of the world's fish stocks are fished at dangerously high levels that is, more fish are taken out each year than are replaced by natural reproduction and growth, and fish are increasingly being caught before they are mature, so stocks will be even lower in future years.

7. Fuel wood

When people depend on wood as a source of fuel, use it at a faster rate than can be replaced, and in a way which damages the forest as a whole, it means that the supply of fuel wood gets smaller over time.

8. Raw materials

When plants and animals are consumed at a faster rate than can be reproduced, then the overall stock of materials goes down. In addition, the ecosystems (food webs and habitats) which they are part of get damaged. We have a tendency to use both raw and processed minerals very wastefully; throwing them away into rubbish dumps, rather than reusing, repairing or recycling them.

9. Medicines

We get a lot of our medicines from plants and animals. We might be missing out on more, for example by destroying rainforests and the plants and animals which live there, before we fully understand what other useful medicines we might get from them.

10. Waste recycling and disposal

Nature can absorb and process our natural waste products - food waste and other plant and animal wastes can be decomposed, used as fertiliser or as food by other animals. But if there is too much of it at any one time or in any one place, nature's systems are overwhelmed. Too much sewage spread on land or draining into rivers can upset the balance, and certain types of algae rapidly increase, suffocating or poisoning other plants and animals. Too much carbon dioxide being released to the atmosphere means that nature's systems cannot reabsorb it all, and the greenhouse effect becomes greater. Some kinds of wastes cannot be processed by natural systems, this leads to their build-up to a level whereby they poison animals or stop them from reproducing. These include chemicals like DDT (a pesticide) and PCBs (used as flame retardants and in electrical equipment), which are now banned.

11. Population

At the turn of this century, the population of the world was put at about 6 billion, presently, it is 7 billion. By the middle of this century it is estimated there will be almost 10 billion people utilising the world's resources.

Table 1.1: World Population Trends

World population trends	
Year	Total world population
Pre-history - settled agriculture, c50,000 BC	10 million
AD1	300 million
1974	4 billion
1995	5.7 billion
1998	6 billion
2025	8.3 billion (UN median projection)
2050	9 - 9.8 billion

Source: United Nations World Population Prospects

4.0 CONCLUSION

We can see that a lot of the resources of nature are not renewable, and even when they are, not as fast as man is utilising these resources. Thus in order to safeguard the future of present and future generations, man will have to review his activities or risk destroying the earth.

5.0 SUMMARY

The environment is where we live and consists of all the living and non-living things around us. Some natural processes keep the earth stable by ensuring a stable climate, availability of fresh water, soil, provision of food, biodiversity, raw materials, medicine, clean up and disposal. These processes involve cycles like the carbon, nitrogen, phosphorus and water cycles with integral processes such as photosynthesis, respiration, phagocytosis. Man's activities are currently destabilising the earth, resulting in climate change and global warming and depleting the earth of resources such as soil, biodiversity, raw materials and fresh water.

6.0 TUTOR-MARKED ASSIGNMENT

i. What is meant by the term "environment"?
ii. Discuss five ways by which nature keeps the environment stable and the negative impact of man's activities have on them.

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UNIT 2 NEED FOR ENVIRONMENTAL SUSTAINABILITY

CONTENTS

1.0 INTRODUCTION

We have seen in the previous unit that there is a need for man to review his present activities in order to ensure the earth is preserved for present and future generations. Thus while man tries to meet his needs today he should do so in a way that the planet can go on providing for the needs of future generations.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the reasons for environmental sustainability

- enumerate measures within your home or work place which will encourage environmental sustainability.

3.0 MAIN CONTENT

3.1 What are we doing to Nature?

It has been observed that the needs of large proportion of the present generations are not met as shown by the following facts:

1. One and half billion people in developing countries having no access to clean water
2. Nearly 11million young children dying each year from preventable illnesses
3. Increasing death rates in sub-Saharan Africa
4. High under 5 mortality rates
5. High rates of adult and childhood illiteracy.

Man is also not staying within the planet's environmental limit so as to be able to provide for future generations. Ecological studies have shown that given the state of the environment, and the number of people on the planet, a sustainable footprint should be 1.8 global hectares per person. But the actual average footprint is 2.2 global hectares with7.3 million hectares of forest being lost without being replaced each year, and half of the world's wetlands having disappeared during the 20th century. To preserve and conserve the environment for quality human life, the following factors must be considered:

Waste and inequality

One way in which we could help to get back within environmental limits, and ensure more people's basic needs are met, is to be more efficient in how needs are met.

When resources are used wastefully, environmental damage is done, with less good done on the 'benefit' side of the deal. More efficient use of resources means more 'benefit' for less 'damage'. Energy, food, consumer goods, water are wasted particularly in developed countries.

This waste is much less in developing nations where poverty is rampant.

Greenhouse gases build up in the atmosphere as a result of thousands of short and long-terms decisions made by everyone, such as: Where we get our energy?, How much do we use? How much do we waste? What we do with our refuse? How we move around? Where do we buy our needs? Which chemicals do we use to make everyday products as well as specialised industrial products? To ensure that everyone enjoys the best from nature, there are certain things that we should do, at work and at home. These include:

1. Using energy wisely: choose energy-efficient appliances and light bulbs, use manual or hand-operated alternatives, do not leave appliances on stand-by; rather, switch them off.

- Use alternative energy sources such as wind, solar, geo-thermal, biomass and tidal wave.

- Avoid the use of ozone depleting substances and ensure that all appliances especially those using ozone depleting chemicals such as CFCs are disposed of properly. Air conditioning and cooling systems, and fire-extinguishers should be disposed of or maintained safely.

- Use public transport, walk or cycle.

2. Freshwater conservation: We use water for drinking, generating energy, agriculture, harvesting fish and seafood, running machinery, carrying waste, washing, cooking, recreation, gardening, etc. It is important therefore, to conserve water in terms of:

    - quantity - use water more efficiently, use water wisely, do not waste it.

    - quality - reduce water pollution by avoiding disposal of sewage and solid waste in water, don't drop paints, varnish, oil or other polluting substances down the drain.

    - regulate effluents from industries including agricultural industries.

    - regulate the use of artificial fertilisers and encourage the use of organic fertilisers.

3. Guide against air pollution**:** Reduce your use of things which contribute to air pollution: drive less and keep your car well maintained. Use public transport, walk or ride bicycle, avoid flying. Choose paint and other DIY (Do it yourself) products which have low levels of VOCs (volatile organic compounds). Don't burn garden waste and rubbish on a bonfire - recycle or compost it. Buy food and other goods which have been produced locally -this cuts down on the amount of transport.

Food webs and fertile soils, fuel, medicines and raw materials

Choose food and other products which have been produced in a 'sustainable' way such as foods produced using organic fertilizers, where soil is not over cultivated or unsuitable cultivation methods are not used, or where large expanses of forests are not destroyed (deforestation) to make way for mechanised farming.

Biodiversity

Help provide places for wildlife, and rebuild natural soil fertility.

Waste disposal

1. Reduce the amount of waste produced by avoiding unnecessary purchases.

2. Reuse - Give products to other people who may find it useful; donation of second hand clothing, furniture, appliances or find alternative use for the same products.
3. Recycle - Use products as raw materials for a different product such as the use of tyres as playground mats, the use of pure water sachets as raw materials for refuse bags.

Travel
Think twice before making a journey by car or plane. Use public transport, walk or cycle.

3.2 The Need for Environmental Sustainability

Being better informed about environmental matters, and reducing the environmental impact is not just in the long-term interests of the planet. It can bring short-term and direct benefits to all organisations (not just businesses).This is often called the ‘‘business case’’ for environmental improvement. There are cost savings (eco-efficiency) from using things more efficiently thus resulting in reduced wastage, reduced cost of labour and capital requirements, additional streams of income from waste products and reduced costs of disposal of by- products or waste products.

4.0 CONCLUSION

The little measures we take at home, at work, at school, at play all reduce our impact on the environment. These measures include walking instead of taking a bike or a car for short distances, carrying a water bottle around instead of buying drinks in disposable containers. Every little bit helps when put together globally.

5.0 SUMMARY

There is a need for man to review his present activities in order to ensure the earth is preserved for present and future generations. Decisions concerning where we get our energy from and how much we use, how much we waste and what we do with our rubbish, how we get around and where we buy things from, the chemicals used to make everyday products as well as for special industrial uses are important in terms of sustaining the environment.

6.0 TUTOR-MARKED ASSIGNMENT

As a manger in a printing factory situated in your region, explain the possible impact your factory may have on the environment and discuss measures to encourage environmental sustainability.

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UNIT 3 ENVIRONMENTAL LEGISLATION

CONTENTS

1.0 INTRODUCTION

Once it was observed that there was a need to preserve the planet for present and future generations, it became necessary to establish environmental laws and standards by which individuals, organisations or nations could be judged.

Before this, environmental laws had been enmeshed with public health laws, which had evolved over time by experience and common sense. However as man has continued to develop, it became necessary to have laid down guidelines expressly developed to protect the environment.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define environmental legislation
- trace the history of environmental legislation in Nigeria
- list the main agencies involved in legislating for the environment
- discuss the history of international environmental lwith reference to some conventions and protocols.

3.0 MAIN CONTENT

3.1 Environmental Legislation

A law is generally defined as a way of regulating human behaviour.
For the purpose of law, the environment is defined along the terms of its physical components including air, water, space, land, plants and wildlife.
Environmental law/legislation is that law or legislation which relates primarily to the protection of the whole or part of the physical components of the environment (Bell. 1997).

However, laws which relate primarily to the public health or particular groups of individuals such as consumers or workers are covered under public health or occupational health laws.

Regulation of environmental protection can be achieved by the use of regulations.

Regulation is the application of rules and procedures to achieve a measure of control over the activities of individuals and organisations**.**

These regulations may exert

a. Anticipatory controls such as:
   - outright bans (e.g. Ban of CFCs)
   - prohibition unless notified (e.g. use of certain nature reserve)
   - prohibition unless registered (e.g. waste disposal)
   - prohibition without license (e.g. importation of chemicals).

b. Continuing controls –continuous controls of activity such as control of factory premises by agencies such as NESREA, LASEPA, OGEPA.

3.2 Environmental Standards

Effective environmental control requires standards which may be

1. Target standards: These are also called environmental quality standards and are set by reference to particular targets and include:

   - emission standards - standardises what is emitted
   - process standards - standardises a whole or part of processes used
   - product standards - standardises characteristics of the final product.

2. Source standards: These are set by reference to the source involved such as standards for specific companies or industries.

Environmental legislation and policies are enacted to protect the health and safety of the general public from adverse interference with environmental resources arising from human and industrial activities. They prescribe minimum standards and grant statutory approvals/permits. Non-compliance with legislation may attract prosecution, imposition of fines and/or imprisonment.

3.3 Development of Environmental Legislation and Agencies in Nigeria

Prior to 1988, there were no laws in force to regulate industrial pollution or hazardous waste. Existing environmental legislation only focussed on the protection and conservation of economically important natural resources (e.g. Oil Pipeline Act 1956, Forestry Act 1958, Mineral Oil (Safety) Regulations 1963, Oil in Navigable

Waters Act 1968). Generous concessions were granted by Federal and State governments to business promoters to establish industries with little or no attention paid to the pollution generated from their operational activities. The Koko toxic waste incident of 1988, in which barrels of toxic waste were imported by a businessman, and dumped in Koko(Delta State), changed this trend and resulted in the FEPA Decree(now an Act) of 1988 and the creation of FEPA (Federal Environmental Protection Agency).

FEPA

FEPA was created by Decree 58 of 1988 as the overall body charged with the responsibility of protecting the environment in Nigeria in cooperation with federal and state ministries, local governments, statutory bodies.

Its functions include establishing and prescribing national guidelines, criteria and standards for:

a. water quality
b. air quality and atmospheric protection
c. noise levels
d. gaseous emissions and effluent limits
e. ozone protection

The agency was empowered to monitor and control hazardous substances, supervise and enforce compliance.

National Policy on the Environment of 1998

A National Policy on the environment was promulgated in 1998.
The goals of the policy are:

a. secure quality environment adequate for good health and wellbeing of the people
b. conserve & use environmental resources for the benefit of present & future generations
c. restore, maintain and enhance the ecosystem
d. raise public awareness and promote understanding of the environment
e. collaboration with other countries and international agencies on environmental protection

Nigeria's agenda 21

Nigeria's Agenda 21 programme seeks to:

a. integrate environment into development planning at all levels of government and the private sector
b. commence a transition to sustainable development
c. address sectoral priorities, plans, policies and strategies for the major sectors of the economy
d. foster regional and global partnerships

National Environmental Standards and Regulations Enforcement Agency (NESREA)

In 1999 FEPA was scrapped and its functions taken over by the newly created Federal Ministry of Environment. In 2007 the National Assembly established the National Environmental Standards and Regulations Enforcement Agency (NESREA), as a parastatal of the Ministry of Environment. NESREA Act repealed FEPA Act of 1988. NESREA now has the responsibility of enforcing environmental laws, regulations and standards and deterring people, industries and organisations from polluting and degrading the environment.

NESREA's mandate includes the following:

- enforcement of environmental standards, regulations, rules, laws, policies and guidelines protection and development of the environment, biodiversity conservation and sustainable development in Nigeria.

- liaison with relevant stakeholders within and outside Nigeria.

- developing guidelines, regulations and standards on the environment other than in the oil and gas sector.

NESREA has powers to:

- prohibit processes and use of equipment or technology that undermine environmental quality.

- conduct field follow-up of compliance with set standards and take procedures prescribed by law against any violator.

- establish mobile courts to expeditiously dispense cases of violation of environmental regulation.

Other regulatory agencies include:

State EPAs such as OGEPA (Ogun State Environmental Protection Agency), RISEPA (Rivers State Environmental Protection Agency).

Department of Petroleum Resources (DPR) - enforces safety and environmental regulations in the oil & gas industry and ensures that operations conform to national and international industry practices and standards.

Standards Organisation of Nigeria (SON) - implements, audits and certifies ISO 14000 Standards in Nigeria. The ISO 14000 family addresses "Environmental Management". This means what the organisation does to minimise harmful effects on the environment caused by its activities, and to achieve continual improvement of its environmental performance.

3.4 International Environmental Regulation

Following the Stockholm Conference in 1970, many countries established ministries of environment and environmental legislation began to increase. There was also growing recognition that pollution does not respect land borders and pollution from one country crosses to another. In addition phenomena such as the greenhouse effect, global warming were identified. As such, there was a need to develop international environmental legislation. This has resulted in the signing of various treaties under the umbrella of various international organisations such as the United Nations (UN).

The most common treaties called conventions include:

i. UN Law of the Sea (1982)
ii. UN Convention on Biological Diversity (1992)
iii. UN Framework Convention on Climate Change (1992)
iv. UN Convention to Combat Desertification (1994)
v. Vienna Convention for the Protection of the Ozone Layer (1985)
vi. Stockholm Convention on Persistent Organic Pollutants (2001)
vii. Basel Convention on the Trans-Boundary Movement of Hazardous Wastes (1989)
viii. Bamako Convention on the Ban of the Import into Africa and the Control of Tran- Boundary Movement and Management of Hazardous Wastes within Africa (1991)

Subsidiary agreements called protocols include:

i. Montreal Protocol on Substances that deplete the Ozone Layer (1987)
ii. Cartagena Protocol on Bio-safety (2003)
iii. Kyoto Protocol to the Framework Convention on Climate Change (1997, effective 2005)

4.0 CONCLUSION

Environmental legislation is a fairly new and emerging field when compared to other aspects of law. It is still evolving in Nigeria and as such the agencies charged with this function are many and continue to evolve. Despite this, it is important to understand the basis for the environmental laws and the agencies involved, as stiffer penalties are currently being applied for flouting environmental laws or polluting the environment. Furthermore, there is a move to organise an international legal system once the problems associated with the various conventions and protocols are ironed out.

5.0 SUMMARY

Environmental laws/legislations are those laws or legislations which relate primarily to the protection of the whole or part of the physical components of the environment. Regulation is the application of rules and procedures to achieve a measure of control over the activities of individuals and organisations **.**These regulations may exert anticipatory control or continuing control.

Effective environmental control requires standards. FEPA was created by Decree 58 of 1988 and charged with the responsibility of protecting the environment. In 1999 FEPA was scrapped. In 2007 the National Assembly established the National Environmental Standards and Regulations Enforcement Agency (NESREA), a parastatal of the Ministry of Environment. Following the Stockholm Conference in 1970, many countries established ministries of environment and environmental legislation has increased.

SELF-ASSESSMENT EXERCISE

i. What incident necessitated environmental legislation in Nigeria and what was Government's response?
ii. List three agencies involved in the control and management of the environment in Nigeria and discuss their functions.

6.0 TUTOR-MARKED ASSIGNMENT

Environmental legislation was introduced formally in Nigeria in 1988. As the Senior Special Assistant to the Commissioner of Environment in your state, Evaluate the present state of legislation and discuss the impact (If any) this legislation has had on the environment and propose a plan for improving the impact.

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UNIT 4 ENVIRONMENTAL MANAGEMENT SYSTEMS

CONTENTS

1.0 INTRODUCTION

In the previous units, we looked at various environmental challenges and the laws which have evolved in order to contain these challenges and ensure environmental sustainability. In order to ensure regulatory compliance, Environmental Management Systems (EMS) have been developed. The most prominent framework is the ISO14001, which requires verification and certification; however other frameworks also exist which do not require certification but have the same generic concepts as ISO 14001.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define EMS
- explain the general characteristics and aims of an EMS
- explain the role of EMS and identify the elements of an EMS
- identify the main elements of ISO 14001.

3.0 MAIN CONTENT

3.1 Definitions of EMS

Environmental management systems are defined as "explicit sets of arrangements and processes designed to manage environmental issues and ensure that organisations' environmental performance, goals and objectives are achieved" (Bragg, 1994).
EMS has also been defined as a part of an organisation management system used to develop, implement and manage its environmental policy.

A management system is a set of interrelated elements used to establish policy and objectives and how to achieve those objectives.

A management system includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources (ISO 14001, 2004).

Thus environmental management systems are means by which organisations comply with environmental regulations and legislation; identify; minimise and manage their environmental impacts.

In order to implement an EMS, organisation must identify performance goals and objectives. To do this, one needs to first identify environmental aspects.

Environmental aspects (also called environmental effects or impacts) are substances which cause environmental impacts.

Environmental aspects are defined as "an element of an organisation's activities or products or services that interact with the environment'' ISO 14001(2004).

Environmental aspects can be divided into categories such as those discussed in the previous units. These are:

1. Air pollution and odour
2. Land pollution
3. Water pollution including surface, ground, waste water

4. Noise
5. Use of natural resources
6. Natural habitats

Aspects should be differentiated into aspects which can be directly controlled such as emissions, discharges, solid waste and aspects which can only be influenced such as selection of materials, customer consumption etc.

To set up a successful EMS, an organisation must identify possible environmental aspects, separate controllable aspects from aspects that can be influenced, then identify aspects with significant impacts.
Environmental impacts are ‘‘any change in the environment whether adverse or beneficial, wholly or partially resulting from an organisation’s activities, products or services’’ (***ISO*** 14001, 2004).

Once the impact of the organisations products and services are established, one must determine which of them are significant, then set objectives and targets to address significant impacts over which the organisation has control.

3.2 Elements of EMS

An EMS will include the following main elements:

1. Planning (Plan): This entails the following action:

i. Establish an environmental policy -the policy commits an organisation, and is defined as ‘‘the overall intentions and direction of an organization related to its environmental performance as formally expressed by top management**.’’** The policy must commit to continual improvement, pollution prevention, regulatory compliance and meet other organisational requirements.

ii. Identify and evaluate environmental aspects -this forms a baseline analysis for comparing set objectives and targets. It involves identification of aspects whether past, present or future; abnormal or normal; frequent or infrequent; controllable or those that can be influenced; significance evaluation based on data, experience, information to determine the significance of aspects. This helps to determine aspects which need control or improvement.

iii. Identify relevant legal and regulatory requirements - a procedure to ensure that the organisation has access to applicable environmental and legal requirements and to determine how these requirements apply to its environmental aspects must be in place.

iv. Develop objectives and targets to control impacts - management should formulate specific performance objectives, targets and goals. These objectives should be SMART i.e.

S - Specific
M - Measurable
A - Attainable
R - Relevant
T - Time bound

They should be documented and aimed at specific functions and levels in the organisation. Technology, finance, operations, business and views of interested parties should be taken into account.

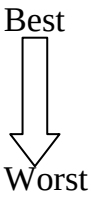
These objectives and targets may be classified in relation to:
Control - relating to operating parameters such as objectives and targets to meet laws and regulations.

- Improvement - based on goals and requirements of stakeholders, organisational vision and available technologies.

- Investigation into future improvements i.e. research.

To ensure interactions with the environment are controlled and improvements of environmental performance are made and maintained, there are four possible measures:

a. Prevention
b. Elimination
c. Reduction
d. Control



These measures control and improve environmental impact. In terms of preference, prevention is the best while control is the worst.

v. Establish and maintain an environmental programme to achieve objectives and targets - the environmental programme outlines how an organisation intends to meet the objectives and targets that are set. It ensures that policy goals, objectives and targets are supported by strategy for implementation. It designates responsibility, plan, authority, control and time scales.

2. Implementation and operation

The responsibilities of different organisational units within the EMS are very important. Job descriptions need to be defined, communicated and understood; and specific environmental management structures should be built into existing ones.

Implementation of EMS including training, documentation, operational control and emergency preparedness; and response requires that the competencies/ qualifications required should be clearly defined and documented.

3. Checking and corrective action (check)

i. Monitoring of activities and record keeping- the monitoring and measurement techniques will depend on the significant environmental aspects, related objectives and targets. Measurements may be scientific e.g. sampling, metering or quantitative e.g. informed estimates.

ii. EMS audit procedures

Audits may be any of the following:

a. internal- auditor is employee of organisation being monitored

b. external- auditor is independent second party from outside the organization

c. third party external audit – auditor is an independent party e.g. certifying agency.

Parameters such as the targets, regularity, personnel responsible, resources necessary, audit protocol, communication procedures, mechanism for corrective actions and preventive and prevention of reoccurrence should be clearly spelt out.

4. Management review (act)

This takes place periodically to determine effectiveness, adequacy and suitability. Based on the review, recommendations are made and incorporated into the company policy. This may require formulation of new objectives and programme modification to achieve these objectives.

3.3 ISO 14000

During preparations for the 1992 UN Conference on Environment and Development which took place in Rio de Janeiro, Brazil, the Business Council for Sustainable Development decided there was a need to develop international standards in environmental performance. Thus the International Standards Organisation (ISO) developed ISO 14001 from British Standards (BS) 7750.The ISO 14000 series covers standards in the field of environmental management tools and systems but excludes test methods for pollutants, limit value of pollutants, setting environmental performance levels, standardisation of products.

ISO 14001 is an auditable standard for systems management and provides the framework for performance improvement, control and regulatory compliance as well as demonstrates commitment to customers and stakeholders. It is intended that the implementation of an environmental management system will result in improved

environmental performance. Environmental performance is the measurable results of an organisation management of its environmental aspects.

3.4 Elements of ISO 14001

ISO 14001 specifies that the requirements for an EMS may be certified by a third party and includes:

i. Development of an environmental policy
ii. Identification of environmental aspects
iii. Establishment of relevant legal and regulatory requirements
iv. Development of environmental objectives and targets
v. Establishment of an environmental programme
vi. Implementation of an EMS including training, documentation, operational control and emergency preparedness and response
vii. Monitoring and measurement of operational activities including record keeping
viii. EMS audit
ix. Management review to determine the effectiveness and suitability of EMS

5.0 CONCLUSION

Environmental management systems are prescribed options for responding to environmental challenges with ISO 14001 being the most prominent framework. However ISO 14001 is not a regulation, it is voluntary and not all organisations will aim to achieve ISO 14001 as a result of costs, intrusion and perceptions of added value which accompanies the certification and verification. However any organisation can manage these challenges using the generic concepts embodied in ISO 14001.

6.0 SUMMARY

Environmental management systems are explicit sets of arrangements and processes designed to manage environmental issues and ensure that organisation environmental performance goals and objectives are achieved. To set up a successful EMS, an organisation must identify possible environmental aspects, separate controllable aspects from aspects that can be influenced, then identify aspects with significant impacts.

Once the impact of the organisation’s products and services are established, it is necessary to determine which of them are significant, thereafter, set objectives and targets to address significant impacts over which the organisation can have control.

SELF-ASSESSMENT EXERCISE

Set an objective and target with respect to energy consumption in a printing company and outline the key elements of the environmental management programme e.g. person responsible, tasks and deadlines.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the elements of a generic EMS and identify its difference from the ISO 14001 EMS.

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MODULE 2 ENVIRONMENTAL ASSESSMENT

UNIT 1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

CONTENTS

1.0 INTRODUCTION

If an organisation is actively seeking to attain the goals of improved environmental performance, it has been discussed from the unit on environmental management systems that the best possible measure is prevention. The most effective tool is one that identifies the implication of an action and prevents it before the action takes place. This tool would allow the decision maker to be fully informed as to the possible consequences of a decision; whether or not an action should go ahead. The EIA takes on the role of the proactive assessment of the potential effects of a project or an action. EIA should identify potential problems and sort them out at a stage when plans can still be modified. Indeed EIA has a particularly useful role to play in the context of an EMS particularly during the identification and evaluation of aspects.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define EIA
- review the history of the EIA internationally and nationally
- describe EIA and identify projects which mandatorily require an EIA
- list the challenges to EIA in Nigeria.

3.0 MAIN CONTENT

3.1 Definition of EIA

Environmental Impact Assessment is a "pre-project" anticipatory process.

The term describes a procedure that must be followed for certain types of project before they can be given "development consent". The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope of reducing them, is properly understood by the public and the relevant competent authority before it makes its decision.Thus Environmental Impact Assessmen*t* is defined by Wathern (1988) "as the process of identifying and evaluating the likely consequences of human actions on the environment and when appropriate mitigating these consequences."

3.2 Origins of EIA

Environmental Impact Assessment originated from the USA in 1969. The US National Environmental Policy Act (NEPA) of 1969 was the first legislation to require an EIA. It initially applied to US federal projects or projects where the Federal Government was directly involved but was later extended to private projects.

The aims were to minimise the long-term environmental effects of federal actions, to specify society's right to a safe/healthy/aesthetic environment, to ensure the widest beneficial use of the environment without undesirable consequences, to preserve historic, cultural and natural heritage, to balance population and resources and to recycle scarce and natural resources.

The following factors are taken into consideration:

a. the environmental impact of the proposed action
b. any adverse environmental effects which cannot be avoided should the proposal be implemented
a. alternatives to the proposed action
b. the relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity

c. any irreversible and irretrievable commitments of resources which would be involved if implemented

The spread of EIA around the world
EIA spread to different countries following this time-line

- Canada (1973)
- Colombia (1974)
- Australia (1974)
- West Germany (1975)
- France (1976)
- Philippines (1977)
- European Commission Directive (1985)
- United Kingdom (1988)
- Kazakhstan (1991)
- Nigeria (1992)

By 1996 more than 100 countries had established EIA systems.

3.3 Environmental Impact Assessment

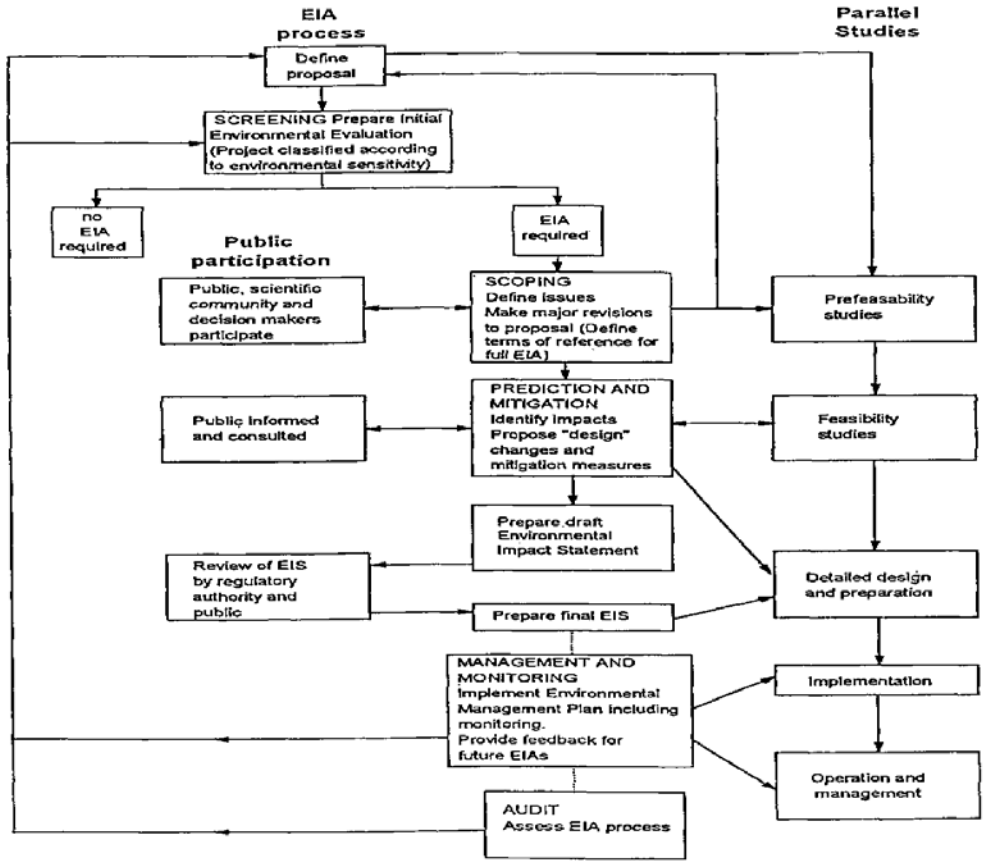

Figure 2.1: Flow Diagram of the EIA Process and Parallel Studies
Source: FAO irrigation and drainage papers: Environmental impact assessment of irrigation and drainage projects

The EIA process ensures environmental issues are raised when a project or plan is first discussed. Issues are addressed as a project progresses to implementation. It is institutionalised in more than 100 countries. Recommendations made by the EIA result in redesign of some project components, further studies and cause changes that affect the economic viability of the project or cause a delay in implementation. It is best that an environmental assessment be done early in the project cycle so that recommendations can be built into the design and cost-benefit analysis without causing major delays or increased design costs. The EIA should lead to a mechanism whereby adequate monitoring is done to realise environmental management.

The way in which an EIA is carried out is not rigid; it is a process comprising series of steps. However in some cases, particularly small projects, the transition from identification to detailed design may be rapid and some steps in the EIA process omitted.
The main steps in the EIA process are:

i. **Screening**- results in the categorisation of the project. From this, a decision is made on whether or not a full EIA is to be carried out. This may be determined by the size of the project, or on site specific information.

ii. **Scoping**- determines the most critical issues to study. It involves community participation. It is at this early stage that EIA can strongly influence the proposal. The project can be cancelled or drastically revised should major environmental problems be identified. It may also be the end of the EIA process should the impacts be found to be insignificant.

iii. **Impact analysis** (**prediction) and mitigation**- these studies follow scoping. The main output report is called an "environmental impact statement" and contains a detailed plan for managing and monitoring environmental impacts both during and after implementation.

iv. Finally, an **audit** of the EIA process is carried out sometime after implementation. The audit serves a useful feedback and learning function.

In other countries, public participation is very important and takes place at a much earlier point than in the Nigerian system. The level of consultation will vary depending on the type of plan or project and new projects involving resettlement or displacement will require the most extensive public participation.

3.4 Development of EIA in Nigeria

Prior to 1988, there were no laws in force to regulate industrial pollution or hazardous waste as previously discussed. The Koko toxic waste incident (1988) led to the enactment of the FEPA Act of 1988. The Federal Environment Protection Agency (FEPA) was charged with the responsibility of protecting the environment in Nigeria. FEPA established and prescribed national guidelines, criteria and standards for: water quality, air quality and atmospheric protection, noise levels, gaseous emissions and effluent limits. The agency was also empowered to monitor and control hazardous substances, supervise and enforce compliance and the EIA was one of the tools FEPA utilised to do this.
The National Environmental Standards and Regulations Enforcement Agency (NESREA) was established by an Act of the National Assembly in 2007. The NESREA Act repealed FEPA Act of 1988. NESREA is now charged with the responsibility of enforcing environmental laws, regulations and standards and deterring people, industries and organisation from polluting and degrading the environment.

3.5 Principles and Procedures of EIA Legislation

EIA principally affects new development projects and may be mandatory, discretionary or voluntary EIA. EIA seeks to compare various alternatives which are available for any project or programme. Each alternative will have economic costs and benefit as well as environmental impacts both adverse and beneficial. EIA is essentially a predictive process which is interdisciplinary in nature. The Project proponent/developer is the sole decision maker who commissions an EIA study of a

project. In Nigeria, he employs an environmental consultant who acts as the proponent agent and liaison officer with EIA Division of the Federal Ministry of Environment, Abuja to commence the study. EIA is a multidisciplinary exercise, the study team comprises of:

a. A project leader
b. A project coordinator
c. Environmental scientists: experts in chemistry, biology (botany, zoology, microbiology), geology, geography, geographical information science
d. Environmental engineers, planners and architects
e. Social scientists: Economics, Sociologists, Anthropologists, Archeologists.
f. Medical scientists: doctors, medical statisticians, medical recorders, public health scientists
g. Other relevant specialists depending on the type and nature of the project
h. Proponent's expert representatives

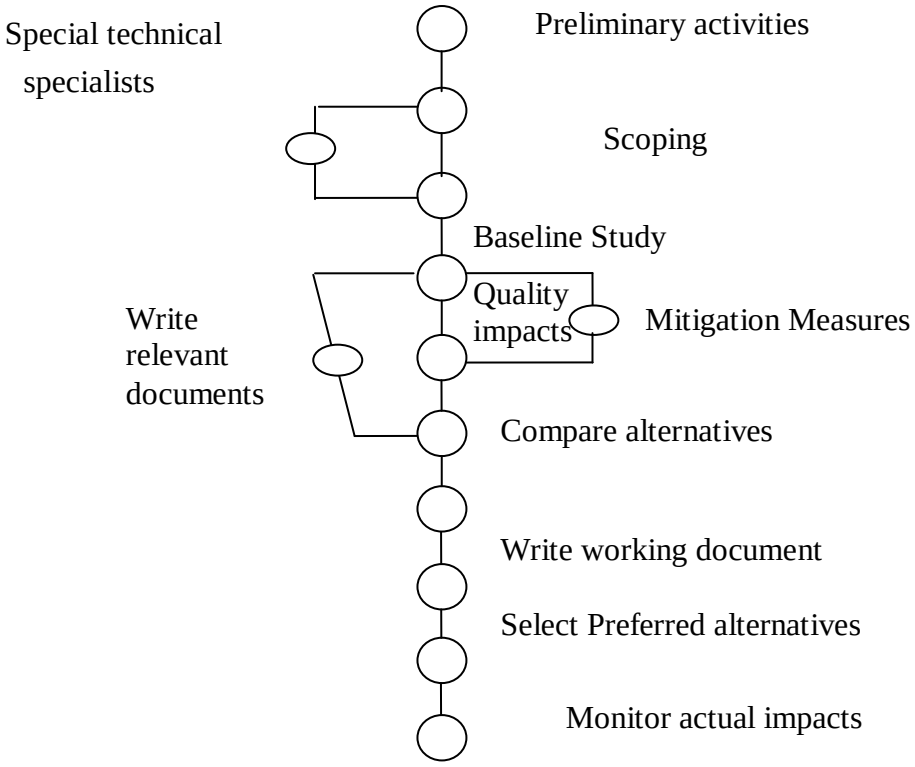

Fig. 2.2: Activity Diagram for EIA

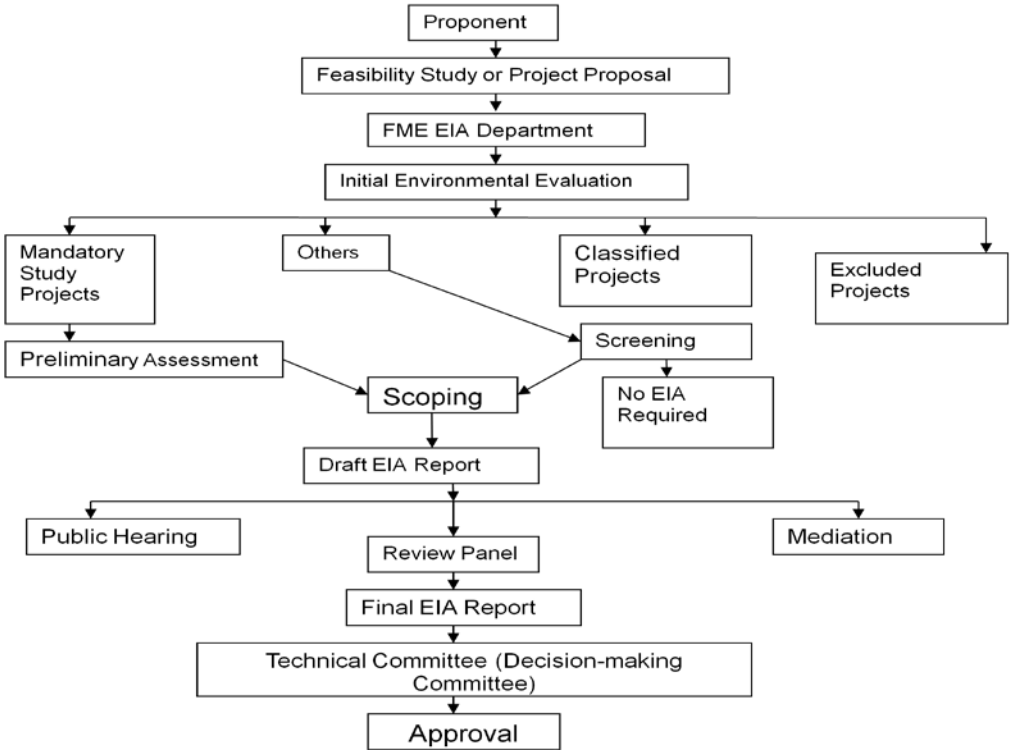

Fig. 2.3: Activity Diagram for Nigerian EIA System
Source: EIA Law (1992)

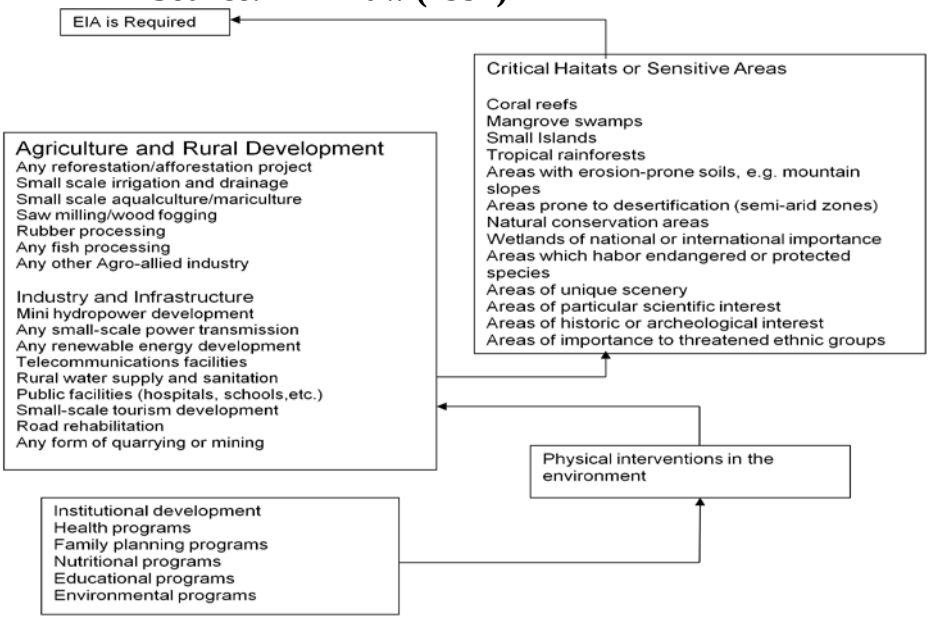

Fig. 2.4: The Process of screening projects to determine if an EIA is required in the Nigerian system
Source: EIA Law (1992)

3.6 Processes of EIA in Nigeria

a. Screening

Screening of all projects must take place. Screening aims to determine whether an EIA is required. Three categories of projects are defined.

i. Category I projects (Mandatory EIA)- large-scale activities such as agriculture (500 hectares or more), airport **(25**00m or longer airstrip),drainage and irrigation (200 hectares or more),land reclamation (50 hectares or more), fisheries (land based aquaculture of 50 hectares or more),forestry (50 hectares or more conversion), industry - chemical (100 tonnes/day), petrochemical (all sizes), non ferrous, non metallic, iron and steel, ship yards, pulp and paper, infrastructure - hospital, industrial estate, expressways, new township, port, pit mining, petroleum, power generation and transmission, quarries , railways, transportation, resort and recreational development, waste treatment and disposal (all waste disposal),water supply.

ii. Category II projects – Screening to determine whether or not EIA is required.

iii. Category III projects – EIA is not required and EIS certificate will be issued.

Once it is determined that there is a need for an EIA, preliminary activities which comprise of writing a description of the proposed study commence. The result is a benchmark statement specifying the exact aims of the project.

b. Scoping

Impact identification i.e. scoping are identified and marked down for studying. An EIA exercise is intended to review the potential impacts of a proposed project on the following environmental factors:

- effects on water
- effects on air
- effects on land
- effects on flora & fauna
- effects on soil & geology
- effects on the climate
- effects on the landscape.

c. Baseline study

Field-work at the project site(s) would entail in-depth studies involving data gathering to constitute the “baseline” research. This is a record of what existed in the area prior to action. Field-work involves physical data collection on project as well as literature search for useful existing information relevant to the project.

d. Prediction of "likely significant" impacts
This prediction relies heavily on the experience of the team of experts using previous knowledge or experience to predict positive or negative impacts on the environment. These impacts may be direct as a result of the development itself or indirect as a result of, but not due to the development itself.

e. Proposed mitigation measures
Measures are proposed to militate against negative impacts or to enhance positive impacts.

f. Public consultation
The public consultation process involves the mandatory newspaper publications in which the Ministry invites the public to read draft copies of the EIA at designated centres throughout the States and Federal Capital Territory. The Ministry calls for comments and public hearings are held to consider the entire EIA report. The stakeholders concerns and issues are discussed at this hearings and the feedback at the public hearings is incorporated into the final EIA report.

g. Submission of EIA report
The reviewed and revised EIA report is submitted to the Federal Ministry of Environment for scientific review by independent experts.

h. Grant of consent by a competent authority
On the acceptance of the final report by the Ministry of Environment, an Environmental Impact Statement (EIS) is issued under the signature of the Honourable Minister of Environment signaling approval for the project to commence.

i. Monitoring & Audit.

3.7 Environmental Impact Assessment (EIA) Decree 86 of 1992

This is the principal legislation on EIA in Nigeria and introduced environmental considerations into development project planning and execution. There are published EIA sectoral guidelines which outline project areas and sizes of projects requiring EIA and prescribed sanctions for non- compliance.

Minimum content of an EIA

i. A description of the proposed activity
ii. A description of the possible affected environment
iii. A description of practical activities
iv. An assessment of the likely or potential environment impacts of the proposed activity
v. An identification and description of measures to mitigate the adverse environmental impacts
vi. A brief and non- technical summary of the report

3.8 Challenges to EIA in Nigeria

i. Policy inconsistency and environmental management not accorded political priority
ii. Poor environmental awareness within the business community
iii. Weak regulatory framework
iv. Weak organisational structure to enforce EIA system
v. Manpower issues and technical competence
vi. Lack of funding
vii. Lack of coordination
viii. Multiple regulators at the Federal/State levels
ix. Public consultation rarely enforced
x. Alternatives rarely considered
xi. Low quality reports

4.0 CONCLUSION

Although the role of EIA in environmental management cannot be over-emphasised since it facilitates increased efficiency, reduced waste, reduced risk and improve stakeholder relationships, it has been seen that EIA is better incorporated at the planning stage, and that it is not over when a project is up and running, as continuous monitoring and feedback must be part of the process.

As is often the case, EIA may only be attempting to reduce impacts which could have been completely avoided if Strategic Environmental Assessments (SEAs) was utilised. This is because while EIA focuses on the mitigation of impacts, SEA maintains a chosen level of environmental quality. Thus SEAs are currently replacing EIAs in the developed world.

5.0 SUMMARY

Environmental Impact Assessment is the process of identifying and evaluating the consequences of human actions on the environment and when appropriate mitigating these consequences. Environmental Impact Assessment originated from the USA in 1969. It is essentially a predictive process which is interdisciplinary in nature. Processes in EIA include screening, scoping, conduction of baseline study, prediction of "likely significant" impacts, proposal of mitigation measures, public consultation, submission of EIA report, grant of consent by a competent authority and monitoring and audit. EIAs are currently being replaced by SEAs in the developed world.

SELF-ASSESSMENT EXERCISE

List 10 category one projects that require a mandatory EIA in Nigeria.

6.0 TUTOR-MARKED ASSIGNMENT

i. What is Environmental Impact Assessment?
ii. As the Environmental Officer of an agricultural plantation about to begin a rubber plantation of 400 hectares, explain the process of EIA in Nigeria to your Finance Manager.

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UNIT 2 STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA)

CONTENTS

1.0 INTRODUCTION

We have seen that the EIA process is usually applied in major development projects to ensure that likely environmental problems are anticipated and appropriate mitigation measures proposed before project commencement and throughout the project cycle. It however became obvious with the global environmental issues and an increased need for a sustainable development that the EIA process occurred too late in the planning process. Strategic Environmental assessment developed from the application of the tenets of the EIA process to actions including policies, plans and programmes.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define strategic environmental assessment (SEA)
- explain the relationship between EIA and SEA
- describe the process of SEA and identify where it differs from EIA in Nigeria
- name the advantages and problem areas in SEA.

3.0 MAIN CONTENT

3.1 Definitions

SEA is defined by Therivel (2004) as **"**the formalised, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan, programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision making.**"**

Policies were defined by Glasson et al. *(2005)* as "an inspiration and guidance for action"**.**

Plans were defined as **"**sets of coordinated and timed objectives for the implementation of policy. Programmes are sets of projects in a particular area."

Table 2.1 Differences between EIA and SEA

EIA	SEA
Actions are immediate, operational	Actions are strategic, visionary, conceptual
Detailed decisions to do with location, design, construction, operation of a project	Wide development options e.g. fiscal, regulatory, organisational, spatial
Short or medium timeline	Medium or long timeline
Reactive, mitigates negative impacts by design	Proactive, prevents negative impacts, promotes positive chances
Focus, methods and techniques specific. More structured.	Focus, methods and techniques change based on decision making level of practitioner
More specific assessment methods legal and industry requirements in assessment. Rigour more certain	Assessment based on professional judgments objective benchmarks and good practice. Rigour more uncertain
Uses more quantitative data	Uses more qualitative data
Less geared towards sustainable development due to methodology	More geared towards sustainable development due to methodology

3.2 SEA Procedures

These procedures are

a. EIA based: structured and rigorous using specific steps.
b. Non-EIA based: less structured and less rigorous, used for decision and higher policy making.

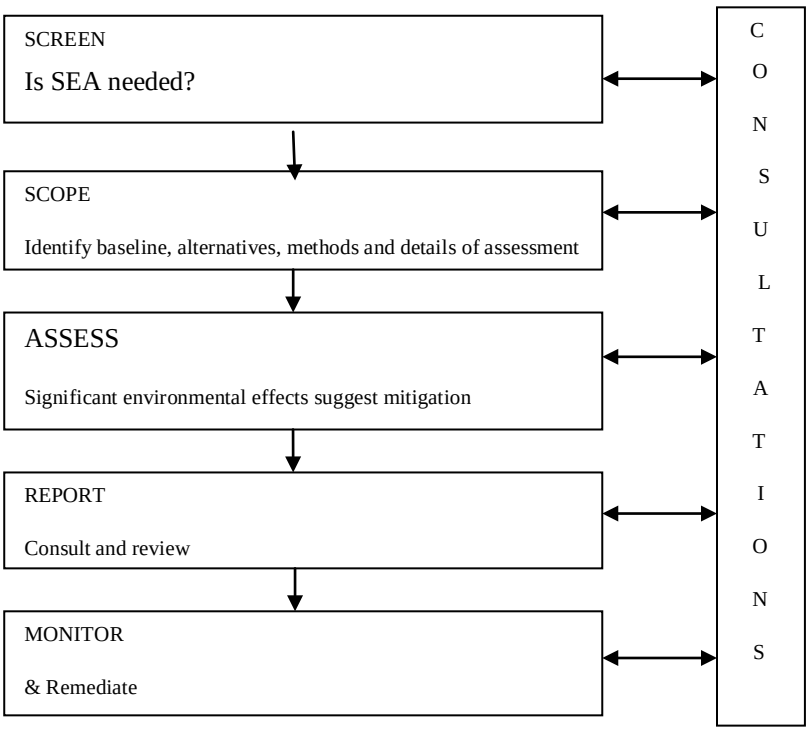

Fig. 2.5: Stages of the SEA Process

Table 2.2: Comparison of the EIA and SEA Process

	EIA	**SEA**
Screening	List method	2 methods used: list method definition method
Scoping	Baseline information detailed and extensive	On-going, depends on resources and purpose
Assessment	Based on specific methods, legal requirements and industry standards	Relies on professional judgement
Report	Environmental statement (called EIA Report in Nigeria)	Environmental Report
Monitoring	Continuation of baseline surveys	Includes iterative feedback review measures for monitoring
Consultation	No consultation in Nigeria only a public hearing after draft EIA report completed	Consultation starts at scoping all the way to findings

3.3 Advantages of SEA

a. Encourages consideration of environmental objectives during policy, plan and programme making for all organisations.
b. Helps consultation between all stake holders.
c. Enables formulation of standard mitigation measures.
d. Encourages consideration of alternatives rejected in EIA.
e. Helps in the identification of the right sites for projects before EIA.
f. Helps thorough analysis of cumulative effects of projects.
g. Helps in the consideration of long-term or delayed impacts.

3.4 Problem Areas in SEA

a. Long timelines and large geographical areas.
b. Ensuring use of relevant baseline information.
c. Limited information.
d. Choice of right alternatives.
e. Identification and assessment of cumulative effects.
f. Difficulty in understanding concepts and methods by stakeholders.
g. Use of SEA as a creative process in strategic decision making.

4.0 CONCLUSION

Strategic Environmental Assessment (SEA) is a process to ensure that significant environmental effects arising from policies, plans and programmes are identified, assessed, mitigated, communicated to decision makers, monitored and that opportunities for public involvement are provided.

Strategic Environmental Assessment is a generic tool and has become important instrument to assist in achieving sustainable development in public planning and policy making in the developed nations. The SEA process informs planners, decision makers and affected public on the sustainability of strategic decisions. It also facilitates the search for the best alternative and ensures a democratic decision making process. This in turn leads to more cost and time effective environmental impact analysis at the project level.

5.0 SUMMARY

SEA is the formalised, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan, programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision making. Although SEA evolved from EIA, SEA procedures may be EIA-based, structured and rigorous using specific steps or non EIA-based, less structured and less rigorous, used for decision making and higher policy making. While EIA deals with detailed decisions about location, design, construction, operation of a project; SEA deals with wide development options e.g. fiscal, regulatory, organisational and spatial. The processes of SEA

include screening, scoping, assessment, report production, monitoring and consultation.

SELF- ASSESSMENT EXERCISE

i. Define the term strategic environmental assessment (SEA).
ii. Compare and contrast the terms EIA and SEA.

6.0 TUTOR-MARKED ASSIGNMENT

i. Define the term SEA.
ii. Identify the reasons why SEA should be introduced in Nigeria and mention possible problem areas.

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UNIT 3 ENVIRONMENTAL AUDIT

CONTENTS

1.0 INTRODUCTION

We have already encountered environmental audit as part of environmental management system. We saw how the audit is used to assess how well the EMS is conforming to the programme and how effective the EMS is fulfilling the organisation's environmental policy. In order for an organisation to effectively manage or control its environment, it has to be able to assess whether the systems already in place are effective.

In order to do this, the aim is to compare the prevailing conditions with baseline conditions or with set criteria. As we have seen, audits can be internal, external or third party audits. Environmental audits were adapted from accounting audits and usually lead to the identification of risks or cost saving activities.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define environmental audit
- explain the different types of environmental audits
- identify the advantages and costs associated with environmental audits
- outline the steps for carrying out an environmental audit.

3.0 MAIN CONTENT

3.1 Definitions of Environmental Audit

Environmental audit has been defined by the International Chamber of Commerce as; "A management tool comprising a systematic documented and periodic and objective evaluation of how well environmental organisation, management and equipment are performing with the aim of helping to safeguard the environment by:

- facilitating management control of environmental practices

- assessing compliance with company policies, which would include meeting regulatory requirements."

This definition means that audits can be used to:

i. Verify compliance with environmental requirements
ii. Evaluate the effectiveness of environmental management systems already in place
iii. Assess risk from regulated or unregulated materials and practices

Environmental management standards such as the ISO have definitions which refer specifically to the EMS. Thus environmental audit has been defined by ISO as "A systematic, independent and documented process for obtaining audit evidence and evaluating its objectivity to determine the extent to which the EMS audit criteria set up by the organisation are fulfilled."

Environmental auditing involves a series of activities set up by management to evaluate the environmental performance of organisations. Legislative compliance checks as well as an assessment of all aspects of the organisation that may impact the environment are carried out. Environmental audit is a vital management tool that works as part of a process of continuous improvement. Audit was first used in the context of the environment in the U.S.A and developed from the audit procedure used for financial reporting.

3.2 Types of Environmental Audits

Environmental audits are divided into three broad classes based on how specific it is to a particular task, issue or activity. This is to suit the needs of different organisations as a result of the aspect those organisations would want to consider.

1. **Liability audits -** Used to identify anything that may result in liability. These are:

    - compliance audits- checks extent to which present and future regulations are complied with.

    - environmental risk audits-to identify potential environmental risks as a result of processes and procedures.

    - due diligence audits-liability audit carried out before purchase of new plants or equipments.

    The frequency of liability audit is put at three months frequency, compliance audits done quarterly by in-house auditors; biannually by external auditors.

2. **Managerial environment audits -** These focus on certain aspects of management such as EMS audits, policy audits and corporate audits. The frequency of management audit is usually four years in the oil and gas industry

(as recommended by Department of Petroleum Resources in the "Environmental Guidelines and Standards for the Petroleum Industry in Nigeria" (EGASPIN). The EU Regulations and ISO 14001 (International Organisation for Standardisation) recommends three years cycle.

3. **Activity audits** - Specific areas or activities audited and includes technical and management issues associated with area/ activity such as product audits, waste audits, energy audits.

3.3 Costs of Environmental Audits

These costs may be direct costs or hidden costs.

Direct costs

i. Opportunity cost of management and staff time
ii. Cost of training internal auditors
iii. Cost of external auditors or verifiers
iv. Disruption during audit
v. Cost of preparation and publishing of audit

Hidden costs

Cost of acting on the audit findings to correct breaches or irregularities.

3.4 Benefits of Environmental Audits

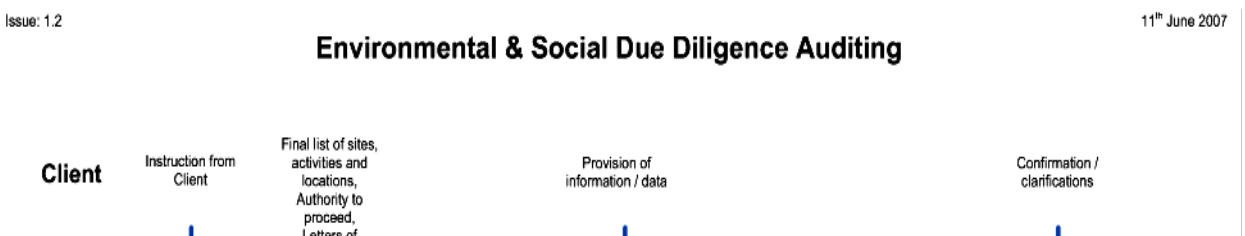
i. Legal compliance: Assured legal compliance
ii. Eliminate the cost of non compliance such as fines
iii. Reduced risk exposure and lower insurance premiums
iv. Stakeholder appeasement: Stakeholders are well informed and companies benefit from goodwill
v. Improved community relations, media coverage and increased staff commitment
vi. Environmental efficiency: Leads to reduction in waste and operating costs
vii. Improved materials efficiency and product quality

3.5 The Process of Environmental Audit

Audit process consists of three phases:

1. Audit preparation-planning and preparation
2. Facility visit -audit proper
3. Assessment and report -reporting and follow up

Each process is reviewed in the figure below.



An audit report should have the following features:

Figure 8.1 Environmental and due diligence audit flow chart Source Atkins

3.

Figure 7.1**:** Methodology of Environmental and due diligence audit process Source: Atkins Methodology of Environmental and Social due Diligence Auditing

3.6 Important Elements of an Audit Report

i. Accuracy - findings of fact must be validated and must be free from errors
ii. Clarity - avoid jargons and technical terminologies
iii. Conciseness - brevity and straight to the point
iv. Timeliness - a draft should be prepared within a week of the audit being completed and the final report ready within four to five weeks of the closing meeting
v. Tone - report should be written in simple English without embellishments

An audit report should contain the following information

a) Contents list
b) Executive summary
c) Purpose and scope of the audit
d) Discussion and analysis of the findings
e) Reference to items for corrective action
f) A list of actions and recommendations
g) The distribution list
h) Records of the audit programme

i) List of participants

Ideally, a quality environmental audit report should not be more than 25 pages.

4.0 CONCLUSION

Although environmental audits evolved from accounting, they have now become essential to all environmental programmes and projects.

5.0 SUMMARY

Environmental audit is a management tool which involves a systematic, documented, periodic and objective evaluation of how well environmental organisation, management and equipment are performing. EAs are divided into three broad classes: liability audits, managerial environment audits and activity audits.

Costs of environmental audits may be direct costs or hidden costs. Audit process consists of three phases: audit preparation; facility visit; and reporting and follow up.

SELF-ASSESSMENT EXERCISE

Define environmental audit and explain the different types of environmental audits.

6.0 TUTOR-MARKED ASSIGNMENT

As the Chief Executive Officer of a printing company in one of the six geopolitical regions of Nigeria, you are required to plan an environmental audit for your company. Explain how you would do this stating the main elements expected of such a report.

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UNIT 4 COST BENEFIT ANALYSIS

CONTENTS

1.0 INTRODUCTION

Once an organisation decides to run an environmental project or programme, it should assess the economic consequence of this programme. Thus, the advantages (benefits) are compared to the disadvantages (costs) to assess how desirable the project is. Traditionally, while organisations are used to rendering financial reports to their shareholders, they must now also assess their environments and give the information obtained from this cost benefit analysis (CBA) to their stakeholders. Thus the CBA has a vital role to play in environmental programmes.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define CBA
- explain the main activities involved in CBA
- identify the importance of CBA as an EMS tool.

3.0 MAIN CONTENT

3.1 Definition of Cost Benefit Analysis

Cost benefit analysis is defined by Boyd and Frears (2007) as "a broader project appraisal tool which provides a framework for measuring the economic costs and benefits of project on society (the stakeholder community) as a whole, including environmental effects, irrespective of whether they are captured in an investor's financial accounts". Project appraisal can range anywhere between two extremes; from simple financial appraisal to complex full-scale social cost benefit appraisal. The choice of type of appraisal would depend on the investor's objective. If the objective is to maximise shareholder's value, then, financial appraisal is the route. However if an investor is interested in addressing the concerns of all relevant stakeholders (not just shareholders) including environmental concerns, then CBA is the route to go.

3.1 Methodology of Cost Benefit Analysis

Cost benefit analysis approach may be divided into three main activities or stages.

a. Identification of all parties affected by the project and quantifying the impacts of the project on these parties.

b. Attaching an appropriate price tag to all economically relevant impacts.

c. Discounting of all costs and benefits that occur in different time periods to determine the net benefit and make a decision on the relative economic project benefit.

3.2 Cost Benefit Analysis Framework

The following figure depicts the framework of cost benefit analysis.

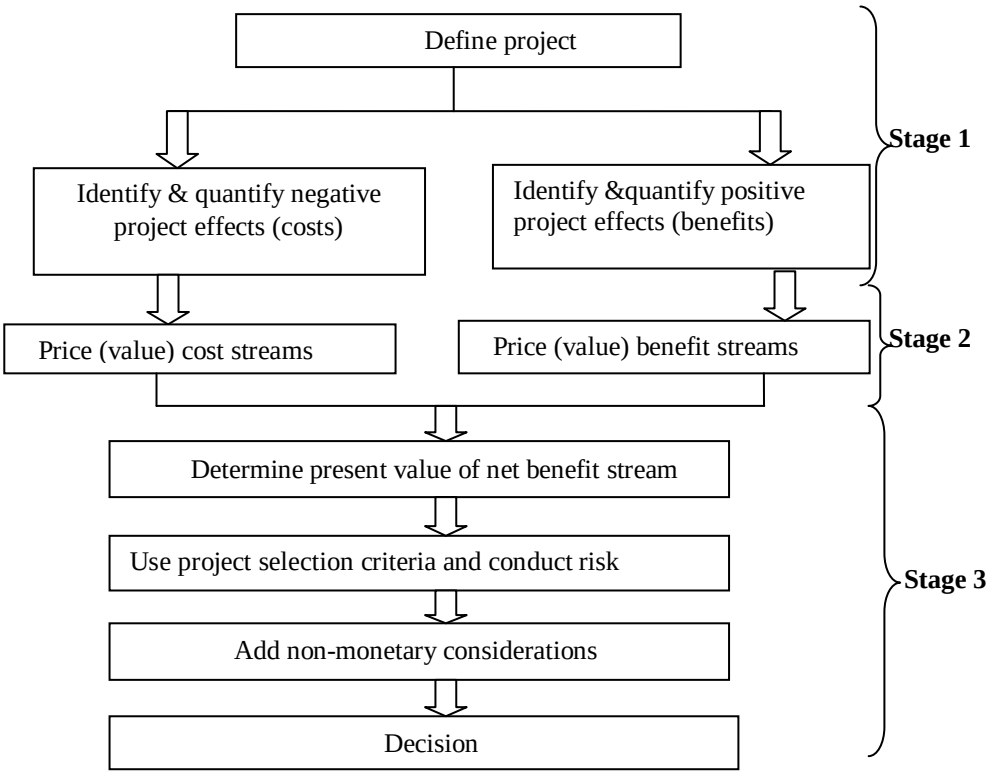

Fig**. 2.7: Cost Benefit Analysis Framework**
Source: Integrated Environmental Management Core Module 2

3.3 Identify and Quantify Project Effects

Costs are usually divided into:

a. Capital or investment costs which are costs incurred at the set up of the project and may be referred to as non-recurrent expenditure. This includes costs of land and property, infrastructure and equipment costs as well as installation costs.

b. Recurrent costs are those costs due to operation and maintenance and include energy costs, labour costs, material costs.

c. External or third party; these may be as a result of activities which adversely affect third parties such as water pollution by industry ; causing illness and all the costs associated with the illness.

Benefits may be:

a. Direct revenue earned from the project's output.
b. Cost savings as a result of the project.
c. Forgone or avoided external costs must also be included in a project's benefit streams.

In identifying ascribed costs or benefits, the base situation is always used as a comparison since it is defined as the 'do nothing' case.

3.4 Value Costs and Benefits

While tangible costs and benefits can be valued using market prices, environmental commodities do not have market prices but must be valued nonetheless. A range of valuation techniques have been developed and which attempt to measure either willingness- to- pay (for improvement in environmental quality) or willingness- to- accept (compensation for reduction in environmental quality). The techniques used to assess this fall into three groups. These are:

1. Actual market price approach - It is possible to value costs and benefits which can be priced whether the project effects can be seen or not. It uses the same valuation method as normal financial accounting.

2. Methods used include:

   - Change in productivity - here, a change in the environment results in a change in the ability to produce a commodity or increase the cost of producing it. An example is air pollution causing reduced farm production. The change in usual production can be evaluated. A dose response method is used such that you can predict the change in output per unit change in environmental quality.

   - Preventive expenditure/ replacement cost approaches - Replacement cost approach uses the cost of repairing or replacing an asset affected by the environmental change as an estimate of the benefit of eliminating the negative environmental change.

     Preventive expenditure approach uses the expenditures as an estimate of the benefit of eliminating the negative environmental change.

3. Surrogate Market Approach - The value of substitute goods in surrogate markets are used to value environmental goods and services. Surrogate market approach includes:

   - Property value approach- using price differentials between houses with different attributes including environmental attributes, the implicit values of the environmental attributes are determined and changes in the attributes can then be valued.

   - Wage differential approach - similar jobs in locations with different environmental conditions are valued, assuming that you need higher wages where increased level of pollution and greater risks to life and health exist. The changes in wage rates are used to determine the effect of the environmental changes.

   - Travel cost approach - the value placed on a recreational activity is inferred from demand. These values are used to monetise changes in quality and/or quality of the recreational activity and its environmental components.

4. Survey Based Approach - Where the market valuation methods- surrogate market techniques and market price techniques- cannot be used, methods based on responses to surveys are used. These methods include:

   - Contingent valuation method- Personal valuations of respondents' willingness to pay or willingness to accept compensation. The valuations are for changes in quality or quantity based on hypothetical and not real situations.

   - Contingent rating - Choices are ranked on hypothetical situations on different goods including environmental attributes.

3.5 Decision Making

Once the inputs and outputs are priced you need to make a decision. This involves comparing costs and benefits and applying a decision rule. However projects tend to run for a period of time, costs incurred today must be compared with benefits accruing in the future. Thus weighting to allow comparison for different points in time occurs to calculate the present value of the costs and benefits. This process is called discounting.

The criteria for discounted project are

a. Net present value (NPV) method- This is the present value of estimated benefits net of costs. A project is accepted if the present value is greater than zero. A

positive NPV means benefits outweigh costs and a negative NPV means that costs outweigh benefits.

b. Benefit- cost ratio method- This is the ratio of sum of the discounted net benefits (benefits-costs) to the discounted investment costs i.e. B/C. A project is accepted if B/C ratio is greater than 1. This implies that NPV is positive.

c. Internal rate of return (IRR) method- The internal rate of return is rate of discount at which discounted net benefits equal discounted investment costs. At this discount rate selected (IRR rate) the NPV is equal to zero. A project is acceptable if its IRR is greater than the discount rate selected thus NPV is positive.

In addition to these three methods the non-monetary or unquantifiable effects are itemised and quantified as much as possible and determine to what extent they would affect the already determined NPV negatively or positively.

3.6 The use of CBA in EMS

In attaining the environmental objectives and targets set by an EMS in line with the environmental policy of an organisation, resources will need to be committed. To ensure efficient use of these resources, an appraisal of the costs and benefits needs to be carried out i.e. a CBA.

Moreover if environmental effects are to be compared with tangible goods and services the means of comparing them in equivalent monetary units is the CBA.

4.0 CONCLUSION

Cost benefit analysis has an important role to play in determining the effects of environmental projects or programmes. Its basic principles are in economics and accounting and by determining net costs to benefits, a decision is made as to whether a programme or project should continue or not.

5.0 SUMMARY

Cost benefit analysis is as a broader project appraisal tool which provides a framework for measuring the economic costs and benefits of project on society as a whole, including environmental effects, irrespective of whether they are captured in an investor’s financial accounts.

CBA approach may be divided into three main stages which are identification of all parties affected by the project and quantifying of the impacts, attaching an appropriate price tag to all economically relevant impacts, discounting of all costs and benefits that occur in different time periods to determine the net benefit and make a decision on the relative economic project benefit.

The criteria for discounted project are net present value (NPV) method, benefit- cost ratio method and the internal rate of return (IRR) method.
CBA ensures efficient use of these resources and enables environmental effects to be compared with tangible goods and services by comparing them in equivalent monetary units.

SELF-ASSESSMENT EXERCISE

i. Define cost benefit analysis.
ii. Identify the three main approaches to valuation of tangible costs under CBA.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the process of making a decision using the CBA and discuss how the three discounted project criteria are used in this context.

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UNIT 5 LIFE CYCLE ASSESSMENT

CONTENTS

1.0 INTRODUCTION

As concern has increased over the relationship between the economy and the environment, various techniques have been developed to assess the effect of human and industrial activities on the environment. Life cycle assessment (LCA) serves the function of taking the account of the environmental effects of a product or service through all of its life stages from raw material to final disposal of the product. It assesses all the relevant effects of the product from cradle-to-grave.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define life cycle assessment and give a brief history of its development
- explain the methodology of LCA
- List the uses of LCA.

3.0 MAIN CONTENT

3.1 History of Life Cycle Assessment

As concern over climate change increased in the late 60's and early 70's, several projects evolved to quantify industry use of raw materials and energy. These were initially called **energy analysis** but their focus broadened to consider use of resources and waste production. The projects are now called **resource analysis.** One of the first resource analysis studies conducted for the Coca Cola Company to determine alternative container systems with the lowest energy and natural resource consumption developed a process which analysed this from cradle to grave**.** This process was called the **Resource and Environmental Profile Analysis (REPA).**This and other studies formed the basis for the life cycle inventory phase of

LCA. Analysis of pollution problems caused by industry as a result of smog in Los Angeles and Tokyo, acid rain in Scandinavia, global warming and ozone depletion resulted in the expansion of the use of methodology to calculate energy and resource consumption, to analyse pollution to land water and air. This expanded analysis was called eco-balance and evolved to be part of the LCA.

The Society for Environmental Toxicology and Chemistry (SETAC) played a leading role in developing terms and methodology of LCA. They developed a methodological framework and a code of practice for LCA to ensure consistent approach, practice and reporting of LCAs. SETAC also had an important role in integrating impact assessment into LCA.

In 1993 however, since LCA was becoming a standard tool for making environmental claims, there was a need for standardisation. The International Organisation for Standardisation evolved some standards in order to achieve this.

ISO 14040 Life Cycle Assessment: Principles and Framework
ISO 14041 Life Cycle Assessment: Life Cycle Inventory Analysis
ISO 14042 Life Cycle Assessment: Impact Assessment
ISO 14043 Life Cycle Assessment Interpretation
ISO 14048 Life Cycle Data Documentation Format
ISO 14049 Life Cycle Assessment- Examples of Application of ISO 14040 Goal and Scope Definition and Inventory Analysis

3.2 Definition of Life Cycle Assessment

LCA is defined by ISO as “the compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle’’.

It has also been defined by the Society for Environmental Toxicology and Chemistry (SETAC) as "a process to evaluate the environmental burdens associated with a process, product or activity by identifying and quantifying energy and materials used and wastes released to the environment; and to identify and evaluate opportunities to affect environmental improvements. The assessment includes the entire life cycle of the product, process or activity, encompassing, extracting and processing raw materials; manufacturing, transportation and distribution; use, re-use, maintenance; recycling and final disposal".
LCAs attempt to quantify the environmental burdens caused by industrial or product systems since the system generates the waste and not the product. A product system is a collection of operations connected by flows of intermediate products which perform one or more detailed functions. When describing a product system it must be done such that another practitioner can duplicate the inventory analysis.

Thus the scope of the LCA must clearly specify the functions of the system being studied. The functional unit is a measure of the performance of the functional outputs

of the product system. A functional unit must be measurable as it forms the basis of the LCA.

After identifying the industrial/product system, you must draw the system boundary differentiating it from the system environment which is the source of all inputs and the receiver of all outputs. There are also usually sub-systems or unit processes which have the same characteristics as the industrial main system and should be enclosed within their own system boundary.

3.3 Methodology of Life Cycle Assessment

There are four key steps to the LCA as defined by ISO14000

a. Define the goal and scope- decide what you want to achieve
b. Life cycle inventory analysis (LCI) –gather and process relevant data
c. Life cycle impact assessment- determine the main environmental impacts
d. Life cycle interpretation- evaluate their relative interpretation

a. Define the goal and scope

It is vital to identify exactly the purpose for carrying out the study i.e. goal definition. The goal of an LCA should unambiguously state the intended application, the reasons for carrying out the study and the intended audience. The goal defines what is to be accomplished by the LCA, how results will be used, what decisions will be based on the LCA output and if results will be used externally or internally. These answers affect the scope of the study. An example of a goal is the quantification of energy, raw materials, air emissions, effluents and solid wastes of a printing factory.

As resources are limited, the researcher must decide the breadth and depth of the study based on the goal. The scope should be well defined to ensure that the breadth and the details of the study are compatible and self sufficient to address the stated goal. Scoping will entail defining the function under study, the system which performs the function, the boundaries of this system, data categories needed to address the stated goal. Sometimes a detailed scoping pinpoints the main impacts of the system and based on the goal removes the need for a full LCA or leads to a reformulation of original decisions concerning the study.

While there is no correct system, it is necessary to specify the system in a clear and transparent manner i.e. system specification, in addition the LCA must cover the life cycle of the system from cradle to grave.

The starting boundary at which the system is considered must be clearly stated, so also the boundaries at the end points of the system .Then the unit operations in between should be defined. This is represented using a process tree.

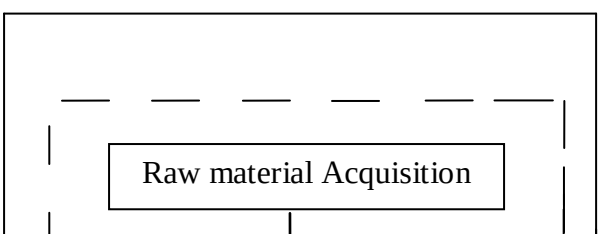

Fig. 2.8: Process Tree of LCA
Source: Integrated Environmental Management Core Module 2

In addition to the main production process represented in the process tree, it is necessary to assess the following:

i. Energy which is a main industrial component. Thus the gross energy requirement which is the total energy resource extracted from the environment must be accounted for.

ii. Ancillary materials which are inputs required for manufacturing but do not form part of the main product.

Sometimes there are various inter- linkages within the system and the system must then be represented as a network.

b. Life –cycle inventory Analysis (LCI)

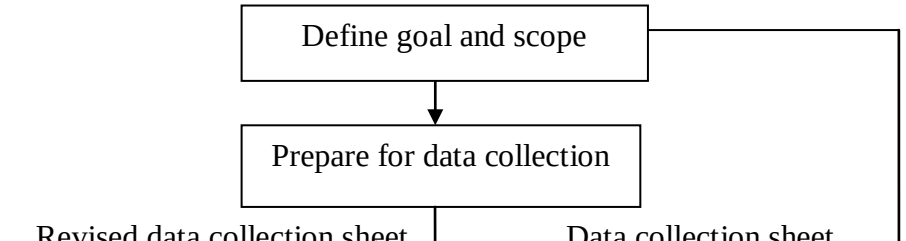

Fig. 2.9: Key Steps in Inventory Analysis Source: ISO 14041

This phase tries to gather the information relating to all the inputs to the extended system including energy and ancillary materials, and all the environmental outputs associated with the various parts of the system. In this regard, the following should be noted:

i. Prepare to collect data - determine type of data required i.e. primary data collected on site to be entered in a worksheet and secondary data obtained from literature, references, government and industry sources, websites, databases. Complete a data set ensuring data quality and proper allocation. Data quality is affected by age, whether it is aggregate, whether it is an estimate or actually measured and data completed. Allocation refers to the procedure where environmental burdens are apportioned between multiple inputs or outputs i.e. in a production unit with multiple products.

ii. Normalising - this is the expression of inputs and outputs to relative standard unit of throughput. This is because the quantity of input/output used /produced per unit process is a function of the mass going through the system at the point in time. The standard unit is called the functional unit.

iii. Computation - Data is entered into a computer model to calculate the inventory of the overall system. This produces data sets known as inventory tables.

c. LCA impact assessment

Once the inventory is generated, the results must be interpreted by assessing the environmental impact of the inputs/outputs identified by the inventory by following the steps below.

i. Selection and definition of impact categories - categories selected of issues such as global climate change, acidification and smog will depend on the goals and scope of the study.

ii. Assignment or classification - allocate the inventory data to the relevant issue categories. Some data (stressors) will impact a number of categories.

iii. Category modeling - calculations are carried out to evaluate the relative significance of each stressor to the overall impact of the system being studied. e.g. using the Global Warming Potential (GWP) in Carbon dioxide (CO_2) equivalents .

Substance	Amount (kg)	GWP in CO_2 equiv/kg @20 years	CO_2 eqiv/kg
CO_2	3.0	1	3.0
Nitrous oxide (NO_2)	0.10	290	29.0
Tetrachloromethane	0.0002	2000	0.4
Total GWP in CO_2 equivalents			32.4

iv. Assessment - this stage involves assessing the import of the impact on the system. This stage may be omitted but when carried out should be done carefully using databases.

v. Weighting - this is a subjective process and involves assigning relative weights or values to impacts. Weighting helps in decision making but is accused of being based on value judgments and politics not science. Relative weights used for ranking is based on societal value and preferences (determined by decision theory techniques) or monetary values (external damage cost estimates).

d. LCA interpretation

Life cycle interpretation is defined by ISO to be a systematic procedure to identify, qualify, check, and evaluate information from the conclusions of the inventory analysis and/or impact assessment of a system, and to present them in order to meet the requirements of the application as described in the goal and scope of the study. It is also a process of communication of the more technical phases of LCA in a form which is both comprehensible and useful to the decision maker (ISO 14043).

Interpretation involves a review to ensure a systematic and consistent process. In addition, when comparing environmental impacts related to different options, the checks must ensure the approach is consistent so comparison is meaningful.

The report produced must state the objectives clearly, explain the scope, explain the system boundary and the reason for its choice, show flow diagrams of important inputs, outputs and products, describe the method used stating the value judgments and assumptions, data showing source and quality; and conclusions drawn from study.

3.4 Uses of Life Cycle Assessment

Internal uses

i. Provides a comprehensive baseline of environmental information. These are determined during inventory and impact assessment components of LCA and are used in the EMS.

ii. Optimises reduction of environmental impact by identifying areas of maximum improvements with least resources.

iii. Provides consumption and environmental loading data for product, process or activity comparisons.

iv. Improves eco-design by providing information that will enhance (re)design of products, processes or activities.

v. Used as an EMS tool for analysing environmental aspects since it identifies and quantifies energy and raw material usage, releases due to products, process or activities and assess environmental impact.

vi. Used as an EMS tool for continuous improvement as actual opportunities are identified and evaluated in the interpretation stage of LCA.

External uses

i. Substantiation of environmental claims.
ii. Help in formulating environmentally benign purchasing - ensure purchases with less impact.
iii. Influence formulation of public policy.
iv. Provide information for public education.
v. Encourage research and development by emphasising gaps.

4.0 CONCLUSION

Life cycle assessment is a useful tool in EMS during the preliminary environmental review, when identifying and evaluating which aspects are significant and when setting objectives and targets since it helps to identify maximum improvements with minimum resources and product, process and activity comparisons.

5.0 SUMMARY

LCA assesses all the relevant effects of the product from cradle-to-grave. It was developed in the 60's and early 70's from fuel cycle studies like energy analysis and resource analysis. The Society for Environmental Toxicology and Chemistry (SETAC) played a leading role in developing terms and methodology of LCA while the International Organisation for Standardisation evolved its standards.

There are four key steps to the LCA

a. Definition of the goal and scope
b. Life cycle inventory analysis (LCI)
c. Life cycle impact assessment
d. Life cycle interpretation

Life cycle assessment is a useful tool in EMS during the preliminary environmental review and for continuous improvement as actual opportunities are identified and evaluated in the interpretation stage of LCA.

SELF-ASSESSMENT EXERCISE

Explain the usefulness of LCA to an organisation.

6.0 TUTOR-MARKED ASSIGNMENT

As the Environmental Manager of a printing press located in one of the six geo-political zones of Nigeria, explain the methodology you would use to conduct an LCA for your company.
(Note: wood is organic and you would need to consider the impact of trees on the environment, where is your source of paper? - import or local, are these sources sustainable?)

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MODULE 3 HEALTH AND SAFETY MANAGEMENT

UNIT 1 CLEAN TECHNOLOGY

CONTENTS

1.0 INTRODUCTION

As man's population as well as his level of development increased, so is his level of discharges to the environment with the accompanying cost to his environment and to public health. There is increasing pressure for all, especially businesses to reduce their discharges.

At the Earth Summit in Rio de Janeiro, in 1992, waste management was discussed with the aim of minimising waste, maximising environmental sound waste reuse, recycling and disposal as elimination is currently unrealistic. New technologies are currently evolving to reduce waste at the design phase.

While one can differentiate between technology which concentrates on prevention (clean technology- used to set objectives and target and establish an environmental management programme), and technology which is used as control (waste minimisation-used in operational control). Waste minimisation and clean technology are often used synonymously, and we shall do the same in this section. Clean

technology focuses on the prevention of waste and pollution, the minimisation of energy consumption and conservation of raw materials.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define waste minimisation, clean technology and cleaner products
- describe the role of clean technology in managing waste
- list the benefits of clean technology
- explain the role of clean technology in EMS.

3.0 MAIN CONTENT

3.1 Development of Clean Technology

Clean technology developed as a result of the realisation that increasing demand for and use of non-renewable resources is unsustainable due to depleted resources, increased by-products of production and consumer waste. There was increased pressure to maximise production efficiency and reduce waste. Waste management is not a new concept and many companies had used waste minimisation measures e.g. reuse, recycle for years for financial reasons.

The Science Advisory Board in America (1988) advocated the need to reduce or prevent pollution at source. In the EU, the 1991 Framework Directive on Waste contains an obligation to reduce waste by cleaner technologies, waste recovery and recycling.

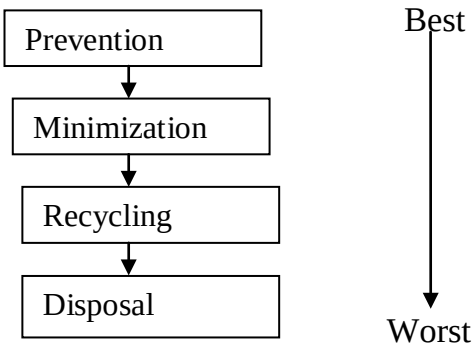

Fig. 3.1: Hierarchy of Waste Management

The EU has developed various directives on waste resulting in a change in thinking from waste disposal to waste management and minimisation.

3.2 Definitions of Clean Technology

Clean technology is the production of goods and services without detectable environmental impact. As this is unattainable, the term cleaner technology is sometimes used.

Cleaner technology is the design and manufacture of intrinsically clean products by intrinsically clean processes.

Cleaner production is the conceptual and procedural approach specific to production which demands that all phases in the life cycle of a product or process should be addressed with the objective of prevention or minimisation of short and long term risks to human health and the environment.

Cleaner products are products whose production has a conceptual and procedural approach which demands that all phases in the life cycle of the product should be addressed with the objective of prevention or minimisation of short and long term risks to human health and the environment.

Waste minimisation is concerned with improvements to existing activities; that is reduction of waste at source and with recycling.

3.3 Benefits of Clean Technology

i. Increased profit as a result of a marketing edge leading to more sales, waste cost savings – cost of raw materials and reduced storage and disposal costs.

ii. Improved process efficiency as a result of constant review of production process and technologies.

iii. Reduced environmental liability due to reduced risks to the environment, health and safety.

iv. Reduced environmental impact as clean technologies usually focus on type, amount and how toxic the discharge is.

v. Improved stakeholder relations since shareholders, staff and regulators will have increased confidence in the organisation.

3.4 Important Elements in the Implementation of Clean Technology

3.4.1 Total Organisational Commitment

Organisational commitment is important for implementation and must be demonstrated by:

i. A statement of organisational policy

ii. A strategy for implementation with allocation of a manager
iii. Training of all staff

Barriers to organisational commitment include:

i. Economic barriers due to insufficient resources
ii. Technical barriers due to a lack of knowledge and expertise
iii. Regulatory barriers if regulations are cumbersome
iv. Cultural barriers due to lack of top management commitment, low awareness and poor communication
v. Resistance to change due to fear.

3.4.2 Clean Technology and Waste Minimisation Techniques

Waste minimisation techniques consist of waste reduction at source (the better option) and recycling.

Waste reduction

Waste reduction at source is achieved by

a. Good housekeeping i.e. good operating practice in existing activities such as
   - maintenance
   - training
   - control procedures.

b. Technological changes which covers equipment and process modification
   - retrofitting where existing equipment and processes are modified
   - cleaner processes where processes are designed to minimise waste and pollution.

c. Input material changes is the replacement of potentially hazardous material inputs with less or preferably non-hazardous inputs with a view to reducing the impact.
d. Product changes involve altering the product to reduce waste in manufacture, use and disposal.

Recycling

Recycling is achieved in the following ways:

a. Re-use within the same process as substitutes for virgin material inputs.
a. Re-use as raw material for another product.
b. Reclamation - sort through waste and use as raw material or sell.

3.5 Methodology of Clean Technology

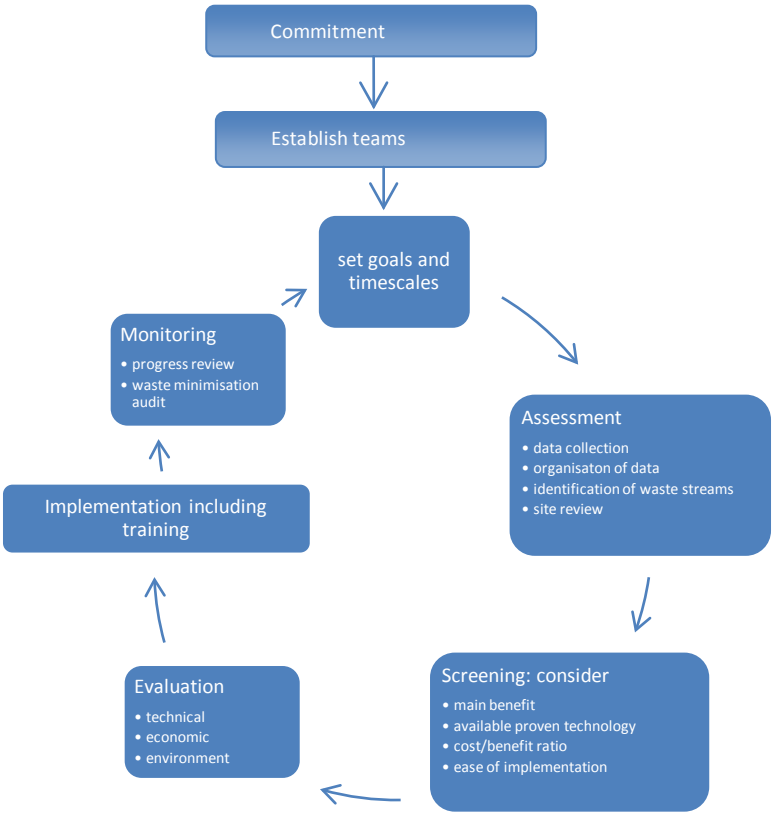

Fig. 3.2: Flow Chart Showing Methodology of Clean Technology.
Source: The UK Environment

3.6 Uses of Clean Technology in EMS

i. Clean technology results in the quantification of inputs and outputs associated within an organisation to establish a baseline.

ii. Clean technology helps to identify areas where improvements are necessary.

iii. Clean technology helps to identify possibilities for the redesign of products and processes thus reducing environmental impact; the main aim of an EMS.

iv. Clean technology helps to reduce waste, pollution, resource consumption thus minimising environmental health and safety risks.

v. Clean technology helps in the identification of significant environmental aspects.

vi. Clean technology can help to offer solutions for areas with problematic environmental implications.

4.0 CONCLUSION

Clean technology is an important tool in EMS. It has its roots in waste management but focuses on the prevention of waste and pollution, the minimisation of energy consumption and conservation of raw materials.

5.0 SUMMARY

Clean technology in the strictest terms is the production of goods and services without detectable environmental impact. Clean technology benefits the organisation by increasing profit, improving process efficiency, reducing environmental liability, reducing environmental impact and improving stakeholder relations. Clean technology requires total organisational commitment and entails waste minimisation at source and recycling methods.

SELF- ASSESSMENT EXERCISE

i. Define clean technology and waste minimisation.
ii. Discuss the benefits of clean technology to an organisation.

6.0 TUTOR-MARKED ASSIGNMENT

As the Environmental Manger in a printing company in one of the six geo-political zones in Nigeria, write an introductory letter on clean technology to your Board of Directors.

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UNIT 2 ENVIRONMENTAL RISK MANAGEMENT

CONTENTS

1.0 INTRODUCTION

Practically every activity no matter how mundane it seems has some degree of risk attached to it. However apart from risks, these activities will also have costs and benefits, thus in deciding if these risks are acceptable or not it will be necessary to weigh the risks against the costs and benefits. The application of risk assessment and management for environmental protection is a relatively new development and the treatment of risk is usually broken into risk assessment and risk management. Although risk management is a management system, it plays a role in the EMS in monitoring risk and in setting objectives and targets.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define the terms: hazard, risk, probability, consequence, risk assessment, risk management, risk estimation and risk evaluation
- describe the method of carrying out risk assessment
- describe the method for managing risk
- explain the role of risk management in an EMS.

3.0 MAIN CONTENT

3.1 Definition of Terms

In order to understand risk management, it is essential to have a thorough appreciation of some terms which we shall constantly use. These include:

a. Hazard: A property or situation associated with an intention that in particular circumstances could lead to harm.

b. Probability: The frequency of occurrence of a defined hazard in a given period, usually presented as a mathematical expression of chance. Where the probability of occurrence is unknown more qualitative terms such as uncertain are used.

c. Consequence: The adverse effects or harm as the result of realizing a hazard. Consequence is also referred to as hazard effect, adverse environmental impacts or externalities.

d. Risk: A combination of probability of occurrence of a defined hazard and a magnitude of the consequences of the occurrence.

e. Risk assessment: The structured gathering of information about risks, and forming a judgment as to their significance. It is also a process in which prediction and evaluation are combined to estimate the risk for a given hazard. Manifestation of risk requires an event, a pathway for transport, and a receptor which could be harmed at exposure point. In essence, risk assessment provides a structured approach for ascertaining the nature and extent of the relationship between cause and effect.

f. Receptors: these are stock or population at risk. Receptors may be living or non-living such as humans, agriculture, buildings, materials and eco-systems.

g. Risk estimation: This is concerned with the consequences of an intention taking the probability of occurrence into account.

h. Risk evaluation seeks to determine the significance of the estimated risks for the receptors.

i. Risk perception relates to the level of understanding an individual has of the risk to which they are exposed.

j. An intention may be ‘do nothing’ or ‘do something’. Intention includes the manufacture and use of a substance; the creation, testing and release of an organism; the construction or demolition of some artifact or scheme; an operation or process; any combination of intentions; and, for all intentions, taking account of inputs, useful and waste products, by-products and emissions.

k. Risk management is the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probabilities of occurrence.

l. The precautionary principle states that the damage done to the natural world should be avoided in advance. Thus when there is a possibility that irreversible damage may result from an intention, although it is not certain that the damage will be caused, the decision maker should, in the lack of firm evidence, err on the side of caution.

m. Risk analysis includes risk assessment (risk estimation and risk evaluation), risk management (risk assessment and option analysis) and risk communication.

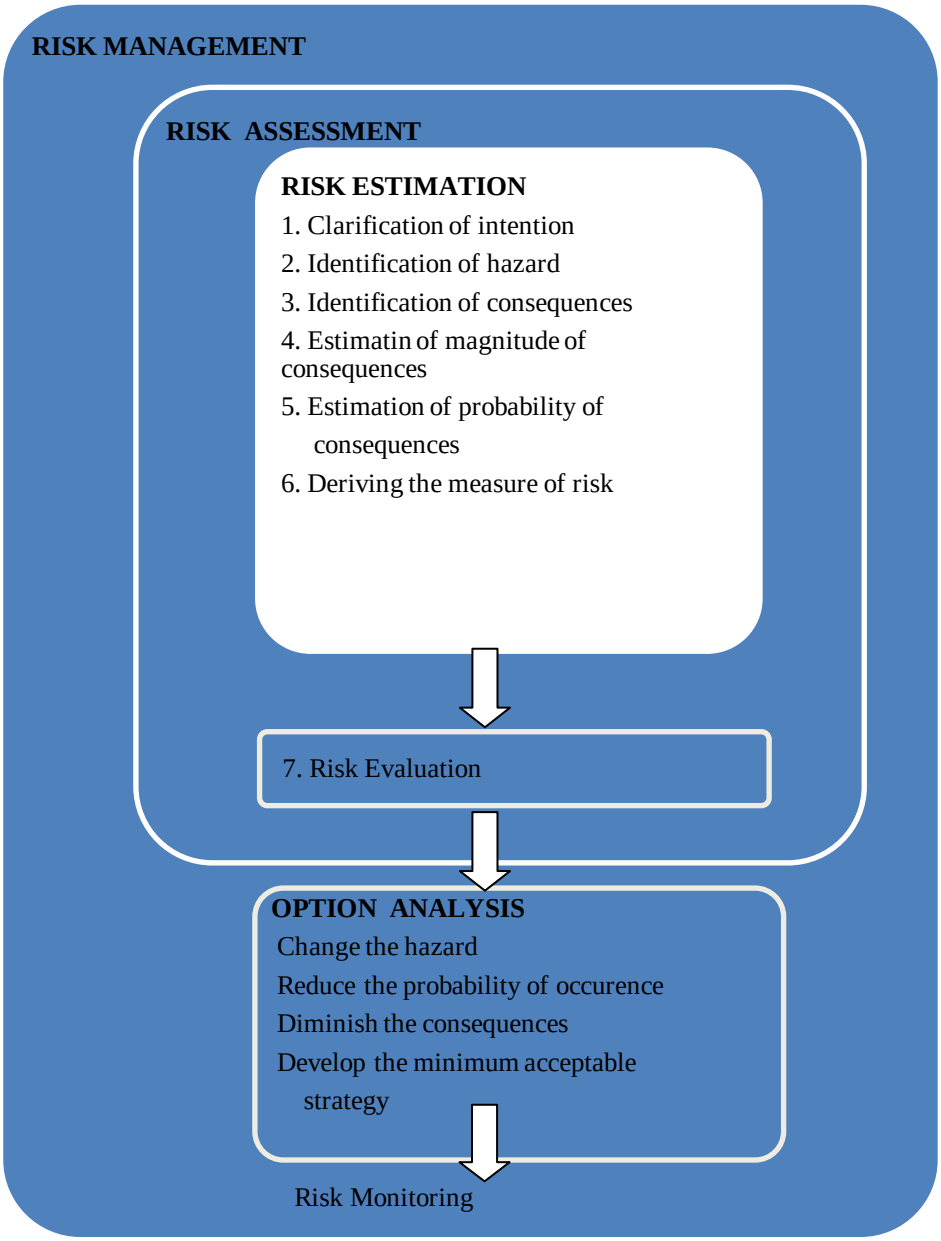

Fig. 3.3: Framework for Risk Management
Source: Royal Society

Risk management involves carrying out a risk assessment and acting on the findings.

3.2 Stages of Risk Assessment

Risk assessment consists of stages 1-6 termed risk estimation and stage 7 risk evaluation.

Stage 1: Clarification of intention

This means setting how exactly what you want to do and how you want to do it. Risk assessment is carried out relative to the base line and can be used to establish the base line in the do-nothing option

Stage 2: Hazard identification
This answers the question where, to what extent, might an operation, substance, process, policy, or the individual stages of one, cause harm to human health or the environment due to their nature or through failure. The hazard which leads to harm is called the hazardous or top event and the chain of lesser events is illustrated in a fault tree. Fault trees, reliability and failure analysis and Hazard and Operability Analysis (HAZOP) are standard techniques used for the systematic identification of hazards. Hazard identification is highly technical and should be done by a team with relevant disciplines who are most familiar with the intention and the baseline conditions.

Stage 3: Consequence identification
The aim is to determine exactly what would happen to the relevant receptors, if a particular hazardous event occurred. The potential consequences are determined due to the identified hazards. The link between the hazard and the consequence are shown using an impact pathway.

Stage 4: Estimate the magnitude of consequences
This stage measures the scale/magnitude of the consequences. This is usually done by using the establishment of a dose-effect or exposure-response type of relationship between the consequence and the receptor.

Stage 5: Estimate the probability of consequences
This may be

a. Objective probabilities determined by prior knowledge from certain events before the hazard/consequence or with hindsight, as a result of the relative frequency of occurrence of a hazard or consequence in the past.

b. Subjective probabilities without prior knowledge and probability assigned based on the judgment of the risk assessor i.e. educated guesses.

Stage 6: Risk estimation
This stage combines the probability rate and the estimates of magnitude to estimate the overall level of risk.

Stage 7: Risk evaluation
Options appraisal is the process of identifying the 'best' risk management technique by evaluation. This may involve scoring, weighting and reporting different risk management options. Various criteria are used for identifying the 'best' option. The aim is to maximise long-term definitions of human well-being such as sustainability, net social benefit or value for money.

Like any other appraisal process risk management involves identifying and reporting the benefits and costs of options, and then ranking those options with regard to the appropriate criteria. Social issues and the perceptions and aspirations of the public should be considered as part of the process.

There are different methods used for comparing and evaluating (or trading off) alternative risk management options. All good policy decisions rely on the effective analysis of alternative options. Therefore, appraisal is important to ensure that the decision-maker is clear about the objectives and how to decide where the balance lies between the benefits from the reduction of the risk and the implications for society of introducing control measures. A systematic appraisal of the options will be the process of identifying, quantifying and weighting the costs and benefits of the measures which have been identified as means of implementation. This process must include all implications of the potential options, and not just those that can be quantified.

All appraisals should be systematic; best achieved through a step-by-step process. A framework can be used consisting of the following steps:

i. Identification of the objective, ensuring a clear and common understanding of what is the desired outcome.

ii. Identification of the options. Different options may be applicable, some more than others. The options identified may be based on policy instruments, economic measures or regulations. The most appropriate could be selected, or one or more options may be merged.

iii. Identification of the impacts of the options by collecting data from stakeholders likely to be affected.

iv. Clarify the decision criteria such as the economic costs, the implications of change, and the human health and environmental benefits.

v. Compare the advantages and drawbacks for each option including the trade-off between quantified and qualitative data to draw conclusions.

Techniques used for this appraisal include:

a. Environmental Impact Assessment
b. Strategic Environmental Assessment
c. Cost Benefit Analysis
d. Environmental capital - this rests on the idea that the environment consists of assets which can provide a stream of benefits or services as long as care is taken not to damage them.

vi. Multi-criteria or multi-attribute analysis; this approach involves multiplying the weighting for each decision factor by the rank, rating or scale value of each option. The resulting products are then totalled to arrive at an overall score for each option.

Ranking, rating and scaling

These involve summarising both quantitative and qualitative information on alternative options using the assignment of a rank, rating or scale value relative to each of a number of decision factors or criteria. These decision factors can include the economic costs and benefits of the intention, social and political perspectives.

Ranking involves placing options from best to worst; scaling refers to the assignment of algebraic or letter scale; rating employs a pre-defined range. The rank, rating or scale value is then presented in a matrix to aid decision-making.

Weighting

Weighting of the risks is done in order to assess the significance of risks. In weighting, various factors are considered, relating to the receptors response and perception of risk by those likely to be affected. The values of these risks are then compared with acceptable levels of risk that have already been set by public agencies such as FME and NESDRA.

Weighting is defined as the act of assigning subjective, value-based weighting of factors to the different impact categories based on their perceived importance or relevance.

This involves weighting the relative importance of each decision factor. Such an approach will always be open to criticism because the weights may be seen as arbitrary or biased. Different assessors, projects, companies and industries use different values as weights. While one assessor may use 1-5 while another may use values 5-100 with the lowest weight having the lowest value. The scores and weights attached to different criteria may be based on one or more of the following:

i. Estimating the probability of events: In environmental risk assessment, there can be situations in which the probability of an event will happen. For example, once the decision to build a dam has been taken, its construction will certainly lead to the loss of habitats, landscape features and structures in the flooded area. In this case, the important parameters to consider are the probability and magnitude of consequences arising from the construction rather than the probability of the event (construction) itself.

ii. Actuarial or historical information: This involves looking at the reliability of components or other factors within a system based on past experience or data. To be useful there has to be a statistically significant number of data points. If the event is very rare (such as a major industrial accident), then it will not be possible to gather sufficient data for a probability estimate.

iii. Synthesised analysis such as fault tree analysis and event tree analysis which are used where processes, industries or sectors do not have sufficient data on which to base such estimates techniques involving synthesised analysis are needed. Logic diagrams are used to show the route events or faults through a system.

iv. Estimating the magnitude of consequences: While in some cases there will be a high level of uncertainty in the estimation of the magnitude of consequences, in most cases, it will be possible to quantify the magnitude of the consequences, and possibly even place a monetary value on them.

v. Estimating the probability of consequences: There are three primary factors to consider when estimating the probability of consequences: whether the event will be initiated; whether exposure to the hazard will occur; and whether harm will result following exposure.

Case Study: Assessing the Risk of Flood Waters to Sections of Land behind a Coastal Defense Scheme

Flood hazard had been previously characterised from specialist studies and the severity of various flood events assessed by considering:

1. The magnitude of consequences: The nature of harm posed by the flood hazard and the vulnerability of receptors determine the magnitude of the consequences.

   The principal consequences were weighted according to the nature of harm:
   - no significant damage (1)
   - minor water damage to properties (10)
   - minor structural damage (50)
   - major structural damage or injury (500)
   - loss of life (2000)

2. Vulnerability to consequences was assigned an indicative 'value', from 1 (for low value structures) to 5 (for developments with a high residential mix).

3. Probability of the consequences: In this case study, the magnitude of the consequences was estimated for floods with annual probabilities ranging from 0 -1; 0.1, 0.02 and 0.005 (i.e. with mean return intervals of 10, 50, and 200 years.

   Magnitude of the consequences for each land section is a product of the weights of probability (e.g. 0.02) and the principal consequence type (e.g. 500) for each land section, weighted according to its vulnerability (e.g. 4).

4. Factors controlling the probability of harm being sustained (weighted)
   - the availability of access by emergency vehicles (5)

- the availability of easy routes of evacuation to shelters (5)
- the amount of advanced warning available (5)
- a prior knowledge of evacuation procedures (3)
- the availability of access to shelter within the property (2)
- the existence of protection for properties (drop boards, etc.) (2).

5. Response profile (weighted);this is the sum of the extent to which these factors were likely to influence community response ,in all land sections following the issue of a red flood warning scoring them on a 1 (low influence) to 5 (high influence) basis. Individual local scores are summed.

   Risk is a sum of damage and response for each of the land sections.

Table 3.1: Damage, response and risk 'profiles' and designations for sections of land behind a coastal defense scheme

Land Section	Damage profile	Response profile	Risk profile	Designation
1	350	102	452	Very High
2	125	102	227	High
3	125	97	222	High
4	100	98	198	high
5	105	87	192	High
6	100	92	192	High
7	105	84	189	High
8	105	69	174	High
9	48	53	101	Medium
10	14	84	98	Medium
11	3	87	90	Medium
12	1	79	80	Medium

Source: Guidelines for Environmental Risk Assessment and Management

3.3 Risk Management

This is using the information from risk assessment and incorporating it into the decision-making process. The final decision may be 'yes, go ahead', 'yes go ahead with modification of intention', or 'no the risks are too great'. Modification of intention to reduce the risk restarts the risk assessment process, so risk assessment becomes a cycle.

3.4 Methods of Managing Risk

In order to reduce risk, one may modify the receiving environment or hazard; modify or avoid exposure; or modify the effects or consequences of a risk. Thus, risk management requires that Option analysis be undertaken. This consists of four stages which are:

i. Changing the hazard
ii. Reduce the probability of occurrence
iii. Diminish the consequences
iv. Develop a minimum acceptable risk strategy.

The opportunities for managing the risk may be to modify your intention (best), divert the impact pathway, protect the receptors, etc. One may

i. Manage specific relevant events by site selection, plant or process design, choice of technology.
ii. Put contingency plans in place in anticipation of accidents or incidents. Since this cannot be done for every single potential accident, plan for those with highest probability or most significant impacts.
iii. After identification, assessment, investigation of the scope for reducing the risk, there is the need to mitigate the risk by transferring or sharing this risk with a third party (e.g. insurance company) and when this is not possible, the risk is then allocated.

The following table may be used as a template when managing risk.

Table 3.2: Template for Risk Management

Impact	**Probability**		
	Low	Medium	High
Low	Ignore	Accept	Manage

Medium	Accept	Share	Transfer
High	Insure	Transfer	Reduce and mitigate

Source: Industrial Safety Health and Environment Management Systems

3.5 Benefits of Risk Assessment

Risk Assessment is beneficial because it:

i) Ensures legal compliance
ii) Reduces the risk of incidents
iii) Improves the quality of the decision making process
iv) Fulfills the commitment to sustainable development
v) Identifies areas where research or regulatory measures are needed

3.6 The Relationship between Risk Management and EMS

i. The development of an EMS is a good starting point for risk management.
ii. Risk assessment is a tool for identifying significant impacts and prioritising significant impacts.
iii. Corporate risk management is useful in making the connection to EMS.
iv. Risk assessment methodology should be used as a guide for assessment, relevant to each organisation.
v. Risk management is useful in the assessment of abnormal operating conditions (emergency preparedness).

4.0 CONCLUSION

Even though risk management is in itself a management system, it has many identified links and similarities with EMS and other environmental management tools such as the cost benefit analysis, environmental audit, life cycle assessment and clean technology.

5.0 SUMMARY

The application of risk assessment and management for environmental protection is a relatively new development and the treatment of risk is usually broken into risk assessment and risk management. Risk assessment has also been defined as a process in which prediction and evaluation are combined to estimate the risk for a given hazard while risk management is the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probabilities of occurrence. Risk management involves carrying out a risk assessment and acting on the findings.

Risk management is in itself a management system, it has many identified links and similarities with EMS and other environmental tools such as cost benefit analysis, environmental audit, life cycle assessment and clean technology.

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SELF-ASSESSMENT EXERCISE

a. Define the following terms:
   i. Hazard
   ii. Risk assessment
   iii. Risk management
b. Describe the method of carrying out risk assessment.

6.0 TUTOR-MARKED ASSIGNMENT

i. Make a general list and explain the hazards you might identify in the context of a new factory. (You might want to identify a specific industry).
ii. Pick one hazard, identify some of the possible consequences, give a subjective estimate of the magnitude, probability, a measure of the risk and evaluate its significance.
iii. Describe how you would manage this risk.

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UNIT 3 SUSTAINABLE DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

We have seen that the ability of the environment to supply raw materials and absorb waste is becoming increasingly undermined. As a specie, we are breaking the limits - using up the “capital” from the planet’s savings account, rather than living off the “interest’’. It has become clear that a link exists between man’s activities and issues

such as global warming, destruction of the ozone layer, pollution of water resources, increasing occupational health and environmental health issues and depletion of biodiversity.

With this in mind, the United Nations set up a commission to find solutions. This commission concluded that sustainable development was the way to address the issues. Sustainable development thus forms the basis for EMS as well as tools such as life cycle analysis, clean technology, environmental audits and cost benefit analysis.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define sustainable development
- identify some of the characteristics and requirements of sustainable development
- identify some of the major agencies and their contribution to the attainment of sustainable development.

3.0 MAIN CONTENT

3.1 Definitions

There are various definitions of the term sustainable development these include:

1. "Development which meets the needs of the present without compromising the ability of future generations to meet their needs." (Brundtland Commission, 1987). "Needs" in this definition refer to essential or basic needs and "compromising the ability" calls for equity within and between generations.

2. "Sustainable development is about ensuring a better quality of life for everyone, now and for generations to come. To achieve this, sustainable development is concerned with achieving economic growth, in form of higher living standards, while protecting and where possible enhancing the environment- not just for its own sake but because a damaged environment will sooner or later hold back economic growth and lower the quality of life-and making sure that these economic and environmental benefits are available to everyone, not just to a privileged few." (UK Department of the Environment, Transport and Regions, 1998).

3. "Sustainable development is a pattern of social and structural transformation which optimises the economic and societal benefits available in the present,

> without jeopardising the likely potential for similar benefits in the future… a primary goal of sustainable development is to achieve a reasonable and equitably distributed level of economic well-being that can be perpetuated continually for many human generations." (Goodland and Ledoc, 1987).

Despite the fact that there are many definitions of the term sustainable development, people and organisations are encouraged to choose or develop an interpretation based on their own context.

Sustainable development means some sort of win-win, between meeting people's needs, and staying within environmental limits - so that people's needs can still be met in the future.

By 2050 it is estimated that there will be 9.5 billion people living on the earth.

Sustainable development is about solving the puzzle of how you meet the needs of 9.5 billion people on a planet which has limits.

3.1.1 Goals of Sustainable Development

a. Integration of the social, economic and environmental decisions of sustainable development in policy making at international, regional and national levels.
b. Wide–spread adoption of an integrated, cross-sectoral approach to sustainable development.
c. Measurable progress in the implementation of the goals and targets of the Johannesburg Plan of Implementation.

3.2 Requirements and Characteristics of Sustainable Development

In order to achieve the desired balance between human activity and development and the protection of the environment, it is necessary to ensure:

a. Integration into formulation and implementation of economic and sectoral policies
b. Integration into public authority decisions
c. Integration into production services
d. Integration into individual behaviour and choice
e. Effective communication.

Sustainable development has the following characteristics:

a. Maintenance of the overall quality of life
b. Maintenance of access to natural resources
c. Avoidance of lasting environmental damage

3.2.1 Requirements for Achieving Sustainable Development

a. Manage resources in processing, consumption and use and encourage re-use and recycling
b. Rationalise production and consumption of energy
c. Change consumption and behaviour patterns of society

3.3 Events Contributing to International Sustainable Development Legislation

This list is by no means exhaustive but includes:

i. World Commission on the Environment and Development (WCED). WCED developed the Brundtland report: "Our Common Future" published in 1987. The report produced the most widely quoted definition of sustainable development and emphasised the need for sustainable development.

ii. UN Conference on Environment and Development (UNCED)
Earth Summit in June 1992 produced

   a. The Rio de Janeiro declaration which places humans at the centre of sustainable development issues and presented 27 principles including the precautionary principle and the polluter pays principle (You pollute you pay to remediate).

   b. Agenda 21- Agenda for 21st century. It called for bottom-up approach thus emphasising the role of small groups and individuals in development.

   c. UN Framework Convention on Climate Change (UNFCC) dealing with the use of fossil fuel, targets a reduction to 1990 levels by 2000 for developed nations called the Kyoto Protocol agreed five years later. America refused to sign the Convention.

   d. UN Convention on Biological Diversity ensures access to biodiversity for countries with biotechnology.

   e. Statement of Forest Principles made when Convention on Forests collapsed. It emphasises national sovereignty over forest reserves.

iii. UNCED, Earth Summit + 5 in New York 1997 to monitor the progress. NGOs were treated as full participants.

iv. UNCED, Earth Summit + 10 in Johannesburg 2002. World Summit on Sustainable development. Millennium Development goals (MDGs) formed an important element of the plan formed.

v. UN General Assembly as part of the General Summit in New York in 2000 produced the Millennium Development Goals (MDGs). Goal 7 Ensures environmental sustainability.

3.4 Agreements in Force which Support Sustainable Development

The agreements which support sustainable development cover several areas and include the agreements in the following table.

Table 3.3: Agreements in Force which Support Sustainable Development

Sector	Agreement	Drafting Agency
Human Rights	Universal Declaration of Human rights	United Nations General Assembly (1948)
Ozone depletion	Vienna Convention for the depletion of the ozone layer	Vienna Convention 1985
Hazardous materials	Basel Convention on the trans-boundary movement of hazardous material	Basel convention,Adopted 1989, came in force 1992
Global warming	UNFCC	Rio earth summit , adopted 1992, in to force 1994
Desertification	UN Convention to Combat Desertification (UNCCD)	UN 1994, into force 1996
Trade agreements	General Agreement on tariffs and trade	World Trade Organisation (1947)
Persistent organic pollutants	Stockholm Convention on Persistent Organic Pollutants	UN 2001

Source: United Nations Treaty Collection

3.4.1 Explanation of Terms

Charter - Solemn instrument of international law; agreements that grant rights

Treaty - a concluded agreement in written form governed by international law

Convention - Formal multilateral treaties with a large number of parties

Protocol - International legal agreement which is subsidiary to existing treaty or convention

Adoption - Formal legal act establishing the form and content of treaty, convention or protocol text.

3.5 Building Sustainable Cities

Many cities have arisen over time and in fact mega-cities now exist (cities with over 10 million inhabitants, e.g. Lagos-Nigeria). These cities bring with them a large number of problems as a result of a large number of people living in them. To ensure that these cities are sustainable, a variety of issues need to be considered. These include:

i. Energy utilisaton
ii. Water pollution and depletion
iii. Green House effect and ozone depletion
iv. Ecology and landscape damage
v. Degradation of land
vi. Land speculation and unplanned development
vii. Poverty alleviation
viii. Utilisation of natural resources in construction

4.0 CONCLUSION

It is clear that in order for development to be sustainable, a global approach must be taken. However, while it takes time to produce, ratify and adhere to treaties, events in one part of the globe such as massive utilisation of fossil fuels continues to affect other parts of the globe, for example, the melting of the ice-caps, which in turn put the well-being of other areas in jeopardy.

5.0 SUMMARY

There is a need for man to review his present activities in order to ensure the earth is preserved for present and future generations. Sustainable development ensures some sort of win-win situation between meeting people's needs, and staying within environmental limits.

Sustainable development is defined as "development which meets the needs of the present without compromising the ability of future generations to meet their needs."

SELF- ASSESSMENT EXERCISE

i. Define sustainable development.
ii. Identify the characteristics and requirements for sustainable development.

6.0 TUTOR-MARKED ASSIGNMENT

i. What is sustainable development?
ii. Explain its role in sustaining the environment.

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UNIT 4 HEALTH AND SAFETY POLICIES IN INDUSTRIES AND WORK ENVIRONMENTS

CONTENTS

1.0 INTRODUCTION

Accidents and ill health are costly to workers and their families. They can also hurt companies because, in addition to the costs of personal injuries, they may incur far greater costs from damage to property or equipment, and lost production. In order to improve the management of occupational health and safety risks, management systems which were already in use in the achievement of quality were introduced with good results, thus forming the basis of occupational health and safety management systems. There are guidelines used for occupational health and safety, the International Labour Organisation (ILO); ILO-OSH:2001 and the British Standards Institution (BSI) Occupational Health and Safety Assessment Series (OSHAS) 18001:1999 and 18002. These systems are occupational health and safety management systems. The starting point of the system is the health and safety policy. While it is pertinent to note that certification is not essential for managing occupational health and safety risks, any company that sincerely wants to manage occupational health and safety risks will utilise occupational health and safety management systems.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define various terms used in occupational health and safety
- list the essential elements of a health and safety policy
- use the draft policy to prepare a health and safety policy.

3.0 MAIN CONTENT

3.1 Terms and Definitions

1. Occupational health and safety refers to conditions and factors that affect, or could affect, the health and safety of employees or other workers (including temporary workers and contractor personnel), visitors, or any other person in the workplace.

2. Workplace is any physical location in which work related activities are performed under the control of the organisation.

3. Organisation is a company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration.

4. Occupational health and safety management system is part of an organisation's management system used to develop and implement its occupational health and safety policy and manage its risks.

5. A management system is a set of interrelated elements used to establish policy and objectives and to achieve those objectives. A management system includes organisational structure, planning activities (including, for example, risk assessment and the setting of objectives), responsibilities, practices, procedures processes and resources.

6. Occupational health and safety policy is defined as the overall intentions and direction of an organisation in relation to its occupational health and safety performance as formally expressed by top management. The occupational health and safety policy provides a framework for action and for the setting of occupational health and safety objectives.

7. Hazard is something with potential to cause harm. The harm will vary in severity; some hazards may cause death, some serious illness or disability, others only cuts and bruises.
8. Hazard identification is a process of recognising that a hazard exists and defining its characteristics.

9. Risk is the combination of the severity of harm with the likelihood of it happening.

10. Acceptable risk is a risk that has been reduced to a level that can be tolerated by the organisation having regard to its legal obligations and its own occupational health and safety policy.

11. Risk assessment is the process of evaluating risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk(s) is acceptable.

3.2 The Occupational Health and Safety Policy

We have seen that the occupational health and safety policy is defined as the overall intentions and direction of an organisation related to its occupational health and safety performance as formally expressed by top management. The occupational health and safety policy provides a framework for action and for the setting of occupational health and safety objectives. Thus the health and safety policy influences all activities, including the selection of people, equipment and materials, the way work is done and the design and provision of goods and services.

A written statement of policy and the organisation and arrangements for implementing and monitoring it shows the staff, and anyone else, that hazards have been identified and risks assessed, eliminated or controlled.

The following questions need to be asked by management when writing or reviewing a policy.

1. Is there a clear policy for health and safety? Is the policy put in writing?

2. What was achieved in health and safety the previous year?

3. How much has been spent on health and safety? Is there value for money?

4. How much money has been lost by not managing health and safety?

5. Does the policy prevent injuries, reduce losses and really affect the work?

3.2.1 Essential Elements of an Occupational Health and Safety Policy

Top management should define and authorise the organisation's occupational health and safety policy and ensure that within the defined scope of its occupational health and safety policy complies with the following:

1. Is appropriate to the nature and scale of the organisation's occupational health and safety risks.

2. Includes a commitment to prevention of injury and ill health and continual improvement in occupational health and safety management and occupational health and safety performance.

3. Includes a commitment to at least comply with applicable legal requirements and with other requirements to which the organisation subscribes that relate to its occupational health and safety hazards.

4. Provides the framework for setting and reviewing occupational health and safety objectives.

5. Is documented, implemented and maintained.

6. Is communicated to all persons working under the control of the organisation with the intent that they are made aware of their individual occupational health and safety obligations.

7. Is available to interested parties.

8. Is reviewed periodically to ensure that it remains relevant and appropriate to the organisation.

3.3 Template for Occupational Health and Safety Policy

The following is a template for an occupational health and safety policy. There is no right or wrong policy and different companies within the same industry may have vastly different policies. What is important is that the above elements are considered in writing the policy and it is in itself a commitment to continual improvement.

This is the Health and Safety Policy Statement of
(name of company)……....

Our statement of general policy is:

- to provide adequate control of the health and safety risks arising from our work activities

- to consult with our employees on matters affecting their health and safety

- to provide and maintain safe plant and equipment

- to ensure safe handling and use of substances

- to provide information, instruction and supervision for employees

- to ensure all employees are competent to do their tasks, and to give them adequate training

- to prevent accidents and cases of work related ill health

- to maintain safe and healthy working conditions

- to review and revise this policy as necessary at regular intervals.

Signed
(Employer)
Date Review date

Source: Health and Safety Executive

3.4 Sample Policies

3.4.1 Natural England Occupational Health and Safety Policy Statement

Natural England is committed to conducting its business in a manner that protects the health and safety of our employees, contractors and the public. In addition to complying strictly with the health and safety measures required by legislation, it is the Natural England's policy to promote and take all reasonably practicable steps to safeguard the health, safety and welfare of its employees and others who may be affected by its actions.

To meet the requirements of this policy Natural England will work with all employees and strive for continuous improvement in health and safety performance. We will operate an integrated, structured and documented system of management control over all our operations. This system of control commits us to:

i. Undertake an appropriate reviews and assessments of our operations and undertakings to measure progress, manage risk, and ensure compliance with this policy.

ii. Ensure that our employees are fully competent to perform the tasks allocated to them by careful recruitment, on-going development, including specialist training, and by provision of the necessary resources.

iii. Maintain the health and safety awareness of all employees by the establishment of sound health and safety practices and operations through competent management and good communications, leading to continuous improvement in health and safety performance.

iv. Ensure that the contractors we engage are competent to perform the work contracted and encouraging good safety practice within such companies in compliance with this policy.

v. Design and maintain our premises and facilities so as to minimise the risks associated with their maintenance and use.

vi. Effective response to, and investigation of accidents, incidents and near misses, to establish root causes and take reasonable actions to prevent their reoccurrence.

Natural England will provide information to, and ensure appropriate consultation with, health and safety representatives on matters relevant to this policy. We will discuss and exchange ideas relating to health and safety with our employees on a

local basis and will, in addition, operate an organisation which will maintain adequate communications and action in these matters.

Prime responsibility for these matters lies with us. Executive Directors, National and Regional Directors, Area Managers and all other managerial and supervisory staff equally have responsibility for matters within their control. (See Part 3). We all have a duty to ensure that health and safety issues are given the fullest consideration at all times, and for providing a safe and healthy working environment for our employees.
The Head of Occupational Health and Safety is directly accountable to the Executive Director for monitoring and reporting on our health and safety performance, and providing such advice as the organisation needs to maintain and improve its performance in this area.

In addition all Natural England employees have a responsibility to themselves and others for the safety and prevention of ill health at work. We must all work together in the spirit of participation and cooperation to ensure the success of this policy and hence the maintenance of human health and well-being while carrying out our important work to protect and improve the environment.

Sir Martin Doughty Helen Phillips
Chair Chief Executive

Natural England Health and Safety Policy and Strategy Approved 28/9/06

Source www.ne/ /healthsafetypolicy_tcm6_6798.pdf

3.4.2 Health and Safety Policy CB Richard Ellis Limited

CB Richard Ellis Limited, and all of its associated and subsidiary companies, is fully committed to achieving the highest standards of health and safety management and performance in order to safeguard our employees, clients, tenants, contractors and any other person that may be affected by our actions and activities.

We will actively promote a culture of health and safety best practices which will lead to the avoidance of, or reduction in, risks to health and safety, and ensure compliance with the Health and Safety at Work Act 1974 and associated legislation.

We believe that an excellent company is by definition a safe company. Since we are committed to excellence, it follows that minimising risk to people is inseparable from all other company objectives. We recognise that good health and safety performance is a positive business investment and is the responsibility of both management and employees.
As an organisation, we will ensure that sufficient resources are provided to ensure effective management and implementation of our health and safety arrangements. Each Service Group Head and Regional Managing Director is responsible for ensuring that they implement all the relevant health and safety policies/procedures

and have clearly defined departmental process for ensuring safe systems of work. Responsibilities and relationships must be developed which promote a positive health and safety culture, and secure the implementation and continued development of our health and safety policies. Objectives and targets will be set for the organisation through the Health and Safety Risk Management Board and will be reviewed at regular intervals.

CB Richard Ellis Limited has in place adequate systems and arrangements to achieve the following:

i. Provide the safest possible environment for visitors, tenants, employees and contractors and any others who may be affected by our activities.

ii. Compliance with all relevant legislation and associated codes of practice.

iii. Effective lines of communication with relevant enforcement agencies.

iv. Minimisation of risks through risk assessment which is used to decide on priorities and to set objectives for eliminating hazards and reducing risks. Risks that cannot be eliminated are minimised by the use of physical controls or, as a last resort, through systems of work and personal protective equipment (PPE).

v) Adequate information, instruction and training to meet employee and business needs.

vi. Assessment of the adequacy of health and safety policies/procedures through consultation with our employees.

vii. Reduce accidents and incidents to the lowest possible level.

viii. Requirements for all employees, contractors and partners, to work safely and with consideration for the health and safety of themselves and others.

Detailed information regarding roles and responsibilities and our arrangements for health and safety management can be found in our document called “CB Richard Ellis Limited – Health and Safety Arrangements” and the supporting policies and procedures that underpin this document.

In addition to CB Richard Ellis Limited fulfilling its responsibilities for health and safety, all employees are required to:

i. Take reasonable care for their own health and safety and that of others who may be affected by their acts or omissions.
ii. Co-operate with CB Richard Ellis Limited on matters relating to health and safety at work by complying with procedures and instructions.

iii. Not knowingly act in such a way which may cause either themselves or the Company to be in breach of the law or damage the reputation of the Company.

iv. Correctly use any items of equipment, in accordance with training given and not interfere with; or misuse, any item of personal protective equipment provided.

v. Attend general and work-related health and safety training as required.

vi. Inform their line manager at the earliest opportunity, if during the course of their work, they are injured, become unwell or involved in or become aware of any potentially unsafe situations.

Signed copies available on request

Managing Director
Martin Samworth

Approved date
2nd January 2010

Source www.cbre.eu/portal/page/portal/uk_en

4.0 CONCLUSION

Although the occupational health and safety policy is the starting point as regards the occupational health and safety management system, it is extremely important as it defines the framework of the system. It must be written by top management, but all levels of the organisation must be involved in its preparation, and must be committed to it in order to ensure its effectiveness.

5.0 SUMMARY

The occupational health and safety policy is defined as the overall intentions and direction of an organisation related to its occupational health and safety performance as formally expressed by top management.

The occupational health and safety policy provides a framework for action and for the setting of occupational health and safety objectives. There is no right or wrong policy and different companies within the same industry may have vastly different policies. What is important is that the essential elements are considered in writing the policy and there is a commitment to continual improvement.

SELF-ASSESSMENT EXERCISE

List and explain the elements necessary in an occupational health and safety policy.

6.0 TUTOR-MARKED ASSIGNMENT

As the Safety Officer of a publishing company, prepare a draft copy of an occupational health and safety policy for the company. (Note the company has a very active union).

7.0 REFERENCES/FURTHER READING

Health and Safety Executive (2008). *An Introduction to Health and Safety. Health and Safety in Small Businesses.* Health and Safety Executive INDG259 (rev1) 08/08.

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UNIT 5 STRATEGIES AND OBJECTIVES

CONTENTS

1.0 INTRODUCTION

We have seen that the occupational health and safety policy is the starting point of the occupational health and safety management system. We have also reviewed Plan-Do –Check-Act (PDCA) as the basis of EMS and other management systems. We will review in this unit PDCA as essential elements of the occupational health and safety system and its relationship to the strategies and objectives of the occupational health and safety policy.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe the essential elements of the occupational health and safety management system
- list the strategies of the occupational health and safety policy
- list the objectives of the occupational health and safety policy.

3.0 MAIN CONTENT

3.1 Elements of the Occupational Health and Safety Management System

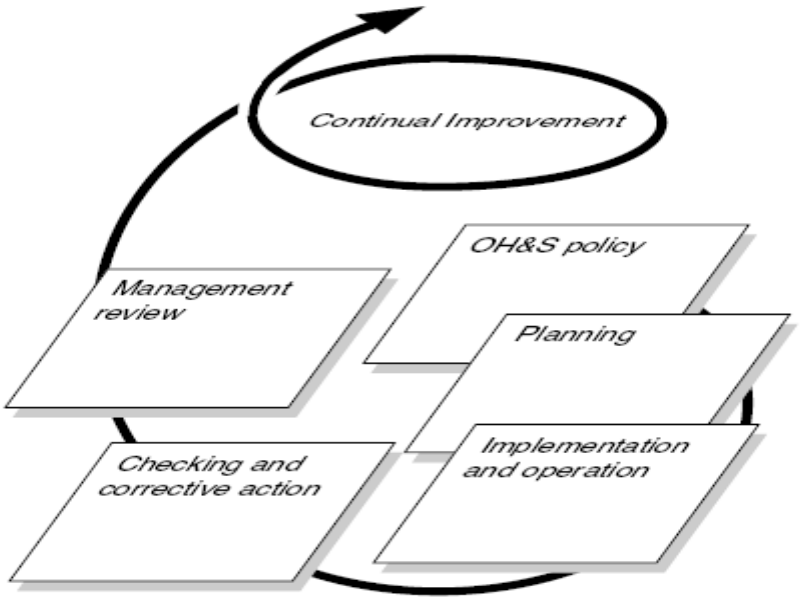


Fig. 3.4: OHS Management System Model for the OHSAS Standard PDCA
Source: Occupational Health and Safety Management Systems – Requirements BS OHSAS 18001:2007

PDCA can briefly be described as follows:

3.1.1 Plan (Planning)

Establish the objectives and processes necessary to deliver results in accordance with the organisation's occupational health and safety policy. This involves:

a. Organisation of staff
Staff involvement and commitment is necessary to make occupational health and safety effective. This is often referred to as a positive health and safety culture.

The four 'Cs' of positive health and safety culture are

- Competence - recruitment, training and advisory support
- Control - allocating responsibilities, securing commitment, instruction and supervision
- Cooperation - between individuals and groups.
- Communication - spoken, written and visible.

b. Plan and set standards
Planning is the key to ensuring that your health and safety efforts really work. Planning for health and safety involves setting objectives, identifying hazards, assessing risks, implementing standards of performance and developing a positive culture. Plans should be written and should provide for the following:

- identify hazards and assess risks, and decide how they can be eliminated or controlled
- comply with the health and safety laws that apply
- align health and safety targets with managers and supervisors
- develop a procurement policy which takes health and safety into account
- design of tasks, processes, equipment, products and services, safe systems of work
- procedures to deal with serious and imminent danger
- cooperation with neighbours, and/or subcontractors
- set objectives against which performance can be measured.

Objectives help to build a positive culture and control risks. They set out what people in the organisation will do to deliver the policy and control risk. They should identify who does what, when and with what result. Objectives must be: specific, measurable, achievable, realistic, time bound (SMART).

Many industry based standards already exist and can be adopted where applicable. In other cases, standards can be set preferably referring to numbers, quantities and levels which are seen to be realistic and can be checked by means such as completing risk assessments and implementing the controls required; maintaining workshop temperatures within a specified range; specifying levels of waste, effluent or emissions that are acceptable; specifying methods and frequency for checking guards on machines, ergonomic design criteria for tasks and workstations, levels of training; arranging to consult staff or their representatives at set intervals; monitoring performance in particular ways at set times.

3.1.2. Do (Implementation and Operation)

Implement the processes. Occupational health and safety management system aims to eliminate or minimise risks to employees and other parties. After hazard identification and risk assessment, determine management controls using the following hierarchy:

a. elimination
b. substitution
c. engineering controls
d. signage/warnings and/or administrative controls
e. personal protective equipment.

3.1.3 Check (Checking and Corrective Action)

Monitor and measure processes against occupational health and safety policy, objectives, legal and other requirements, and report the results.
Measure your performance: where you are; where you want to be; what is the difference and why.

Active monitoring before things go wrong, involves regular inspection and checking to ensure that standards are being implemented and management controls are working. Are you achieving the objectives and standards you set and are they effective?

Reactive monitoring, after things go wrong, involves learning from your mistakes, whether they have resulted in injuries and illness, property damage or near misses. Investigating injuries, cases of illness, property damage and near misses identifying in each case why performance was substandard.

Ensure that information from active and reactive monitoring is used to identify situations that create risks, and do something about them. Priority should be given where risks are greatest, at serious events and those with potential for serious harm. Investigate and record what happened, find out why. Refer the information to the people with authority to take remedial action, including organisational and policy changes.

3.1.4 Act (Management Review)

i. Take actions to continually improve occupational health and safety performance
ii. Learn from experience, audit and review
iii. Monitoring provides the information to review activities and decide how to improve performance.

Internal and external audits complement monitoring activities by looking to see if the policy, organisation and systems are actually achieving the right results. They tell about the reliability and effectiveness of systems. Learn from experiences. Combine the results from measuring performance with information from audits to improve the approach to health and safety management. Review the effectiveness of the health and safety policy, paying particular attention to:

- the degree of compliance with health and safety performance standards (including legislation)
- areas where standards are absent or inadequate
- achievement of stated objectives within given time scales
- injury, illness and incident data analyses of immediate and underlying causes, trends and common features.

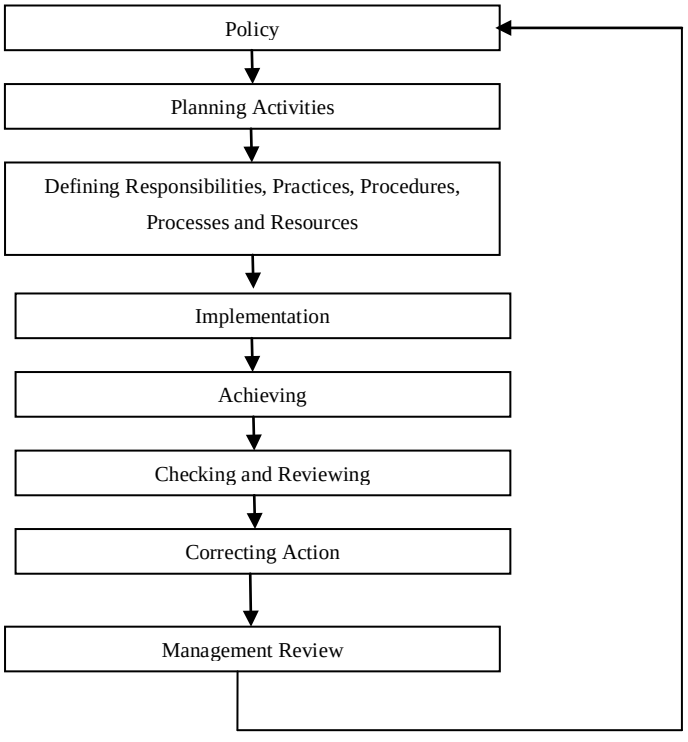
Continual improvement is the recurring process of enhancing the occupational health and safety management system in order to achieve improvements in overall occupational health and safety performance consistent with the organisation's occupational health and safety policy.
Many organisations manage their operations via the application of a system of processes and their interactions, which can be referred to as the "process approach".

ISO 9001 promotes the use of the process approach. Since PDCA can be applied to all processes, the two methodologies are considered to be compatible.

The level of detail and complexity of the occupational health and safety management system, the extent of documentation and the resources devoted to it depend on a number of factors, such as the scope of the system, the size of an organisation and the nature of its activities, products and services, and the organisational culture. This may be the case in particular for small and medium-sized enterprises.

3.2 Objectives of Occupational Health and Safety Management System

i. Reduce workplace injuries and illnesses
ii. Reduce costs
iii. Increase productivity
iv. Improve insurance liability rating
v. Positive response from customers
vi. Demonstrate due diligence
vii. Regulatory compliance.



Continual Improvement to maintain organisation's OHS Policy

Fig.3.5: Elements of Organisational Structure for OHS Management
Source: Occupational Health and Safety Management Systems – Requirements BS OHSAS 18001:2007

Table 3.4: Essential Elements of PDCA

Element	**What it Means**
OHS policy	Commitment to safety and occupational health and know what we need to do about it
Planning Hazard identification, Risk assessment and Risk Control	Awareness of the hazards and risks in our activities and have prioritized on how we will manage them
Legal and other requirements	Compliance with all legal regulatory and other requirements

Objectives and targets	Set OHS goals for relevant organisational functions and levels
OHS management programme	Action plans, system elements and activities to achieve our goals
Implementation and Operation Structure and Responsibility	Who does what, when and/or how often
Training awareness and competence	Tell people what to do, train them to do it, keep them informed
Consultation and communication	Clarity on how we will communicate and follow through
OHSMS Documentation, Document and Data Control	Provision of information on OHSMS , knowledge of where and how to assess it
Operation Control	Work, plan and control operations and maintenance safety
Emergency preparedness and response	Know of all dangerous situations and be prepared to meet them
Checking and Corrective Action Monitoring and measurement	Check things are done and on time
Accidents, Incidents, Non-conformities, corrective and preventive action	Identify mistakes, correct them and prevent recurrences
Records and records management	We can prove our actions
Audit	We check what we are doing

	periodically
Management Review Management Review	 Improvement of the OHS management system

Source: Guidelines for the Implementation of OHSAS 18001

Non-conformity is non-fulfillment of a requirement. Non-conformity can be any deviation from: relevant work standards, practices, procedures, legal requirements, etc. or occupational health and safety management system requirements.

Preventive action is action to eliminate the cause of a potential non-conformity or other undesirable potential situation. There can be more than one cause for a potential non-conformity. Preventive action is taken to prevent occurrence whereas corrective action is taken to prevent recurrence.

3.3 Strategies of the Occupational Health and Safety Policy

It is important to understand the causes of process hazards, develop techniques and methods to eliminate them, thus reducing accidents, consequences and increase productivity. It has been shown that accidents occur as a result of complex interactions of management systems, human behaviour and process technologies during the life cycle of the plant.

Occupational health and safety assessment series (OHSAS) recommend 14 elements for a good process safety management system. These are the strategies which can be utilised by industries for an effective safety management system and are the strategies which are part of the health and safety policies.

1. Employee participation - Plan of action needed to get and use employee advice and contribution

2. Process safety information- Ensure there is complete and accurate information on plant operation and plant safety for hazard analysis. Update regularly with changes.

3. Process hazard analysis-Identify and manage risks; identify, evaluate, eliminate, control hazards.

4. Operating procedures- Operating procedures must address steps for each operating phase

5. Training.

6. Contractors- Use of contractors who work without compromising safety, health and environment.

7. Pre-start up safety reviews.
8. Mechanical integrity- Ensure equipment, piping and instrumentation are designed, constructed and maintained to minimise risks.

9. Hot work permit- Non-routine work requires a permit.

10. Management of change- Review all changes to ensure change has no adverse safety effects.

11. Incident investigations-Identify causes of incidents and develop actions to prevent recurrence.

12. Emergency planning and response.

13. Compliance audits-Evaluate the effectiveness of process safety management by identifying deficiencies and assigning responsibilities for corrective action.

14. Trade secret override-Operating and maintenance personnel must be given all information needed for process safety.

4.0 CONCLUSION

The strategies and objectives of the occupational health and safety (OHS) policy are indeed the strategies and policies of the occupational health and safety management system whose objectives are basically to reduce work place injuries and accidents.

5.0 SUMMARY

The elements of the OHS management system are Plan-Do-Check-Act (PDCA). These ensure that primary objective of the OHS policy which is reducing work place illness and accidents is achieved. Various strategies to achieve the attainment of this policy include employee participation, training and incident investigations.

SELF- ASSESSMENT EXERCISE

List and discuss the essential elements of the OHS management system.

6.0 TUTOR-MARKED ASSIGNMENT

i. What are the objectives of the OHS policy?
ii. List the strategies of the OHS policy.

7.0 REFERENCES/FURTHER READING

BSI (2007). *Occupational Health and Safety Management Systems – Requirements BS OHSAS 18001:2007 Occupational Health and Safety Assessment Series*. London: BSI.

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MODULE 4 HEALTH AND SAFETY AUDIT

UNIT 1 FIRST AID AND TECHNIQUES

CONTENTS

1.0 INTRODUCTION

First aid is the first or immediate care given to a victim of an accident, sudden illness or medical emergency. First aid is given on site without waiting for medical personnel. First aid can save a life or prevent further complications. The scope of first aid training should be geared to the organisation or industry from which the trainee works. For instance more burns training is given in foundries or chemical manufacturing companies. First aid procedures are based on medical knowledge and practical experience and enable a trained person to save a life using available materials. Section 43 of the Factories Act of Nigeria 1987 deals with first aid and mandates the presence of one first aid box per one hundred and fifty personnel.

2.0 OBJECTIVES

At the end of the unit, you should be able to:

- list the principles of first aid
- describe the first aid technique for burns, stings, artificial respiration, cardio-pulmonary respiration.

3.0 MAIN CONTENT

3.1 Principles of First Aid

i. The first aider will need to check for their safety. The first aider is of no use if they become a second casualty. Protective clothing and equipment should be used where necessary.

ii. Speaking calmly to the casualty establishes consciousness and may provide useful information about the accident and assist in eliminating continuing danger.

iii. If immediate danger threatens, remove the casualty carefully to a safe place without endangering yourself. If the person's clothing is on fire, roll the casualty on the ground in a coat or fire blanket, etc.

iv. Casualties should be seated or reclined when being treated, as appropriate.

v. Do first things first- quickly, quietly without fuss or panic.

vi. Check for vital functions, maintain artificial respiration cardiac massage.

vii. Stop bleeding if any.

viii. Guard against or treat for shock – handle gently, change position.

ix. Do not over do, do not allow people to crowd around fresh air.

x. Do not remove clothes unnecessarily.

xi. Keep calm, assess the situation, reassure the casualty, keep the patient warm.

xii. Immobilise fractures if present, wash burns with a lot of water.

xiii. Arrange transfer to medical centre.

xiv. Apply cold compress to the seat of haemorrhage if known.

3.2 General Rules of First Aid

Analyse the situation quickly and decide if you can help the victim. If you can, begin at once. If you are unsure, do not give first aid.

Begin first aid by:

i. Calling for assistance - Send someone to call for medical assistance or if alone call as soon as possible. Be ready to describe the injury/ illness, first aid given and receive additional instructions. Emergency numbers should be posted near the telephone.

ii. Provide urgent care as required - Treat medical emergencies such as bleeding, shock, poisoning or cessation of respiration.

iii. Examine the victim for injuries and treat individual injuries. Make the victim comfortable, handle as little as possible, remain calm and reassure.

iv. Treat the victim for shock if necessary by placing the victim on his back with legs slightly raised.

3.3 Artificial Respiration

This is required in electric shock, drowning, gas poisoning any other accident causing breathing to stop. Diagnose cessation of breathing by the absence of movement of the chest and abdominal wall, blue lips, tongue or fingernails. Start artificial respiration immediately, two to three minutes not breathing can cause damage and five minutes can be fatal.

Remove the cause of failure- remove source of airway blockage if present, clear nose, remove foreign objects, dentures and mop up secretions with handkerchief.

Give artificial respiration- the most efficient method is mouth-to mouth respiration.

Mouth-to-Mouth Respiration

i. Lie the casualty flat if possible.

ii. Ensure no obstructions are in the mouth (remove dentures, etc.).

iii. Ease constrictions at the neck, chest and waist.

iv. Place a rolled jacket or pad under the shoulders to arch the neck or place one hand on forehead.

v. Take a deep breath and if the casualty is a child, place your mouth over the nose and mouth, if the casualty is an adult, pinch the casualty's nostrils and draw the chin forward to open the mouth.

vi. Breathe steadily into the casualty's mouth (chest will rise).

vii. Lift your own head and allow the casualty to exhale (see chest deflate).

viii. The first eight to ten breaths should be rapid thereafter repeat this cycle at a rate of six to eight per minute.

ix. Continue until the casualty resumes breathing unaided or until qualified medical services take over, however long this takes.

x. If breathing resumes, place the casualty in the open airway (recovery) position and treat as an unconscious casualty.

Fig. 4.1: Open Air Recovery Position
Source: Cardonal College Glasgow First Aid Training

3.4 Bleeding

i. If bleeding is severe, apply firm direct pressure on the wound to stop the bleeding using pads, dressings, etc.

ii. Maintain pressure until professional help is available.

iii. If the bleeding is from a limb, elevate it 25cm to 30cm to reduce the blood flow.

iv. Do NOT use a tourniquet.

3.5 Shock

Shock can be caused by trauma or fluid loss. When this occurs, do the following:

i. Keep the casualty quiet, reassured and comfortable.

ii. Keep the casualty warm by a light covering but do not overheat.

iii. Do NOT give anything to eat or drink to the casualty as this may cause complications if medical attention is required.

3.6 Electric Shock

i. Do not touch the casualty until the current is switched off.

ii. If the current cannot be switched off, stand on some dry insulating material and use a wooden or plastic implement to free the casualty from the electrical source.

iii. If breathing has stopped, start mouth-to-mouth respiration and continue until the casualty starts to breathe or until medical help arrives.

3.7 Burns and Scalds

Determine if burns are; first degree- red and welted or swollen skin, second degree under skin affected blisters present, third degree skin and tissues underneath destroyed.

3.7.1 First, Second Degree and Chemical Burns

Burns and scalds, however large or small and from whatever cause (including chemicals) should be cooled by flushing with copious amounts of cold water for at least 10 - 15 minutes (longer if necessary). The affected area should then be covered with a dry sterile dressing or cling film (this does not stick to burns and prevents air and airborne contaminants coming into contact with the burn).

Never apply any lotions, ointments or anything similar to a burn or scald. But only cold water should be applied.

Do not burst blisters or attempt to remove charred materials from a burn. Always obtain medical attention.

3.7.2 Third Degree Burns

Obtain medical help promptly. Apply above measures on the way to hospital or while awaiting medical help. Do not remove adhered particles of charred clothing.

3.8 Foreign Bodies in the Eyes

Foreign bodies (including chemicals) in the eye should be flushed out using clean cool water for at least 10 - 15 minutes. Sterile (aseptic) eye wash bottles of the sealed cap type may be used if tap water is not immediately available. Casualties with eye injuries should always be sent to the hospital with the eye covered by a pad.

3.9 Snake Bites

Treatment depends on if snake is poisonous or non- poisonous.

a. Non-poisonous - Wash bite thoroughly with soap and water

b. Poisonous - Bites are usually deep with intense pain and discolouration. Patient may have numbness or difficulty in breathing within minutes. First aid actions for such bites are as follows:

   i. Kill the snake if possible and keep for identification

   ii. Arrange for medical help

   iii. If the bite is on a limb stop circulation by means of a band on the limb loose enough to slip a finger beneath

   iv. Keep in position for ten minutes, relax for 90 seconds or until skin is pink

Repeat alternatively until doctor arrives

   v. Wash the wound preferably with light pink potassium permanganate to remove any venom possibly on the skin
   vi. Make a deep cut with knife or razor blade at bite site to bleed the site

   vii. Keep patient absolutely still and warm

   viii. If patient is able to swallow, give hot drinks like tea, coffee, milk

   ix. If breathing fails apply artificial respiration.

Table 4.1: Suggested First Aid Personnel to be Available Based on Needs

Level of hazard	No of employees	No of first aiders
Low hazard	Less than 25	At least one

	offices, shops, libraries	25-50	At least one FAW
		More than 50	At least one FAW per 100
	Higher Hazard Light engineering, food processing, sharp instruments, construction, use of chemicals	Less than 5	At least one
		5-50	At least one EFAW or FAW
		More than 50	At least one per 50

Source: Health Safety Executive, First Aid at Work

4.0 CONCLUSION

All factories are required by law to keep first aid boxes. They should also ensure that they have trained first aiders who can give first aid. This is important because this first care can sustain life, prevent the condition from getting worse and promote recovery.
First aid should be followed by medical attention.

5.0 SUMMARY

First aid is the first or immediate care given to a victim of an accident, sudden illness or medical emergency. The first aider will need to check for their personal safety. The first aider is of no use if they become a second casualty. Protective clothing and equipment should be used where necessary. The first aider is required to analyse the situation quickly and decides if the victim can be helped. If you can, begin at once. If you are unsure, do not give first aid. Begin first aid by calling for assistance, provide urgent care as required, examine the victim for injuries, treat individual injuries and treat the victim for shock if necessary.

SELF-ASSESSMENT EXERCISE

List the principles of first aid.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the appropriate first aid method for the following:
i. Bleeding
ii. Snake bites
iii. Electric shock

7.0 REFERENCES/FURTHER READING

Cardonal College Glasgow First aid training www.ed.ac.uk/schools-department/health-safety/firstaid training

Health safety executive, F*irst aid at work* www.hse.gov.uk/pubns/indg214.pdf

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UNIT 2 ACCIDENTS: CLASSIFICATION, CAUSES AND COSTS

CONTENTS

1.0 INTRODUCTION

Accidents are a common feature in industry particularly in the developing world. In fact, some industries such as the mining industry are well known for accidents as evidenced by the Chilean miners accident, the Copiapo mining accident of 2010. Accidents result in losses to the workers and their families, the industry, as well as nations. One thing is evident, a concerted effort must be made to reduce the number and the severity of accidents occurring worldwide since majority of accidents are preventable. In Nigeria, the Factories Act of 1987 deals with the registration of factories, factory workers and professionals exposed to occupational hazards, the safety of workers and penalties for any breach of its provisions, notification of accidents and industrial diseases while the Employees' Compensation Act of 2011 deals with compensation and penalties**.**

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define accidents and classify accidents
- identify the causes of accidents
- list the costs of accidents
- describe methods which are useful in the prevention of accidents.

3.0 MAIN CONTENT

3.1 Terms and Definitions

The ILO defines an accident as "an incident which has given rise to injury, ill health or fatality." It has also been defined by the WHO as "an unpremeditated event resulting in recognisable damage and as an occurrence in a sequence of events which usually produces unintended injury, death or property damage."

Accidents do not just happen, they occur as a result of unsafe acts or unsafe conditions or both. Prevention of accidents requires cooperation of all members of the entire organisation.

An **incident** is a work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

An incident where no injury, ill health, or fatality occurs may also be referred to as a "near-miss", "near-hit", "close call" or "dangerous occurrence".

An **emergency situation** is a particular type of incident.

3.2 Classification of Accidents

Accidents may be classified based on the following:

- the degree of danger to life and property
- principal cause and effect
- place of occurrence.

3.2.1 The Degree of Danger to Life and Property

It may be divided into four categories:

- minor - no loss of life
- moderate - injury but no loss of life and property
- major - loss of life
- disaster - extensive loss of life/ property.

3.2.2 Principal Cause and Effect

i. Fire and Explosions
ii. Electrical Accidents
iii. Chemical Accidents and Explosions
iv. Accidents with machines, plant, tools
v. Falling Objects on the body
vi. Falling of persons in pits or from heights
vii. Accidents from civil works
viii. Human-made accidents
ix. Natural disasters

3.2.3 According to their Place of Occurrence

i. Road traffic accidents

ii. Domestic accidents including drowning, burns , poisoning, falls, injuries, bites and injuries

iii. Industrial accidents - these are further classified based on the industry involved such as agricultural accidents, fishing/trawler accidents, mining accidents, construction accidents, quarry accidents, aviation accidents, factory accidents, e.t.c.

iv. Railway accidents

v. Violence including trauma, homicide, suicide and war

3.3 Causes of Accidents

The causes of accidents are multifarious but are grouped under two main headings

a. Human factors
b. Environmental Factors

3.3.1 Human Factors

Human factors have been adjudged to contribute about 85% of all accidents and these factors include:

i. Physical - the physical capability of the worker may be inadequate for the job e.g. visual acuity, hearing.

ii. Physiological:
    a. Sex - females have less accidents than men
    b. Age - younger people and elderly people have more accidents
    c. Time – accidents are more common as the day end
    d. Experience - less experienced workers are more prone to accidents
    e. Working hours - longer working hours are usually associated with more accidents

iii. Psychological - mental factors such as carelessness, inattentiveness, overconfidence, ignorance, emotional stress, lack of knowledge, accident proneness.

3.3.2 Environmental Factors

i. Mechanical failure -these are factors such as temperature, poor illumination, humidity, noise and unsafe machines.

ii. Acts of nature- weather conditions such as hurricanes, floods, avalanches, landslides etc.

3.4 Costs of Industrial Accidents

These costs are as follows:

i. Costs to the worker

Direct costs - costs of treatment, morbidity, disability, mortality
Indirect costs - psychological stress, loss of livelihood

ii. Costs to the organisation
Direct costs - medical costs, costs of rehabilitation, compensation costs, fines by regulatory authorities, legal costs, loss of trained manpower, absenteeism, and disruption of production schedule.
Indirect costs - poor public perception, stake holder engagements such as strikes by unions, blockades by surrounding communities.

iii. Costs to family
Direct costs - loss of family members, loss of livelihood
Indirect costs - stress to care- giver, loss of income to care- giver

iv. Costs to the community/nation
Direct costs - loss of trained manpower, pressure on medical facilities

3.5 Accident Prevention

Studies have shown that as much as 98% of accidents are preventable.

3.5.1 Principles of Accident Prevention

i. Adequate pre-placement examination
ii. Adequate job training
iii. Continuing education
iv. Ensuring safe working environment
v. Establishing a safety department under a competent safety engineer
vi. Period surveys/risk assessment to identify hazards
vii. Careful reporting, maintenance of records, review and publication

4.0 CONCLUSION

It is evident that a concerted effort must be made to reduce the number and the severity of accidents occurring worldwide since majority of these accidents are preventable.

5.0 SUMMARY

An accident is an incident which has given rise to injury, ill health or fatality. Accidents do not just happen, they occur as a result of unsafe acts or unsafe conditions or both. Accidents may be classified based on the degree of danger to life and property, principal cause and effect, according to their place of occurrence. The causes of accidents are multifarious and are grouped under two main headings: human factors and environmental factors. Costs of Industrial Accidents may be costs

to the worker, costs to the organisation, costs to the family, costs to the community/ nation. Studies have shown that as much as 98 % of accidents are preventable.

SELF-ASSESSMENT EXERCISE

i. What is an accident?
ii. How do you classify accidents?

6.0 TUTOR-MARKED ASSIGNMENT

i. Identify the causes of accidents.
ii. List the costs of accidents.
iii. Describe methods which are useful in the prevention of accidents.

7.0 REFERENCES/FURTHER READING

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UNIT 3 FIRE AND FIRE FIGHTING

CONTENTS

1.0 INTRODUCTION

Fire is rapid combustion resulting in release of heat and light of flame. Fire occurs in different situations: domestic, agricultural, forestry, industry and may result in loss of life and property. Loss of life is due to poisonous gases and flames. Fire danger to life is given higher weight than fire hazard to property. More than 85% of fires are caused by electrical sparks or short circuits.

While most organisations aim to be insured against fires, the insurance is often not equal to the losses as some items are indeed irreplaceable. Thus it is more expedient that fires are minimised by adopting scientific engineering approach.

Aspects to be considered during design, construction and operation of organizations include: safe escape of personnel, fire prevention, fire fighting and minimisation of loss of life and property, safety of personnel from fire, gases and smoke, reducing spread of smoke and gases, emergency operations and first aid measures.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the fundamentals and elements of fire
- identify the general fire prevention and fire control measures
- list the different types of fires and identify the extinguishers useful for each type.

3.0 MAIN CONTENT

3.1 Fundamentals and Elements of Fire

Fire is an active, rapid, burning (combustion) fast oxidation process accompanied by heat, light and poisonous gases/ smoke/carbon dioxide due to combustion. The flame is the luminous hot zone of fire. Fire starts at a hot spot and spreads along combustible path to neighbouring areas in the presence of combustible material, air and heat. Various materials differ in their ignition temperatures and fire characteristics. Combustion rate may be slow; there is slow evolution of heat but not by light, rapid; rapid evolution of heat accompanied by light, spontaneous absorption of atmospheric oxygen at ordinary temperature.

Elements of Fire

i. Fuel: combustible material, most fuels have a flash point at which they give up vapours.

ii. Heat or ignition and temperature: combining oxygen with fuel vapours releases heat energy which in turn vaporises more fuel.

iii. Oxygen (air): oxygen combines with flammable vapours at a flash point causing burning.

Initiation of fires requires heat and hot spot, air and flammable material.

Causes of Fires

a. Lapses in safety management- negligence, carelessness, poor house- keeping, poor wiring, gas leaks.
b. Human error- negligence, lack of awareness/ training.
c. Accident beyond human control.

3.2 General Fire Prevention

Fire is probably the most serious danger which any organisation will ever have to face. It can break out almost anywhere and can affect everyone. Fire prevention aims at not allowing the combination of the elements of fire.

Regular fire prevention routines are one of the simplest and most efficient means of preventing fire. These routines are as follows:

i. Safety documentation for plant/ equipment and for civil/ storage/ installation/ commissioning/ operation/ maintenance phases of the project.

ii. Provision of fire fighting systems- permanent or portable.

iii. Provisions for fire prevention at the civil design and works stage. Smoke and Carbon –monoxide alarms have been found to be very effective as means of early detection and control thus limiting fires and reducing loss of life and property. Fire doors play an important role in the precautionary system; their purpose is to contain the fire, and to prevent the spread of smoke and toxic gases, which can be lethal even in small quantities.

iv. Provisions in the electrical design and works. All electrical work should be carried out or supervised by certified personnel, avoid overloading electrical equipment, earth all equipment.

v. Organisation, awareness and training of personnel- The value of the nightly routine of switching off and unplugging electrical equipment (unless the equipment concerned is designed to run continuously cannot be overemphasised). It is essential that the fire alarm system and a pre-arranged plan specific for the evacuation of each building should be tested regularly. Heads of Units must ensure that fire drills are held based upon agreed intervals following a risk assessment. Where appropriate, some staff can undertake the extra duties of Fire Marshals/Officers. These must be specially trained and given specific duties in times of fire hazards or during a fire. Information concerning fire safety should be widely dispersed and staff trained where necessary.

vi. Ensure signage relating to fire safety such as the fire routine procedure, fire exits, fire assembly points are conspicuously placed.

vii. Precautions against fires, housekeeping and monitoring- proper storage and handling of flammable and explosive materials- liquids or gases, avoid use of inflammable material, develop check list and monitor regularly. Ensure all fire-fighting equipment are checked, refilled and/ or serviced when due. More people die through inhaling smoke than through burns. Fire doors must therefore not be propped or wedged open; to prop open a fire door can cost lives if a fire breaks out. The Safety/Fire Officer should routinely assess for fire risks during monitoring.

viii. First aid facilities.

ix. Insurance coverage during construction and operation.

3.3 Fire Control

Fire extinguishing techniques

i. Starvation: Removal of fuel

ii. Smothering: Reducing the amount of oxygen available by dilution or by introducing other inert media.

iii. Blanketing: Cutting off of fuel vapours mixing with oxygen by applying an external media such as the use of foam. It is valuable in extinction of fires of oils and other flammable liquids.

iv. Cooling: Reduces the temperature to one at which combustion cannot continue.

v. Breaking of branched chain reaction: Dry chemical powder containing halogenated hydrocarbon reacts with the hydrocarbon molecule on fire.

Fire-fighting systems

i. Fire hydrants (water systems) - these may be internal or external. Pump should be independent of other equipment within the premises.

ii. Portable fire extinguishers -new extinguishers are 90% red and are distinguished by colour panel
   a. Red (water) - The extinguisher is of limited use; can only be used for class A fires of wood, paper or organic material; works by cooling.
   b. Green Panel (foam) - Cools and smothers fire. Suitable for Class B fire of fuel or liquid and class A fires. Do not use for electrical fires.
   c. Black Panel (Carbon dioxide) - Smothers fire. Good general purpose extinguisher. Good for class B fires.
   d. Blue Panel (Dry Powder)- Smothers fire and is a good general purpose fire extinguisher. Useful for class A, class B and class C (flammable gasses).

iii. Buckets: filled with sand

iv. Hose reels

v. Water spray systems may be high velocity or medium velocity

vi. Sprinkler systems: used mainly in stores or usually unoccupied buildings

vii. Foam system

3.4 Fire Routine Procedure

Each Head of Unit must ensure that all members of staff are instructed in the action to be taken should a fire break out. This is most conveniently done by giving each member of staff written instructions in the form of a fire routine procedure probably in the induction hand book. This fire routine procedure should also be placed at very visible sites where even visitors can easily site them. Visitors should be encouraged to view the notices. Staff should be encouraged to commit to memory the standard instructions in the fire routine procedure; there will be no time to read these instructions in an emergency.

3.4.1 On Discovering a Fire

If a fire is discovered, the discoverer should:

i. Raise the alarm: Operate the nearest fire alarm. If no fire alarm is provided, shout "Fire".
ii. Act Swiftly: Leave the building. Ensure that the nearest fire service is informed of the fire. Do not panic.
iii. Do not take risks.

Other measures:

i. Electric power supply and other fuel supplies switched off
ii. Use of portable fire extinguisher , water or sand for small fires if trained/ able/ allowed
iii. Activate automatic fire fighting system.

3.4.2 On Hearing the Fire Alarm

On hearing the fire alarm, all staff must leave the building immediately by the nearest available exit, closing doors. Lifts must not be used.

It is essential that the means of escape from a building should function efficiently. Exit doors should be fastened so that they can be easily and immediately opened from the inside without the use of keys. Exit routes must not be obstructed or used as storage areas.

In addition, all fire/smoke doors should be closed when buildings are empty.

All personnel are well advised to become familiar with as many as possible of the exit and escape routes from the building in which they normally work.

All staff should assemble at the fire assembly point (muster point) and a head count taken.

3.5 Fire Fighting

Table 4.2: Classes of Fire

Fire Class	Combustion Material involved	Fire extinguishing medium
Class A	Fires involving ordinary solid materials such as wood, coal, plastics, cloth, paper, rags, rubbish, construction and packaging material	Water or solution with high water content. Cooling and wetting of material quenches fire
Class B	Fires involving Flammable liquids/ vapours/solvents: Transformer oil, diesel oil, solvents, liquid, chemicals, lubricating oils, paints/varnishes/thinners, greases, contained, uncontained	Limiting air or oxygen supply, inhibiting fire, Dry chemicals, foam, Halon. Water is unsuitable

Class C	Fires involving live electrical equipment in energized state. If equipment is dead becomes class A or B	CO_2 gas , dry chemicals, water is unsuitable
Class D	Fires involving metals like magnesium, titanium	Normal extinguishing media unsuitable. Special chemicals and techniques used
Class E	Fires involving Flammable gases and fuels, hydrogen, ammonia, acetylene, LPG, petrol, Furnace oil	Starvation of fire is most useful. special methods, close inlet valve

Source: Industrial Safety, Health and Environment Management Systems

Four types of fire extinguishers should be provided within the premises. The extinguishing media used are: water, carbon dioxide, foam and dry powder. The external appearance of each type of extinguisher is different and each carries its own instructions for use. In some buildings, hose reels are also provided. Fire blankets should be provided in many locations and should be used for smothering fires involving flammable liquids or burning clothing.

All personnel should know the location of the firefighting equipment in their area of work, to know on what type of fire each piece of equipment can be used and how each should be used. This is achieved by training.

Whenever firefighting equipment has been used, an immediate report must be made to the Safety Officer or to the Fire Safety Unit (If there is one) so that the equipment may be recharged or replaced.

In all buildings, particularly residences, protection of human life must take priority over fighting fires. The person discovering a fire must promptly initiate the emergency procedures listed above. Delay can be fatal as, once a fire is out of control, it can spread rapidly and cut off escape routes.

If allowed by the organisation, especially when trained, and without endangering personal safety, attempts can be made to contain and control a fire until the Fire Service arrives. It must be ensured that the correct type of fire extinguisher is used. The wrong choice can turn a minor incident into a major event. The fire extinguisher must be used according to manufacturer’s instruction. It must be remembered to take a position between the fire and the exit so that the escape route cannot be cut off, ensure awareness of what is happening in the surrounding area and take account of limitations. The greatest hazards to fire fighters are the effects of asphyxiant, irritant and toxic gases, smoke and fumes generated from the combustion of plastics and other materials. Never attempt to fight a fire wearing a respirator or breathing apparatus. Never fight a fire without anyone else’s knowledge.

After a fire

Even if a fire appears to have been successfully extinguished by staff, it will still be necessary to ask the Fire Service to check that the fire has not unknowingly spread, and that materials or the building fabric cannot reignite.

Unit heads must ensure that all fires within the building are recorded and reported to the Health and Safety officer or Manager.

4.0 CONCLUSION

While Fire prevention is everyone's responsibility, fire fighting should best be taken on by trained personnel. It would be in the best interest of all organisations particularly those with a high risk for fires due to their production processes to ensure fire training for every member of staff, if feasible. Otherwise, it is important for all staff members to be conversant with the fire routine procedures and participate in fire drills.

5.0 SUMMARY

Fire is probably the most serious danger which any organisation will ever have to face. It can break out almost anywhere and can affect everyone. "Prevention is better than cure". Fire Control is achieved using fire alarms, smoke and carbon monoxide alarms, fire extinguishers, fire doors, fire drills and fire marshals. Ensure every employee is knowledgeable of the fire routine procedure. On discovery of a fire, the discoverer should raise the alarm, act swiftly, do not take risks and do not panic. Fire fighting should best be taken on by trained personnel.

SELF-ASSESSMENT EXERCISE

ABC Company is a petrochemical company situated in Delta State.
List the different types of fires which can occur and identify the extinguishers useful for each type (Note different fires could occur in different departments).,

6.0 TUTOR-MARKED ASSIGNMENT

As the Safety Officer in a printing press, develop the fire safety segment of the induction manual.

7.0 REFERENCES/FURTHER READING

Health and Safety Authority (2011). *Fire.* http://www.hsa.ie/eng/Topics/Fire/

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UNIT 4 HEALTH AND SAFETY AUDITS AS MANAGEMENT TOOL

CONTENTS

2.0 INTRODUCTION

We have already seen the use of audits in the environment. We know that an audit is a systematic, independent and documented process for obtaining “audit evidence”, evaluating it objectively to determine the extent to which “audit criteria” are fulfilled. Independent does not mean just external as audits may be internal or external. In this section we shall be reviewing the use of audit in health and safety as a management tool.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define health and safety audit
- list the main elements evaluated during a health and safety audit
- identify the advantages and costs associated with health and safety audits
- outline the steps for carrying out a health and safety audit.

3.0 MAIN CONTENT

3.1 Definition

Health and safety audit is defined in *Management of Health and Safety at Work Regulations* (1999) as "the systematic evaluation of performance in health and safety to identify deviations from agreed standards".

Arrangements to conduct periodic audits should be made in order to determine whether the occupational health and safety management system and its elements are in place, adequate, and effective in protecting the safety and health of workers and preventing incidents.

To do this, an audit policy and programme should be developed, which includes a designation of auditor competency, the audit scope, the frequency of audits, audit methodology and reporting.

Types of audits

a. Walk through audits: Least expensive, evaluates unsafe conditions during construction, security, operation and maintenance.

b. Intermediate audits: More detailed study and review of plant design and operations

c. Comprehensive audit: comprehensive consisting of envelope audit-civil works, electrical, stores, offices, canteens, security lighting etc.

d. Functional audit: Organisational structure, training, responsibility, delegation etc. Safety facility audit-reviews risk.

The Comprehensive audit is an evaluation of all of the organisation’s occupational health and safety management system elements or a subset of these, as appropriate. The audit should cover:

a. Health and safety policy
b. Worker participation

c. Responsibility and accountability
d. Competence and training
e. Occupational health and safety management system documentation
f. Communication
g. System planning, development and implementation
h. Prevention and control measures
i. Management of change
j. Emergency prevention, preparedness and response
k. Procurement
l. Contracting
m. Performance monitoring and measurement
n. Investigation of work-related injuries, ill health, diseases and incidents, and their impact on safety and health performance
o. Audit
p. Management review
q. Preventive and corrective action
r. Continual improvement
s. Any other audit criteria or elements that may be appropriate.

The audit conclusion should determine whether the implemented occupational health and safety management system elements or a subset of these:

a. Are effective in meeting the organisation's health and safety policy and objectives

b. Are effective in promoting full worker participation

c. Respond to the results of health and safety performance evaluation and previous audits

d. Enable the organisation to achieve compliance with relevant national laws and regulations

e. Fulfil the goals of continual improvement and best health and safety practice.

Audits should be conducted by competent persons internal or external to the organisation who are independent of the activity being audited.

3.1.1 Internal Audit

The organisation shall ensure that internal audits of the occupational health and safety (OHS) management system are conducted at planned intervals to:

a. Determine whether the OHS management system:
   - conforms to planned arrangements for OHS management

- has been properly implemented and is maintained
- is effective in meeting the organization's policy and objectives.

b. Provide information on the results of audits to management.
Audit programmes are planned, established, implemented and maintained by the organisation, based on the results of risk assessments of the organisation's activities, and the results of previous audits and address:

- the responsibilities, competencies, and requirements for planning and conducting audits, reporting results and retaining associated records.
- the determination of audit criteria, scope, frequency and methods. Selection of auditors and conduct of audits shall ensure objectivity and the impartiality of the audit process.

3.2 Audit Procedure

a. Notification

Once an audit schedule is produced, health and safety officer should consult with appropriate unit manager / faculty head to agree on the timing of the audits within the schedule.

b. Pre – audit meeting

A pre – audit meeting takes place with the unit manager / faculty head approximately two weeks before the actual audit.

The purpose of this meeting is to:

- provide a general overview of the audit process and method
- confirm subjects and areas to be audited
- request material to be provided for the audit e.g. risk assessments or maintenance records
- collect a copy of the unit / faculty safety plan where relevant
- indicate other relevant personnel who may be required to assist during the audit process e.g. section leader
- discuss outstanding issues from previous audits.

c. Audit interview and verification

The audit itself is a three-stage process consisting of an initial audit interview with the unit manager / faculty head, verification of the information provided and a final close – off meeting.

- The audit interview will be conducted using the audit questionnaire, which lists a series of questions covering all aspects of health and safety.
- Verification of the answers given will be made by reviewing the documentation requested and a random physical conditions check. This

verification inspection also allows the auditors to gain a general view of the health and safety culture which exists in the department/division.

- The close – off meeting allows for the appropriate manager to be provided with a verbal report, highlighting strengths and opportunities for improvement. Corrective action, timescales and responsibilities will be agreed at this stage.

During audits, each performance indicator (PI) will be rated as a percentage of full compliance. This rating will be known as the compliance value. Compliance values given for each PI will be based on answers to a set of audit protocols relating specifically to that PI.

Overall compliance value for PI (%) and interpretation

Compliance value	Interpretation (all or some of the following may apply)
0 - 10%	No controls in place. Significant risk to the organisation in terms of personal injury, civil or criminal litigation. Further action required immediately.
10 - 20%	Part controls exist. Risk to the organisation in terms of personal injury, civil or criminal litigation. Further action required within a short time period.
20 - 30%	Controls inadequate. Possible risk of personal injury and civil litigation. Unlikely risk of criminal litigation, but possible risk of improvement notice being served by the enforcing authorities. Further action required within a short time period.
30 - 40%	Controls not used. Possible risk of personal injury and civil litigation. Unlikely risk of criminal litigation, but possible risk of improvement notice being served by the enforcing authorities. Further action required within a medium time period.
40 - 50%	Irregular use of controls. Possible risk of personal injury and civil litigation. Unlikely risk of criminal litigation, and low risk of improvement notice being served by the enforcing authorities. Further action required within a medium time period.
50 - 60%	Additional training/measures required. Not complying with best practice. Possible risk of personal injury and civil litigation. Unlikely risk of criminal litigation, and low risk of improvement notice being served by the enforcing authorities. Further action required within a medium time period.

60 - 70%	Basic legal compliance. Unlikely risk of personal injury and civil litigation. Very unlikely that enforcing authorities would take action. Further action required, but should be programmed as part of the continuous improvement process.
70 - 80%	Significant controls. Unlikely risk of personal injury and civil litigation. Highly unlikely that enforcing authorities would take action. Further action required, but should be programmed as part of the continuous improvement process.
80 - 90%	Advanced control. Unlikely risk of personal injury. If such injury occurred, it is unlikely that civil litigation would succeed. Negligible risk of action from enforcing authorities. Further action required, but should be programmed as part of the continuous improvement process.
90 - 100%	Optimum controls. Highly unlikely risk of personal injury. If such injury occurred, it is unlikely that civil litigation would succeed. If standard is maintained, no risk of action from enforcing authorities. No further action is required other than to maintain the exemplary standard being achieved in health and safety.

d. Audit report

The audit report (paper copy) will be produced within two weeks of the audit taking place and will consist of three parts.

Part one is the health and safety audit summary report which summarises the audit finding and gives the overall audit score as a percentage.

Part two is the non- conformity/observation record which details the problems identified in the audit. A non-conformity highlights areas where, in the opinion of the auditors, policy and/or health safety legislation/guidance or best practice is not being adhered to in a satisfactory manner. An observation highlights areas where improvements could be made and acts as a guide for future health and safety planning.

In allocating a non- conformity or observation, auditors will take into account circumstances where managers have not dealt with health and safety issues arising from policy changes occurring at the time of the audit.

Part three is the corrective action record which details the corrective action required, the person responsible and target date for implementation as agreed at the close - off meeting.

The draft audit report will be forwarded to the relevant unit manager for an accuracy check before authorisation by the Chief Executive. Copies will be given to the manager concerned, management and health and safety representatives.

e. Review meeting

A review meeting will be held between the auditors and manager after the audit .The purpose of this meeting is to determine the status of the corrective action required, review due dates and offer further assistance if necessary.

3.3 Costs of Occupational Health and Safety Audits

These costs may be direct costs or hidden costs

Direct costs

i. Opportunity cost of management and staff time
ii. Cost of training internal auditors
iii. Cost of external auditors or verifiers
iv. Disruption during audit
v. Cost of preparation and publishing of audit

Hidden costs

Cost of acting on the audit findings to correct breaches or irregularities.

3.3.1 Benefits of Occupational Health and Safety Audits

i. Legal compliance: avoiding the cost of non compliance such as remediation and fines.

ii. Reduced risk exposure, lower insurance premiums. Assured legal compliance, cheaper finance.

iii. Stakeholder appeasement: Stakeholders are well informed and companies benefit from good will.

iv. Improved community relations, improved media coverage, increased staff commitment.

4.0 CONCLUSION

Occupational health and safety audits are an essential component of occupational health and safety management systems and ensure that all aspects of the system are efficient and effective. They are thus important in ensuring continuous improvement which is essential in OHS systems.

5.0 SUMMARY

Health and safety audit is defined as the systematic evaluation of performance in health and safety to identify deviations from agreed standards. The audit includes an evaluation of the organisation's OHS management system elements or a subset of these, as appropriate. Audits should be conducted by competent persons internal or external to the organisation who are independent of the activity being audited.

The audit procedure consists of notification, pre – audit meeting, audit interview and verification, audit report and the review meeting.

SELF-ASSESSMENT EXERCISE

i. Define Health and Safety Audit.
ii. List the main elements evaluated during a health and safety audit.

6.0 TUTOR-MARKED ASSIGNMENT

As the Safety Officer in a printing company in one of the six geo-political regions of Nigeria, explain the steps you would take to carry out an internal audit.

7.0 REFERENCES/FURTHER READING

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UNIT 5 HEALTH AND SAFETY PLANS

CONTENTS

1.0 INTRODUCTION

Health and safety plan is the framework for preventing personal injuries and deaths. It is the responsibility to set out a policy which serves as a basis for the preparation of the health and safety plans.

2.0 OBJECTIVES

At the end of the unit, you should be able to:

- list the elements of a health and safety plan
- use the template provided to prepare a health and safety plan.

3.0 MAIN CONTENT

3.1 Outline for Preparation of a Health and Safety Plan

If the organisation is managing safety correctly, then the creation of a formal safety plan should not entail a great deal of additional work and be merely a "tick-box" exercise, though it will create a more formal way of demonstrating compliance with legal requirements. For those who are essentially starting from scratch and who have very little in place in terms of a safety management system, the outline is a basis for a safety management framework and highlights the main hazards in the workplace that need to be adequately controlled. The plan includes an initial status review of the overall management system and a list of hazards that will be examined to check that adequate control for each of the hazards are in place.

3.1.1 Initial Status Review

As part of an annual plan, a review of the key safety arrangements should be carried out. This will ensure that systems and procedures are in place to effectively manage health and safety. This review covers:

i. **Policy -** There is a need to check whether any changes have been made to the safety policy, or to draft one if none exists. The initial review is a useful time to pick the members of the safety team to carry out certain tasks.

ii. **Organising** - To ensure that health and safety is managed effectively, a team of people is needed to ensure that everybody is familiar and happy with their defined responsibilities.

The initial status review gives the opportunity to check that adequate communication systems are in place.

iii. **Planning -** A good idea of hazards existing in the workplace should be known. By using a hazard inventory form that lists common types of hazards in the workplace, it is possible to create the more detailed part of the plan to supplement the initial status review. Examples of hazard inventories exist on

the safety web pages. A regular annual review is worth conducting as it prompts a check that no new hazards have been introduced in the organisation which have not been properly assessed.

Risk assessments need to be carried out. As part of the initial status review, high risk activities should have been identified and risk assessments carried out or at least have been given priority when planning the risk assessment programme.

Organisations should set performance standards for the activities they carry out. As a minimum, these should meet legal requirements.

Dates should be set for regular safety meetings, review sessions with the Head of Department, and times to circulate safety information (e.g. specific topic information). Try and set the sessions in advance so that they become part of the safety plan for the year and everybody is well aware in advance of the dates.

iv. **Monitoring -** Two safety monitoring and inspection exercises should be done each year at a minimum. Introduce additional inspection/checks particularly if high risk activities are carried out. Spot checks and safety tours can also be carried out as deemed necessary. These can be built into the topics chosen in the second part of the safety plan document.

In previous plans, check that any actions or recommendations made as part of the plan are being managed. It is likely that some items of your previous plan may not have been completed. These should be carried over into the next plan and progress monitored. Outstanding actions could include recommendations from accidents, frequent maintenance and repair work, outstanding issues from previous inspection exercises, etc.

3.1.2 Core Topics

The second part of the plan focuses on key safety topics that need to be assessed as part of the plan. The aim should be to check on the range of hazards across the year to ensure that the arrangements in place to control the risks associated with each topic are robust and appropriate, e.g. when looking at electrical safety and testing you may ask:

i. Do you have an inventory of electrical equipment in the organisation?
ii. Do people tell the safety department when new equipment is purchased?
iii. Are new pieces of equipment visually checked prior to use?
iv. Are items clearly marked with test labels?

On-going development

The initial status review should be a permanent part of each plan developed. This will ensure that the management framework remains in place and that any changes to safety, critical personnel, activities, premises changes etc. are captured and addressed.

The hazard topics listed on the plan will vary depending on the approach taken by the safety department. Once the relevant hazards have been identified, some may choose to keep all the hazards listed on the plan and check all the relevant controls each year. This may be possible for smaller organisations. Larger organisations may not be able to do this and may decide to concentrate on their high risk activities one year and then look at lower risk issues the following year. Alternatively, larger organisations may want to look at all the hazards but just concentrate on particular issues each year, e.g. under Control of Substances Hazardous to Health (COSHH) one year an organisation may look at chemical container labeling; the next year they may check their arrangements for handling of chemical waste and the next year they may review the risk assessments of a few of the high priority activities involving toxic chemicals. Clearly, the more people are involved in monitoring the control measures, the more that can be covered and accomplished in any particular year. Whatever option is chosen, the aim should be to ensure that hazards have been identified, adequate controls have been introduced and that these are being used in a consistent manner.

Thus the essential elements of a health and safety plan are:

a. OHS policy
b. Safety organisation at plant level with responsibilities
c. Safe procedures for carrying out various activities
d. Identification of hazards
e. Procedure for obtaining permission to work for operations which may affect safety
f. Accident reporting and investigation
g. Plans and procedures to achieve objectives and targets set by management
h. Feedback system for managerial review at prescribed frequency
i. Appointment of competent persons for carrying out inspection, testing, certifying various equipments, structures and environment for carrying out jobs safely
j. Responsibilities of management, safety departments, unions and Staff are spelt out.

3.2 Template Health and Safety Plan

This is the Health and Safety Policy Statement of
(name of company)…….

Our statement of general policy is:

- to provide adequate control of the health and safety risks arising from our work activities
- to consult with our employees on matters affecting their health and safety
- to provide and maintain safe plant and equipment
- to ensure safe handling and use of substances
- to provide information, instruction and supervision for employees
- to ensure all employees are competent to do their tasks, and to give them adequate training
- to prevent accidents and cases of work related ill health
- to maintain safe and healthy working conditions
- to review and revise this policy as necessary at regular intervals.

Signed
(Employer)
Date Review date

Responsibilities

1. Overall and final responsibility for health and safety is that of…….....

2. Day-to-Day responsibility for ensuring this policy is put into practice is delegated to
   ……

3. To ensure health and safety standards are maintained/ improved, the following people have responsibility in the following areas

Name	Responsibility
…….....	.....……
……	.....
……	.....

4. All employees have to:
   - cooperate with supervisors and managers on health and safety matters

- not interfere with anything provided to safeguard their health and safety
- take reasonable care of their own health and safety
- report all health and safety concerns to an appropriate person mentioned in this policy statement).

Health and safety risks arising from our work activities

1. Risk assessments will be undertaken by…….....

2. The findings of the risk assessments will be reported to…….....
3. Action required to remove/control risks will be approved by…….....

4. …….....will be responsible for ensuring the action required is implemented.

5. ……..... will check that the implemented actions have removed/reduced the risks.

6. Assessments will be reviewed every…… or when the work activity changes, whichever is soonest.

Consultation with employees

1. Employee representative(s) are
   ……

2. Consultation with employees is provided by….....

Safe plant and equipment

1. …….....will be responsible for identifying all equipment/plant needing maintenance.

2. …….....will be responsible for ensuring effective maintenance procedures are drawn up.

3. …….....will be responsible for ensuring that a dented maintenance is implemented.
   Any problems found with plant/equipment should be reported to…….....

4. …….....will check that new plant and equipment meets health and safety standards before it is purchased.

Safe handling and use of substances

1. …….....will be responsible for identifying all substances which need a COSHH assessment.

2. …….....will be responsible for undertaking COSHH assessments.

3. …….....will be responsible for ensuring that all actions identified in the assessments are implemented.
4. …….....will be responsible for ensuring that all relevant employees are informed about the COSHH assessments.

5. …….....will check that new substances can be used safely before they are purchased.

6. Assessments shall be reviewed every …..... or when the work activity changes, whichever is soonest.

Information, instruction and supervision

1. The Health and Safety Law poster is displayed at/leaflets are issued by…….....

2. Health and safety advice is available fro…….…….

3. Supervision of young workers/trainees will be arranged/undertaken/monitored by…….....

4. ……is responsible for ensuring that our employees working at locations under the control of other employers are given relevant health and safety information.

Competency for tasks and training

1. Induction training will be provided for all employees by……

2. Job specific training will be provided by……

3. Specific jobs requiring special training are……

4. Training records are kept at/by……

5. Training will be identified, arranged and monitored by……

Accidents, first aid and work related ill health

Health surveillance is required for employees doing the following jobs…….....

Health surveillance will be arranged by……..……..

Health surveillance records will be kept by/at…….....

The first aid box(es) is/are kept at…….....

The appointed person(s)/first aider(s) is/are…….....

All accidents and cases of work related ill health are to be recorded in the accident book. The book is kept by/at……

……is responsible for reporting accidents, diseases and dangerous occurrences to the enforcing authority

Monitoring

To check our working conditions, and ensure our safe working practices are being followed, we will……

……...is responsible for investigating accidents.

…….....is responsible for investigating work related causes of sickness absences.

…….....is responsible for acting on investigation findings to prevent a recurrence.

Emergency procedures – fire and evacuation

…….....is responsible for ensuring the fire risk assessment is undertaken and implemented.

Escape routes are checked by/every……..

Fire extinguishers are maintained and checked by/every…….

Alarms are tested by/every……

Emergency evacuation will be tested every……

Obtained from Health and Safety Executive

3.3 Accident Case Studies

We have already seen the causes of accidents and have identified health and safety plans as a means of avoiding some of them. Nonetheless here are some accidents resulting in huge costs/ losses with a description of the technical/human failures. The following case studies were obtained from Health and Safety Executive which keeps records of industrial accidents worldwide.

1. Accident summary Union Carbide India Ltd, Bhopal, India. 3rd December 1984

In the early hours of 3 December 1984 a relief valve on a storage tank containing highly toxic methyl isocyanate (MIC) lifted. A cloud of MIC gas was released which drifted onto nearby housing.

Prior to this, at 23.00 hrs on 2 December, an operator noticed the pressure inside the storage tank to be higher than normal but not outside the working pressure of the tank. At the same time a MIC leak was reported near the vent gas scrubber (VGS). At 00.15hrs a MIC release in the process area was reported. The pressure inside the storage tank was rising rapidly so the operator went outside to the tank. Rumbling sounds were heard from the tank and a screeching noise from the safety valve. Radiated heat could also be felt from the tank.

Attempts were made to switch on the VGS but this was not in operational mode.

Approximately 2,000 people died within a short period and tens of thousands were injured, overwhelming the emergency services. This was further compounded by the fact that the hospitals were unaware as to which gas was involved or what its effects were. The exact numbers of dead and injured are uncertain, as people have continued to die of the effects over a period of years.

The severity of this accident makes it the worst recorded within the chemical industry.

Failings in technical measures

i. The flare system was a critical element within the plant's protection system. However, this fact was not recognised as it was out of commission for some three months prior to the accident.

ii. Plant modification / change procedures: HAZOP, identification of safety critical elements.

iii. Hazards associated with runaway reactions in a chemical reactor are generally understood. However, such an occurrence within a storage tank had received little research.

iv. Reaction / product testing: laboratory testing.

v. The ingress of water caused an exothermic reaction with the process fluid. The exact point of ingress is uncertain though poor modification/maintenance practices may have contributed.

vi. Design codes - Plant: ingress of unwanted material.

vii. Maintenance procedures: training and competence levels.

viii. Plant modification / change procedures: hazard operating procedure analysis (HAZOP)

ix. The decommissioning of the refrigeration system was one plant modification that contributed to the accident. Without this system, the temperature within the tank was higher than the design temperature of 0°C.

x. Plant modification / change procedures: HAZOP, decommissioning procedures.

xi. The emergency response from the company to the incident and from the local authority suggests that the emergency plan was ineffective. During the emergency, operators hesitated when to use the siren system. No information was available regarding the hazardous nature of MIC and what medical actions should be taken.

xii. Emergency response / spill control: site emergency plan, emergency operating procedures/training.

2. Accident Summary Warehouse Fire

An automatic fire alarm operated in a warehouse storing various materials including oxidising materials, solvents and various other chemicals in drums. The fire alarm was transmitted to the local fire service. By the time the fire service arrived, flames were shooting through holes in the roof. An explosion then occurred which broke the glass in the site gatehouse.

15 minutes into the incident another explosion occurred in a store holding oxidising materials. This blew out a roller shutter door, which hit the wall of a building about 10m away. This was now a serious fire engulfing both the oxidising materials store

and an acid pen area. Drums of solvents were beginning to explode in the intense heat. Some of these exploding drums were propelled several hundred feet into the air.

The fire also spread to the roof of a nearby building on the boundary of the site and after 30 minutes from the alarm being raised another offsite building 30m away was beginning to be endangered. Several explosions then occurred engulfing the front of this second building. A flying, burning solvent drum also crashed through the roof in the main store area, immediately starting another fire. The off-site emergency plan was progressively implemented during the course of the incident.

The Fire Brigade was advised of the broad generic basis of the materials involved in the fire, and a print out of stored materials was obtained. This list was too detailed for the needs of the emergency services. The resulting smoke from the fire contained a cocktail of 11 different chemicals including hydrogen chloride. Approximately 3,000 residents were evacuated from their homes.

Failings in technical measures

i. Lack of chemical segregation in the storage of a vast range of chemicals led to the extremely rapid and violent spread of the fire. Although the specific root cause of the fire has not been identified with a degree of certainty, a number of chemical routes to ignition in the event of spillage or exothermic reaction were present in the oxidising materials store where the fire started. The probable cause was leakage of a corrosive substance onto organic materials.

ii. Segregation of hazardous materials: incompatible substances.

iii. The building was constructed in 1982 in accordance with the building regulations in force at the time. However, later HSE guidance suggests that a more substantial thermal barrier, such as a double brick wall, should have separated the store from the adjacent area containing drums of flammable liquids.

iv. Design codes - buildings / structures: design of buildings to withstand plant excursions.

v. The drainage system on-site was adequate and able to cope with firewater run-off. Some minor pollution in the harbour did occur but this produced no obvious acute effects.

vi. Emergency response / Spill control: fire fighting.

3. Contractor suffers electric shock after failure to isolate power supply

A self-employed contractor sustained 415-volt electric shock injuries from the bare electrical wires supplying an overhead travelling crane while working from a cherry picker installing computer cabling. The defendant company failed to follow their procedures for safe isolation of the power supply to the crane.

Action

The company was prosecuted and fined £15 000.

Failings in technical measures

The Company should have:

i. Carried out a risk assessment of the cabling activity that should have identified the hazard from the electrical wires.

ii. Taken action to warn the contractor of the nearby presence of electrical wires; only allowed work when the power had been turned off.

4. Fatal ATV overturn

A 14-year-old child on a work placement scheme with a company operating a commercial shoot was killed when the all-terrain vehicle (ATV) he was riding overturned. He had ridden the ATV into woods on his own to feed pheasants and was later found next to the overturned vehicle on sloping ground. He was not wearing a helmet, although this was not the cause of his death

Action

i. The company was prosecuted for failing to adequately assess the risks associated with using ATVs and for allowing its gamekeepers to use them without training.

ii. Magistrates also heard that the tyres on the ATV were inflated to different pressures, which could have made the bike less stable. The company pleaded guilty, was fined £35 000 and ordered to pay £25 000 costs.

Failings in technical measures

The company should have:

i. Made sure that people using such machines have been properly trained, are capable of remaining in control of the bike at all times, are capable of the task and are supervised.

ii. Used personal protective equipment. Head protection is particularly essential, as is following the manufacturer's safety instructions, which advise specific age limits for different types of machine.

iii. Carried out thorough risk assessment before a child or young person uses any machinery or equipment. Employers and users should be aware also that use of some work equipment by children is specifically prohibited. Even if the risk assessment indicates that the risk is low or can be controlled, adequate instructions and training should be given (appropriate to the physical and emotional maturity of the individual child or young person.

4.0 CONCLUSION

Health and safety plans are initiated by management, prepared by the safety department but require the input of all members of staff to be successful. In our case review, we have seen that effective and efficient implementation of the health and safety plan may have prevented most of these accidents.

5.0 SUMMARY

Health and safety plan is the framework for preventing personal injuries and deaths. The plan includes an initial status review(policy, organising, planning and monitoring**)** of the overall management system and a list of hazards that will be examined to check that adequate control for each of the hazards are in place. Essential elements of a health and safety plan include the OHS policy, safety organisation at plant level with responsibilities, safe procedures for carrying out various activities and identification of hazards.

SELF-ASSESSMENT EXERCISE

i. List the elements of the OHS plan.
ii. Explain the importance of two of these elements in the OHS plan.

6.0 TUTOR-MARKED ASSIGNMENT

As the Safety Officer of the company with the warehouse fire, use the safety template to write an OHS plan that could have prevented the fire. (Ensure all the technical problems cited are covered).

7.0 REFERENCES/FURTHER READING

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ACRONYMS

BS	-	British Standards
CFCs	-	Chloro-Flouro-Carbons
DDT	-	(Pesticide)
DETR	-	Department of the Environment, Transport and the Regions
DIY	-	Products do it Yourself Products
EEC	-	European Economic Community
EU	-	European Union
FEPA	-	Federal Environmental Protection Agency
HFCs	-	Halogenated Flouro Carbons
ILO	-	International Labour Organisation
ISO	-	International Organisation of Standardisation
LASEPA	-	Lagos State Environmental Protection Agency
LPG	-	Liquefied Petroleum Gas
NESREA	-	National Environmental Standards and Regulations Enforcement Agency
OGEPA	-	Ogun State Environmental Protection Agency
PCBs	-	Polychlorinated Biphenyls (used as flame retardants and in electrical equipment)
PI	-	Performance Indicator
UN	-	United Nations
UNEP	-	United Nations Economic Programme
VOCs	-	Volatile Organic Compounds
WHO	-	World Health Organisation