

## EMT 517

### ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

#### ENVIRONMENT:

This is the sum in totality of human life, the physical, chemical and biological setting and where and how people live (ecosystem). Thus issues bordering on human health are major specifics in environmental health and safety management. Therefore, home (habitat), air, water, food, neighborhood, workplace and even the climate constitutes element of human environment.

However, there are threats associated with the human environment, as useful activities tend to impact negatively on the state of health of the environment. There is thus a link between human environment and hazard. Within an environment, there are hazard that can cause harm, sickness, reduced life span, and or contribute in other ways to human misfortune.

Therefore in the context of environmental health, a hazard is anything that can cause: injury, disease or death to humans; damage to personal or public property; and deterioration or destruction of environmental components.

Hazard does not necessarily mean that undesirable consequences inevitably follows, rather it is the connection between a hazard and something happening because of that hazard as a risk. Risk is the probability of suffering injury, disease, death or some other losses as a result of exposure to hazard.

Vulnerability is also an important factor, e.g. poor people are vulnerable to certain risk than the others. Therefore, the appropriate notation for risk can be expressed mathematically as:

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability.}$$

#### HEALTH:

Definition:- World Health Organization (WHO) defines health as a state of complete mental, physical and social wellbeing and not merely the absence of diseases or infirmities.

Health has many dimensions and it would best be understood when grouped into: physical health, mental health, spiritual health and emotional health.

The measurement of all these dimension of health for a society is virtually impossible, it is therefore easy to study environmental health in terms of indicators as manifested in injury, ailment and state of health with focus on diseases, and as well consider good health as absence of disease. The measures or indices used are morbidity and mortality

**MORBIDITY:** This is the incidence of disease in a population used commonly to trace the presence of a particular type of illness such as diarrheal etc.

**MORTALITY:** is the incidence of death in a population.

**EPIDEMIOLOGY:** is the study of the presence distribution and prevention of disease in population.

### **ENVIROMENTAL HAZARD:**

Fundamentally there are two ways of considering hazard to human health:

- i. Lack of access to necessary resources e.g. clean water, nourishing food etc: Looking at hazard from this perspective means considering the social economic and political factors that prevents a person from having access to such basic needs. This study will be limiting primarily to the exposure to hazard in the environment as a result of access dermal. The question is, what is in an environment that causes risk to injury, disease or death people?

### **Types of environmental hazard:**

- Cultural hazard
- Biological hazard
- Chemical hazard
- Occupational hazard

### **CULTURAL HAZARD:**

The factors contributing to mortality and disability are a matter of choice. People engage in risking behavior and subject of themselves to hazard. They may eat too much, drive too fast, used addictive or harmful drugs, consume alcoholic beverages, smoke, sun bathe, engage in risky sexual practices, get too little exercise, or choose hazardous occupation.

Thus people generally subject themselves to hazards because they derive some pleasure or benefits from them. For want of benefits, people are willing to subject themselves to these hazards or take risk that the hazard will not harm them.

Factors such as living in inner cities, engaging in criminal activities etc are cultural sources of mortality too. Statistics on cultural hazard in the united state showed that 1/3 of all deaths can be traced to cultural hazard and in most cases death from cultural hazard are preventable i.e. if people refrain from risky behaviors.

### **BIOLOGICAL HAZARDS:**

The battle with pathogenic bacteria/microbes and viruses can be best traced from the perspective of human history. The outburst i.e. epidemic such as black plague and typhus which ravaged the middle ages, killing millions in every city and of small pox which swept through the new world are evidences of proliferation and prevalence of pathogenic bacteria/microbes and viruses.

In the 19<sup>th</sup> century, the first vaccination was unwanted, and in the golden age of bacteriology (spanning 30yrs only), bacteriologist discovered most of the major bacteria diseases, and brought bacteria into laboratory culture. The 20<sup>th</sup> century saw the advent of virology, the great discovery of antibiotics immunization that eradicated small pox, defeat of polio and victory over childhood diseases as well as the growing influence of molecular biology as a tool in the battle against diseases. “The basic truth is that the battle is not over and will never be”. Pathogenic bacteria, fungi, viruses, protozoan and worms plague every society and person. They are inevitable component of the environment. Many are there regardless of our human presence, and others are uniquely human pathogens whose access to new susceptible host is mediated by the environment (Wright 2008). The 2002 World Health Organization (WHO) estimated a record of over 15million infectious diseases. The table below showed the summary of the WHO rated global killers and the annual number of deaths caused by pathogenic bacteria/microbes and viruses.

### **MORTALITY FROM MAJOR INFECTIOUS DISEASES (2002)**

Causes of death	Estimated yearly death
Acute respiratory infections	3,845,000
HIV/AIDS	2,521,000
Diarrheal diseases	1,767,000
Tuberculosis	1,605,000
Malaria	1,222,000
Measles	760,000
Pertussis (whooping, cough)	301,000
Tetanus	292,000
Meningitis, bacteria	173,000
Syphilis	157,000
Hepatitis	156,000
Leishmaniasis	51,000
Trypanosomiasis (sleeping sickness)	48,000
Dengue	19,000
Schistosmiasis	15,000
Intestinal roundworms	12,000

Extracted from WHO Report (2004)

Thus a quarter of global deaths are due to infectious and parasitic diseases. A leading cause of death in this category are acute respiratory infections e.g. pneumonia, diphtheria, influenza and streptococcal infections both bacteria and viral with pneumonia been by far the most deadly.

### **PHYSICAL HAZARD:**

Natural disaster such as hurricanes, tornadoes, flood, forest fires, earthquakes, landslides and volcanic eruptions leads to the elimination of human life and destruction of properties every year. These hazards are the outcome of hydrological, meteorological, or geological forces. e.g.

2004 Indian Ocean tsunami, August 29, 2005 Hurricane Katrina on the US Gulf, October 8 2005 Earth quake in Pakistan, December 26, 2004 Earth quake spawned tsunami and many others.

The record shows the emergence of two patterns:

1. Hazard like tsunami, tornadoes, and earthquakes that are almost impossible to anticipate
2. Hazard that are largely consequence of choice people make about where to live and what they do.

Thus, much of the harm and loss brought by natural disaster is a consequence of poor environmental stewardship. Hillsides and mountain are deforested, leaving the soil unprotected, people build houses and town on floodplains, villages nestled up to volcanic mountains, cities are constructed on known geological fault lines, coastal marshes and mangrove forests are replaced by house dots etc. Worst still is the spate of industrial development that does not pay recourse to the attendant development and operational consequences, but rather the gains and potential benefits.

A general human tendency is to assume that why disaster happens to other people in other places; and even if there is a risk, e.g. of hurricane striking a coastal island, many people are willing to take the risk in order to enjoy life on the water edge. Apparently, one of the reasons for the rising human and economic cost of natural disaster is the fact that, there are more people in the world to be affected. "A climatologist said if natural disasters are having an increasing greater impact, the culprit is not Mother Nature, but human nature".

### **CHEMICAL HAZARD:**

Industrialization has brought with its host of technologies that employs chemical such as cleaning agents, pesticides, fuels, paints, medicines and many directly used in industrial processes. The manufacture, use and disposal of these chemicals often bring humans into contact with them. Exposure is either through ingestion of contaminated food and drinks, through breathing of contaminated air, by absorption through the skin, by direct use or by accident.

Chemical Toxicity depends on exposure route: Mutagenic, Carcinogenic and Teratogenic effect are products of chronic exposure, while acute exposure can lead to permanent damage or even death. For most substances, there is a threshold below which no toxicity can be detected. However, environmental health and safety in chemical environment is more difficult because different people have different threshold of toxicity for a given substances, this is due to slight variation in genetics and body physiology. For example, children have greater risk than adults because children grow rapidly and can incorporate more of their food and contaminant in them in new tissues. Developing embryo is even more sensitive. Substances transmitted across the mother's placenta can have great impacts on the embryos development especially in early stages.

Carcinogens, Teratogens and Mutagens: Chemical such as some heavy metals, organic solvents and pesticides are hazardous to human health in low concentration. Episodes of acute poisoning are easy to comprehend and are clearly preventable, but the long term exposure to low levels of many of these substances present untidy knots to understanding. Some chemicals like carcinogen is taking a large toll in the developing countries accounting for 1/3 of mortality. This is because cancer takes below 10-40yrs to develop and it is difficult to connect the cause with the effect. The 11<sup>th</sup> report on carcinogen (2005) from the department of health and human services, list 54

chemicals and 3 biological agent known to be human carcinogens and 188 more that are “reasonably” anticipated to be human carcinogens because of animal test. Incidentally many of these substances are in use in both developed and developing countries. Other potential effect of toxic chemicals are impairment of immune system, brain impairment, infertility and birth defect, but many developing countries are in double jeopardy because of their levels of infectious diseases and the rising exposure to toxic chemicals due to industrial processes and home use of such chemicals. In both cases the risk are largely preventable.

In places where industrial growth is especially rapid, insufficient alteration is often given to a pollutant which accompanies that growth. For example 13 of 15 cities with the worst air pollutant are in Asia, where economic growth has rapidly risen.

## **HARZADOUS CHEMICAL IN THE ENVIRONMENT**

1. Chemicals found in air in urban environment
  - Lead (from dust and industrial processes)
  - Hydrocarbons and other volatile organic compounds (from vehicular exhaust and industrial processes)
  - NO<sub>x</sub> and SO<sub>x</sub> (from vehicular exhaust and fixed combustion processes like those carried out in power plant)
  - Particulate matter (dust, soot and metal particle from vehicle exhaust, industrial processes and construction)
  - Ozone (a secondary pollutant produced from the interaction of hydrocarbons and nitrogen oxides in sunlight)
  - CO (from vehicular exhaust and other combustion processes)
2. Chemicals found in food and water
  - Pesticides and herbicides (agricultural application to food crops)
  - Heavy metals such as arsenic, aluminum and mercury (in soil and water contaminated with industrial chemical)
  - Lead (from water pipe)
  - Aflatoxins and other natural toxins (in foods contaminated by fungal growth)
  - Nitrates (industry water with high nitrogen content)
3. Chemicals found in the home and workplaces (indoor)
  - Lead (in house hold parts)
  - Smoke and particles (from the combustion of biofuels, coal and kerosene)
  - Carbon monoxide (from the incomplete combustion of fuels)
  - Asbestos (in insulation)
  - Tobacco smoke
  - Household products (causing poisoning and exposure from their improper use)
4. Chemical contaminating some land sites
  - Cadmium, chromium and other heavy metals (in industrial waste)
  - Dioxin, polychlorinated biphenyls and other POPs (in industrial waste)

## **OCCUPATIONAL HAZARD**

In the pursuit of livelihood, human engage in economic activities that provides for their basic needs i.e. food, shelter and clothing. In doing this they become exposed to occupational hazards

## **CONCEPT OF HEALTH SAFETY AND ENVIRONMENT**

The conceptualization of Health Safety and Environment (HSE) is based on the following:

- Care for life and health. Life is the dearest resource and health is the foundation of life.
- Protect the environment by integrating energy efficiency and energy consumption reduction into the works, and always devote to the harmonious coexistence between human beings and the natural environment.
- Dedicate to one's career, and care for the family, trying to improve the quality of life.
- Incorporation of HSE as a fundamental Culture by advocating and paying attention to HSE, and pushing ahead the implementation of the effective HSE management system and principles of conduct.
- Advocate the effective, rational utilization of resources, and combat extravagance and waste.

The HSE concept opines that the most important resources in the world are human being themselves and the natural environment in which we live. Protecting the environment as well as the health of employees and the safety of their life and properties is one of the key work elements of the company. A good HSE achievement is a necessary condition for our long term protection of human and the environment. Therefore, it is important to rigidly adhere to various HSE regulations and rules, and to implement the HSE protection for all employees, customers and the public within the domestic and work places by establishing and implementing a HSE management system under continual improvement.

### **Objectives of Health Safety and Environment (HSE)**

The attitude towards HSE in any place in the world and in any field of occupational and or work operations is by strictly abiding by the laws and regulations on HSE in the relevant countries and regions; and all operation activities should be carried out within the range permissible by HSE laws and regulations. The objective include

- The ultimate objective is to implement HSE management is to minimize accident, minimize harm to the employees and associated personnel and minimize damage to the natural environment.
- Every individual at home and employee of a company has the obligatory responsibility on HSE management affairs. Scientific and effective training methods to raise the HSE management sense and HSE quality of all employees and management should be adopted in order to establish and maintain HSE enterprise culture;
- Companies should provide necessary manpower, materials and financial resources, to continuously improve the working conditions and environment and continually improve the HSE management, to realize the HSE management objectives of the Company;
- Companies should stop and correct any conduct in violation of HSE, and shall honor and reward those employees and contractors who have made outstanding contributions on HSE management;

- Companies should make public in a frank manner HSE achievements, extensively collect opinions of people of all circles of society, and meet the reasonable demand of the people and associated parties on HSE management.

The CQ University, in developing a Management System to addresses Health, Safety, Environment, summarized the concept by Environmental Health and Safety Management Work-cover and Sustainability (SHEWS) diagram below. Each highlighted factor can be further improved, streamlined and simplified to the effective management of Environment, Health, Safety, Work-cover and Sustainability, and making the responsibilities of all staff and managers clear as to what is expected of them as well as in domestic places.



CQ University SHEWS model

This model is broken down as follows

**Safety:** This is a commitment to developing and implementing best practice safety controls that will lead *Towards Zero* injuries to staff, students, contractors and members of the public.

**Health:** Health and wellbeing, both physical and psychological is extremely important. This involves a commitment to programs which lead us *Towards Zero* health impacts from work and study activities.

**Environment:** This is the commitment *Towards Zero* environmental impacts from its campus operations including research, teaching and support activities.

**Workcover:** Companies should aim to have best practice rehabilitation and injury management process, our aim is *Towards Zero* Common Law Claims and reduction in statutory claims.

**Sustainability:** Environmental Sustainability should be a priority of companies. There should also be a commitment to fulfilling all obligations aiming *Towards Zero* harmful local and global effects through careful planning and decision-making.

## **Concept on Health and Safety at Work (Occupational Health and Safety)**

The right to life and health protection is a fundamental human right. The right of employees to just and satisfactory working conditions is incorporated among the economic, social and culture rights. Therefore constitutional policy that guarantees the right to health and safety at work for the employees should be put in place.

The concept on Health and Safety at Work is in consonance with respecting conventions of the International Labor Organization (the “ILO”), the European Social Charter, and others such as the laws of the European Union and the strategy of the European Commission “Improvement of Work Quality and Productivity: Community Strategy 2007 – 2012 on Health and Safety at Work” (the “Community Strategy for OHS”).

## **Significance of Occupational Health and Safety (OHS)**

The quality and level of protection of the “occupational” life and health of employees presents the cultural, social and economic development of employers and the state within a wider context. Improving OHS can be ensured by implementing preventative measures and specific programs and measures by employers which will improve working conditions and eliminate risks and factors determining the incidence of occupational accidents and diseases or other occupational health damage. The continual improvement of OHS can be supported by the social policy of the government and the active participation of both social partners in solving OHS issues individually and in mutual cooperation. The interest in OHS is determined by social and economic aspects which are mutually equal and influential upon each other. That is why it is necessary to ensure the harmony of economic and social aspects also in connection with the human factor, which constitutes the determining element of almost every job. Society as a whole and individual employers, must implement economic and other activities with distinctive consideration for the creation and maintenance of suitable legal labor relations, working conditions and requirements for ensuring OHS in particular. This also relates to natural persons who are businessmen but not employers (“self employed natural person”). Optimizing working conditions allows for the long-term maintenance of the health and working ability of self employed natural persons. Developing care for the life and health of employees and self employed natural persons and optimizing working conditions constitute a humanizing instrument for the workplace and for enhancing the quality of life. They subsequently create the conditions for the development of the entire society and individual employers, since correct relationships between the employer and employee, which constitute one of the basic preconditions of an employer's economic development, also arise from the application of OHS.

## **Occupational Health and Safety (OHS) and Competitiveness**

A good level of OHS may prevent and minimize the loss of human life and health due to occupational accidents, occupational diseases and other occupational health damage. These health problems constitute material loss in addition to human loss. The positive economic



influence on improving the working conditions and OHS in particular is expressed through higher productivity, effectiveness and the quality of work and provided services. Thus attention to safe and healthy working conditions assists in enhancing competitiveness determined by quality products, quality services for customers, new products and services and profits which are only created by healthy and motivated employees. Thus it creates the precondition for the competitiveness of products and services of Slovak employers and self employed natural persons at home and abroad.

### **Responsibility for Occupational Health and Safety (OHS)**

The employer is responsible for OHS. It is obliged to create and maintain the conditions for ensuring that OHS, at least on the level of standards established by the legal regulations and other regulations for ensuring OHS. It's best if these standards are voluntarily improved according to the actual conditions of individual workplaces. The self employed natural persons are responsible for their own OHS.

The promotion of OHS constitutes one of the activities of state bodies and representative organizations for employers and employees. The state implements its OHS policy through legislative measures, and through the system of inspection and supervisory bodies it controls the adherence to and implementation of measures for ensuring OHS for employers and self employed natural persons. It also ensures the fulfillment of other significant tasks, such as foreign cooperation, research, development, upbringing and education, adult education, promotion, counseling, insurance, taxation and fund contribution policy.

The current status of OHS and the need for continuous development of care for OHS by employers emphasize the requirement that the representative organizations of employers more actively support their members through expert activities assisting the OHS activities of employers. The activities of the representative organizations of employers lie especially in the field of education, enforcement of interests of employees and the control of the OHS status at the workplace. The improvement of the overall OHS situation could be achieved if the representative organizations of employers and employees would influence the attitudes of employers, employees and self employed natural persons towards a healthy form of "working" life, increasing the labour culture, strengthening responsibility for one's own economic activities in connection to health and safety protection and the consequent implementation of the instruments for prevention.

### **Occupational Health and Safety (OHS) Policy**

Pursuant to the Policy Statement of the Government of the Safety Regulation, the re-evaluation of pertinent legal norms and the improvement of their consequent adherence to the legal OHS regulations by employers by strengthening the performance of labour inspection constitute part of Government of the Safety Regulation intentions. Improving conditions to ensure OHS, i.e.

improving working conditions even in connection with the need to decrease the number of occupational accidents and occupational diseases constitutes the purpose.

### **International Aspects of Occupational Health and Safety (OHS)**

Occupational Health and Safety (OHS) issues have a significant international dimension and all area of OHS policy is bound by the ILO international agreements and conventions. The laws of the Federal Republic on Nigeria regulating OHS (FMEnvr., NESREA, SEPAs) are significant in particular for OHS practice.

Occupational Health and Safety (OHS) in the international context is preferred, but not only in terms of accident prevention and the creation and maintenance of conditions for ensuring OHS. In the wider context it includes conditions for satisfactory work, wellbeing at work and social and legal protection of employees and other persons at workplaces with the employers' awareness. This has a distinctive positive impact on public health and environmental protection. It contains elements of safety and health protection with a consideration of all aspects of work, directly or indirectly related to work including social and psycho-social factors, such as employment, stress, violence and harassment at the workplace and gender equality. This is also in compliance with the philosophy of the World Health Organization, according to which health is a condition of physical, mental and social wellbeing. Good working conditions, including the ensuring of OHS constitute the necessary conditions for dignified or good work required from its members by the Community and the ILO.

### **International Labor Organization**

The ILO regulates the conditions for ensuring OHS through a complex of conventions and recommendations, all of which are mandatory and binding on member countries. Some of which include ILO Convention No. 13 of 1921 on the Use of White Lead in Painting Work, ILO Convention No. 115 of 1960 on the Protection of Employees from Ionizing Radiation, ILO Convention No. 155 of 1981 on the Safety and Health of Workers and the Working Environment and ILO Convention No. 184 of 2001 on Safety and Health in Agriculture and many others, although some member states are yet to apply and ratify all, especially the basic ILO standards on labor inspection.

### **The European Union**

The basic OHS framework in the Community is regulated through an extensive set of 26 Regulations; the key aspects are contained in the Council Regulation of June 12, 1989 on the Introduction of Measures for the Promotion of the Improvement of the Health and Safety of Workers at Work (89/391/EEC). Their purpose is to establish equal minimum OHS standards for all EU Member States. This complex of Regulations is supplemented by other acts of EU bodies, such as Regulations and Decisions. The health and safety of workers at work constitutes one of the most developed aspects of the Community policy in the area of employment and social

affairs and represents a contribution to the implementation of basic rights. It represents the precondition for applying the basic principle of the Community – the right to free movement of workers within the common EU space.

The Community equally prefers the social dimension to economic aspects and it is based on the principle that the health and safety of employees at work constitutes a phenomenon in which it is impossible to see only the economic aspect of the matter. The non-acceptance of this approach by employers is perceived by the EU as the illegal economic preferential treatment of one subject over others and disturbing the equality necessary for free economic competition.

The satisfactory working conditions and especially the safe and non-threatening health factors of work at workplaces are significant for the Community in two cardinal policies i.e. the solution of situations arising from demographic developments (the aging of the economically active population) by employing “more mature” persons in connection with the prolonging of the old age pension age and the significant of implementing the growth and employment strategy of the revised Lisbon Strategy in connection with the creation of more and better jobs. The basic OHS intentions of the Community are contained in the Community Strategy for OHS. Its purpose is to revive the policy of health and safety at work and to improve its implementation within the Community space.

### **Present Status of Occupational Health and Safety (OHS) OHS in Nigeria**

The practice of OHS is low, as lip service is often paid to legislation resulting in ineffective monitoring and evaluation. Many companies especially the multinational have taken advantage of corruption to cut expense where needed for effective implementation of the OHS policy as entrenched in national law and the ILO agreements and conventions. Thus employees are exposed to dangers which frequently pose threat to their health when fulfilling their work duties. Dangers or their effects on employees are eliminated or limited through suitable preventative or protective measures for ensuring OHS.

### **Creating and Maintaining the Conditions for Ensuring OHS**

Monitoring and evaluation activities have revealed that the care for OHS by employers is frequently minimal or formal. The creation of suitable working conditions for employees and the protection of their life and health at the workplace in particular do not constitute a priority or natural need for a number of employers. Frequently, the lack of interest of employers in ensuring satisfactory working conditions and their greater concern for economic and business intentions prevail. These statements are valid especially in the case of SMEs - production enterprise subjects as a rule, and especially self employed natural persons. Especially dangerous working procedures, the organization of work, dangerous equipment and risky jobs are often found in the production and service sectors. These factors represent a constant potential threat and the cause of health damage.

The outcome of such approach is the lack of a systematic and unified approach to the issues; care for OHS is usually formal. Insufficient attention is paid to risk assessment, the cooperation between managing employees and employees is too frequently unsatisfactory, and the quality of notifying the employees of OHS issues is unsatisfactory. The OHS activities of employees and representatives of employees in requiring and enforcing satisfactory working conditions, including the conditions for ensuring OHS at employers' workplaces is also limited by their fear of losing their jobs. The direct proof of the low level of care for OHS are insufficiently secured and equipped operation buildings, working spaces and working environments, not to mention unsuitable machinery and technical equipment.

### **Status of Occupational Accidents and Occupational Diseases**

In the case of the occupational accidents, the long term positive development of the decrease in their number continues. Records are inadequate but unverified report showed that the number of occupational accidents has increased. A long-term unfavorable development may be reflected in the increasing average time (days) of sick leave due to occupational accidents. From the statistics on occupational accidents it arises that the largest number of accidents occurred in relation to the manipulation with objects and loads, in falls, the effect of sharp edges, etc. Means of transportation have constituted the most frequent source of fatal and severe or serious occupational accidents over the past. Dangerous procedures or methods of work, acting without authorization and lack of personal preconditions for work constitute the most frequent causes of the occurrence of serious occupational accidents. The largest number of fatal and severe or serious occupational accidents occurs in industrial production. The trend in the incidence of occupational diseases is clear; however a number of new occupational diseases have been reported. The following are the most significant factors of the working environment from the aspect of the number of exposed employees. Physical factors include excessive noise, vibrations and ionizing radiation; chemical factors include dust and chemical substances and agents with toxic effects. Recently, one of the major positive factors determining the decrease of health damage at work is constituted by the introduction of new technologies in which a higher level of unconditioned technical safety is integrated.

### **Economic Motivation**

The present economic instruments are not sufficiently effective in encouraging employers to create and apply satisfactory working conditions, including conditions for ensuring OHS. The basic economic instruments which significantly lead to increases in the level of care for OHS, such as ensuring preventative activities in the field of OHS through accident insurance policies and the allocation of a certain amount of financial resources earmarked for accident insurance for guaranteeing this prevention, are not legislatively regulated and used. The absence of these economic instruments is significant especially in the financial coverage of implementing preventative measures by SMEs.

## **Education and Promotion**

In general, legal awareness in relation to OHS among employers, their statutory bodies and other managing employees, self employed natural persons and employees is low. The unawareness or unreasonable underestimation of the risks of health damage, the effort and willingness to solve working tasks even at the expense of one's health and the unwillingness to prevent health damage through preventative measures continue. It is difficult to enforce the philosophy of personal responsibility for the protection of one's own safety and health in the working process with employees. The sensitivity of the population, employers and employees towards these issues is insufficient. This status also arises from the fact that an adequate system of school education of pupils, students and teachers in the area of OHS is insufficient or lacking.

## **The Relation of the Concept of OHS to OHS Legislation**

OHS legislation is in compliance with the pertinent laws of the Community. The legal regulations and other regulations for ensuring OHS establish a wide circle of tasks directly or indirectly related to implementing the right to life and health protection of employees at work. This includes organizational, technical, healthcare, upbringing-educational, social and other measures targeted on the management, implementation and control of technical, organizational and personal aspects, for the creation of working conditions that will ensure OHS and preserve the health and working capacity of employees. The application of legal regulations and other regulations for ensuring OHS in the practice of employers, self employed natural persons and employees is problematic. That is why the measures of the OHS Concept are targeted on the support of employers in the more conscientious performance of obligations established by the legal regulations for ensuring OHS; they are also designed to support related aspects determining or developing the performance of these obligations.

## **OHS Concept Objective**

Optimizing the working conditions of employees, including the conditions for ensuring OHS constitute the means for implementing the basic axiom in the field of OHS according to which the "occupational" health of employees constitutes a valuable national resource. It represents the expression of accepting the essence and value of human life. The significance of this approach is growing. This objective is in compliance with the Community Strategy on OHS. The anticipated OHS Concept is created with the consideration of the present status of OHS and current social conditions. It proposes a complex package of measures whose implementation will significantly promote the application of life and health protection at work for employees and self employed natural persons in the implementing of their business activities. The primary objective of the OHS Concept is to gradually decrease the number of occupational accidents. The support of employers and self employed natural persons in the conscientious application of legal regulations and other regulations for ensuring OHS and related legislation is also an instrument that will help to achieve this objective. The bodies of state administration in the field of labour inspection and

state supervision and the strengthening of their activities in enforcing the protection of employees at work in compliance with the Community standards and the ILO make up another important instrument for enforcing the established objective.

### **OHS Concept Priorities**

In the interest of the successful and gradual achieving of the OHS Concept objective, it is necessary to decrease the value of the monitored indicator of the number of occupational accidents. In order to achieve this in the interest of improving the status of working conditions, including OHS in Nigeria and to decrease the number of occupational accidents in general, all employers must show increased effort and adopt more effective measures. This refers to employers performing work with a higher incidence of health injury cases, especially those whose monitored indicators exceed its average value in the pertinent division according to the statistical classification of economic activities. Small and middle-sized enterprises in particular must equally concentrate on ensuring these activities. Self employed natural persons must also take more distinctive care of their safety and health by themselves.

From the aspect of the number of occupational accidents, high risk areas include the construction industry, agriculture and forest management, the extraction of raw materials and industrial production, especially in processing timber and wood products, metal production and the production of metal products, the production of machinery and transportation means. In terms of the seriousness of occupational accidents and the number of fatal accidents per 100 employees, the construction industry, agriculture, hunting and forest management, transportation, storing and communications and industrial production, especially the production of pulp, paper and paper products, the production of non-metal mineral products, the processing of timber and wood products, chemical products and chemical fibers are especially risky. Increased risks can also be found in working activities in which extremely tragic events have recently occurred, for example in mining.

Employers and self employed natural persons involved in the performance of these activities must more thoroughly implement suitable protective and especially preventative measures in the interest of decreasing the amount of health damage at work and achieving the OHS Concept objective. In the interest of monitoring the fulfillment of the overall objective, the recommended year on year values for decreases in the monitored indicator will be established after receiving the consent of the representatives of employers on the OHS Coordination Committee. Increased attention must also be focused on specific groups of employees which may be excessively exposed to risks connected with the performance of their occupation or to the special and specific risks, for example juvenile employees (up to 20 years of age), employees performing their job for a short period of time, employees with insufficient knowledge and experience, distinctively older employees (over 60 years of age), migrating persons and pregnant women. Greater attention must also be devoted to improving OHS care in the performance of working

activities by persons with disabilities, with an emphasis on protected workplaces, protected workshops and social enterprises.

The supervisory, advisory and informational attention of all involved, especially inspection bodies and supervisory authorities, must be targeted on these activities, sectors and groups of employees. The following priorities of the OHS Concept define the basic circles of measures which in the interest of the further development of the attention of employers for OHS and decreasing the number of occupational accidents and occupational diseases promote OHS activities of employers.

### **Enforcement of the Application of the OHS Concept**

In the interest of the effective implementing of the tasks and measures of the OHS Concept, it is necessary to universally promote its dissemination, explain its importance and promote its benefits. This is especially important in relation to the expert public, employers, self employed natural persons, and SMEs. It is suitable to use the media, seminars, etc. for this purpose.

### **Monitoring of the Implementation of the OHS Concept Objective**

Implementing the OHS Concept objective and fulfilling its priorities including individual measures and tasks should be monitored and evaluated on a semi-annual basis by the OHS Coordination Committee, which constituted the Counseling Body established for the purpose of creating and assessing the state OHS policy. For this purpose, the administrators and cooperating institutions submit information on the fulfillment OHS concepts which will then be forwarded to the Coordination Committee. The members of the Coordination Committee are continuously informed of the fulfillment of the Concept tasks.

It has been proposed that the report on implementing the OHS Concept be submitted to the session of the Government as stipulated e.g. Quarterly Air quality Assessment Report, biannual Environmental Audit Report, Annual Impact Statement report etc.

## **GOOD HOUSEKEEPING AND EQUIPMENT MAINTENANCE**

### **Housekeeping**

Good housekeeping can eliminate some workplace hazards and help get a job done safely and properly. Poor housekeeping can frequently contribute to accidents by hiding hazards that cause injuries. If the sight of paper, debris, clutter and spills is accepted as normal, then other more serious health and safety hazards may be taken for granted.

Housekeeping is not just about cleanliness, it includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to

important details such as the layout of the whole workplace, aisle marking, safety signage, adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing accidents.

### **Purpose of workplace housekeeping**

Poor housekeeping can be a cause of accidents, such as: tripping over loose objects on floors, stairs and platforms, being hit by falling objects, slipping on greasy, wet or dirty surfaces, striking against projecting, poorly stacked items or misplaced material, cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping etc. To avoid these hazards, a workplace must "maintain" order throughout a workday. Although this effort requires a great deal of management and planning, the benefits are many.

### **Benefits of good housekeeping practices**

Effective housekeeping results in: reduced handling to ease the flow of materials, fewer tripping and slipping accidents in clutter-free and spill-free work areas, decreased fire hazards, lower worker exposures to hazardous substances (e.g. dusts, vapours), better control of tools and materials, including inventory and supplies, more efficient equipment cleanup and maintenance, better hygienic conditions leading to improved health, more effective use of space, reduced property damage by improving preventive maintenance, less janitorial work, improved morale and improved productivity (tools and materials will be easy to find)

### **Good housekeeping program**

A good housekeeping program plans and manages the orderly storage and movement of materials from point of entry to exit. It includes a material flow plan to ensure minimal handling. The plan also ensures that work areas are not used as storage areas by having workers move materials to and from work areas as needed. Part of the plan could include investing in extra bins and more frequent disposal.

The costs of this investment could be offset by the elimination of repeated handling of the same material and more effective use of the workers' time. Often, ineffective or insufficient storage planning results in materials being handled and stored in hazardous ways. Knowing the plant layout and the movement of materials throughout the workplace can help plan work procedures.

Worker training is an essential part of any good housekeeping program. Workers need to know how to work safely with the products they use. They also need to know how to protect other workers such as by posting signs (e.g., "Wet - Slippery Floor") and reporting any unusual conditions.

Housekeeping order is "maintained" not "achieved." Cleaning and organization must be done regularly, not just at the end of the shift. Integrating housekeeping into jobs can help ensure this



is done. A good housekeeping program identifies and assigns responsibilities for the following: clean up during the shift, day-to-day cleanup, waste disposal, removal of unused materials, and inspection to ensure cleanup is complete

It is important not to forget out of the way places such as shelves, basements, sheds, and boiler rooms that would otherwise be overlooked. The orderly arrangement of operations, tools, equipment and supplies is an important part of a good housekeeping program. The final addition to any housekeeping program is inspection. It is the only way to check for deficiencies in the program so that changes can be made. The documents on workplace inspection checklists provide a general guide.

## **Elements of effective housekeeping program**

### **Dust and Dirt Removal**

In some jobs, enclosures and exhaust ventilation systems may fail to collect dust, dirt and chips adequately. Vacuum cleaners are suitable for removing light dust and dirt. Industrial models have special fittings for cleaning walls, ceilings, ledges, machinery, and other hard-to-reach places where dust and dirt may accumulate.

Special-purpose vacuums are useful for removing hazardous substances. For example, vacuum cleaners fitted with high efficiency particulate air (HEPA) filters may be used to capture fine particles of asbestos or fibreglass. Dampening (wetting) floors or using sweeping compounds before sweeping reduces the amount of airborne dust. The dust and grime that collect in places like shelves, piping, conduits, light fixtures, reflectors, windows, cupboards and lockers may require manual cleaning. Note that Compressed air should not be used for removing dust, dirt or chips from equipment or work surfaces.

### **Employee Facilities**

Employee facilities need to be adequate, clean and well maintained. Lockers are necessary for storing employees' personal belongings. Washroom facilities require cleaning once or more each shift. They also need to have a good supply of soap, towels plus disinfectants, if needed. If workers are using hazardous materials, employee facilities should provide special precautions such as showers, washing facilities and change rooms. Some facilities may require two locker rooms with showers between. Using such double locker rooms allows workers to shower off workplace contaminants and prevents them from contaminating their "street clothes" by keeping their work clothes separated from the clothing that they wear home. Smoking, eating or drinking in the work area should be prohibited where toxic materials are handled. The eating area should be separate from the work area and should be cleaned properly each shift.

### **Surfaces**

Floors: Poor floor conditions are a leading cause of accidents so cleaning up spilled oil and other liquids at once is important. Allowing chips, shavings and dust to accumulate can also cause accidents. Trapping chips, shavings and dust before they reach the floor or cleaning them up

regularly can prevent their accumulation. Areas that cannot be cleaned continuously, such as entrance ways, should have anti-slip flooring. Keeping floors in good order also means replacing any worn, ripped, or damaged flooring that poses a tripping hazard.

**Walls:** Light-coloured walls reflect light while dirty or dark-coloured walls absorb light. Contrasting colours warn of physical hazards and mark obstructions such as pillars. Paint can highlight railings, guards and other safety equipment, but should never be used as a substitute for guarding. The program should outline the regulations and standards for colours.

### **Maintain Light Fixtures**

Dirty light fixtures reduce essential light levels. Clean light fixtures can improve lighting efficiency significantly.

### **Aisles and Stairways**

Aisles should be wide enough to accommodate people and vehicles comfortably and safely. Aisle space allows for the movement of people, products and materials. Warning signs and mirrors can improve sight-lines in blind corners. Arranging aisles properly encourages people to use them so that they do not take shortcuts through hazardous areas.

Keeping aisles and stairways clear is important. They should not be used for temporary "overflow" or "bottleneck" storage. Stairways and aisles also require adequate lighting.

### **Spill Control**

The best way to control spills is to stop them before they happen. Regularly cleaning and maintaining machines and equipment is one way. Another is to use drip pans and guards where possible spills might occur. When spills do occur, it is important to clean them up immediately. Absorbent materials are useful for wiping up greasy, oily or other liquid spills. Used absorbents must be disposed of properly and safely.

### **Tools and Equipment**

Tool housekeeping is very important, whether in the tool room, on the rack, in the yard, or on the bench. Tools require suitable fixtures with marked locations to provide orderly arrangement, both in the tool room and near the work bench. Returning them promptly after use, reduces the chance of being misplaced or lost. Workers should regularly inspect, clean and repair all tools and take any damaged or worn tools out of service.

### **Maintenance**

The maintenance of buildings and equipment may be the most important element of good housekeeping. Maintenance involves keeping buildings, equipment and machinery in safe, efficient working order and in good repair. This includes maintaining sanitary facilities and regularly painting and cleaning walls. Broken windows, damaged doors, defective plumbing and

broken floor surfaces can make a workplace look neglected; these conditions can cause accidents and affect work practices. So it is important to replace or fix broken or damaged items as quickly as possible. A good maintenance program provides for the inspection, maintenance, upkeep and repair of tools, equipment, machines and processes.

## **Waste Disposal**

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities. Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. All waste receptacles should be clearly labeled (e.g., recyclable glass, plastic, scrap metal, etc.).

## **Storage**

Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere with work but they should still be readily available when required. Stored materials should allow at least one metre (or about three feet) of clear space under sprinkler heads.

Stacking cartons and drums on a firm foundation and cross tying them where necessary, reduces the chance of their movement. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations. All storage areas should be clearly marked.

Flammable, combustible, toxic and other hazardous materials should be stored in approved containers in designated areas that are appropriate for the different hazards that they pose. Storage of materials should meet all requirements specified in the fire codes and the regulations of environmental and occupational health and safety agencies in your jurisdiction.

## **Equipment Maintenance Management**

Equipment Maintenance is a risk management practice used to maximize production and minimize loss and waste. Selecting a successful maintenance strategy requires a good knowledge of equipment failure behaviour and maintenance management practices. Once you appreciate why equipment fails, how equipment fails and when equipment fails you can select the right mix of maintenance strategies to extend and maximize its service and performance. To master a thing, there must be a thorough understanding of its operation. Hence, expertise is a clear and intimate knowledge absorbed with specialty of equipment. When an equipment operation is understood, its behaviour is known under all circumstance; hence when there is a change its impact and effect can be anticipated.

Maintenance is therefore a strategy for performance enhancement. Strategic maintenance decision making involves selecting the right care and repair methodologies that maximize equipment life and performance for the least cost to the user. But to be able to make successful maintenance management strategy choices you must understand how equipment fails. When you know the equipment's weaknesses and strengths you can care for it properly and get maximum service from it at least cost.

## **Equipment Failure**

Today's equipment technologies can be broadly grouped as mechanical or electrical. Equipment in both groups has physical presence because they are made of solid matter which can break or deteriorate. However, equipment fails because its physical substance and structure cannot support the last duty required of it. In some cases the end of an equipment's life is instantaneous and without warning. Many times there is a gradual worsening of performance that can be detected. Equipment can therefore fail because some part of it can be broken or deteriorated. The question is "what could be the cause of equipment part breakdown or deterioration?" There are usually hundreds of combinations of causes that can make a piece of equipment fail which can be categorized into:

### **Over-stressed Components**

Physical matter can only survive within a limited range of imposed stresses and environments. Once matter is stressed beyond its endurance it will suddenly fail. Some common examples are overloading, becoming too hot and placing an item under fluctuating forces leading to fatigue situations.

### **Physical Attack**

This is the case where the environment around the equipment actually damages the equipment. When environmental attack gets too severe the equipment is compromised and fails, as it no longer has the strength or capacity to handle its duty. Common examples are rusting, chemical corrosion, wear, erosion and cavitation.

### **Error or Mistake**

Equipment can fail due to the wrong thing being done to it, or a wrong choice being made in ignorance. Failure by error can start on the drawing board at the design stage. It can be due to an operator or maintainer making a mistake. It can be due to incompetent management decision. Some examples include starting equipment when not fully rebuilt, forgetting to put oil in a gearbox, introducing incompatible chemicals and doing the wrong instruction sequence. Poor Design Choices and-or Poor Manufacturing / Assembly Quality

There are times when equipment part is made incorrectly, built incorrectly or its design was unable to withstand the imposed service duty. Such design errors include selecting undersized equipment, wrongly specified components which introduces safety risks. Manufacturing errors like poor welding, poor casting, incorrectly positioned holes and out of tolerance machining are

real possibilities. Similarly, assembly errors, such as under-torque on bolts, poorly fitted electrical connections and short-cut assembly quality practices will eventually lead to equipment failure.

### **Lack of Maintenance and Care**

When equipment is designed the designer makes the assumption that it will be treated with reasonable care and it will undergo a minimum amount of required maintenance. When care and maintenance is withheld from equipment for an extended period of time, accumulated problems develop which eventually cause failure. This can include not changing lubricating oil, leaving electrical equipment open to dust and dirt ingress, starting machines under full load, not checking remaining service life and not cleaning equipment down.

### **Unimagined Incidents and Knock-on Effects**

Occasionally an unexpected disastrous event occurs that destroys equipment. These include sabotage, acts of God, such as lightning and terrorism. Included in this category are unforeseen preventable events that are a consequence of planned events. An example is where a bolt falls into a machine during a repair and is not noticed. On start-up the bolt is jammed into the working parts and causes a breakdown. Another example is negligent behaviour, such as backing forklifts into operating plant or out-of-control vehicles running into machinery.

Consequently, equipment failure is defined as the point when the equipment no longer delivers the minimum duty required of it. It may not yet be broken, but it is not able to deliver the needed service. The actual time of failure depends on when the cause of the failure coincides with the item's ability to accommodate the failure mechanism. This means that the failure happens at the time the item can no longer operate as required. This point in time can be controlled by the selection of the right maintenance strategies. However, equipment failure can even be totally prevented with appropriate maintenance strategy.

### **Equipment Maintenance Strategies**

There are several maintenance strategies available, which range from pre-emptive methods that remove the need for maintenance. There are those that cover the ways to maintain well and on to failure analysis methods for removing existing failures. These include:

**Pre-emptive Detection and Elimination** which is a strategic maintenance planning and starts on the drawing board. Once an item of plant is built you are stuck with it. A statement of equipment maintenance requirement is needs is made to maintain its performance. There is no escaping the fact that the design specifies the maintenance requirements. Unless the necessary maintenance is done it will fail.

**Quality Control and Assurance** is a strategy originated in the manufacturing industries and applies equally to maintenance work. It is simply the proper and correct control of manufacture and assembly so that equipment is built precisely as it was designed, with correct and accurate components. It involves substantiating and proving that each equipment item meets its design

requirements and that it is assembled into the equipment correctly. When equipment is accurately and properly assembled using the right parts, it lasts longer between repairs and so has a longer mean time between failures (MTBF). It also runs sweeter and produces more consistent output. This translates into better running equipment with longer mean times between failures.

**Preventative Maintenance (PM)** strategy was one of the very first and it is still very effective. It comes in two forms – 1) inspection and observation and 2) intervention and replacement. The first Preventative Maintenance form is the usual response used for equipment and parts that show signs of age and wear-out, which involves inspecting and noting the condition of equipment and its parts and servicing it on a regular basis, such as changing old lubricant so that servicing is done it is an ideal time to look for evidence of impending failures in critical and working parts. If failure evidence is found, the part is changed for new immediately or at the earliest convenient time before breakage.

**Shutdown Overhaul Maintenance** is the second PM form which involves automatic replacement of parts known to experience age and use related degradation on a set frequency shorter than the mean time between failures. Doing this should prevent an unexpected failure and give maximum production time. Such work is typically done as an overhaul where the whole of the equipment is removed from operation during a shutdown and taken to the workshop to be stripped down to its component parts and rebuilt as new.

**Predictive Maintenance (PdM)** is a very powerful maintenance strategy. It involves monitoring for evidence of changed conditions within the equipment. The amount of change and the rate of change are tracked and used to predict the time of failure. PdM is based on the recognition that many failures take time to happen. Typically there is a start point, a gradual worsening, and eventually a point where the item cannot perform its duty. Finally there is a point in time when it breaks and totally fails. Hence if it is possible to detect early onset of the failure then there is often time to manage the equipment carefully and continue operation until a replacement is actually needed. When predictive maintenance management strategy is used problems can be immediately and can act on them before a failure occurs that shuts the operation down.

**Intentional Over-Design Selection:** there are times when it is useful to select more robust equipment than superficially appears necessary. This is a strategic maintenance choice that is intended to produce longer periods of equipment operation between failures. It involves specifying equipment with stronger, harder, more resistant parts, using longer lasting components, applying improved protection against ingress of the external environment and the like.

**Improved Technologies:** new inventions and innovative designs usually occur in response to existing problems. It is a wise and valid maintenance strategy to be constantly looking for new technologies that reduce equipment operating problems. When there is a change to a new technology that solves a maintenance problem, there is immediately gain in the benefit of improved production output.

**Root Cause Elimination and Design-Out:** is a maintenance strategy that solves problems and continually improves plant and equipment performance. This is a strategic maintenance step that

if not done, results in long-term deterioration in production plant performance. If operating problems are not removed by designing them out, then the problems will accumulate to the point where production falls because equipment continually fails.

**Proactive Education and Training:** people can only change their behaviour and thoughts when they find better ways to behave and think. Once a person knows what is right to do, they will most likely do it. Ignorance is hugely expensive. One of the best maintenance strategies is to teach the engineering design requirements of the equipment to the operators and maintainers who will run and care for it. This is a sound strategic step because it means key knowledge is transferred to the users of the machinery. Knowledgeable users will make wise choices and take correct actions.

**Maintenance Planning and Scheduling** is a key strategic maintenance planning move. It is based on the principle that prior planning and preparation will improve the actual performance and execution. Here operations and maintenance must be thoroughly planned and organized before being done.

**It should be noted that there is no one maintenance strategy for all situations and all companies. Rather you require a blend of maintenance management strategies that are right for your operation and for the age of the equipment. This will always require an amount of preventative maintenance, as well as an amount of predictive maintenance when equipment ages, along with root cause analysis to eliminate non-random failures. To this is added appropriate training, occasional overhaul shutdowns, replacement of old technologies with new, and so on.**

## **STRATEGIES FOR PROTECTING WORKERS IN WORK PLACES**

In view of the attendant associated risk involved in both operational and practice procedures in work places, there is need for developing proactive and pragmatic approaches to limit employees exposure to peculiar hazards in industries and the SMEs. There are a few simple strategies that can be used to protect your workers work hazards. These strategies can be documented in employee's protection policy. These include:

### **Provide training**

All employees should receive training and education to raise their awareness and knowledge about lifestyle factors including work practices that contribute work and industrial hazards peculiar to their work environment and their attendant exposure risk. This should include emergency response procedure and what to do (first aid practice) in case of accident.

### **Provide protective clothing**

Employees should be provided with protective clothing, the use of which must be enforced even when working in shade. Employees still need suitable clothing to protect them from exposure

industrial fumes, UV radiation etc which is scattered in the atmosphere or reflected off water, sand, snow, cement or grass. Both the design and the type of fabric used in the garment are important in maximizing the protection it offers.

**Design:** get employees to wear loose-fitting clothing that covers as much skin as possible - shirts with long sleeves and collars (turned up), trousers, or skirts or shorts that are at least knee-length.

**Fabric:** the more closely woven the fabric the less UV radiation or noxious gases will penetrate through to the skin. Purpose-made protective work clothing will be most effective.

### **Provide hats and headgear**

A well-designed hat can substantially reduce risk to head injury which can reach the face, neck, ears and head. Common sites of head damage are the neck, ears, temples, lips, face and nose.

When choosing hats for your employees, remember: hats should shade the face, neck and ears, and be made of tightly woven material; broad-brimmed hats (8-10cm), and caps with neck flaps (legionnaire caps) offer good protection; use brims and neck flaps to attach to hard hats or helmets; and baseball caps don't cover the face, ears and back of the neck adequately.

### **Use of eye protection device**

#### **Sunglasses**

Sunglasses are vital in the outdoor workplace. Repeated exposure of the eyes to high intensity optical radiation, UV radiation, thermal energy, flying objects etc can cause short-term eye complaints and permanent eye damage. When choosing sunglasses, remember: close-fitting, wrap-around styles are best and stop high intensity optical/UV/ thermal radiation coming in at the sides as well as from in front; sunglasses should meet the look for category 2, 3 or 4 and a lens description that states "good optical and UV protection"; sunglasses with an eye protection factor that offer the most effective protection; and UV radiation protective eyewear and safety glasses used in laboratories, industry and medicine.

#### **Provision of shade**

Try using available shade, such as trees and other plants, buildings or temporary shade structures, such as umbrellas, canopies and awnings, to reduce thermal, radiation and sun exposure. Always provide a shaded or indoor area for tea breaks and lunch.

### **INDUSTRIAL POLLUTANT AFFECTING COMMUNITIES (dust, effluents, fire, etc)**

Industrial Pollution sources could be from Point and Nonpoint sources. The pollution could result air, water and soil pollution which all have different adverse effect on the environment. Pollutant could range from one or a combination of the following:



Heavy metals from industrial processes can accumulate in terrestrial areas or in nearby lakes and rivers. These are toxic to marine life such as fish and shellfish, and can affect the rest of the food chain. This means that entire animal communities can be badly affected by this type of pollutant.

Industrial waste often contains many toxic compounds that damage the health of aquatic animals and those who eat them. Some toxins affect the reproductive success of marine life and can therefore disrupt the community structure of an aquatic environment.

Microbial pollutants from sewage often result in infectious diseases that infect aquatic life and terrestrial life through drinking water. This often increases the number of mortalities seen within an environment.

Organic matter and nutrients causes an increase in aerobic algae and depletes oxygen from the water column. This is called eutrophication and causes the suffocation of fish and other aquatic organisms.

Sulfate particles from acid rain change the pH of water making it more acidic, this damages the health of marine life in the rivers and lakes it contaminates, and often increases the number of mortalities within an environment.

Suspended particles can often reduce the amount of sunlight penetrating the water, disrupting the growth of photosynthetic plants and micro-organisms. This has subsequent effects on the rest of the aquatic community that depend on these organisms to survive.