TAU PELE
CONSTRUCTION (PTY) LTD

ENVIRONMENTAL AWARENESS TRAINING

INTRODUCTION

This training is intended to ensure that all employees currently employed at Tau-Pele (Pty) Ltd are informed on all the procedures and best practices regarding the environmental management on site.

The training will also be included in the induction of any newly appointed person on the site.

After attending this training, the employee will:

- Be acquainted with environmental concepts and understand the strategy behind worldwide environmental conservation.
- Understand a waste disposal control program
- Understand the term pollution and the responsibilities of each role player in controlling pollution.

1. ENVIROMENTAL AWARENESS

1.1 ENVIRONMENTAL CONCERN – A GROWING TREND

The last few decades have seen an unprecedented rise in what is referred to as the "global environmental consciousness". People all over the world, but especially in the developed countries, are realizing that their activities have a measurable and significant effect on the world around them. The impact of activities can be seen in increasing smog in cities, polluted rivers, dwindling supplies of fuel-wood in rural area, and, on a global scale, in the build-up of greenhouse gases, causing the earth to slowly warm up and seasonal changes affecting plant growth on the planet.

GLOSSARY

Duty of care. Each individual person has an obligation towards all the other inhabitants and all living things on this planet to play his part in ensuring continued sustainability of life on this planet and protection of the environment.

Cradle to grave. Each person or company/organisation who generates (creates) waste is responsible for the effect it may have on the environment from when it was created and for as long as it exists.

1. This means that if the waste does not bio-degrade, the generator remains responsible for that waste even after is has been disposed of.
2. The generator is responsible for the impact the generation of that waste has on the environment.

Leachate. An intensive wastewater generated as rain falls onto the landfill, or as offsite storm water flows across the landfill. All landfills will generate Leachate.

1.2 GLOBAL ENVIRONMENTAL PROBLEMS

Pollution

Acid rain is formed when pollutants in the air, such as nitrogen oxides and oxides of Sulphur, react with water in the air to form weak acids. These precipitate out of the air as rain or in mists, causing degradation of water and land resources, vegetation and building materials (particularly marble, limestone and slate). Water pollution has progressed to the stage where in some countries tap water cannot be used for drinking purposes anymore.

Global warming

The "greenhouse effect" is a necessary function of the gases in the atmosphere, which regulate the temperature of the earth. However, the build-up of gases such as carbon dioxide, as a result of industrial emission, is leading to a situation where this effect is being significantly enhanced. As the concentration of these "greenhouse gases" increases, more heat is trapped in the earth's atmosphere, leading to rising global temperatures.

Ozone depletion

Chemicals produced in industrial operations, such as chlorofluorocarbons (CFCs), react chemically in the stratosphere resulting in the destruction of ozone molecules. The ozone layer protects the earth from harmful ultraviolet radiation, which may be lethal to plant, bacteria and animal species. In humans, there is likely to be an increase in burns and skin-related fatalities from excess radiation.

Depletion of natural resources

There are certain materials that the ecosystem cannot regenerate. One of them is our dwindling oil resources. Our mines for minerals and ores are going deeper and deeper to reach ever dwindling reserves. Sometime in the future these reserves may be depleted. While we have the natural resources, we need to remove waste and use the resources sparingly. Simultaneously, we need to look for alternatives so that they can be preserved for processes that cannot use alternatives.

1.3 LOCAL ENVIRONMENTAL PROBLEMS

Local environmental problems are explored daily in our newspapers and magazines. Those of greatest concern include:

- Water availability and water quality
  At present, five out of every hundred children in rural areas die before the age of five from diseases caused by contaminated water. Urban areas also face increasing water supply problems, as soil erosion and sedimentation cause the loss of hundreds of cubic meters of storage capacity in dams each year.

- Erosion
  South Africa currently loses topsoil at the rate of 300 to 400 million tons each year. This is thirty times faster than the rate of which soil is being formed. Apart from the loss of potential farmland, the nutrients in our soil are being washed away steadily to the sea.

- Pollution
  Pollution of air, water and ground resources, particularly in the urban areas, has resulted in the development of environmental laws, and increasing community involvement in an effort to address this complex problem.

- Fuelwood
  Subsistence communities collect wood for cooking, heating and building at a rate of between three-quarters and one ton per person per year. Across Africa, 29 trees are being cut down for every one that is planted. A fuel-wood crisis is emerging in large areas of South Africa, and in some localized areas, trees have disappeared altogether.

1.4 ENVIRONMENTAL LEGISLATION

Environmental Management

Environmental Policy and Research

- According to the rights enshrined in South Africa's Constitution, everyone has the right:
  - To an environment that is not harmful to their health or well-being; and
  - To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
    - prevent pollution and ecological degradation;
    - promote conservation; and
    - secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
- The Environmental Policy directorate undertakes research to develop, communicate and promulgate environmental policy, legislation, norms, standards and strategies within National Environmental Management Act (NEMA) (Act 107 of 1998).
- The Department of Environmental Affairs and its regional offices ensure the execution of the provisions of NEMA, through processing applications and reports, issuing or granting

environmental authorisations, approving environmental management programmes (EMPs), monitoring performance, undertaking corrective actions and issuing closure.

- The directorate is also responsible for reporting on the performance of the "environmental right" in terms of South Africa's Constitution to the South African Human Rights Commission on an annual basis. This function also includes the strengthening of enforcement through co-operation with other government departments, memorandums of understanding, structures and so on.

2. INDUSTRY AND THE ENVIRONMENT

- Raw materials, water and energy are used as inputs in the production process. By-products and waste are produced during manufacturing or other processes.
- The products that are sold to consumers may also impact on the environment. Detergents and soaps, for example, are washed down the drain after use.
- Some concepts you may have heard about are: "cradle-to-grave", "life cycle analysis" or "extended producer responsibility". They all refer to more or less the same idea, that it is no longer possible for industry to manufacture its products without taking account of the environmental impacts. Producers need to look at the raw materials they use, the processes involved in making the products, the possible impact of the use of their products, and how their products are eventually disposed of.

Safety officers, representatives, and employees can play a useful role in helping management form strategies around these issues at a mining pit.

2.1 REASONS FOR IMPLEMENTING AN ENVIRONMENTAL PROGRAMME

Mining pit sites by law have to implement an Environmental Management Program:

- Environmental programs, which focus on waste minimization or resource conservation normally save money and other resources.
- Some companies are forced to introduce pollution control measures as a result of complaints of neighboring communities or non-compliance with government regulations.
- Some companies are forced to comply with environmental standards of countries they are exporting to.
- We feel that it is also our moral duty to conserve resources and prevent pollution.

2.2 INTEGRATING THE ENVIRONMENTAL PROGRAMME WITH THE SAFETY AND HEALTH PROGRAMME

The safety and health system on our site are well established.
Safety, health and environment have many factors in common. These include the need:

- For timely management, rather than crisis control.
- To set clear policies and adhere to them.
- To check and audit the program continually.
- To report progress to management.

By integrating the three aspects, management can save time and resources, and can generally improve the efficiency of the overall program.

2.3 WHO ARE THE STAKEHOLDERS IN THIS PROCESS?

Environmental legislation binds the following parties to be involved in environmental awareness of a mining pit site:

Top management.

Employees.
Shareholders.
Financial houses.
Customers.
Suppliers.
Surrounding communities.
Non-governmental environmental organizations.
Government departments.

Public opinion is becoming more aware of environmental issues and their negative effect on ultimate survival of life on the planet.

3. WASTE MANAGEMENT

3.1 WHAT IS WASTE?

Waste can be in solid, liquid or gaseous form. Liquid wastes may be watery effluent that leaves the pit through drainage systems, or used chemicals. Gaseous wastes may leave the pit as emissions, or may be stored and treated on site. Waste can also refer to the excess energy or water used by the operation of a pit.

Solid wastes may be generated from:

- Raw materials that are not used (for example, off-cuts).
- Packaging removed from components used in construction and operation of the pit (for example, corrugated cardboard boxes, drums or wooden pallets).
- Contractor operations (for example, construction rubble).

There are many costs associated with waste. Upfront costs include the direct cost of disposal into a landfill and the price you paid for the raw materials you did not use.

But waste also imposes other "costs" on society. These include the environmental problems associated with landfills (leaching and bad smells) and the use of scarce land for landfill operations.

Any waste generated that could have been avoided, means that we have unnecessarily used up some of the earth's resources. Some of these resources cannot be replaced therefore sustainability for our descendants has been put into jeopardy. For these reasons, waste minimization has become an important aspect of environmental management in mining and industry.

3.2 WASTE MINIMIZATION

The best way to manage waste is by not producing it in the first place. Avoiding waste generation is the ultimate goal of a waste minimization program – and should be an objective of our mining pit sites as well.

The basic principles of waste minimization are as follows:

<u>Waste minimization:</u>

- planned into the initial stages of each new project.
- Changing existing processes to be less wasteful.
- Improving quality of production to cut down on scrap and waste.

<u>Re-use of waste:</u>

- Re-introduction of waste into the production process as raw material or as a by-product.

- Using waste as a catalyst or by-product in an alternative process.

All waste generated should be separated into different waste streams (i.e hazardous, construction, general, recyclable, etc).

3.3 HAZARDOUS WASTE

All hazardous waste may only be disposed of at a hazardous waste site approved by the Department of Water Affairs and Forestry.

Hazardous substances are classified into classes 1 to 4 and this, with the aid of the guidelines published by the Department of Water Affairs and Forestry, gives the waste generator guidance on correctly classifying the waste and the type of disposal method required for that particular type of waste.

All hazardous waste must be correctly labeled by the waste generator and may not be kept on site for longer than 3 months.

Medical (biological waste) is normally incinerated at an approved site.

After disposal, the waste operating agency/contractor must issue the waste generator with a waste disposal manifesto document.

The waste generator remains responsible for the waste whilst in transit and for the full period it is at the waste disposal site.

Note: It is the duty of the waste generator to lessen the impact on the environment and look to alternatives to the disposal of hazardous waste by;

- Using alternative materials in processes that use less hazardous or non- hazardous materials.
- Making the waste less hazardous through treatment before disposal at the hazardous waste site.
- Minimising the amount of hazardous waste disposed of.

Further, any drained petrochemical substances (diesel, petrol, oil etc) should be stored in tanks/containers on an impermeable surface within a bunded area which can contain 110% the volume of the stored substance to avoid any spillages and contamination of the soil

These containers should be inspected for leaks on a regular basis to prevent any contamination.

Bunded areas should have controlled outlets in order to drain the water from these areas after rain.

NOTE: This water will be regarded as a hazardous waste.

All equipment (generators) that could potentially cause spillage must be stored within a bunded area or on a drip tray.

3.4 MAINTENANCE OF VEHICLES AND EQUIPMENT

- All vehicles must be serviced at the workshop
- If emergency on site repairs are required, a drip tray must be used for spillage
- Vehicles, machines or other equipment which are taken apart must be done on a concrete surface.
- Vehicles should be washed at the wash bay with an oil separator. This will minimize the potential of soil contamination

3.5 GENERAL WASTE

- All general waste must be disposed of in marked bins placed in designated work areas on the site.
- Bins will be emptied regularly into a skip at the main entrance to the pit from where it will be transported and disposed of at the nearest registered landfill site.
- General waste will never be burned or buried on site.

3.6 RECYCLABLE WASTE

- An area on the site should be demarcated to place all recyclable waste that will be sold as scrap metal or reused. All records of scrap sold should be kept.
- A salvage yard must be demarcated to store all products that will not be used immediately.

3.7 CONSTRUCTION WASTE

- Construction waste can be used as a filling material, if available or should be disposed of at the local landfill site.

3.8 TYRE WASTE

- Old tyres should be stored separately from other waste products. Used tyres can be recycled or used for other purposes or disposed of separately. If a contractor is used for collection of tyres, certificates of collection must be kept on site.

3.9 SPILLS

- Spills that occur on site must be cleaned by removing the spill with the contaminated soil and contained inside the bunded area.
- Spills of any hazardous waste will never be covered with soil or other material as this will result in the contamination of the surface, groundwater and soil.
- Hazardous fluids (i.e oil) must be stored/disposed of separately from hazardous solid waste (i.e contaminated soil).

<u>Improve quality of waste:</u>

Process waste so that it becomes bio-degradable or less toxic. Use alternative products to replace the use of toxic materials.

The idea is to "reduce, re-use and recycle", wherever possible. Office waste paper is a good example of this approach. There are a few companies which do not generate vast amounts of office paper waste.

3.10 WASTE DISPOSAL

Waste disposal is done generally through the following methods:

- Land filling at a general waste site
- Disposal at a hazardous waste disposal site.

<u>Responsibility of the waste generator:</u>

- Classify the waste into the correct category for disposal at the correct site. Use a reputable waste disposal agency/contractor.
- Ensure that the waste disposal company disposes the waste at a site registered with the Department of Water Affairs and Forestry.
- To ensure that the waste disposal agency/contractor runs his entire operation in a manner that will not jeopardize the environment.
- Enter into a contract with the waste disposal agency/contractor in which the above conditions are stipulated.
- Ensure that a waste manifesto document is issued for each load of waste disposed of by the waste disposal agency/contractor.

- Responsible for any environmental impact the waste may have whilst in transit or at the disposal site after having been disposed of.

Environmental concerns associated with land filling are:

- Using up scarce land for waste site sites.
- It is an unsightly area with flies, odours, and windblown litter.
- Pollutes underground water also used for drinking purposes through the use of boreholes, through leaching through the landfill site.

4. ESTABLISHING A RECYCLNG PROGRAMME

- Do not be fooled by anybody: the establishment of a good recycling program involves organization and time. However, this cost may well be offset by the revenues received from the sale of materials that can be recycled, or the corporate image and community involvement benefits of support to a worthwhile cause, such as a local school.
- There are companies who will be able to collect your recyclable waste. They provide a "market" for your recyclable waste.
- The aim of recycling is to separate recyclable waste from other waste materials. Recyclable waste is collected and stored in separate areas. While separation of waste can be done at the disposal area, it is usually more effective to implement a system which ensures wastes are separated at sources – before they land up mixed together in your waste area.
- Ensure all employees are fully informed of which materials are acceptable and unacceptable for recycling. It is obviously equally important to inform and assist the cleaning staff, who will be clearing the bins, of the purpose of and reasons for recycling.

5. POLLUTION

5.1 WHAT IS POLLUTION?

Pollution is that which when introduced into the ecosystem has a negative/detrimental impact on the environment. It can be a hazard which endangers life, or it can be a nuisance such as a bad odour. It is that which disturbs the original balance of the ecosystem and has no benefit to man or beast.

5.2 APPROACH TO POLLUTION MANAGEMENT

- Recognition of the need for pollution control arose in the United States and Europe during the 1970s. The initial approach to addressing the problem was to try and clean up pollution after it was created. This proved to be extremely costly. Large amounts of money were spent with no noticeable form of improvement.
- A decade of experience led to a breakthrough: people realized it would be cheaper to prevent pollution from occurring rather than to try and control it.

5.3 IMPLEMENTING POLLUTION PREVENTION AT THE MINING PIT

Common barriers to pollution prevention are:

- Lack of knowledge.
- Equipment vendors focus on treatment rather than prevention (Better profits for them).
- Reluctance to spend money on costs that do not generate income. Individuals may not be rewarded for pollution prevention.
- Worker involvement may be limited.
- Appropriate technologies may not be available.

- Some solutions may negatively affect the process of product.
- Laws are highly prescriptive and do not provide incentives for pollution prevention.
- However, experience in this country has shown that a few successful projects will frequently achieve positive changes in the attitude of management and employees, as they realize that environmental issues really are part of their business.

AIR

The atmosphere:

- The atmosphere extends to an altitude of more than 2000km above the surface of the earth. It consists of a mixture of gases and liquid droplets. It is reactive – for example, chemicals in the air will react with metals, causing them to rust. Atmospheric – or air – pollutants will take the form of dust, mists, fumes, odours, smoke or vapours. They may be solids (soot or ash), gases (e.g. carbon monoxide) or aerosols (tiny solid or liquid particles that are mixed with the air).

Air pollutants and their sources:

- There are few human activities, which do not result in emissions of some sort. Industry, agriculture, burning of forests, and mining contribute in various ways to the problem. Air pollutants may occur indoors or outdoors.
- **Outdoor air pollution.** Carbon Monoxide, Hydrocarbons, Lead, Nitrogen Oxides, Particulate Matter, including asbestos dust, Sulphur Oxides and Volatile Organics (include benzene, aromatics, and dioxins).
- **Indoor air pollutants.** Tobacco smoke, Carbon monoxide, Ozone, nitrogen oxides and iron, Asbestos, Lead, Radon and Organic chemicals.

Legal requirements and monitoring:

- The Atmospheric Pollution Prevention Act, 45 of 1965, provides for the control of all air pollutants in South Africa. A total of 69 industrial processes, which are generally regarded as the major sources of air pollution in this country, have been "scheduled" in terms of the Act. A registration certificate is required to carry out one of these scheduled processes. The certificate is issued subject to certain minimum standard specifications. The polluting industry is expected to adopt the "best practicable means" of minimizing the emission of noxious gases to the atmosphere.
- "Best practicable means" refers to measures which are "technically possible and economically feasible", bearing in mind the importance of the well-being of employees and the surrounding communities.

Air pollution control technologies:

- An emissions survey may be conducted to ascertain the need for air pollution control. This survey will locate sources and define quantities of all air contaminants.

Control technologies need to be assessed in terms of their:

- Suitability for removal of pollutants.
- Capital and operating costs.
- Operating efficiencies.

Waste disposal practices:

- As mentioned above, an option that results in pollution prevention, rather than control, should be sought.

Monitoring:

- Monitoring stations operated by local authorities, and industries such as AECI, Sasol and Eskom, continually assess levels of a key air pollutants (Sulphur dioxide, particulate matter and smoke).

WATER

Water resources:

South Africa is running out of water. Our average rainfall is a little under 500mm per annum. Although water supplies are renewable, they are not unlimited. Nearly half of the water demand in South Africa comes from irrigation in the agricultural sector. As our population increases, the demand for water places increasing strain on our rivers, dams and groundwater.

- Water should be used cautiously to avoid water wastage
- All leaking pipes, pumps, etc should be reported to the supervisor immediately to avoid unnecessary loss of water.
- The volume of water extracted from the water source will not exceed the volume applied for with the department of Water and Sanitation

Pollution of water resources places additional stress on these systems, and the Department of Water Affairs and Forestry has indicated that the quality of many water sources in South Africa is declining.

Water pollutants and their sources:

The main sources of water pollution come from:

- Effluent discharge from industrial sites, containing pollutants emanating from processes.
- Storm water run-off where the water passes over polluted ground, or industrial sites. Leaching out through polluted ground into the underground water system.

Key water pollutants:

- Organic material
- Nutrients
- Toxic chemicals
- Acids
- Colour and foam
- Solids
- Oils and grease
- Litter
- Hot water

Legal requirements:

Effluent discharge

- Water pollution control is governed by the Water Act, 54 of 1956. The Act requires that water used in industrial enterprises be purified to a specified standard before being discharged. Standards for discharge are set by various authorities. Most industries fall under a local authority who is the authority to monitor and control the discharge.

- Many local bye-laws stipulate that permission must be obtained in writing from the local authority before any industrial effluent may be discharged to the sewer system. In obtaining such permission, the authority will typically require:
    - A description of the processes which give rise to the effluent. The nature and quantity of the effluent.
    - The rate of discharge.

- In terms of most local authority bye-laws, industrial water users are charged both according to the quantity of waste water discharged, and a "treatment charge

formula", based on pollution loading.

- Direct discharge into water courses/rivers (incl. storm water)
- Where water is discharged directly to a stream or other natural watercourse, far more stringent standards are applied. A further legal stipulation is that **no water from any process shall be allowed to enter the storm water drains, which are intended for** clean storm water run-off only and also that no storm water may run into effluent drains.

Control Technologies: Pollution:

- The controlling authorities take periodical samples of both storm water and effluent at discharge at set points monitoring points. They can thereby measure the quality of water and also ascertain from which site it is coming from. The guilty parties receive heavy fines, normally through having to pay for their services at higher tariffs. If the pollution persists they are required to take additional precautions such as for instance having to install effluent plants to improve the effluent quality before discharge into the sewer system.
- Most industries will employ a simple means of separating grit, oils and greases from their waste water. Oil interceptors or grease traps work by settling out solid materials, such as sand and metal grits, and floating out oils and grease. They may also provide temporary containment in the event of an accidental spill.

Water Conservation:

- High consumers of water are required by the controlling authorities to institute water savings programs. Where they consume excessive amounts, they are penalized through having to pay higher tariffs. This motivates such consumers to control their consumption within accepted limits and so cut out water wastage.

5.4 LAND DEGRADATION

Soil resources:

- Soil is much more than just sand. It is a mixture of minerals and organic matter, formed slowly by the interaction between living creatures and the physical environment. It is an extremely valuable natural resource, sustaining the agriculture needed to provide us with food.
- Despite its importance, South African soil is deteriorating due to poor management practices. Erosion, compaction, acidification, stalinization and infestation by weeds and pathogens pose serious threats to the soil resource.

Ground pollutants and their sources:

- The activity associated most directly with soil degradation is agriculture. In other industries, accidental spills of chemicals or contaminated waste waters, during transportation, storage, handling or disposal, can seriously pollute localized soils. Common sources of land degradation are listed in the table below.

DEGRADATION	PREDOMINANT SOURCES
Erosion and compaction	Poor land management.
Acidification	Excessive use of fertilizers, acid rain.
Stalinization	Over-irrigation.
Biological invasion	Introduction of alien or noxious species
Pollution	Accidental spills or illegal dumping or chemicals, irrigation with polluted water, windblown litter.

Legal Requirements:

- Numerous Acts exist to encourage the sound management of agricultural land. Pollution of land is regulated by the Environmental Conservation Act, 73 of 1989.

Controls for ground pollution:

- Planning, proactive management and the development of appropriate contingency plans provide a safeguard against accidental spills.
- Storage tanks containing chemicals should be monitored and bunding walls of sufficient capacity (110% of the volume of the tank) constructed to prevent spillage and leaks onto the ground.
- Underground tanks should be registered, and levels monitored carefully. The leakage from underground tanks can go undetected for long periods of time, resulting in serious pollution of soils and eventually groundwater.
- Overfill prevention measures, such as automatic shut-off devices, overfill alarms or ball float valves, should be installed.
- An accurate leak detection system must be employed and planned corrective actions available for every tank on site.
- Mines have to be committed to rehabilitating land after mining activities, i. e excavation, accidental spillage or any activity that upsets the land. This may take simple forms, such as the removal and storage of topsoil for reintroduction after excavation. Topsoil is rich in organic matter and will contain seeds to encourage the re-growth of natural vegetation.
- Soils polluted with organic compounds, such as petroleum products, may need to be removed entirely or can be bio-remediated on site through the introduction of micro- organisms into the soil. These procedures are invariably extremely costly and provide an incentive for sound planning and control.
- In addition to pollution control, industrial environmental programs need to lead the company to adopt responsible policies towards vegetation management. It is not enough to have beautiful gardens – programs must take into account:
    - The protection of endangered plant and animal species on site. The promotion of indigenous species.
    - The promotion of irrigation systems that conserve water.
    - The need to eradicate noxious weeds.
    - The control of invasive alien species.
    - Control of herbicide and pesticide use.

TAKE-HOME MESSAGES FROM THIS SECTION

- Pollution can occur in the air, in water and on the ground.
- As with waste, it is better to prevent pollution at the source rather than to control it.
- A systematic way of identifying pollution sources and preventive or control measures should be implemented at the mining pit.
- Management of pollution will require technical, legal and organizational skills.

6. MANAGEMENT OF HAZARDOUS MATERIALS

- Hazardous materials indicate the strong link between safety, health and environmental programs. Environmental disasters, whether linked to worker safety or damage to natural resources, usually involve hazardous chemicals.
- Various chemical hazards will have been defined in other course Modules. This section provides a brief overview of hazardous materials and hazardous waste management but does not focus on the health issues again.

6.1 WHAT ARE HAZARDOUS MATERIALS?

The SABS Code 0228, which is based on the International Maritime Dangerous Goods Code, provides for a classification of hazardous or notifiable wastes. These are listed in the table below.

CLASS	DESCRIPTION
Class 1	Explosives
Class 2	Gases: compressed, liquefied or dissolved under pressure
Class 3	Flammable liquids
Class 4	Flammable solids or substances
Class 5	Oxidizing substances
Class 6	Poisonous (toxic) and infectious substances
Class 7	Radioactive substances
Class 8	Corrosives
Class 9	Other miscellaneous substances considered to be dangerous

In general, it is easy to remember that hazardous substances are mainly:

- Flammable (for example, cleaning solvents, fuels, thinners).
- Corrosive (for example, acids, caustic paint strippers).
- Reactive (for example, explosives).
- Toxic (for example, heavy metals, pesticides).

The term "toxic" is sometimes confused with "hazardous". The toxicity of a substance refers to how much of the substance is required to cause harm. It is the only factor for determining whether a hazard exists. The most important factor in toxicity is the chemical structure of a substance. Substances with similar structures often cause similar problems.

The National Environmental Management: Waste Act, 2008 (Act 59 of 2008), covers a number of aspects on hazardous materials management. Draft policies and guideline documents issued by the Department of Water Affairs and Forestry indicate a trend towards holding the generator of hazardous waste indefinitely liable for that waste.

Legal compliance aside, the high cost of most hazardous materials, and their potential for harm to employees and the environment, provide adequate incentive for careful management practices to be adopted.

6.2 BASIC PRINCIPLES OF HAZARDOUS MATERIALS MANAGEMENT

There are three key principles, namely:

- Avoid using hazardous materials wherever possible.
- Minimize the potential for exposure.
- Adopt and follow written procedures for safe issuing, use, storage and disposal.

For any chemicals on site, it is a requirement that a Safety Data Sheet be obtained from the manufacturer of the chemical or substance concerned. This is clearly of great importance when the chemicals involved may be hazardous.

Literally hundreds of potentially hazardous chemicals can be found in industrial enterprises, and the task of maintaining updated registers at all relevant work areas can be a daunting one. This factor has prompted numerous companies to use computer- based hazardous chemical data programs, which can provide instant access to data sheets, emergency response plans, and chemical inventories in designated zones throughout the facility.

6.3 HAZARDOUS CHEMICALS

No matter how carefully we plan our activities, incidents can happen. Spill clean-up procedures and contingency plans therefore need to be documented for all hazardous materials.

These procedures will vary depending on the chemical, its hazard rating, and the area in which the spill occurs. Clear instructions should be available and understood by employees. Specially trained emergency response team members should be aware of their duties in the event of a spill. There should be an effective communication system so that the spill crew can be on site with a minimum of response time.

6.4 HAZARDOUS WASTES

Hazardous wastes are an inevitable result of using hazardous materials. A procedure for the management of hazardous waste is clearly described in the DWAF (1994). Waste Management Series, Volume 1.

- For the transportation or movement of hazardous waste a manifest system is used to keep track of the movement of waste. This is because of the cradle to grave principal a detailed document known as the waste manifesto document is used and an example shown below.
- This document accompanies the load of waste and after having been disposed of by the disposal contractor, a copy endorsed to the effect is returned to the waste generator who must keep it on record.

WASTE MANIFEST

FOR SHIPMENT OF HAZARDOUS AND SPECIAL WASTE

Generator's Name and address:

…… Transporting
Company Name:

…… Designated
Waste Facility:
……
Description of

Name, Class, Hazard Rating	**Type of Containers**	**No. of Containers**	**Unit Wt/Vol.**
a.			
b.			
c.			
d.			

Special Handling Instructions and Additional Information:

Certification: I hereby declare that the contents of this consignment are fully and accurately described by the above names, and are classified, packed, marked and labeled according to applicable government requirements. I furthermore certify that I have made a good faith effort to minimize my waste generation and have selected the best waste management method that is available to me and that I can afford.

Name: …….. Signature: …… Date:……..

Transporter: Acknowledge Receipt of Materials
Name: …… Signature: …… Date:……..

Waste Facility Owner or Operator: Certification of Receipt of Hazardous Materials as Covered by Manifest:

Name: …… Signature: …… Date:……..

- Notice in the certification statement above reference to minimizing waste generation. Hazardous wastes may be reduced through many common sense measures, including:
  - Switching to non-hazardous alternatives where possible and economical.
  - Not mixing hazardous with non-hazardous wastes.
  - Installing drip trays and racks to prevent chemicals dripping onto the ground.
  - Adopting a "first in, first out" materials usage policy to prevent obsolescence of chemicals.
  - Using a laundry service for dirty rags, overalls and other items that may be thrown away.
  - Not mixing other materials with waste oils, as this may render them unacceptable for recycling.
  - Avoiding spillage and leaks of hazardous materials.
  - Implementing an orientation and training program for employee environmental awareness.
  - Developing and implementing written policies and procedures for working with hazardous substances.
  - Investigating the feasibility of on-site treatment of hazardous wastes (for example, neutralization of acids or recycling of solvents).

- Requiring that a chemical manufacturer takes back its waste as part of your purchasing contract.
- Documenting departmental successes in waste reduction and providing assistance and encouragement to other departments.

6.5 REDUCING THE USE OF HAZARDOUS MATERIALS

As with waste and pollution, it should be obvious to you by now that reducing the use of hazardous materials – and therefore the waste associated with them – gets first prize in the environmental game. Substitution of chemicals with less toxic alternatives, process modifications, such as internal recycling technologies, and alternative technologies, can provide opportunities for cost savings and improved efficiency.

Environmental improvements will not result from the hard work of the SAFETY OFFICER alone. In order to succeed, goals need to be established and integrated into the business plans of all departments. A particularly important department in this regard is Purchasing. The purchase of hazardous materials needs to be carefully controlled. The Purchasing Department needs to be made aware of materials safety data sheet requirements, as well as the objective of minimizing the use of hazardous chemicals. A checklist could be generated for purchasing, which would ensure that:

- Non-hazardous alternatives were considered before the purchase.
- Costs of disposal of resulting wastes were factored into the purchase decision.
- Accurate material safety data sheets accompany the product when it is delivered to the mining pit.

TAKE-HOME MESSAGES FROM THIS SECTION

Sound management of hazardous chemicals is important for safety, health and environmental reasons. Reducing the use of hazardous chemicals will usually save money and improve safety and environmental management. A material safety data sheet must be available for every chemical on site.
Regular employee training and practice of emergency responses will decrease the impacts of accidental spills.
Storage of hazardous waste requires careful monitoring and control.

7. MEASURING, MONITORING AND REPORTING

7.1 TRAINING AND AWARENESS

- ✓ Training and awareness need to take place at all levels at the pit. It is not sufficient to simply inform management of strategic environmental issues in the hope that the awareness will filter down to all levels. Too frequently, it does not.
- ✓ At the outset, remember that environmental awareness, like safety training, is above all about a change in attitude and behaviour. This usually means that training cannot be done overnight, or by conducting a one-off course. Neither can courses or seminars be forced from the top onto unwilling employees. There needs to be an atmosphere of co- operation and an understanding of common goals shared by employees and management.
- ✓ Environmental training and awareness need to be part of a long-term program for all employees. By combining environmental training with safety and health, employees will be able to identify common elements and an understanding of the integrated nature of safety, health and environmental management.
- ✓ Usually, the person best placed to effect environmental improvements is the worker on the ground. These employees are keenly aware of what waste is being produced by which processes, of hazardous chemicals which are used indiscriminately, or of the

extent to which water and energy are wasted on a day-to-day basis.

- ✓ Finally, the results of the environmental performance indicators should be displayed clearly in each department. This will serve to increase awareness, and even a sense of challenge to meet the stated target.

7.2 ENVIRONMENTAL REPORTING

Internal environmental reporting is crucial to maintain the momentum of the environmental program. Reporting environmental progress to employees and management effectively "closes the loop", allowing improvements to be made to existing objectives, plans and management procedures.

TAKE-HOME LESSONS FROM THIS SECTION

As South Africa becomes more involved in world markets, additional pressure to implement sound environmental management systems will be felt.

An environmental management system is a systematic way of ensuring a mining pit addresses the impact associated with its activities.

Well-developed performance indicators are necessary to measure improvement in environmental performance.

Regular environmental audits are important for evaluating the environmental performance of a mining pit.

Training and environmental awareness needs to happen at all levels of the organization.