# CHAPTER 7 : ENVIRONMENTAL LITERACY/ DEMONSTRATE ENVIRONMENTAL LITERACY

## 7.1    Introduction

Demonstrate environmental literacy unit of competency is among the seven basic competencies units offered in all the TVET level 6 qualification. The unit covers knowledge, skills and behaviours and also entails complying with workplace sustainable resource use, evaluating current practices in resource use, developing, and adhering to environmental protection principles. The significance of environmental literacy is to equip the learners with skills to create a sustainable and friendly environmental world for quality life for all.

The aspects of competency to be covered include control of environmental hazard, pollution, demonstrate sustainable resource use, evaluate current resource use practices and monitor activities on environmental protection according to the different environmental issues and based on management standards procedures. The basic resources required include workplace storage facilities, trash bags, cleaning materials and tools, PPE, manuals and references among others. The unit of competency comprises nine learning outcomes. Each of the learning outcome presents; learning activities that cover performance criteria statements, thus creating in trainees an opportunity to demonstrate knowledge and skills in the occupational standards and content in curriculum. The Information sheet provides; definition of key terms, content and illustration to guide in training. The competency may be assessed through written test, demostrations, practical assignment, interview/oral questioning and case study. Self assessment is provided at the end of each learning outcome. Holistic assessment with other units relevant to the industry sector workplace and job role is recommended.

## 7.2    Performance Standard

Apply storage and disposal methods of hazardous materials, demonstrate sustainable resource use, evaluate and monitor environmental protection activities according to environmental regulations and OSHS, workplace procedures, environmental management and coordination Act 1999.

## 7.3    Learning Outcomes

### 7.3.1 List of learning outcomes

a)    Control environmental hazards.

b)    Control environmental pollution.

c)    Demonstrate sustainable resource use.

d)    Evaluate current practices in relation to resource usage.

e)    Identify environmental legislations/conventions for environmental concerns

f)    Implement specific environmental programs

g)    Monitor activities on environmental protection/programs

h)    Analyze resource use

i)    Develop resource conservation plans

### 7.3.2 Learning Outcome No. 1: Control Environmental Hazard
### 7.3.2.1 Learning Activities

| Learning Outcome No 1: Control Environmental Hazard | | |
|---|---|---|
|  | **Learning Activities** | **Special Instructions** |
| | 1.1. Follow storage methods (…) for environmentally hazardous material according to environmental regulations and OSHS. <br> 1.2. Follow disposal methods (…) of hazardous waste according to environmental regulations and OSHS. <br> 1.3. Use PPE (masks, gloves, goggles, safety hat, overall, hearing protector) according to OSHS. | Personal protective equipment should be used at all times. Trainees to handle hazardous waste storage and disposal in groups. |

### 7.3.2.2 Information Sheet No7/LO1: Control Environmental Hazard

**Introduction**

This learning outcome covers storage methods for environmentally hazardous materials, disposal methods of hazardous waste and use of PPE in accordance with environmental regulations, such as Environmental Management and Coordination Act (EMCA) 1999, and occupational safety and Health Standards (OSHS)

**Definition of key terms**

**Environment:** Literally it refers to the surroundings. It is an integration of physical, chemical and living factors that act upon an organism determining its form and survival. It includes both living and non-living things.

**Environmentally Hazardous materials:** These are the substances which have the potential to threaten the surrounding by affecting plants' and animals' health, pollution causing natural disasters.

**Personal Protective Equipment (PPE):** These are the garments or materials worn in order to safeguard a person from hazards such as injury or infection.

**Environmental Management and Co-ordination Act (EMCA) 1999:** It is a legal framework that provides for environmental management and conservation in Kenya. The original act was recently revised in 2015 to align to the2010 Kenyan Constitution.

**Occupational Safety and Health Standards (OSHS):** These are guidelines or principal set in order to foster a safe a safe and health work environment.

| Content/Procedures/Methods/Illustrations |
| --- |

## 1.1 Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS

Environmentally hazardous material are items or agents (chemical. biological, physical or/and radiological) that potentially have the ability to cause harm to the surroundings. The control of environmentally hazardous materials in Kenya is governed by the National Environment Management Authority (NEMA) under the Kenyan Constitution. NEMA was formed by an act of parliament in May 1996, starting operations in July 2002, serving as the national body to implement environmental policies within Kenya across all sectors. In addition, it is also tasked with supervising and coordinating environmental activities. NEMA is able to enforce its roles and responsibilities using environmental Management and Co-ordination Act (EMCA), the law framework on environmental management and conservation in Kenya. The principal act of 1999 was amended in 2015 in accordance with the 2010 constitution. EMCA is thus tasked with the management of environmentally hazardous substances and waste shall not be imported into Kenya without the authority, (NEMA) issuing a valid permit. Hazardous materials under the globally harmonized Systems are categorized into three classes:

- Health Hazards
- Physical Hazards
- Environmental Hazards

These classes are further classified into different categories. In line with our topic focus, environmental hazards are divided into:

- Acute
- Aquatic Toxicity
- Chronic Aquatic Toxicity.

Storage methods for environmentally hazardous materials must follow the below procedures according to Occupational Safety and Health Standard (OSHS):

  i. Follow all the storage instructions on the product label. Storage requirements vary based on the material's hazardous properties.
 ii. Be sure to store all volatile products in well ventilated areas. Fumes can be toxic to living things, both plants and animals.
iii. Make certain you store flammable products in the recommended temperature range. The container will expand if you store them in too high temperatures. In too low temperatures, liquid materials will expand, freeze and burst if you store them
 iv. Keep all hazardous materials out of children's reach and away from all animals. This can be done through:
   - Covering materials with safety lids whenever possible
   - Putting all hazardous materials stared behind locked doors.
  v. Use the original container to store the hazardous material.
 vi. Reduce the amount of hazardous materials you keep in storage. Buy only the amount required for your task.

vii.    Do regular maintenance of storage areas. Regular clean-ups and inspections of storage areas.

viii.   Storage methods for environmentally hazardous materials can be resolved by answering four questions.

ix.     What materials are being stored? Understanding the properties of a hazardous material is paramount. Be it physical or chemical or biological properties. The material being stored may be incompatible with some conditions and/or substances. For example, flammable liquids should not be stored with an oxidizing agent.

x.      Why is the material being stored? Ways should be developed to either use less hazardous materials or reduce the quantity of materials stored?

xi.     Where is the material being stored? Ensure that storage is clearly defined as permanent, temporary or transient location?

xii.    How is the material being stored? It reviews local, state and federal regulations and the manufacture's specifications? What type of container? Is also answered here.

**Storage Methods**

In Environmental Health Requirements, materials should be stored in a manner that does not harm or threaten human health or the environment. It is in line with this, that storage methods of environmentally hazardous materials are considered. These methods are;

**Storing in tanks and containers.**

Containers are portable whereas tanks are stationary. Tanks and containers chosen for storage should meet the following criteria.

- Good condition
- Closed/sealed
- Chemically compatible
- Impervious surface
- No floor drains
- Under cover, if outside

Container Management involves;

- Can only accumulate in containers and tanks (criteria for container choice)
- Inspection logo
- Adequate aisle space-Not less than an adjacent distance of two feet.
- Container/Tank marking
- Storage time=be less than 90 days.
- Outdoor security measures such as controlled entry and barrier creation

**Onsite waste storage facilities**

They include open waste piles and ponds. Must be constructed over an impervious base and be in compliance with regulatory requirements. The pile must be protected from

weather conditions such as wind, rain and direct sunshine. Used to store temporary hazardous waste before disposal.

**Open pit or holding pond (lagoon)**
Used to store temporary hazardous liquid waste. Lagoons must be lined with impervious soils and ground water must be protected by flexible membrane liners.

**1.2    Disposal methods of hazardous waste are followed according to environmental regulations and OSHS**
**Disposal methods of hazardous waste**
Disposal of hazardous waste is governed and overseen by NEMA**.** The major guideline under which NEMA enforces its mandate is the Environmental Management and Coordination Act (EMCA). Just as storage methods, disposal methods of hazardous waste can be resolved by answering the following four questions:

- What waste is being disposed? All properties (chemical, physical and biological) of the waste must be put into consideration.
- Why is the waste being disposed? Some materials may be marked for disposal yet they may be useful for another function though not the one originally purchased for?
- Where is the waste disposal taking place: The waste can be disposed far away from human and animal settlement? If it is a specific area, then certain regulations must be adhered to. Different counties or states have different policies and legislations of hazard waste disposal
- How is the waste being disposed? It involves reviewing local, state and federal regulations and the manufacturer's specifications.

**Disposal Methods**
**a)    Incineration**
This involves burning the substance in high temperatures. Incineration destroys and terminates most of the waste. This method is beneficial as flammable waste can also be used as energy sources when burned. The backside that comes with incineration is the release of toxic gases to the environment. This has however been solved by the current technology which has developed more efficient incinerator units that limit the amount of emissions released.

**b)    Recycling**
E-waste is mostly disposed in the form. For example, part of a dead phone or computer maybe used to fix a broken-down phone or computer.

**c)    Landfill disposal**
This technique involves storing solid hazardous waste into the ground. Landfills for hazardous wastes are lined with a double layered non-porous material such as clay to inhibit

leaching. After dumping, the landfills are covered to prohibit animals such as rodents and insects from entering. Unfortunately, this method occupies a huge space.

### d) Dumping at sea

Hazardous waste is deposited into the deep sea after treatment to minimize its impact on ground water sources. This method however is currently under heavy scrutiny or even banned around the world to preserve the blue economy.

### e) Underground disposal

Termed to be the most ideal and economical for radioactive waste. It is only conducted on inhabitable lands such as inactive mines which must meet a particular geological and technical criterion. It involves injecting the hazardous waste deep into the ground. They are also referred to as injection wells. The hazardous waste that can use this method include medical treatments, brine from mining of radioactive ores and the production of nuclear fuel.

## 1.3 PPE (masks, gloves, goggles, safety hat, overall, hearing protector) usage according to OSHS

**Personal Protective Equipment.**

Personal Protective Equipment (PPE) is protective clothing or garments or instruments designed to protect the body of the wearer from hazards that may cause injury or infection. It should be noted that PPE does not eliminate the hazard or danger at the source but rather protects the wearer's body in case the hazard happens, that is, an accident happens. PPE are provided under the Occupational Safety and Health Standards (OSHS). OSHS are formulated guidelines that safeguard an employee's economic and social well-being as well as his/her physical health and safety. OSHS strives to foster a healthy working environment. OSHS in Kenya is guided by the Occupational Safety and Health Act (OSHA) 2007 and implemented by the Directorate of Occupational Safety and Health Services (DOSHS). OSHS provides for PPE in any working environment to reduce risk of harm or injury. OSHS requires PPE to be offered to employees free of charge. PPE must be carefully chosen and training offered to employees on how to use them properly and know how to detect and report any damages. When selecting and using PPE, the following should be considered;

- Who and what is exposed?
- Duration of exposure
- Extent of exposure

**Types of PPE**

i. Eyes: Safety spectacles, face screens, goggles, face shields, visions: Hazards include dust, metal or chemical splash, radiation, gas and vapour.

ii. Head and Neck: Bump caps, helmets. Hazards include impact from falling or flying objects, risk of head bumping, drips, splashes.

iii.  Ears: Ear muffs, earplugs, semi-insert/canal caps. Hazards include noise (combines duration, intensity and exposure time)
iv.  Hands and arms: Gloves and gauntlets. Hazards include cuts, punctures, abrasion, electric shock, radiation, extreme temperatures.
v.  Feet and legs: Safety books. Hazards include slipping, cuts, punctures, falling objects, splashes, vehicles.
vi.  Lungs: Respiratory Protective Equipment (RPE). Hazards include toxic gases, dust
vii.  Whole body: Overalls (Conventional and disposable), boiler suits, aprons. Hazards include heat, splashes, sprays, impact, entanglement of own clothing.

## Conclusion

At the end of this learning outcome, the trainee should have learnt; how EMCA regulates storage and disposal of environmentally hazardous materials, classification of hazardous materials and waste to know how best to store and dispose them. The trainee should be able to know what OSHS entails and how it is used to perform its roles. The trainee should able to provide PPE for various working environment in accordance with OSHS and environmental regulations.

## Further Reading

Revised Environmental Management and Co-ordination Management (EMCA) 2015
Occupational Safety and Health Act (OSHA) 2007

### 7.3.2.3 Self-Assessment

**Written Assessment**

1. Which is the environmental governing body in Kenya?
   a) EMCA
   b) NEMA
   c) Ministry of Environment
   d) Government of Kenya

2. In which year was EMCA amended to align with the Kenyan Constitution?
   a) 2015
   b) 1999
   c) 2007
   d) 2010

3. Among the following, which is not a hazardous material?
   a) Mine Brine
   b) Used oil

c) Natural gas
d) Broken computers
4. Which of the following is a storage method of environmentally hazardous material?
   a) Open Tanks
   b) Open pits
   c) Injection wells
   d) Incineration
5. Which disposal method is most ideal for hazard waste from Uranium mining?
   a) Landfills
   b) Recycling
   c) Injection wells
   d) Sea dumping
6. What does OSHS not deal with?
   a) Provision of PPE
   b) Employability
   c) First Aid training
   d) Workplace safety
7. Chemical splashes are common hazard at Coca Cola Company. Which PPE does not protect from this?
   a) Goggles
   b) Overall
   c) Safety boots
   d) Earplugs
8. Name three aspects to be considered when choosing a suitable storage method for hazardous materials.
9. Briefly explain four disposal methods for hazardous waste.
10. Describe PPE you can recommend in a welding industry.
11. Differentiate between OSHS and OSHA.

**Practical Assessment**
1. Develop an instruction manual describing procedures on how to store and dispose-off a hazardous chemical material
2. Write a report on the storage and disposal methods of hazardous materials used in school.

**7.3.2.4 Tools, Equipment, Supplies and Materials**
- Standard operating and/or other workplace procedure manuals
- Environmental Management and Co-ordination Act 1999
- Machine/equipment manufacturers specifications and instructions
- Personal Protective Equipment
- Occupational Safety and Health Act 2007

## 7.3.2.5 References

Government of Kenya (1999). *Environmental Management and Co-ordination Act.* Nairobi. Kenya

Government of Kenya (2007). *Occupational Safety and Health Act.* Government Press. Nairobi. Kenya

*http://www.britannica.com/technology/hazardous.waste.management/Treatment.storage. and.disposal*

*http://www.SourthernCouncil.org/common.methods.of.hazardous.waste.disposal*

easytvet.com

### 7.3.3 Learning Outcome No. 2: Control environmental pollution
### 7.3.3.1 Learning Activities

| Learning Outcome No. 2: Control Environmental Pollution | | |
|---|---|---|
|  | **Learning Activities** | **Special Instructions** |
| | 2.1. Comply with environmental pollution control measures (methods for minimizing or stopping spread and ingestion of airborne particles, gases, fumes and liquid wastes) following standard protocol. <br> 2.2. Observe procedures for solid waste management according to environmental management and coordination Act <br> 2.3. Comply with methods for minimizing noise pollution following environmental regulations. | Personal protective equipment should be used at all times. <br><br> Group discussions on pollution and their specific control measures. |

### 7.3.3.2 Information Sheet No7/LO2: Control Environmental Pollution

**Introduction**

This learning outcome covers environmental pollution control measures, procedures for solid waste management according to standard procedure, Environmental Management and Coordination Act 1999 (EMCA) and environmental regulation.

**Definition of key terms**

**Waste management:** Waste management is the collection, transportation, processing or disposal of solid or liquid waste, usually produced by human activities, in order to reduce their effect on human health and natural ecosystems such as lakes, forests and oceans.

**Control measures:** These are activities taken to prevent, reduce or eliminate an environmental hazard that has been identified. In this learning outcome, the control measures that are going to trained on concern solid waste and noise pollution.

**Environmental Management and Coordination Act 1999 (EMCA):** This is the principal framework law on environmental management and conservation in Kenya. First enacted in 1999, it has been amended to align to the 2010 Constitution. The latest amendment to the principal Act was in 2015.

**Standard Protocol:** This is a mandated, statutory or fixed procedure for completing a task or complying with regulations. The procedure may be expressed through a flow chart, or spelled out as text. Standard protocol may be nationally recognized or be part of an organization structure.

## 2.1 Environmental pollution control measures compliance following standard protocol

**Types of pollution**

**Air Pollution**

Air pollution may result from a quantitative change by increasing the concentration in air of some of the gases, for example Carbon (iv) Oxide or a qualitative change due to introduction of external compounds (synthetic organic substances), or a combination of these two phenomena. The source of these gases may be from anthropogenic activities (from human activities) or from natural events such as volcanism, respiration of living things or forest fires. Some pollutants in the atmosphere can result from the reaction between many substances to give new highly toxic compounds, for example Sulphur (IV) Oxide can react with water vapor in the atmosphere to give Sulphuric acid.

Table 10. Sources and nature of atmospheric pollutants

| Nature of Pollutant | | Source |
|---|---|---|
| **Gas** | 1.Carbon dioxide | • Volcanism<br>• Respiration of living things<br>• Fossil fuels |
| | 2.carbon monoxide | • Volcanism<br>• Combustion engines |
| | 3.hydrocarbons | • Plants<br>• Bacteria<br>• Combustion engines |
| | 4.Organic compounds | • Chemical industries<br>• Incineration of refuse<br>• Various combustions |
| | 5.Sulphur dioxide and Sulphur derivations | • Volcanism<br>• Sea spray<br>• Bacteria<br>• Fossil fuels |
| | 6.Nitrate derivatives | • Bacteria<br>• Combustion |
| | 7.Radio nuclides | • atomic power stations<br>• nuclear explosions |
| **Particles** | 1.Heavy metals Inorganic compounds | • volcanism-meteorites<br>• wind-spray erosion<br>• various industries<br>• combustion engines |
| | 2.Organic compounds Natural or synthetic | • forest fire<br>• chemical industries<br>• various industries<br>• combustion engines |
| | 3.Radionuclide | • nuclear explosions |

**Impacts of air pollution**

- Air pollution has effects on health and the nature. The effects of air pollution on natural ecosystems can be felt at different geographical levels, and they can spread to water and land ecosystems in the form of dry or wet deposits.
- Over acidification and over fertilization**.** Sulphur and Nitrogen inputs are responsible for acidification and over fertilization of ecosystems such as forests, rivers, lakes and swamps.
- Necrosis on plants. Necrosis is the death of cells in tissue. High concentration of pollutants can cause death to plants and animal cells, leading to organ failure or death of tissues.
- Air pollution can cause reduction in plant growth (stunted growth) or reduce the ability of plants to resist diseases and infections.
- Air pollution can also change the chemical composition of the atmosphere, therefore affecting biogeochemical cycles such as the nitrogen cycle, water cycle and carbon cycle.

**Control Measures**

Control measures to prevent, reduce or eliminate pollutants in the air are guided by the Environmental Management and Co-ordination Act (No 8 of 1999). The regulations to be followed can be found in the Environmental Management Co-ordination (air quality) Regulations of 2014. The air quality regulations of 2014 have different ways in which they ensure air quality standards are fit for humans, animals and plants. The following are measures to ensure safety of workers:

- The owner of the facility should inform the workers of the hazards in specific work environment.
- Train the workers on the potential hazards of any hazardous substance to which they are exposed, and the safety precautions to be taken to prevent any harm to their health.
- Ensure that measurements of pollutants are carried out by a laboratory designated by Environment Management Authority in order to determine compliance with the prevailing allowed levels of exposure.
- Ensure that record of measurements carried out, are reported to the Authority on a quality basis.
- Take exposure reduction measures.

**Ambient air quality limits**

Ambient air quality standards, means these ambient air quality standards which are required to protect the human health and allow adequate margin of safety. Under the Environmental Management and Coordination Act, limits have been set for the following gases, Sulphur oxides, Oxides of Nitrogen, Nitrogen Dioxide, Suspended particulate, Respirable particulate matter, carbon monoxide, Carbon Dioxide, hydrogen Sulphide and Ozone among others.

## 2.2 Procedures for solid waste management observed according to environmental management and coordination Act

Solid waste is discarded material that is disposal and is considered garbage. Refuse and sludge from wastewater can be in solid, semi-solid, liquid or contained in gaseous material.

**Types of Solid Waste**

**Domestic Waste**

Domestic waste is also referred to as garbage, refuse, or trash. It consists mainly of biodegradable waste which is food and kitchen waste, green waste paper and non-biodegradable such as plastics, glass bottles, cans, metals and wrapping materials.

**Waste Tires**

These are tires that have reached their end due to wear or damage and cannot be recycled or reused. The bulk of the tires are informally collected and often illegally burnt in open to recover steel for recycling.

**Construction and Demolition Waste**

This type is generated as a result of construction works, remodeling or demolition. It comprises debris, steel, timber, iron sheets, tiles and ceramics among others.

**Industrial waste**

This is waste produced by industrial activities which includes any material that is rendered useless during manufacturing process industries produce both hazardous and non-hazardous waste. They include chemical solvents, paints, sand paper and paper products, industrial by products, metals, municipal solid waste and radioactive waste.

**Bio-Medical Waste**

Bio medical waste refers to waste generated in health facilities, research institutions or during immunization of human beings and animals. It is classified into; infectious waste sharps, pharmaceutical wastes, chemical waste and pathological waste. Biomedical waste pose risks to human health

**Sewage Sludge**

This is a sediment material that accumulates over time. In the sewage treatment plants and ponds. Sewage sludge that is contaminated by heavy metals from industrial effluent can severely contaminate agricultural land to which it is applied.

**E-Waste**

This is waste generated from electrical and electronic equipment (EEEs) becoming obsolete e-waste comprises of heavy metal components and materials used in the manufacture of electronic goods. They include; mercury, brominated flame retardants and cadmium, which are considered hazardous.


**Procedure for solid waste management**

**Waste Generation**

Most of the waste is generated at household, market places, cities, town, institutions and industrial zones. The waste generator should endeavor to minimize waste by reducing, reusing, refusing, returning waste or by adopting cleaner production technologies. Waste should be segregated at the source; this can be made possible by county governments providing coded bags and bins.

**Waste Collection**

Collection centers or transfer stations should be established at strategic areas within a town. These collection areas should be properly managed and maintained with frequent and timely collection of waste to avoid scattering into undesignated areas. Adequate measures should be put in place to manage any leachate from the waste receptacle and collection areas.

**Waste transportation**

This involves transportation of various segregated solid waste types. Waste transportation trucks should be closed and suitable for the transportation of various types of waste to waste treatment facilities and landfills. These transportation vehicles should be lincensed to be operated by NEMA.

**Waste treatment**

  **a) Recycling**

This is the processing of waste materials. Into a new product of similar chemical composition. Recycling prevents wastage of potentially useful materials, reduce the consumption of raw materials and ultimately reduces pollution.

  **b) Composting**

Composting is the biological decomposition of biodegradable solid waste under controlled aerobic conditions to produce compost. Compost is used as an organic fertilizer in agricultural production.

  **c) Thermal treatment of waste**

This is the combustion of waste at specific temperatures with or without air supply as part of the process and includes waste incineration, gasification and pyrolysis. This process reduces the volume of waste and inert any hazardous components.

**Waste Disposal**

Disposal refers to the depositing or burial of waste in land. The sanitary landfills should be filled with systems to collect leachate and methane gas. There should be frequent spreading, compacting and covering of waste with soil or any other appropriate covering material so as to avoid environmental pollution and scavenging birds.

**2.3 Methods for minimizing noise pollution with compliance following environmental regulations**

Noise pollution or sound pollution is the transmission of sound in levels that have harmful impacts on the functioning of humans and animals. High sound frequency can be from activities of human beings or be caused by natural events such as volcanic explosions. Sound intensity is measured in decibels (dB).

**Types of Noise Pollution**

**Industrial Noise**

This is high intensity sound caused by machinery, such as generators, turbines and shredders from industry process. Noise from mechanical saws and drills is unbearable and

protective equipment for workers is needed. Industry noise does not only affect only workers but also those who are close to the factory may suffer the effects.

**Transportation Noise**

Transport noise mainly is from traffic from road, rail and aircraft. With increase in population, there has been an increase in the number of vehicles on roads, like motorcycles, cars, and buses, trucks, and diesel engines vehicles. This has aggravated the noise pollution problem. Noise pollution from aircrafts can be experienced by staff who work in airports and military airbases and those living nearby. This type of noise pollution is usually experienced in urban areas where traffic is high.

**Neighborhood Noise**

This type of noise includes disturbance from household electronics and community activities. Common source of this type of noise pollution include TVs, loudspeakers and musical instruments. Community activities carried out in neighborhoods such as parties, cultural functions and wedding and burial ceremonies.

**Methods of Minimizing Noise Pollution**

**Source Control**

This involves reducing the transmission of sound from the source. This includes modifications such as acoustic treatment to machine surface, design changes to factory facilities, limiting operations to a certain time.

**Transmission path intervention**

This involves containing the source inside a sound insulate, enclosure, construction of a noise barrier or provision of sound absorbing materials along the path of travelling sound.

**Receptor control**

The protection of the receiver by changing the work schedule or provision of Personal Protective Equipment (PPE) such as ear plugs when operating noisy machinery. It may also include the dissipation and deflection of sound that it may not reach humans and animals.

**Machinery Maintenance**

Proper oiling and maintenance of machinery will reduce noise from machines that are rusty or will avoid friction from moving parts of a machine. Maintenance of vehicles will reduce noise produce by automobiles.

**Conclusion**

At the end of this learning outcome, the trainee should have gained knowledge on; types of pollution, environmental pollution, control measures, types of solid wastes, procedures for solid waste management, different types of noise pollution and methods for minimizing noise pollution. The trainee will also have clear understanding of the control measure applied in Kenya in accordance to the Environmental Management and Co-ordination Act (EMCA) and other guiding regulations.

**Further Reading**

Air Quality Regulations (2014)
Environmental Management and Coordination Act (1999)

**7.3.3.3 Self-Assessment**

**Written assessment**

1. Which of the following is an example of solid waste?
   a) Bio-medical waste
   b) Carbon Dioxide
   c) Vibrations
   d) Noise from house electronics

2. Which of the following is NOT an impact of air pollution?
   a) Over-fertilization
   b) Stunted growth
   c) Improve health
   d) Acidification

3. Which of the following is a type of noise pollution?
   a) Sewage sludge
   b) Waste tires
   c) Industrial
   d) E-waste

4. Identify which is not a source of air pollution from the option below
   a) Audio-Visual equipment
   b) Carbon dioxide
   c) Sulphur oxides
   d) Volcanism

5. Which one of the following ways can be used to minimize noise pollution?
   a) Recycling
   b) Source control

      c) Composting

      d) Thermal treatment

6. Which one of the following is the principal Act that guides Environmental management in Kenya?

      a) Water Act

      b) County government by laws

      c) Environmental Management Co-ordination Act

      d) Air quality regulation 2014

7. Define the following terms

      i. Sewage Sludge

      ii. Necrosis

8. List four methods of minimizing noise pollution

## Practical Assessment

1. Identify a waste solution source from an institution or area near, where you live and up with practical measures to control the solid waste pollution

2. Write a report on the effects of air pollution on biogeochemical cycles

## 7.3.3.4 Tools, Equipment, Supplies and Materials

- Environmental Management and Co-ordination Act 1999
- The Environmental management and Co-ordination (Air Quality) regulations, 2014

## 7.3.3.5 References

African Forest Forum (2019). *Basic Science of climate change*. A compendium for technical training in African Forestry, Page 32-34

Government of Kenya (2014). *The Environmental management and Co-ordination* (Air Quality) Regulations, Government Press. Nairobi. Kenya

Government of Kenya (2015). *The National solid Waste Management Strategy,* Government Press. Nairobi. Kenya

*http://mjcetenvsci.blogspot.com/2013/11/noise-pollution-causes-ypes-effects.html?m=1*

### 7.3.4 Learning Outcome No. 3: Demonstrate sustainable resource use
### 7.3.4.1 Learning Activities

| Learning Outcome No. 3: Demonstrate Sustainable Resource Use | | |
|---|---|---|
| | **Learning Activities** | **Special Instructions** |
| | 3.1. Comply with methods for minimizing wastage. <br> 3.2. Employ waste management procedures following principles of 3Rs (Reduce, Reuse, Recycle). <br> 3.3. Practice methods for economizing or reducing resource consumption. | Personal protective equipment should be used at all times. Group discussions. |

### 7.3.4.2 Information Sheet No7/LO3: Demonstrate sustainable resource use

### Introduction

This learning outcome covers complying with methods for minimizing waste, employing waste management procedures following principles of 3Rs (Reduce, Reuse, Recycle) and practicing methods for economizing resource consumption.

### Definition of key terms

**Waste management:** These are activities carried out to control unwanted or unusable materials from its inception to its proper disposal. It includes waste collection, transport, treatment, storage and disposal, in conjunction with regulation and monitoring of the process as a whole.

**Resource consumption:** It is the usage of resources in any form to meet our own needs and wants. Consumption is spending for acquisition of utility of resources.

**Reduce:** It is when resources are utilized in a manner that limits the amount of waste created or toxicity of waste created.

**Reuse:** It is a waste management concept that involves using resources again after cleaning up or treatment. Although the items reused still end up as waste, by reusing them, waste produced at a given time is reduced and the lifespan of the item expanded.

**Recycle:** It is a process that involves converting already waste materials into new materials and products. Recycling prevents wastage of potentially useful materials and reduces the use of fresh raw materials.

### Content/Procedures/Methods/Illustrations

### 1.1 Methods for minimizing wastage

### Types of Environmental resources

They are categorized in the following groups:

### a) Renewable and Non-renewable Resources

**Renewable Resources**

They are also known as infinite resources. These are resources that are consistently available despite their utilization. After usage, they can be fairly replaced or recovered. Examples include air, water, vegetation and energy from the sun. Animals can also be categorized as renewable resources since they reproduce offspring to replace the older generation. It is important to note that as much as these resources can be replaced, it may take a long period of time to do that hence need to use then sustainably.

Renewable resources are further divided into two categories:

- Organic renewable resources. These are those that are extracted from living things, that is, plants and animals.
- Inorganic renewable resources. These come from non-living things like sun, wind and water.

**Non-renewable Resources.**

These are resources that cannot simply be recovered or substituted once they have been extracted and utilized or destroyed. They are also known as finite resources. Example includes minerals, fossil fuel. Even though minerals and fossil fuels occur naturally, they are categorized as non-renewable resources as their formation take a very long period of time. Most recently, some animals, mostly the endangered species are also regarded as non-renewable resources as they are at the verge of extinction.

### b) Biotic and Abiotic Resources

**Biotic Resources**

These are resources that come from organic and living materials, that is, the ecosphere. They include animals and plants and other materials obtained from them such as fossil fuels, as they are produced from dead and decaying organic matter.

**Abiotic Resources**

These are resources generated from non-organic and non-living materials. Examples include water, land, air, minerals.

### c) Stock, Reserve, Actual and Potential Resources

**Stock resources**

They are resources that are present and have been surveyed but their usage is limited due to lack of technology to extract them. An example of such a resource is hydrogen.

**Reserve Resources**

These are resources that have been surveyed and their quantity and quality determined butt are not currently been used. They are however to be developed for profits in the future.

**Actual Resources**

These are resources present in a region whose quality and quantity have been surveyed and determined, and they are currently being used as the required expertise and technology is available.

### Potential Resources

These are resources whose knowledge and existence in a region is present and can be exploited in the future. For instance, in a region that sedimentary rocks rich in petroleum; it is a potential resource until its actual quality and quantity is surveyed and determined.

From the above resources, we learn that environmental resources are classified according to the following criteria:

- Based on their renewability
- Based on their source of origin.
- Based on their development stage.

Wastage minimization entails limiting the amount of waste that is produced hence aiding in eliminating the production of harmful waste effectively supporting efforts that promote a society that is sustainable. Minimizing waste includes a change of society patterns that relate to production and consumption as well as redesigning products to eliminate the generation of waste.

### Benefits of minimizing waste

- Improved product quality. Innovations and new technological practices will not only reduce wastage but also contribute to improved quality input leading to improved products.
- Economic benefits. Efficiency and effectiveness in resource use translates to reduced cost when it comes to purchasing value of products hence affecting financial performance significantly.
- Efficiency of production practices. Wastage minimization will attain more output of the product in relation to raw materials and environmental resources.
- Environmental responsibility. Minimizing or eliminating wastage makes it easier for one to adhere to set environmental policies, regulations and standards.
- Public image. Embracing wastage minimization of resources boasts an organization's image, as it is a reflection of proactive movement in the bid to protect the environment.

### Wastage minimization techniques
### Optimization of resources.

This involves full exploitation of resources once they are extracted from their natural setting. For example, a dressmaker will arrange the pieces of a pattern in a certain manner along the length of the fabric in the quest to use a small portion of the fabric.

Optimization also includes use of all products achieved in the manufacturing or processing of the main products. These products include by-products and waste products. Waste products and by-products from one process are used as raw materials for other processes.

### Quality control improvement and process monitoring.

Wastage minimization can be put in place to limit number of rejects and wastage generated. Can be attained through increased frequency of inspection and increase of inspection guidelines.

Resources used in manufacture can be scrutinized through monitoring and evaluation to make them more effective and efficient minimizing wastage.

These methods of minimizing wastage are practically similar to the methods for economizing or reducing resource consumption. Reducing or economizing resource consumption is a priority sustainability issues because we all share the burden of responsibility to leave the environment fit if not better for ongoing prosperity and quality of life for future generations.

## 3.2 Waste management procedures following the principles of 3Rs (Reduce, Reuse, Recycle)

These principles are the most commonly preferred methods for minimizing wastage. They are the easiest and commonly used techniques.

### Reduce

It calls for usage of resources that are just enough to cater to your needs for example, building a small house. It lowers cost in resource consumption. Reducing can be attained through attaining accurate measurements to ensure that there is little or no wastage of the resources. The process of reducing begins with determining what you are using and for what purpose. There are three simple steps used to assess the reduction value of an item. They are:

- Is there something else that can be used for this purpose? Use of multi-purpose items is essential in reduction. This reduces the amount of energy used or packaging material used.
- Is there something that needs to be done? A lot of waste materials are considered disposable in the sense that means whether or not the item allows you to do any real purpose or meaning.
- Is the item a part of something that you need to do or want to do in your life? There is a limit to what you need in preparation for your life. For example, when living in the forest, you won't need a car equipped to handle a desert sandstorm. Always make certain that what you use matches reality of potential opportunity in your life. Some of the things you can do to minimize wastage may include; printing on both sides of the paper, using cloth napkins instead of proper paper napkins and avoid using disposable utensils

### Reuse

It involves re-purposing items for a use different from what it was initially produced for. One appropriate example is the modular construction of homes and offices that is being created out of discarded shipping containers.

### Recycle

Recycling means that an item will be transformed again into a raw material that can be shaped into a new item. The following approaches can be used to enhance efficient recycling:

- By products that are made up of recycled materials, i.e. products that are environmentally friendly.
- Buy recyclable products such as glass bottles.
- Create and invent new methods to recycle different items.
- Buy non-toxic products whenever possible.
- Buy items made from recycled materials.
- Use recycled paper for printing.

## 3.3 Methods for economizing or reducing resource consumption
**Measuring Techniques of Current Resource Usage**

Current usage of resources needs to be measured as most of these resources are exhaustible meaning they are available in a limited quantity and can be used up. Measuring techniques are thus crucial in order to avoid depletion. Currently, there is a huge tug of war centered on resource depletion (increased scarcity) and the exploitation of resources.

A measuring technique involves a six-stage process that involves understanding your current resource consumption and waste production, understanding how to measure it, using the data and ultimately making informed decisions.

**Stage 1: Understanding resource consumption and waste production. This is undertaken in two parts: Initial reviews and process mapping**.

**Initial Review**

Helps in gathering basic information. Assists one in understanding how various resources are being used highlighting areas that can be improved on.

**Process Mapping**

Having acquired an insight from the initial reviews, process mapping helps controlling resources usage by adopting the most efficient and effective resource consumption to minimize waste collected, cost and environmental impact.

**Stage 2: Data Collection**

This stage involves quantifying the exact amount of resources used. Some of the data collected may be exact figures while others may be estimates depending on nature of the resources in question. Data can be collected: by taking measurements, estimating, financial data and bills, and mass balances.

**Stage 3: Data Analysis**

This section involves managing and collating the data previously collected. Collected data is represented in tables, graphs and charts.

**Stage 4: Data Interpretation**

This stage involves relating data analyze to measuring indicators such as carbon metrics and carbon footprints. It outlines the current resources usage with trends cropping up in the sector.

**Stage 5: Summary**

It involves coming up with a conclusion of the process in relation to knowledge gathered from the data. It helps identify priority areas to target, how to go about target setting and to plan on improving on resource consumption to be sustainable.

**Stage 6: Reviews and progress communication**

This section involves giving a way forward from all you have gained from the process. A report is developed outlining the whole process and how/what next from the knowledge gained.
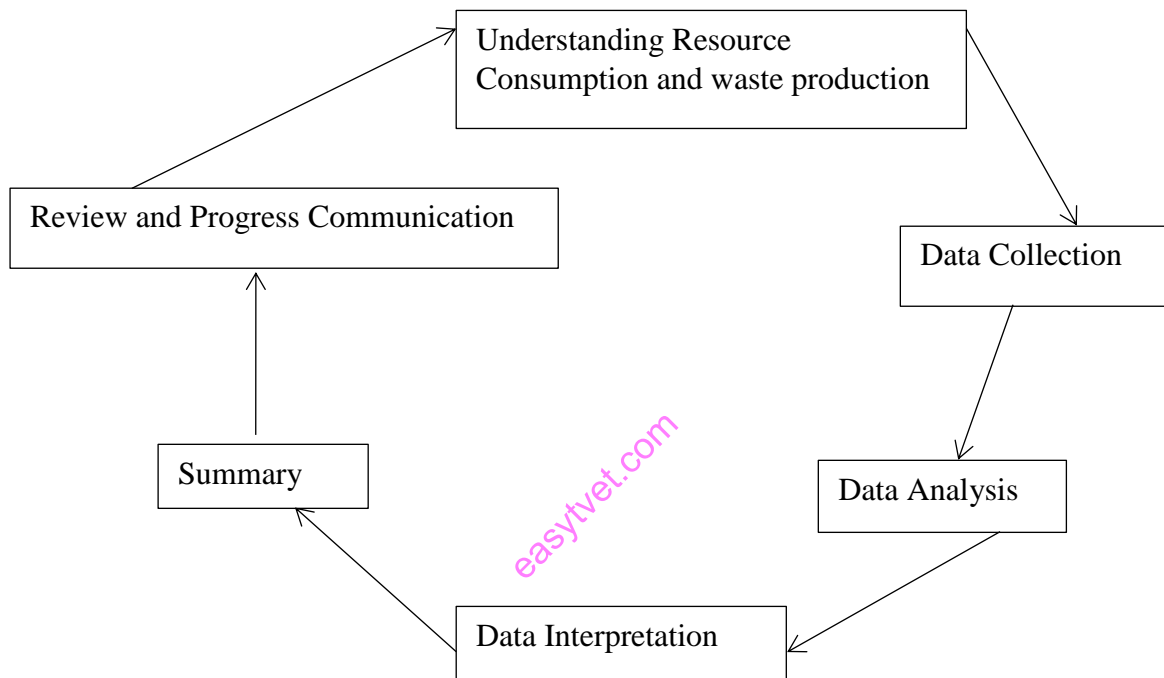


Figure 27. A measuring technique process

The most commonly used measuring technique of current resource usage is Environmental Resources Accounting. It is a subject of accounting proper, its target being to incorporate both environmental and economic information. It is a field that identifies usage of resources, measures and communicates costs of a company's or national economic impact on the environment. Costs include clean up or reclaim of contaminated sites, environmental fines, penalties and taxes, purchase of pollution prevention technologies and cost of waste management.

**Conclusion**

This learning outcome covered methods for minimizing waste, waste management procedures following the principles of 3Rs (Reduce, Reuse, Recycle) and methods for economizing or reducing resource consumption. The trainee should be able to come up with innovations to enhance all these.

**Further Reading**

ISO standards

*Innovation in waste minimization and reduction of resources consumption methods.*

### 7.3.4.3 Self-Assessment

**Written Assessment**

1. Which of the following is not a principle of the 3Rs?
    a) Reduce
    b) Replenish
    c) Reuse
    d) Recycle
2. Identify which of the following resource is odd one out.
    a) Air
    b) Fossil fuel
    c) Water
    d) Sun
3. Classification of environmental resources is based of the three of the following apart from?
    a) Based on source of origin
    b) Based on renewability
    c) Based on development stage
    d) Based on region.
4. Which is not a wastage minimization technique?
    a) Resource optimization
    b) 3Rs principles
    c) Quality control improvement
    d) Replenish
5. Benefits of minimizing waste do not include?
    a) Public image
    b) Fun
    c) Environmental responsibility
    d) Economic benefits
6. Explain the principles of 3Rs according to environmental resources giving examples
7. Briefly outline the types of environmental resources.
8. Give three examples of measuring techniques of current resource usage.

**Practical Assessment**

A report on methods for minimizing wastage used in the school.

## 7.3.4.4 Tools, Equipment, Supplies and Materials

- Standards operating and/or other workplace procedures manuals
- Specific job procedures manuals
- Environmental Management and Coordination Act 1999
- Machine/equipment manufacturers specifications and instructions
- Personal Protective Equipment (PPE)
- ISO standards
- Company Environmental Management Systems (EMS)
- Montreal protocol
- Kyoto protocol

## 7.3.4.5 References

Ahmad, Y. (1989) *Environmental Accountability and Sustainable Development:* A UNEP World Bank Symposium. World Bank. Washington D.C.

*https://courses.Lumenlearning.com/boundless-economics/chapter/introduction-to-natural-resources-economics/*

*https://www.conserve-energy-future.com/what-is-the-process-of-minimizing-waste.php.*

### 7.3.5 Learning Outcome No 4: Evaluate current practices in relation to resource usage

**7.3.5.1 Learning Activities**

| Learning Outcome No. 4: Evaluate current practices in relation to resource usage | | |
|---|---|---|
| | **Learning Activities** | **Special Instructions** |
| | 4.1. Collect and provide information on resource efficiency systems and procedures to the work group where appropriate. <br> 4.2. Measure and record of current resource usage by members of the work group. <br> 4.3. Analyze and record of current purchasing strategies according to industry procedures. <br> 4.4. Analyze current work processes to access information and data following enterprise protocol. | Group discussions on resource efficiency systems and procedures. |

**7.3.5.2 Information Sheet No7/LO4: Evaluate current practices in relation to resource usage**

**Introduction**

This learning outcome covers collection and provision of resource efficiency systems and procedures, measuring and recording of current resource usage, analyzing and recording purchasing strategies, according to industry procedures and analyzing work processes to access information and data.

**Definition of key terms**

**Resources:** They are the flows and reservoirs of matter and energy that can sustain or benefit living systems.

**Resource efficiency systems:** These are procedures that ensure the limited resources are used sustainably while minimizing impact on the environment. The systems allow for creation of more using less and deliverance of greater value output with less input.

**Purchasing strategies:** These are actions that may be undertaken in order to increase overall saving from buying of goods and services. They are used in order to make cost effective buying decisions from a group of efficient vendors who will deliver quality goods and services on time and at mutually agreeable terms.

**4.1 Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate**

**Environmental Resource Efficiency Systems**

Resource efficiency is a sustainable development aspect. Sustainable development is a dynamic process that enables people of present and future generations to realize their potential and improve their quality of life in terms of consequently protecting and enhancing the environment's life support systems. Resource efficiency systems involve gaining the most out of what you have. The systems can be beneficial in ways such as reducing the amount of material used, hence reducing manufacturing costs, waste and compliance to environmental regulations thus reducing impact on the environment.

In the resource efficiency process, it is important to firstly understand the inputs and outputs before analyzing environmental impact. This is usually done using a life cycle analysis.

When developing an environmental resource efficiency system, the following procedure is followed:
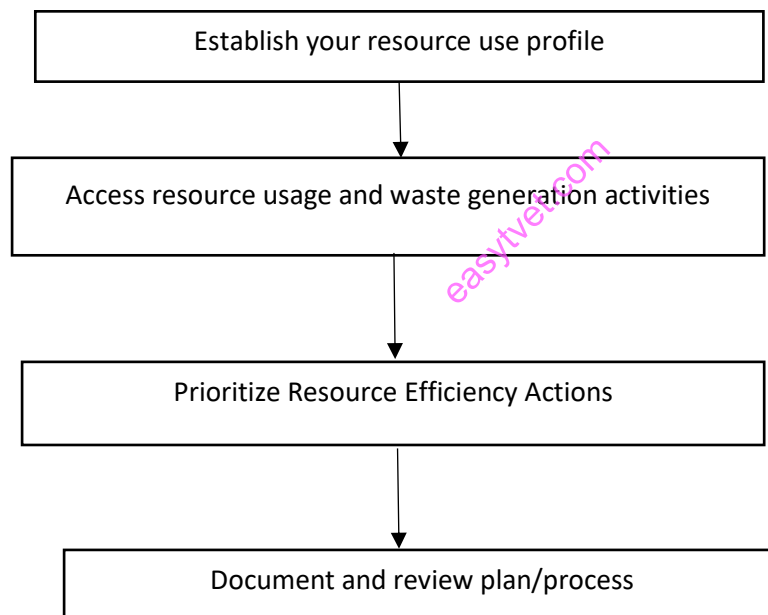


Figure 28. Developing an environmental resource efficiency system procedure

**Establish resource use profile**

It entails collecting, analyzing and determining baseline data for current resource use and waste generation and monitoring the efficient strategy gains. Baseline date includes:

- Energy use by fuel type
- Water use by source of water
- Waste generation by type of waste

Potential sources of these data include:

- Bills
- On-site metering information
- Existing internal resource management and tracking databases

**Access resource consumptions**

Offers an opportunity to consider the key processes for their potential to reduce resource usage and optimize saving. This steps also involves the development of resource efficiency indicators.

**Prioritize resource efficiency actions**

It involves integrating known opportunities, evaluating the costs and benefits of each activity and prioritizing ideal activities in the resource efficiency strategy.

These actions may include: Most effective technology available, most ideal product design that minimizes wastage.

**Document and review the plan/strategy**

This is the monitoring and evaluation stage of the cycle. It seeks to ascertain the resource efficiency strategy that is best suited for the resource.

## 4.2 Current resource usage is measured and recorded by members of the work group
**Resource usage**

Resource can be distinguished into at least three different definitions of resource:

- The economist's view (any means that enters into the production of goods and services)
- The Physical's view (energy, material and information)
- The ecologist's view (naturally occurring components of the environment that can sustain or benefit organisms, populations or communities within an ecosystem)

Resources can be termed as the flows and reservoirs of matter and energy that can sustain or benefit living systems.

**Measures for resource use**

a) **Energy Analysis**

It is the analysis of the available energy that is lost in the course of material and energy transformation.

b) **Product-oriented Methods**

Life cycle assessment – it is based on analyzing output in relation to input. It involves calculation of environmental impacts.

Material input per unit of service (MIPS) – deals with flows into and out of the techno sphere but pay little attention to the way these flows are dealt with within the techno sphere.

c) **Entropy-based Measure**

Evaluation occurs without reference to transformations of energy or materials. It takes into account all resource consumption in the form of lost energy.

d) **Muller-Wenk and operationalized in the Eco-indicator 99 Method**

It is not based on the questions of how long resources last and how much they are decreased by current practices, but instead evaluates the effects on future generations by examining

the future additional investment (in terms of energy) due to the extraction of resources in the present time.

## 4.3 Current purchasing strategies are analyzed and recorded according to industry procedures

**Purchasing strategies**

These are the activities taken in order to increase overall savings from buying. It requires input from all functional areas and departments of an organization. For a successful purchasing strategy, the following steps can be used:

- Conduct an internal needs analysis
- Conduct an assessment of the supplier's market
- Collect supplier's information
- Develop a sourcing/outsourcing strategy
- Implement the sourcing strategy
- Negotiate with the suppliers and select the winning bid
- Implement a transition plan or contractual supply chain improvements

### i. Conduct an internal needs analysis

You will need to benchmark current performance and then identify needs and targets in this stage before developing a procurement strategy. It involves collection of different types of data. Initial data collection is to benchmark current performance, used resources, cost for all functions in the organization and current growth projections.

### ii. Conduct an assessment of the supplier's market

Potential suppliers that are feasible sources of the required goods and services are identified. Specific requirements by the organization limits number of suppliers that are suitable, such as technological requirements, quality.

### iii. Collect supplier's information

The business reputation and performance of the supplier must be evaluated. A supplier's ability to meet selection criteria may result in significant profits or losses. Use of agents who are experts with the market and stakeholders can be beneficial. A competitive environment may be created by selecting more than one supplier in order to avoid potential supply disruptions.

### iv. Develop a sourcing/outsourcing strategy

Examples of sourcing/outsourcing strategies include: direct purchase, acquisition, and strategic partnership. Determination of the right strategy is dependent on the competitiveness of the supplier's market and the organization's risk tolerance, business strategy and outsourcing/sourcing motivation.

### v. Implement the sourcing strategy

Sourcing strategies involve partnerships that are strategic and/or acquisition. Suppliers may possess the following characteristics:

- Activities involvement core to the buyer such as correct technological requirements, raw material for product
- A limited number of suppliers with the specific skilled labor

- Part of the broader business strategy of the organization.

The organization may develop a competitive bidding process in case of a direct purchase.

### vi.   Negotiate with the suppliers and select the winning bid

The team must evaluate suppliers' response and apply its evaluation criteria. Suppliers may request additional information in order to make the most realistic bid. Evaluation of received bids is done and the selection criteria used and the bidders shortlisted. After the evaluation process, contract negotiations begin.

### vii.   Implement a transition plan or contractual supply chain improvements

Suppliers who won the bid should be invited to participate in implementing improvements. A communication plan must be developed and a system for evaluating and measuring performance will need to be developed using key performance indicators. Transition plans are very important when switching suppliers.

## 4.1   Current work processes to access information and data is analyzed following enterprise protocol

**Data Analysis of Current Work Processes**

An analysis of current work processes to access information and data is important as it helps to increase the effectiveness and efficiency of a process. It offers an assessment of how well the process attains its end goal, by examining every part of the structure. It can therefore help identify potential improvements making it easier to carry out a re-engineering initiative later on in the process. Data analysis is the process of collecting, transforming, cleaning and modelling data with the goal of discovering the required information. Results obtained are communicated, suggesting conclusions and supporting decision making. Data analysis process consists of the following phases that are interactive in nature:

- Data Requirement Specification
- Data collection
- Data processing
- Data cleaning
- Data analysis
- Communication

**Data Requirement Specifications**

Required data for analysis is based on a question or experiment or project. Data necessary as inputs such as population is identified. Specific variables regarding this population such as age may be specified and obtained. Data can be numerical or categorical. Clear measurement priorities must be set according to:

- What to measure?
- How to measure it?

**Data collection**

It is the process of gathering information on targeted variables identified as data requirements. Data collection ethics are paramount in regards to accurate and honest data. It provides a target to improve and a baseline to measure.

**Data processing**

It involves organizing data for analysis. It includes structuring the data as required for the relevant analysis tools. Creation of a data model might be necessary.

**Data cleaning**

Processed and organized data may be incomplete, contain duplicates or errors. Data cleaning is the process involving correcting the errors. It is dependent on the type of data.

**Data analysis**

Processed, organized and analyzed data is now ready for analysis. Various data analysis techniques work to understand, interpret and derive conclusions based on the requirements. Data visualization may also be used to examine the data in graphical format in order to obtain insight on the messages within the data.

Statistical data models such as correlation, regression analysis may be used to identify the relations among the variables. They are descriptive and help in analysis simplification and results communication.

**Communication**

Results are to be interpreted in a format as required by the users to support their decision making. Feedback from the users might result in additional analysis.

Visualization techniques such as tables, charts and graphs are used by data analysts to aid in communicating messages clearly and efficiently to the users.
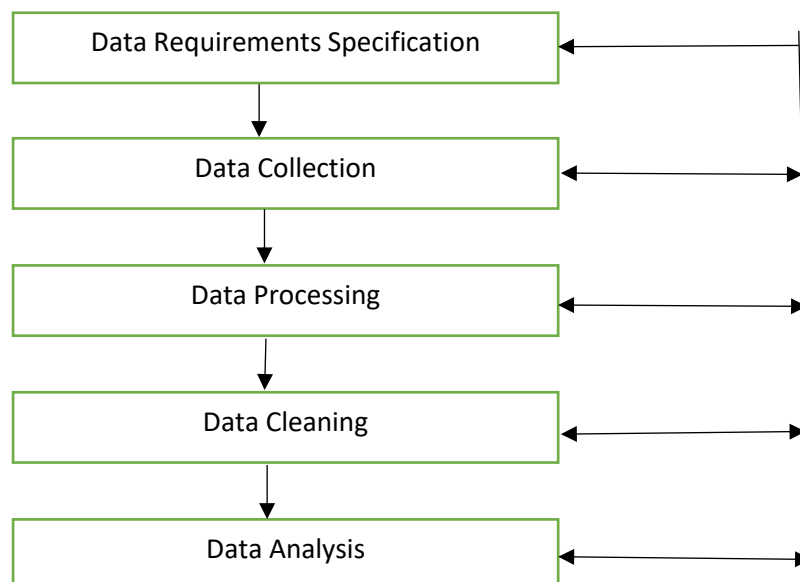
Figure 29. Data analysis process

**Conclusion**

At the end of this learning outcome, the trainee should be able to properly develop an effective resource efficiency system, quantify current resource usage, implement efficient purchasing strategies and analyze data and access information on current work processes.

**Further Reading**

Mugenda, O. M. & Mugenda, A. G. (2008). *Research methods: Quantitative and Qualitative Approaches.* Nairobi: African Centre for Technological Studies

### 7.3.5.3    Self-Assessment

**Written Assessment**

1. Which is not a benefit of using resource efficiency systems?
    a) Sustainable Development
    b) Cast reduction
    c) Environmentally friendly
    d) Less value output
2. Data analysis on current work processes involves certain phases apart from which one?
    a) Data processing
    b) Data guessing
    c) Data collection
    d) Data cleaning
3. Which is the odd one out in relation to resource usage?
    a) Resource exploitation
    b) Resource efficiency systems
    c) Purchasing strategies
    d) Data analysis on work processes
4. Baseline data in establishing resource use profile does not include?
    a) Water use
    b) Waste generation
    c) Premises
    d) Energy use
5. Which of the following is not included in the life cycle analysis?
    a) Establishing resource use profile
    b) Documenting and reviewing plan
    c) Data collection
    d) Prioritizing resource efficiency actions
6. Describe development procedures of a resource efficiency system.
7. Outline steps taken in developing purchasing strategies.

8. Define data analysis and explain the phases it involves.

**Project**

Do a project. An assessment of the work process involved in an organization

## 7.3.5.4 Tools, Equipment, Supplies and Materials

- Standards operating and/or other workplace procedures manuals
- Specific job procedures manuals
- Environmental Management and Coordination Act 1999
- Machine/equipment manufacturers specifications and instructions
- Personal Protective Equipment (PPE)
- ISO standards
- Company Environmental Management Systems (EMS)
- Montreal protocol
- Kyoto protocol

## 7.3.5.5 References

*https://www.google.com/amp/www.tradeready.ca/2017/fittskills_refresher/7_steps_of_a_ strategic_procurement_process/amp/*

*https://www.tutorialspoint.com/excel_data_analysis/data_analysis_process*

United Nations research institute for social development, 200. *Business for sustainable development.* An occasional paper no. 2 by Peter Utting

*www.betterregulation.vic.gov.au>*…PDF DRAFT GUIDELINES ENVIRONMENT AND RESOURCE EFFICIENCY PLANS.

### 7.3.6 Learning Outcome No. 5: Identify environmental legislations/conventions for environmental concerns

### 7.3.6.1 Learning Activities

| Learning Outcome No. 5: Identify environmental legislations/conventions for environmental concerns | |
|---|---|
| **Learning Activities**  | **Special Instructions** |
| 5.1. Identify environmental legislations/conventions and local ordinances according to different environmental aspects/impact <br> 5.2. Describe industrial standard/environmental practices according to the different environmental concerns | Use the Kenyan Constitution <br><br> Group Discussions |

### 7.3.6.2 Information Sheet No7/LO5: Identify environmental legislations/conventions for environmental concerns

**Introduction**

This learning outcome covers identification of environmental legislations/ conventions and local ordinances according to different environmental aspects as well as description of industrial standards/environmental practices according to the different environmental concerns.

**Definition of key terms**

**Environmental legislations/conventions**: Also known as multilateral environmental agreements. Are agreements between states that guide global, regional and national action on environmental issues and are therefore key elements of environment, legal and governance regimes?

**Industrial standards:** Industry standards are a set of requirements to be followed by a member of that industry in relation to the standard functioning and carrying out of operations.

**Local ordinances:** These are laws for an area smaller than a nation e.g. local government or county and should be consistent with the constitution and public policies.

Environmental concerns: These are harmful effects on the biosphere brought about by anthropogenic activities (human influence) or natural internal processes. These issues include global warming, climate change, waste disposal, water pollution and deforestation.

## 5.1 Environmental legislation/conventions and local ordinances are identified according to the different environmental aspects/impact

**Environmental policy and legislation**

Environmental legislation is the collection of laws and regulations aimed at protecting natural resources and the environment from harm or misuse. The laws are implemented in different jurisdictions depending on the structure of government or local authorities. Environmental policy: This is a course or a system of principles adopted by an organization or country to guide decision making and achieve beneficial outcomes. Protection and conservation of natural resources happens on different levels of jurisdiction such as the international level, regional level and national level. At the international level, the global environmental authority, known as the United Nations Environment Program (UNEP) was established in June 1972 as a result of the Stockholm conference on the human environment. UN Environment is the recent abbreviation used and is located in Nairobi, Kenya. At the regional level Kenya is part of the African Union and the economic block East African Community. The African Union was officially launched in 2002 as a successor to the Organization of African Unity (1963 – 1999). The African Union policy on the environment in Africa is under the department of Environment, Climate change, Water, Land and Natural Resources. The DREA guides Africa on issues such as climate change, project on environmental restoration and rehabilitation and capacity building of environmental institutions in Africa. At the national level, we have the National Environment Management Authority (NEMA), established under the Environmental management and coordination act no. 8 of 1999 (EMCA) as the principle instrument of government for the implementation of all policies relating to environment. The authority has been in operation since 1$^{st}$ July 2002. Environmental policy at the county level is run by the county governments and they control the use of resources but have no jurisdiction over resources share by more than one county, because such resources are considered National resources and are under the national government.

**Multilateral environmental agreements/international environmental protocols**

Multilateral environmental agreements are agreements between states that guide global, regional and national action on environmental, legal and governance regimes. Timeline of major environmental conference and protocols.

- Conference on Human Environment, in Stockholm in June 1972.
- Montreal Protocol on Substances that Deplete the Ozone Layer in Montreal (1987).
- United Nation Conference on Environment and Development, in Rio de Janeiro (1992)
- Kyoto Protocol, in Kyoto (1997).
- World Summit on Sustainable Development, Johannesburg (2002).
- UN conference on Sustainable Development, Rio de Janeiro (2012).
- UN Sustainable Development Summit, in New York (2015).

- Conference of the parties of the UNFCCC in Paris (2015).

**Protocols**

This is the original draft of a multilateral environmental agreement, specifying the terms of a treaty agreed to in a conference and signed by the parties.

**Kyoto Protocol**

Kyoto Protocol is an international treaty that was agreed upon in 1997. It commits state parties to reduce greenhouse gas emissions, adopted in Kyoto, Japan on 11th December, 1997 and entered into force on 16th Feb 2005. The protocol mirrors the convention in recognizing the specific needs and concerns of developing countries, especially the most vulnerable among them. Annex 1 parties must thus provide information on how they are striving to meet their emission targets, while minimizing adverse impacts on developing countries. The target for the first commitment period of the protocol cover emission of the following greenhouse gases; carbon dioxide, methane, nitrous oxide, hydroflouro carbons (HFCs), perfluoro carbons (PFCs) and sulfur hexafluoride. An adaptation fund was established to finance concrete adaptation projects and programs in developing countries that parties to the Kyoto protocol. The fund financed with the share of proceeds from clean development mechanism (CDM) project activities and other sources.

**Montreal Protocol**

The Montreal Protocol on Substance that Depletes the Ozone layer, is a Global agreement to protect the stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances. It was agreed on 26th August 1987, and entered into force in 1989.

It has gone through nine revisions, in 1990 (London), 1991(Nairobi), 1992(Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), 1998 (Australia), 1999 (Beijing) and 2016 (Kigali). Montreal protocol has been innovative and successful and is the first treaty to achieve universal ratification by all countries in the world. The Montreal protocol's Scientific Assessment Panel estimates that it will even greater benefits worldwide. The latest amendment to the protocol was on October 15, 2016 in Kigali, Rwanda. The amendment seeks to phase down production and consumption of hydroflouro carbons (HFCs) worldwide. This amendment creates market certainly and opens international market to improved technology that are better for the environment.


**Environment law and policy in Kenya**

**Environmental Management and Coordination Act (1999)**

This act is the framework law on environmental management and conservation. It guides the country on all areas concerning the environment and all the institutions responsible for enforcement. The following institutions have been established through this principle act; National Environment Management Authority, Public Complaints Committee, National Environment Tribunal, National Environment Action Plan Committees and County Environment Committees. Section 9 (1) of EMCA mandates the National Environment Management Authority (NEMA) to exercise general supervision and coordination over all matters relating to the environment and to be the principle guide to the government of Kenya in the implementation of all policies relating to the environment. The authority has been in operation since 1st July 2002. NEMA is also responsible for ensuring Kenya's

compliance with Multilateral Environmental Agreements. The Act provides for environmental protection through; environmental impact assessment, environmental audit and monitoring and environmental restoration orders, conservation orders and easements. The latest amendment to the act was in 2015 to align to the constitution, 2010. The changes in the amendment include; functions of the cabinet secretary, national environmental complaints committee and access to information.

## Industrial standards

Industrial standards are a set of requirements to be followed by a member of that industry in relation to the standards functioning and carrying out of operations. In the environmental sector, the Environmental Management and Coordination Act is the principal instrument guiding professional practices. There are regulations that guide specific sectors in the environment. An example is the Air Quality Regulations (2014). The Air Quality Regulations (2014) specifies air quality limits, air quality management plan, emission standards, vehicular emission reduction measures, guidelines on air pollution monitoring parameters from stationary sources among others.

## Features of an environmental strategy

An environmental strategy is a set of initiatives that can be implemented to reduce the impacts and effects on the natural environment through products, processes and policies. An example is the National Climate Change Action Plan (NCCAP) 2018 – 2022. Features of an environmental strategy include:

## Introduction

The introduction gives a background of what has been there before and what the strategy seeks to change or achieve. In this section goals and objectives are clearly explained.

## Enabling policy and legal framework

In this section, international, regional and national policy and legal framework that supports and guide the strategy are clearly outlined and explained.

## Priority areas the strategy seeks to change

In this section, the actions to be carried out are spelled out. The institution for implementation of the action is clearly stated and their mandate made clear. The sectors to be involved in the activities are also found in this section of the strategy or plan.

## Delivering the strategy

In this section, all of the activities, resources and stakeholders needed for the delivery of the strategy are outlined and how they all come together and how they are connected. It also has information on technology, finance and resource mobilization, delivery and coordination mechanisms and institutional roles and responsibilities.

## Conclusion

A clear end to the strategy or action plan detailing the important content and expected outcomes in the period specified for achieving the plans. Environmental management system is a framework of process and practices that enable an organization reduce its environmental impact and increase efficiency by training personnel, monitoring and generating reports.

Basic elements of an EMS include the following:

- Reviewing the organizations environmental goals.
- Analyzing its environmental impacts and legal requirements.
- Setting environmental impacts and legal requirements.
- Establishing programs to meet these objectives and targets.
- Monitoring and measuring progress in achieving the objectives.
- Ensuring employees environmental awareness and competence.
- Reviewing programs of the EMS and making improvements.

**ISO 14001 Environmental Management Systems**

This standard now emphasizes life cycle analysis in the new 2015 version. It also encourages risk analysis along the supply chain. It allows more sustainable management of companies and is an important tool in controlling the impacts of the organization. Approaches in this family of standards include audits, communication, labeling and life cycle analysis as well as environmental challenges such as climate change. ISO 14001:2015 specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. It is intended to be used by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillars of sustainability. It helps an organization achieve its intended outcomes of its environmental management system, which provide value for the environment, the organization, government policy, and the intended outcomes is produced and returned back into the environment. Main types of pollutants include; noise pollution, light pollution, solid waste, air and water pollution.

**5.2    Industrial standard/environmental practices are described according to the different environmental concerns**

**Environmental Concerns**

Environmental concerns are harmful effects on the biosphere brought about by anthropogenic activities (human influence) or natural internal processes. These issues include global warming, climate change, waste disposal, water pollution and deforestation. They include:

**a)  Climate change**

The relationship between climate and weather is quite close. Climate is the averaging of atmospheric weather conditions over long periods over at least 30 years. Climate change refers to a change in the climate system that is caused by significant changes in the concentration of greenhouse gases due to human activities and which is addition to natural climate change that has been observed during a considerable period.

**Causes of climate change**

- Green-house gases: They are gases that absorb and emit radiant energy within the thermal infrared range. The main GHGs are carbon dioxide, methane, nitrous oxide, etc. they increase the temperature of the atmosphere therefore affecting climate over a period of time.
- Volcanic eruptions: Volcanic gases like sulphur dioxide can cause global cooling, while volcanic carbon dioxide, a green-house gas has the potential to promote global warming.
- Air pollution: Processes such as fossil fuel burning in industry, motor vehicles and buildings emit substances that cause local and regional pollution. They release greenhouse gases, mainly $CO_2$, methane and nitrous oxide, which are linked to global climate change.

**Factors that increase climate change**

- Urbanization.
- Industrialization.
- Technological development/advancement.
- Land use and land cover change.

**Effects of climate change**

- Flooding.
- Drought.
- Crop failure.
- Loss of bio-diversity.
- Human health.

**b) Global warming**

Refers to the observed/projected gradual increase in global surface temperature. It is one of the consequences of climate change. Energy from the sun reaches the earth in the form of ultraviolet (UV), visible and infrared (IR) radiation. Most of this thermal radiation is absorbed by the atmosphere, thereby warming it. Greenhouse gases cause the greenhouse effect. It is useful because trapping some energy keeps the temperatures on our planet mild and suitable for living things. However, too much CHG can cause the temperature to increase out of control.

**Effects of global warming**

- Sea level rise: The Polar Regions are particularly vulnerable to rising temperatures. This rise in temperature is causing the ice sheet to melt. The increase in sea levels affects people and infrastructure along the coast, wildlife and plants.
- Shrinking ice sheets: Greenland and Antarctic ice sheets have decreased in mass. This affects the wildlife such as polar bears and whales that breed near the ice sheets. The glaciers act as a cooling system for the earth and when they melt this is greatly compromised.
- Decrease in biodiversity: As land and sea undergo rapid change, the living organisms that inhabit them are affected and their population decreases. Plants and

animals survive at optimum conditions and when these conditions are compromised by increase in temperature, plants and animals are more susceptible to diseases.

- Severe weather: Higher temperatures are worsening weather events such as storms, floods, heat waves and droughts. A warmer climate creates an atmosphere that can collect, retain and drop more water, changing weather patterns in such a way that wet areas become wetter and dry areas drier.
- Death: Intense weather events, increase in diseases has all contributed to increase in death rates.

### c) Pollution

This is the addition of a substance either liquid, solid or gas or any form of energy, such as heat, light sound at a higher rate than it can be recycled, decomposed, diluted or stored and affects normal environmental processes. Types of pollution includes:

- Solid waste. Solid waste is any discarded material that is abandoned by being disposed of, burned, recycled and can be solid, liquid or semi-solid form. Examples of solid waste include; domestic waste, waste tyres, construction and demolition waste, asbestos, industrial waste, biomedical waste, E-waste, pesticide waste, used oil and sludge and sewage waste.
- Noise pollution. This is the transmission of high intensity sound that causes discomfort to living beings. The intensity is measured in decibels. Types include industrial noise, neighborhood noise etc.
- Air pollution. Air pollution may result either from a quantitative change, by raising the concentration in air of some of its normal constituents (e.g. co2, nitrogen peroxide) or a qualitative change due to introduction of external compounds such as radio-nuclides and synthetic organic substances.
- Water pollution. This is the introduction of chemical, biological compounds into water ecosystems at a rate higher that it can be recycled, decomposed or diluted. This affects life in these ecosystems leading to diseases and in some cases deaths. One of the most common is the problem of solid waste finding its way into oceans through rivers and this has affected breeding of some aquatic life and suffocation of both plants and animals.

### d) Land use and land cover change

Humans have been modifying land to obtain food and other essentials for thousands of years but current rates are far greater than ever in history, and are driving unprecedented changes in ecosystems and environmental processes at local region and global scales. Land cover refers to the physical and biological cover over the surface of land, including water, vegetation, bare soil and/or artificial structures. Land use can be defined in terms of human activities such as agriculture, forestry and building construction that alter land surface processes including hydrology, biogeochemistry, and biodiversity.

**Effects of land use and land cover change**

- Biodiversity loss
- Climate change
- Pollution

## Conclusion

The unit covered environmental legislations/conventions and local ordinances as well as industrial/environmental practices according to different environmental aspects/impacts/concerns.

### Further Reading

ISO 14001, Environmental Management Systems
National Climate Change Action Plan

### 7.3.6.3 Self-Assessment



### Written Assessment

1. Which year was the Montreal protocol agreed?
    a) 1999
    b) 2001
    c) 1987
    d) 2000
2. Which of the following is not a greenhouse gas?
    a) Carbon dioxide
    b) Hydrogen
    c) Methane
    d) Nitrous oxide
3. Which of the following is the principal guiding Act in environmental matters in Kenya?
    a) Environmental Management and Coordination Act (EMCA)
    b) Water Act
    c) National Climate Change Action Plan (NCCAP)
    d) Air Quality Regulations (2014)
4. Which one of the following is an effect of climate change?
    a) Urbanization
    b) Flooding
    c) Seal level decrease
    d) Reduction in diseases
5. Which year did National Environment Management Authority become operational?
    a) 1999
    b) 1995
    c) 2001

d) 2002
6. Identify environmental legislations for environmental concerns
7. List five effects of global warming

**Practical Assessment**

Identify an environmental issue in your home area and come up with an environmental strategy to solve it.

.

## 7.3.6.4 Tools, Equipment, Supplies and Materials

- Standards operating and/or other workplace procedures manuals
- Specific job procedures manuals
- Environmental Management and Coordination Act 1999
- Machine/equipment manufacturers specifications and instructions
- Personal Protective Equipment (PPE)
- ISO standards
- Company Environmental Management Systems (EMS)
- Montreal protocol
- Kyoto protocol
- Air Quality Regulations (2014).
- National Climate Change Action Plan

## 7.3.6.5 References

Africa Forest Forum, (2019). *Basic science of climate change, a compendium for technical training in African Forestry*, p 120 – 123.

Africa Forest Forum, (2019). *International Dialogues,* Processes and Mechanisms on climate change, a compendium for professional and Technical Training in African Forestry, p 11.

Government of Kenya, (1999). *Environmental Management and Coordination Act, Government Press.*

## 7.3.7 Learning Outcome No. 6: Implement specific environmental programs
### 7.3.7.1 Learning Activities

| Learning Outcome No. 6: Implement specific environmental programs | |
|---|---|
| **Learning Activities** | **Special Instructions** |
| 6.1. Identify Programs and Activities according to organization's policy and guidelines.<br>6.2. Determine and perform individual roles/responsibilities based on the activities identified.<br>6.3. Resolve problems/constraints encountered in accordance with organization's policies and guidelines.<br>6.4. Consult stakeholders based on company guidelines. | Trainees to discuss in groups on environmental programs implementations. |

### 7.3.7.2 Information Sheet No7/LO6 Implement specific environmental programs

### Introduction

This learning outcome covers identification of programs/activities guidelines, determining individual roles/responsibilities based on the identified programs, resolving problems encountered and consulting stakeholders according to organization's policies and guidelines

### Definition of key terms

**Environmental programs:** These are a set of measures and interventions aimed at ensuring compliance with national, county and institutional environmental regulations and the overall goal of reducing negative environmental impacts.

**Stakeholders**: A stakeholder is either an individual, group or organization who has interest or concern in a certain area or who is impacted by the outcome of a project. They can be within or outside the organization that is sponsoring or funding the project.

**Roles**: These are the positions team members assume or the parts that they play in a particular operation or process.

**Responsibilities**: These are the specific tasks or duties that members are expected to complete as a function of their roles.

**Problem solving**: It is the art of defining a problem, determining the cause of the problem, identifying prioritizing, and selecting alternatives for a solution; and implementing solutions.

## 6.1 Programs/Activities are identified according to organization's policies and guidelines

### Environment Programs

These are a set of measures and interventions aimed at ensuring compliance with national, county and institutional environmental regulations and the overall goal of reducing negative environmental impacts. Environmental programs can be initiated at the national level by the government of Kenya, or international environmental organizations such as the United Nations Environment Programme (UNEP) or at the county level by county governments. The nature of a project and the shareholders involved or affected by a project depend on the type of project and what it seeks to achieve. One important step before initiating a project, is understanding the needs and expectations of the community affected by the project.

### Community Needs and Expectations

These are the things or services required by a certain group of people because they are essential for survival and for a life of dignity. Needs can be identified through assessing the strengths and resources available in the community to meet the needs of children, youth, women and families. The assessment also focuses on the capabilities of the community including its citizens, agencies and organizations. In the environment sector, sustainable development is key where needs of the current generation are met without compromising the needs of the future generations. Sustainable development has three pillars namely; social, economic and environmental. Problems that usually face communities include:

- Health
- Food security
- Lack of employment
- War and conflict
- Poverty

### Identification of programs

The following process can be used in identifying programs and activities;

- Developing a plan for assessing local needs and resources
- Understanding and describing the community and stakeholders
- Conducting stakeholder meetings and forums
- Collecting information about the problem(s)
- Analyzing community problems
- Identifying community assets and resources
- Developing baseline measures
- Collecting feedback from the community
- Developing and using criteria and processes to set priorities
- Producing a final report on program interventions

## Developing a plan for assessing local needs and resources

Developing a plan helps gain a deeper understanding of the community. A community assessment helps to uncover not only needs and resources, but also the underlying culture and social structure that will help you understand how to address the community's need and utilize its resources.

## Understanding and describing the community and stakeholders

This entails understanding physical aspects, infrastructure, patterns of settlement, commerce and industry, demographics, history, community, leaders, culture and existing institutions. This will give a general idea of the community's strengths and the challenges it faces.

## Conducting stakeholder meetings and forums

Stakeholder meetings and forums are a valuable resource in upholding open lines of communication with the public. Community participation can help identify and solve problems.

## Collecting information about the problem(s)

Quantitative information is crucial to building awareness and gathering support for community issues. Analysis of data provides concrete approach for assessing, planning and implementing community projects.

## Analyzing community problems

This is a way of thinking carefully about a problem or issue before acting on a solution. It first involves identifying reasons a problem exists, and then identifying possible solutions and a plan for improvement.

## Identifying community assets and resources

A community asset or resource is anything that can be used to improve the quality of community life. It can be a person, physical structure, community service or business.

## Developing baseline measures

One of the first activities needed to be done is figuring out how much the different factors and trends to be examined are happening in the first place.

To have an effective program, you have to know how much of an effect your efforts are having and this can be achieved the baseline measures.

## Collecting feedback from the community

It's important to collect input from members of the community when working on plans to address environmental problems and concerns. Actively soliciting the involvement of community members in the process as it begins and continuing to approach them for their input will help them become more interested and actively involved.

## Developing priorities

This is meant to bring to light issues of the community that need to be addressed. Criteria are standards for making a judgment and provide guidelines for making decisions. In this

step, the order of important things in relation to others is determined. A set of criteria priorities may change in people's concern or knowledge.

**Producing a final report on program interventions**

After all these steps have been followed and there's a clear understanding of what needs to be done to remedy the environmental issue, a final report is made. This report is important because it will guide the implementation of the program and will clearly state the issues experienced so as to improve in subsequent projects.

## 6.2    Individual roles/responsibilities are determined and performed based on the activities identified

**Setting of individual roles/responsibilities**

A lack of clarity regarding roles, responsibilities and expectations of the various agencies or individuals can impede success of teams. It is therefore important for team members to understand their roles and responsibilities and to share their expectations about the roles and responsibilities of others.

**Roles** – These are the positions team members assume or the parts that they play in a particular operation or process.

**Responsibilities** –These are the specific tasks or duties that members are expected to complete as a function of their roles. These activities or obligations are specific to a person who is accountable for a role on a project that has been assigned to them.

**Importance of assigning roles and responsibilities**

- **Efficiency**

Having a clear understanding of project roles allows the leader to develop a timeline. This gives a clear idea of which task and when the specific portion is expected to be completed. Assigning roles enables team members to get a better idea of which members have closely related tasks. Coordination in the workplace is easier and efficient.

- **Productivity**

When the responsibility is assigned closely to the strength of an individual, productivity is enhanced. It increases only when all members agree on the responsibilities assigned to them. If they agree and own their roles and responsibilities, they will easily understand how to achieve success.

- **Enthusiasm**

Issuing responsibilities to team members gives each person a sense of ownership. They become invested in the project's outcome, thereby increasing their efforts to create a quality product. If roles and responsibilities are not defined, team members lack morale, get disinterested and detached. Leaders should ensure work is evenly distributed to avoid conflict and creating stress for some workers.

## 6.3 Problems/constraints encountered are resolved in accordance with organization's policies and guidelines

### Resolving problems and issues

Problem solving is the act of defining a problem; determining the cause of the problem; identifying prioritizing; selecting alternatives for a solution and implementing solutions. Problem solving gives us an opportunity to improve the system and relationships.

### Steps in problem solving process

#### a) Define the problem

This involves differentiating facts from opinions, being specific with the underlying causes, identifying what standard or expectation has not been met and what can be improved, and determine in which process the problem lies.

#### b) Generate alternative solutions

In this stage there's room for creativity and ideas can be shared through brainstorming. All parties affected should be involved in generating alternatives. The alternatives should be consistent with the goals of everyone involved in the process.

#### c) Evaluate and select alternatives

There is a need to go deeper after generating alternatives so that realistic and appropriate options can be prioritized. The evaluation should be relative to a target standard and the selection should not be biased or favor a particular individual or a group.

#### d) Implementation and follow up

Implementation of the chosen alternatives is the final step. It is important to gather feedback from the stakeholders as implementation is taking place. This can be part of an ongoing monitoring and evaluation. Long-term results should be evaluated so as to learn on areas that can be improved in future initiatives.

## 6.4 Stakeholders are consulted based on company guidelines

### Stakeholder Consultation

A stakeholder is either an individual, group or organization who has interest or concern in a certain area or who is impacted by the outcome of a project. They can be within or outside the organization that sponsoring or funding the project. It's important to get output from members of the community when working on plans to address environmental problems and issues. This will help them become more interested and more actively involved.

Public participation is one of the fundamental principles of democracy. Democracy is premised on the idea that all citizens are equally entitled to have a say in decisions affecting their lives. Citizens' participation in government decision making and projects is fundamental to the functioning of a democratic system of governance as stated in chapter one of the constitution of Kenya, 2010. Stakeholder consultation or public participation is not only important in government initiatives but also in any project so that community members can be fully involved and own the project.

**Importance of stakeholder consultation**

- It increases the likelihood of stakeholders getting actively involved and staying involved throughout the implementation process.
- It increases understanding of the priorities of the community members and what problems and issues are the major concern. This information may not be known by professionals.
- It is a reliable, systematic and easy way to acquire information from the beneficiaries of a project.
- It provides a useful source of data, information and direction for donors, government and participants.
- It keeps the government's agenda and organization objectives to reflect the interests of the community by getting their perspective.

## 5 S of Good Housekeeping

This method contains five steps and is essential for being organized and working efficiently. Henry Ford originally developed what we know now as the 5s methodology in 1972. It was however popularized by Hiroyuki Hirano in Japanese in 1980. 5s of good housekeeping is a management technique that is aimed at optimizing the workplace and improving the efficiency of work performance. These five steps include:

### i. Seiri – Sort

First you should identify what is necessary and what is unnecessary. Items can be physical, such as broken equipment, or non-physical such as outdated files in a network and information that is no longer needed. Enlist a team to identify which items are needed and classify them by frequency of use. This should extend to software. Sorting out software needs will reduce costs, increase available storage space and make organization more effective.

### ii. Seiton - Straighten

After sorting resources and removing what is unwanted, you can put them in order. Resources should be clearly labelled and stored in an appropriate place where they can be found easily.

Physical resources used often should be kept close by, while items that are used less often stored further away. For computers, files should be saved appropriately, in distinguishable folders with appropriate names using dates where applicable.

### iii. Seiso – Shine

After the workplace is in order, it should be cleaned. This should be a regular event, making it easy to monitor the condition of machinery and tools. This will make it easy to do regular maintenance. Clean files regularly to ensure that only the latest versions are left, and ensure that the computer is regularly updated to the latest version.

### iv. Seiketsu – Standardize

Creating a standardized procedure to ensure the good work practices are maintained is the next step. Having a standard in place will serve as best practice and will remove uncertainty

amongst your team. It should be communicated in written form, and checklists be created to help team members perform all of the steps correctly.

### v. Shitsuke – Sustain

Finally, the new processes and standards need to be sustained. This can be attained by building the whole process into performance evaluation. The process can evolve over time, and so 5s should be modified appropriately, and changes communicated to team members. Assessment of adherence to standards and success of the process can be done through project review or meetings.

## Conclusion

This learning outcome covered implementation of specific environmental programs through identification of programs/activities, individual roles/responsibilities, resolving of problems/constraints and consulting stakeholders based on organization policies and guidelines.

### Further Reading

EMCA 1999
ISO Standards

### 7.3.7.3 Self-Assessment

**Written Assessment**

1. Which of the following is a problem faced by communities in Kenya?
   a) Budget surplus
   b) Wealth
   c) Conflict
   d) Democracy

2. Which of the following choices describes a stakeholder?
   a) Infrastructure
   b) History
   c) Donor agency
   d) culture

3. Which of the following is a step-in good housekeeping?
   a) Re-use
   b) Sustain
   c) Recycling
   d) Repurpose

4. At which level does the central government initiate projects?
   a) Regional level
   b) National level

c) County level

d) International level

5. Which of the following is the leading environmental organizations at United Nations?

    a) World Meteorological Organization

    b) United Nations Environment Program (UNEP)

    c) Intergovernmental Panel on Climate Change (IPCC)

    d) United Nations Framework Convention on Climate Change (UNFCC)

6. List down the 5s of good housekeeping

7. List 5 importance of stakeholder consultation.

8. Discuss three importance of assigning roles and responsibilities.

**Practical Assessment**

Observe the activities in the administration block of your learning institution and make observations if the activities conform to the 5s of good housekeeping. Identify a stakeholder meeting near your learning institution or in your home area and make observation on how the meeting is conducted and how the community members are engaged.

**Project**

Determine the weaknesses of stakeholder consultation in the Kenyan context.

**7.3.7.4 Tools, Equipment, Supplies and Materials**

- Standards operating and/or other workplace procedures manuals
- Specific job procedures manuals
- ISO standards
- Company Environmental Management Systems (EMS)

**7.3.7.5 References**

Africa Forest Forum (2019), *international dialogues, processes and mechanisms to climate change:* A compendium for professional and technical training in African forestry, Technical working paper pg. -99

*Environmental Management Systems, ISO Central secretariat*

Government of Kenya (2017), *the National Assembly,* public participation in the legislative process, Government Press.

*International Organization for Standardization,* (2017) ISO 14001

**7.3.8 Learning Outcome No. 7: Monitor activities on environmental protection/programs**

**7.3.8.1 Learning Activities**

| Learning Outcome No. 7: Monitor activities on environmental protection/programs | |
|---|---|
| **Learning Activities** | **Special Instructions** |
| 7.1. Monitor and evaluate activities periodically according to the objectives of the environmental program.<br>7.2. Gather and consider feedback from stakeholders in proposing enhancements to the program based on consultations.<br>7.3. Analyze gathered data based on evaluation requirements<br>7.4. Submit recommendation based on the findings.<br>7.5. Set and establish management support systems to sustain and enhance the program.<br>7.6. Monitor and report environmental incidents to concerned/proper authorities. | Personal protective equipment should be used at all times. Trainees to gather and analyze data in groups. |

**7.3.8.2 Information Sheet No7/LO7**

**Introduction**

This learning outcome covers monitoring and evaluating activities, gathering and considering feedback from stakeholders based on consultations, analyzing it based on evaluation requirements and submitting recommendations based on findings. The unit also deals with establishing management support systems as well as monitoring and reporting environmental incidents to concerned authorities. This learning outcome will provide essential skills and knowledge for monitoring and evaluating activities, gathering and considering feedback from stakeholders based on consultations, analyzing it based on evaluation requirements and submitting recommendations based on findings.

**Definition of key terms**

**Environmental protection:** It is any practice to maintain or restore the quality of natural environment by individuals, organizations and government based on policies and procedures.

**Monitoring:** This is the ongoing assessment of project progress towards achieving set targets and goals.

**Evaluation Periodic:** It is analysis of the efficiency, impacts and significance of either a project's completed actions (or ongoing activities).

**Management support systems:** They are used to provide input to the implementation of ongoing activities, to inform decision making processes.

**Stakeholders:** These are people who are directly or indirectly affected by the development of a project/ program.

| Content/procedures/methods/illustrations |
|---|

## 7.1    Activities are periodically monitored and evaluated according to the objectives of the environmental program

### Monitoring and Evaluation

Monitoring and evaluation involves collection and analysis of data of a program while it is ongoing(monitoring), and periodic assessment of program that might be conducted internally or by external evaluators (evaluation).monitoring ensures figuring out new strategies and actions needed to be taken to ensure progress towards the most important results.it also involves watching the progress of a program against time, resources and performance schedulers while the program is ongoing so as to identify the lagging areas requiring timely attention and action. Evaluation helps to understand the worth, quality, significance, amount, degree or condition of any intervention desired to tackle a social problem. Monitoring and evaluation are therefore important to assess program results, improve project management and planning to understand different stakeholder's perspective and ensure accountability. Hence it is important first to determine the programs that need to be assessed, over what time period and whether it is an ongoing activity which requires monitoring or a completed activity that requires evaluation.

## 7.2 Feedback from stakeholders are gathered and considered in proposing enhancements to program based on consultations

### Stakeholders Involvement

To ensure that monitoring and evaluation is relevant and efficient to the stakeholders, it is essential that their information needs are considered. Key internal and external stakeholders need to be identified. There should be careful decisions on how to involve them in the design, implementation, analysis and/or communication of findings. Various stakeholders include public/communities, private/public organizations, the government, donor agencies among others. These are individuals who will directly or indirectly be affected by the program. Clarity on aims, objectives, activities and pathways to change key issues and questions need to be identified from both internal and external sources. Some of these issues include; needed resources (human, financial, technical), management (roles and responsibilities), clarity about aims and goals, cost effectiveness and to identify; relevance/acceptability of the project to the community, the effectiveness of the project; i.e. Are you achieving for your objectives? The impact of the program on people's lives and to the contributions made to the outcomes and impacts.

In order to assess progress, the aims, objectives and pathways to change need to be clarified what you are trying to achieve and how. The aims are the final impacts of people's lives or the environment, that you wish to achieve. The desired outcomes are the objectives which are the changes needed to be made to achieve the aims. The pathway to change desires how the project activities will contribute to the desired outcomes (objectives); which will in turn contribute to final impacts (aims).

### 7.3 Data gathered are analyzed based on evaluation requirements

The information to be collected may include:

- Quantitative data expressed in numerical terms (numbers, ratios). This information will allow answering of what, how many, questions.
- Qualitative data is expressed through descriptive prose and can address questions about 'why' and 'how' as well as perspectives, attitude and beliefs.

Information is collected through indicators need to be SMART (specific, measurable, achievable, relevant and time-bound). Qualitative information is analyzed by identifying categories, themes and data, interpreting findings in relation to research questions and watching out for the unintended results and data that does not fit the expectations. Quantitative data is analyzed by calculating simple totals, averages, percentages and statistical tests. Effective monitoring generates a solid data base for evaluations. Data, reports, analysis and decisions based on monitoring evidence should be retained with a view to making them easily accessible to evaluations.

### 7.4 Recommendations are submitted based on the findings

Recommendations on how the project should be effectively implemented should be recorded and documented for submission. These recommendations are based on the findings of the analyzed data. The following issues are often included in the recommendations;

- Operation mechanics and responsibilities; proper delegation of responsibilities to permit smooth operations and holding liaison meetings periodically
- Identifying and meeting staff and training needs
- Initiation of extension activities with regular resources
- Development of a work schedule to progress logistics and to streamline program

### 7.5 Management support systems are set/established to sustain and enhance the program

Management support systems are established to sustain and enhance the programs. Environmental management system is a powerful sustainable tool developed as part of an organizations strategy to implement environmental policies and address governmental regulations. The purpose of management system is to specify general requirements and guidelines that, when followed, should provide reasonable assurance that the outputs from the system will have minimal negative environmental impact and improved environmental performance. Management support system processes include document control, record and internal auditing. These are beneficial for ensuring a holistic approach to environmental impacts and focusing on only critical aspects and processes.

## 7.6 Environmental incidents are monitored and reported to concerned/proper authorities

Environmental incidents are then monitored and reported to concerned authorities such as National Environment Management Authority which is responsible for carrying out environmental and rationally utilization of environmental resources and enhance environmental protection. These concerned authorities will ensure follow-up.

### Conclusion

The learning outcome dealt with monitoring activities on environmental protection/programs by periodic monitoring of activities/programs, considering stakeholders' feedback, submitting recommendations based on findings, setting management support systems as well as monitoring and recording environmental incidents. Upon completion of this learning outcome, the trainee should be able to monitor activities on environmental protection /programs, evaluate environmental incidents and set management support systems.

### Further Reading

Environment regulations on monitoring and evolutions.
ISO Standards

### 7.3.8.3 Self-Assessment

**Written Assessment**

1. Which of the following is not considered monitoring?
    a) Counting the number of people trained
    b) Tracking the number of brochures disseminated
    c) Attributing changes in health outcomes to an intervention
    d) Collecting monthly data on clients served in a clinic
2. At what stage of a program should monitoring take place?
    a) At the beginning of the program
    b) At the midpoint of the program
    c) At the end of the program
    d) Throughout the life of the program
3. A good monitoring system helps answer which of the following questions?
    a) Is the project progress according to schedule
    b) Have periodic benchmarks been met?
    c) Is the project under or over achieving output targets?
    d) All of the above
4. Which of the statements is true?
    a) A gender audit is not a type of assessment
    b) Monitoring is conducted while the program is finished
    c) Evaluation is conducted while the program is ongoing
5. Define the terms
    a) Monitoring

b) Evaluation
6. What is the significance of monitoring and evaluation on a program?
7. State the importance of stakeholder involvement in monitoring and evaluation.
8. How is data analyzed in monitoring and evaluation?
9. State the relevance of authorities such as NEMA in environmental protection in regard to monitoring and evaluation.

**Oral Assessment**

Distinguish between monitoring and evaluation

**Practical Assessment**

NEMA is undertaking a clean-up on the Nairobi River. Develop a monitoring and evaluation plan for the project.

### 7.3.8.4 Tools, Equipment, Supplies and Materials
- Standards operating and/or other workplace procedures manuals
- Specific job procedures manuals
- Environmental Management and Coordination Act 1999
- Machine/equipment manufacturers specifications and instructions
- Personal Protective Equipment (PPE)
- ISO standards

### 7.3.8.5    References

Boyle, M, 1998. *Developing Policy Performance Indicators for Ontario Ministry of Natural Resources.* Universite' de Waterloo, Canada.

*http://www.fao.org/3/to165e/t0165e11.htm*

*http://www.geog.ox.ac.uk/research/technologies/projects/monitoringandevaluation*

Patton, M. H (1990). *Qualitative Evaluation and Research Methods.* Newbury Park, CA: SAGE Publication

Peoples-Shep, M.D, Rogers, M.M. & Finerty, E.J. (1990). *Monitoring Progress towards Achievement of Objectives.* Chapel Hill, NC: University of North Carolina at Chapel Hill

*United Nations Development Programme Evaluation Office*-Handbook on Monitoring and Evaluating for results

### 7.3.9  Learning Outcome No. 8: Analyze resource use
### 7.3.9.1 Learning Activities

| Learning Outcome No. 8: Analyze resource use | |
| --- | --- |
| **Learning Activities** | **Special Instructions** |
| 8.1.   Identify all resource consuming processes.<br>8.2.   Determine quantity and nature of resource consumed.<br>8.3.   Analyze resource flow through different parts of the process.<br>8.4.   Submit recommendation based on the findings.<br>8.5.   Classify wastes for possible source of resources. | Group discussion on resource consumption and flow |

### 7.3.9.2 Information Sheet No7/LO8 Analyze resource use

**Introduction**

This learning outcome covers identification of resource consuming processes, determination of quality and nature of resource flow through different parts of the process and classification of wastes for possible source of resources.

**Definition of key terms**

**Resource use:** This is the consumption or utilization of raw materials such as water, soil, air, biodiversity and land to satisfy our needs such as recreation, energy, food and manufacture products.

**Resource:** A resource is a source of supply mostly comprised of a part of earth that is valued by humans and from which a benefit is derived.

**Biotic resources:** These are resources that come from living things or organic materials. Examples, include plants and animals.

**Abiotic resources:** These are resources that come from non-living and inorganic materials, examples include air, water and sunlight.

**Environmental Management System (EMS):** This is a framework of processes and practices that enable an organization reduce its environmental impacts and increase efficiency by training personnel, monitoring and generating inputs.

## 1.1    All resource consuming processes are identified

A resource is a source or supply mostly comprised of a part of earth that is valued by humans and from which a benefit is derived. All-natural resources fall under two main categories namely; renewable and non-renewable resources.

### Renewable resources

These are resources that are available consistently and can be reasonably replaced or recovered. Examples include; water, air and vegetation. Replacing these resources is possible but the time taken to replenish them might be very long. Sustainable use of these resources is encouraged because they might be depleted and degraded beyond levels that replacing them will be difficult. The renewable raw materials that come from living things namely animals and trees are termed as biotic renewable resources while those that come from non-living things such as sun, water and wind are termed as abiotic renewable resources.

### Non-renewable resources

These are resources that cannot simply substituted or recovered once they have been consumed or utilized. Examples of such natural resources include fossil fuels and minerals. These resources exist in food quantities and their regeneration rate is lower than their exploitation rate. The non-renewable materials that come from living things such as fossil fuels are known as biotic non-renewable resources while those that come from non-living things such as rocks and soil are known as abiotic non-renewable resources.

### Resources consumption

Resource use is the consumption or utilization of raw materials such as soil, air, biodiversity and land to satisfy our needs such as recreation, energy, food and manufacture of products.

## 8.2    Quantity and nature of resource consumed is determined

### Standards that determine resource use

**Environmental Management System**: This is a framework of processes and practices that enable an organization reduce its environmental impacts and increase efficiency by training personnel, monitoring and generating inputs. Basic components of an EMS include the following;

- Reviewing the organization's environmental goals
- Analyzing its environmental impacts and legal requirements
- Setting environmental impacts and legal requirements
- Establishing programs to meet these objectives and targets
- Monitoring and measuring progress in achieving the objectives
- Ensuring employees' environmental awareness and competence
- Reviewing progress of the EMS and making improvements

## ISO 14001 - Environmental Management Systems

This standard now emphasizes life cycle analysis in the new 2015 version. It also encourages risk analysis along the supply chain. It allows more sustainable management of companies and is an important tool in controlling the impacts of the organizations. Approaches in this family of standards include, audits, communication, labelling and life cycle analysis as well as environmental challenges such as climate change. ISO 14001:2015 specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. It is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability. It helps an organization achieve the intended outcomes at its environmental management system, which provide value for the environment, the organization itself and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system include;

- Enhancement of environmental performance
- Fulfilment of compliance obligations
- Achievement of environmental objectives

Other standards that are critical to resource use include ISO 20400 and ISO 50001

## ISO 20400 – Sustainable Environment

Although not a requirement standard, this standard establishes very useful guidelines for the definition of purchasing management procedures that stimulate the circular economy. It is precisely in the purchase s management that the decision-making process is concentered on which way to going the acquisition of natural resources and raw materials with less impact in the life cycle. By implementing ISO 20400, an organization will contribute positively to society and the economy through making sustainable purchasing decisions and encouraging suppliers and other stakeholders to do the same. The standard will help address the following issues;

- Reduce impact on the environment
- Tackle human rights
- Manage supplier relations
- Harmonize long-term global costs
- Improving purchasing performance of an organization
- Giving an organization a competitive edge

## Factors to consider before using ISO 20400

- Examining buying culture
- Know your supply chain
- Thin strategically
- Get buy-in from top management

**ISO 50001 – Energy Management Systems**

Defines management requirements for one of the most significant environmental aspects today; energy consumption. These requirements support the management of companies in the definition of strategies that allow not only to reduce the impact of energy bills, but also to reduce consumption (acquisition of new and more efficient technologies? or to choose the origin of energy (renewable or non-renewable). It is based on the management system model of continual improvement. This makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management. It provides a framework of requirements for organizations to;

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet the policy
- Use data to better understand and make decisions about energy use
- Measure the results
- Review how well the policy works
- Continually improve energy management

## 8.3 Resource flow is analyzed through different parts of the process
**Circular economy**

The components of the circular economy involve re-use, sharing, repair, refurbishment and recycling to create a closed system that minimizes waste production and the use of resource input. This system replaces the end-of-life concept therefore eliminating use of toxic chemicals, waste that impair reuse and return to the biosphere. The circular economy is an efficient and environmentally friendly system for resource consumption. It achieves this by designing out waste and pollution, keeping products and materials in use are regenerating natural systems. This system aims to keep products, equipment and infrastructure in use, thus improving productivity of resources. All the waste that has been produced should become an input or byproduct or recovered resource for another industrial process for example, rice husks can be reused in the wine making process. When the rice husks are added to a basket press for making wine the piece the skin of grapes to release more tannins and provide a path for pressed juice to flow. This is an example of using a waste product from one process and reusing it in another process. The circular economy is supported by the ISO standards namely ISO 20400 sustainable procurement, ISO 14001 Environmental Management Systems and ISO 50001 Energy Management Systems.
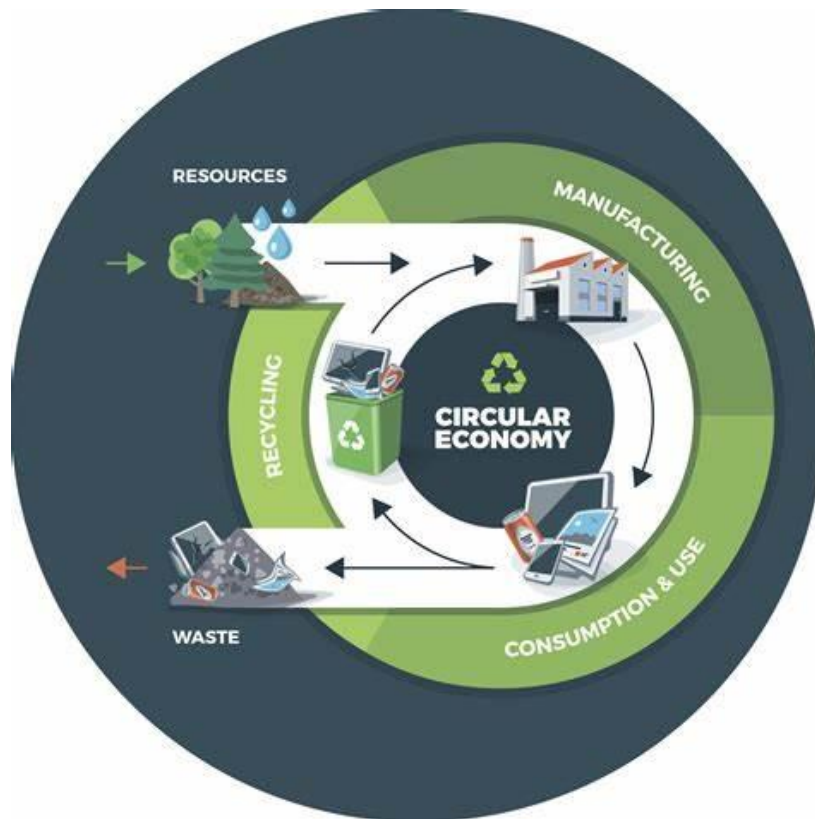
Figure 30. Circular economy cycle. Source: www.ies.be

**Importance of circular economy**

- It reduces waste production and prevent waste from entering the natural environment
- It saves money for companies that use by-products to manufacture other products
- It reduces the emission of greenhouse gases which are the major causes of global warming and climate change
- It reduces the pressure on the environment and its resources.
- It improves the supply of raw materials by reducing and eliminating wastage.
- The system stimulates innovation on resource use and new manufacturing processes to reuse and repurpose waste and by-products
- The new manufacturing processes provide employment and creates more jobs
- Consumers are provided with more durable and innovative products that will increase the quality of life and save money in the long-term

**Linear economy**

The linear economy relies on using finite resources such as metals, minerals and fossil fuels. It also relies on water and land which when depleted or degraded will be hard to restore. In this system resources are extracted, consumed and eventually waste is produced and returned back into the environment. This waste and pollution are destroying the living systems that are dependent on for resources and healthy living for plants and animals. When products are discarded, resources, energy, labor and knowledge that was invested to

produce the products is wasted. This is why the linear economy has to be replaced by the circular economy. The linear system involves endless resource extraction, cannot satisfy human needs sustainably and involves endless waste dumping.

**Disadvantages of the linear economy**
- Production of goods is at the expense of the productivity of our ecosystems. Excessive pressure on the environment compromises the provision of essential ecosystem services such as water, air and soil
- Rate of exploitation is higher than the rate of replenishing of the resources therefore some resources will be exhausted. This will compromise the survival of the future generations
- Health and wellbeing of animals and plants is affected due to introduction of waste in the natural ecosystems. This affects food security and quality of life.
- Fluctuating of raw material prices make investment expensive and may lead to job losses. This system is not flexible in sourcing of raw material and if the supply of one raw material is compromised the whole system is affected.
- Waste produced has increased to levels that are affecting various ecosystems and the cost of rehabilitation is beyond what most countries can afford or are willing to use for restoration and rehabilitation efforts.

## 8.4 Wastes are classified for possible source of resources
**Recycling**
Recycling is the process of converting waste materials into new, reusable objects or products. Waste recycling involves the collection of waste materials and the separation and clean-up of those materials. Recycling waste means that fewer new products and consumables need to be produced, saving raw materials and reducing energy consumption. Waste can be in different forms, either solid, liquid or gas. Examples of solid waste include; domestic waste, waste tires, construction and demolition waste, biomedical waste, E-waste and sewage sludge. Recycling prevents wastage of potentially useful materials, reduces the consumption of fresh raw materials and energy usage in addition to reducing pollution.

**Methods used in recycling and treating waste**
**Thermal treatment of waste**
Thermal treatment is the combustion of waste at specific temperature with or with no air-supply as part of the process and includes waste incineration, gasification and pyrolysis. This is an environmentally sound technology that reduces the volume of waste and inerts any hazardous components. Energy can be recovered as an end product.

a) **Waste incineration**

Waste incineration is controlled burning of solids, liquids and gaseous waste. The technology is applicable in the management of both hazardous waste streams as well as municipal solid waste. Facilities that undertake incineration should meet the requirements

in the Third Schedule of the Environmental Management Coordination (waste management) Regulations of 2006

### b) Gasification

This is a process of reacting waste at high temperatures greater than ($>700^0$C) without combustion, with a controlled amount of oxygen and or/stream to generate useful products such as electricity, chemicals, fertilizers and natural gas. This could be an important option in landfills. Pyrolysis is a form of treatment that chemically decomposes organic materials by heat in the absence of oxygen. Pyrolysis typically occurs under pressure and at operating temperatures above 400-500 degrees Celsius. It can either be anaerobic or aerobic.

### c) Water treatment

Drinking water sources are subject to contamination and require appropriate treatment. The following are steps to water treatment;

 i. **Cocigulating and flocculation:** This step involves adding chemicals with a positive charge. The positive charge neutralizes the negative charge of dirt and other dissolved particles.

 ii. **Sedimentation:** Solid particles settle at the bottom, due to weight. This settling process is known as sedimentation.

 iii. **Filtration:** Once the solid particles have settled at the bottom of the water supply, clear water is allowed to pass through filters in order to dissolve particles in the water.

 iv. **Disinfection:** After water has been filtered, a disinfectant, for example chlorine can be added to kill remaining bacteria and parasites.

## Recycling of plastics

Plastic waste is recycled through pyrolysis and hydrolysis. There are three types of plastic recycling namely; primary recycling, secondary recycling and tertiary recycling.

 i. **Primary recycling:** This is a physical method. It involves processing of a waste/scrap into a product with characteristics similar to those of original product. Remolding is an example of this process

 ii. **Secondary recycling:** It involves processing of waste/scrap plastics into materials that have characteristics different from those of original plastics product. This process needs segregation of plastic waste so as to be successful.

 iii. **Tertiary recycling:** This is a chemical method of recycling plastic waste. Tertiary recycling involves the production of basic chemicals and fuels from plastics waste using pyrolysis as a process. Pyrolysis is a form of treatment that chemically decomposes organic materials by heat in the absence of oxygen. Pyrolysis typically occurs under pressure and operating temperatures above 400-500 degrees Celsius. In anaerobic treatment, waste is broken down in the process of micro-organisms and in the absence of air while in the aerobic treatment, biological degradation of organic waste take place in the presence of oxygen.

**Conclusion**

This learning outcome covers, natural resources, types of natural resources, resource consuming processes, quality and nature of resources used, resource flow through different parts of the process and classification of wastes.

**Further Reading**

ISO Standards

**1.3.9.3 Self-Assessment**
**Written Assessment**
1.  Which of the following ISO standard defines Energy Management Systems?
    a)  ISO 20400
    b)  ISO 14001
    c)  ISO 50001
    d)  ISO 17743
2.  Which of the following is NOT a physical method of recycling plastic waste?
    a)  Primary recycling
    b)  Tertiary recycling
    c)  Secondary recycling
    d)  Remodeling
3.  Which of the following is NOT a renewable resource?
    a)  Water
    b)  Fossil fuels
    c)  Air
    d)  Vegetation
4.  Which of the following is the ISO standard for Environmental Management System?
    a)  ISO 20400
    b)  ISO 14001
    c)  ISO 50001ISO 17743
5.  Which of the following is a non-renewable resource?
    a)  Minerals
    b)  Sunlight
    c)  Air
    d)  Water
6.  State four benefits of the ISO 14001 (Environmental Management Systems) to an organization?
7.  Highlight five importance of circular economy?
8.  Give four advantages of linear economy?

**Practical Assessment**

1. Observe the water purification process and write a report on the observations made.
2. In groups, come up with an idea of a company and explain how you would use the ISO 14001 (Environmental Management Systems) to comply with environmental statutory obligations.

**Project**

Water purification and treatment methods, latest technology and challenges in Kenya

### 7.3.9.4 Tools, Equipment, Supplies and Materials

- ISO 14001
- ISO 50001
- ISO 20400
- The National Solid Waste Management Strategy

### 7.3.9.5 References

Africa Forest Forum, (2019), *International dialogues, processes and mechanisms to climate change:* A compendium for professional and technical training in African Forestry, Technical Working Paper, p.94

Government of Kenya (2015), *the National Solid Waste Management Strategy,* Government Press

International Organization for Standardization, (2017), ISO 20400, *Sustainable Procurement,* ISO central secretariat

International Organization for Standardization, (2015), ISO 14001, *Environmental Management Systems,* ISO central secretariat

International Organization for Standardization, (2015), ISO 50001, *Energy Management Systems,* ISO central secretariat

**7.3.10 Learning Outcome No. 9: Develop resource conservation plans**
**7.3.10.1          Learning Activities**

| Learning Outcome No. 9: Develop resource conservation plans | |
|---|---|
| **Learning Activities** | **Special Instructions** |
|  | |
| 9.1. Determine efficiency use/conversion of resources following industry protocol<br>9.2. Determine causes of low efficiency of use of resources based on industry protocol<br>9.3. Develop plans for increasing the efficiency of resource use based on findings | Group discussion on resource efficiency |

**7.3.10.2          Information Sheet No7/LO9: Develop resource conservation plans**

**Introduction**

This learning outcome offers the knowledge and skills for determining efficient/of use/conversion of resources and developing plans for increasing the efficiency of resources use based on findings.

**Definition of key terms**

**Resource conservation:** It is the protection, maintenance and restoration of natural resources such as water, soil, minerals, forests and wildlife.

**Industry protocol:** It is the official system of rules or procedures governing affairs of an industry.

**Content/procedures/methods/illustrations**

**9.1     Efficiency of use/conversion of resources is determined following industry protocol**

Resource conversation includes protection of natural resources because they are limited. These resources should therefore be maintained and processed. Various resources are conserved in the following ways;

**Soil**

- Reforestation: Planting trees helps in reducing soil erosion
- Terracing: Terraces control fast flow of water which takes away soil as it flows, usually in hilly areas
- Soil fertility: Maintenance of soil fertility is obtained by adding manure or fertilizers or crop rotation

**Water**

- Rain water harvesting: Process of storing rain water
- Treatment of industrial wastes before being released into water bodies
- Dams and reservoirs that store water & supply when needed. Also help in producing energy
- Glowing flora: Helps prevent flow of water & makes it sink into the soil increasing groundwater levels.

**Energy sources such as coal, biomass, and natural gas**

- Promoting green technology like solar panels & other renewable sources of energy
- Minimize the over-exploitation of non-renewable resources
- Creating awareness about the need for conservation

**Biodiversity**

- In-situ conservation: Protecting plants and animals within their natural habitats e.g. national parks, wildlife sanctuaries
- Ex-situ conservation: Protecting outside e.g. seed banks, zoo, botanical gardens

## 9.2 Causes of low efficiency of use of resources are determined based on industry protocol

**Causes of resource depletion**

Resources depletion is the consumption of a resource faster than it can be replenished. Natural resources are commonly divided between renewable resources and non-renewable resources. Major causes of resource depletion are;

### a) Population growth

With the increase in population, natural resources are stretched out to meet the people's needs.

Man, overexploits natural resources to meet his needs thus ultimately leading to the scarcity of these resources in the near future.

### b) Over consumption

For example, the number of motor vehicles is increasing day by day which needs a huge amount of petroleum.

Overconsumption reduces the earth's carrying capacity. Excessive unsustainable consumption will exceed the long-term carrying capacity of its environment and subsequent resource depletion, environmental degradation and reduced ecosystem health.

### c) Deforestation

Due to increased population there is high consumption of products obtained from trees. This hence leads to the cutting down of trees for provision such products as firewood. Deforestation results in decline in biodiversity causing extinction of many species. The water cycle will also be affected by cutting down of trees and there will be increased soil erosion.

## d) Natural calamities

These include flood and drought that adversely affect biodiversity. Earthquakes and volcanic eruptions can alter the earth's topography

## e) Pollution

The effect which pollution has on natural resources is substantial. Water bodies are the most affected by pollution from toxic discharge from industries

## f) Climate change

With increasing global warming, ecosystems and species are likely to be affected by the extreme weather conditions. Some regions will experience more extreme heat while others slightly cool. Flooding, drought and intense heat could result

## 9.3 Plans for increasing the efficiency of resource use are developed based on findings

Having a clear plan or roadmap, helps focus limited resources on priority activities. That is, the ones most likely to bring about the desired change. With the growing population and increased consumption of natural resources. It is critical to ensure conservation of the scarce resources. This is by promoting use of natural resources sparingly in order to meet the needs of the current generation without compromising the ability of the future generation to meet their own needs.

**Conservation planning** is a natural resource problem-solving and management process. The process integrates ecological, economic and social considerations to meet people's needs. This approach, improves natural resource management, minimizes conflict and address problems and opportunities. A conservation plan entails two things; first, it is a written record of management decisions and natural resources. Second, it contains the recommended conservation practices chosen to implement and maintain natural resources. The purpose of conservation planning is the sound use of and management of soil, water, air, plant and animal resources to prevent their degradation and ensure their sustained use and productivity while also considering related human social and economic needs.

**Benefits of developing a resource conservation plan include;**

- Protection of soil productivity
- Protection of water quality
- Improvement of soil fertility through crop rotation
- Management of soil moisture
- Promoting green technology such as renewable sources of energy
- Enhances open space and wildlife habitat

**Steps required in development of an efficient resource conservation plan include;**

- Preparing a conservation plan
- Providing technical assistance
- Providing information about possible financial assistance
- Monitoring progress and providing documentation
- Evaluating monitoring and providing re-planning technical assistance if necessary

The above requirements are based on industry protocol. Therefore, the efficiency use/conversion of resources and causes of low efficiency of use of resources are determined

based on industry protocol. Plans to increase efficiency of resources can be developed based on the findings of monitoring and evaluation carried out. Recommendations provided from the monitoring and evaluation process, will help in providing better conservation and management practices on the natural resources

**Conclusion**

Upon completion of this learning outcome, the trainee should be able to determine the efficiency of conservation of resources and develop plans for increasing the efficiency of resources.

**Further Reading**

Conservation practices carried out in Kenya
Kenyan policies governing resource conservation

### 7.3.10.3    Self-Assessment
**Written Assessment**
1. The three R's to save the environment are;
    a) Reserve, Reduce, Recycle
    b) Reuse, Reserve, Reduce
    c) Reserve, Reuse, Reduce
    d) Reduce, Recycle, Reuse
2. The concept of sustainable development encourages
    a) Form of growth that meets basic needs
    b) Preservation of the resources for the need of future generation
    c) A change in all aspects of life
    d) Growth to meet current needs, preservation for the needs of future and change in all aspects of life
3. The management of natural resources should take into;
    a) A long-term perspective
    b) Environmental pollution
    c) Their equitable distribution
    d) a, b, c, and safe disposal of water
4. What is the significance of resource conservation?
5. State way to improve efficiency use of;
    a) Soil
    b) Water
    c) Wildlife

**Oral Assessment**
1. Define resource conservation plan
2. What are some of the human activities that affect resource conservation?

**Practical Assessment**

Discuss in groups how you would develop a resource conservation plan for a National Park near you

### 7.3.10.4 Tools, Equipment, Supplies and Materials

- Standards operating and/or other workplace procedures manuals
- Specific job procedures manuals
- Environmental Management and Coordination Act 1999
- Machine/equipment manufacturers specifications and instructions
- Personal Protective Equipment (PPE)
- ISO standards
- Company Environmental Management Systems (EMS)

### 7.3.10.5 References

Constanza, R, ided. 1991. *The Science and Management of Sustainability*. New York: Columbia University Press

Curry-Lindah L, K. *Ecological Research as a Basis for Management*

*http://www.marionswcd.net/conservation-planning-practices/conservation-planning*

Khan, F. I, T. Husain & R. Hejazi, 2004. *An overview and analysis on site remediation technologies.* Journal of environmental management 71:95-112