

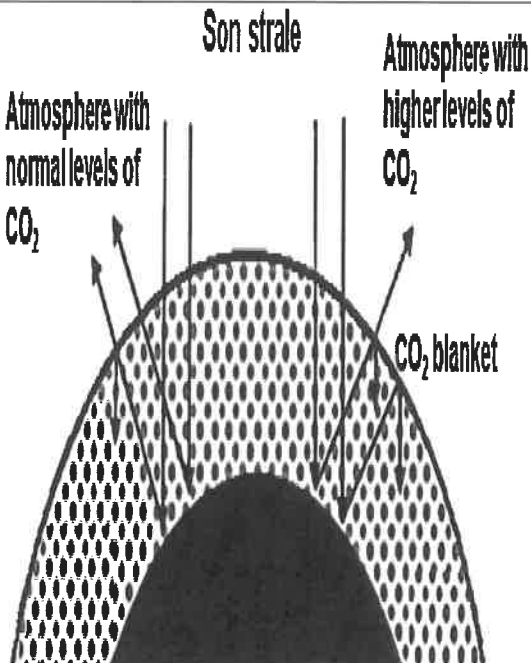
HUMAN IMPACT ON THE ENVIRONMENT

- Human beings are constantly changing their environment to meet their demands and to satisfy their needs
- These changes have enormous impact on the environment

GREENHOUSE EFFECT

- Life on earth is dependent on radiant energy from the sun
- The greenhouse effect is a **natural** effect created when radiant energy of the sun moves through the glass panels of a greenhouse and is trapped – keeping the heat inside





- Solar energy strikes the earth in short waves.
- Short waves make it easy for energy to pass through the atmosphere.
- Most of the energy strikes the earth and is reflected back as long waves
- Long waves don't pass through the atmosphere easily.
- Some of the long waves are reflected back to the earth.
- Greenhouse gases act as a natural 'insulating blanket' that traps heat energy and makes the earth warm and habitable
- Without greenhouse effect the earth would be too cold.

- Greenhouse gases in the atmosphere act like the glass panels of a greenhouse, preventing the loss of heat.
- Greenhouse gases are gas molecules in the earth's atmosphere that have three or more atoms
- EXAMPLES:
 - Water vapour
 - Carbon dioxide
 - Methane
 - Surface ozone
 - Nitrous oxide
- **Climate change** is the long term change in the earth's climate.

ENHANCED GREENHOUSE EFFECT

- Human activities are responsible for the excessive release of greenhouse gases which intensifies the greenhouse effect. This is known as **Enhanced greenhouse effect**.
- Since 1750s CO₂ levels increased.
- Forests are regarded as **carbon sinks**
- Trees absorb CO₂ for photosynthesis and store it in the form of carbohydrates.
- Deforestation causes an increase in CO₂ levels
- Higher levels of CO₂ in the atmosphere result in an enhanced greenhouse effect which in turn leads to a further increase in the earth's temperatures – **GLOBAL WARMING**

Actions that can reduce release of GH gases:

- Improve international cooperation and legislation.
- Introduce incentives
- Reduce use of fossil fuels
- Reduce deforestation
- Re-plant forests
- Encourage use of solar power and wind power

CARBON DIOXIDE EMISSIONS

- Carbon dioxide is the primary greenhouse gas released from human activities
- Fossil fuel – fuel formed from remains of living organisms.
- Fossil fuels are;
 - Coal
 - Petrol
 - Diesel

Sources of Carbon dioxide emission	Possible actions to reduce emissions
• Electricity - burning fossil fuels to generate electricity • Transport – burning petrol and diesel fuel • Industries – many industrial processes release carbon dioxide during of fossil fuel	• Save electricity • Introduce stricter measures against excessive CO₂ • Create awareness of excessive release of CO₂ • Introduce incentives

METHANE EMISSIONS

- Methane is the largest contributor to the enhanced greenhouse effect
- Methane traps more heat than even carbon dioxide

Sources of methane emissions	Possible actions to reduce emissions
• Industries – released during the production, processing, storage and distribution of natural gas • Agriculture – growth of rice plants, stored animal manure and animal faeces • Decomposition of organic waste in land-fill sites • Released during purification of sewage in sewage treatment plants	• Reduce or find alternatives for the use of fossil fuels • Reduce waste production by humans • Use methane as an alternative fuel or energy source

CARBON FOOTPRINT

- Carbon footprint – a measure of the amount of carbon dioxide released as a result of activities that cause greenhouse gas emissions.
- We all have a carbon footprint
- Depends on our use products and services as well as the waste we generate.
- Industries, organizations, country or continent have a carbon footprint.
- EXAMPLE:
 - C.F of a new Car
 - gases released in its manufactory
 - delivery to sales outlet
 - Fuel and maintenance in its life span
 - Final scrapping process

Possible actions to reduce carbon footprint:

- Buy energy saving equipment/appliances
- Use alternative sources of energy
- Walk, cycle or use public transport
- Reduce, re-use and recycle

GLOBAL WARMING

- Global warming is the increase in the earth's temperature as a result of an enhanced greenhouse effect

Effects of global warming

- **Melting of polar ice caps and glacier** – due to increase in atmospheric temperatures
- **Rising sea levels** – due to melting of polar ice caps and glaciers
- **Rise in sea surface temperatures** – leads to less absorption of CO₂
- **Droughts and frequent heat waves** – high temperatures increase rates of evaporation
- **Floods** – due to rise in sea levels and leads to destruction of vegetation
- **Tropical cyclones** – warmer water leads to more evaporation
- **Loss of biodiversity** – due habitat destruction
- **Global food and water shortages** – elevated temperatures reduce availability of water and crop productivity
- **Sea water becomes acidic** – increased levels of atmospheric CO₂ cause CO₂ to dissolve in sea water decreasing the pH of water
- **Spread of disease** – certain diseases spread easily in warmer weather e.g. Malaria

Possible actions to combat global warming

- Implement strategies to improve energy efficiency
- Develop technology to improve fuel economy
- Use alternative energy sources (solar power, wind power, Hydrogen, methane, biofuels, nuclear power)
- Planting of forests (afforestation) to decrease carbon dioxide levels

DESERTIFICATION

- The process through which semi-arid or arid land is transformed into desert.
- A drastic loss of vegetation cover occurs
- The quality of the soil decreases and becomes unsuitable for any form of agriculture
- The deterioration in the quality of soil is called Soil degradation

Causes of desertification

- **Changes in rainfall patterns** – a decrease in the total rainfall in arid and semi-arid areas increases the risk of desertification
- **High temperatures** – high temperatures and prolonged droughts lead to loss of vegetation cover
- **Overgrazing** – damages and destroys natural vegetation which exposes the soil to wind and water erosion
- **Over-cultivation** – same crop is planted on same piece of land depleting the soil nutrients
- **Poor irrigation** – leads to salt build up and soil erosion
- **Deforestation**

Effects of desertification

- **Loss of vegetation cover** – leads to soil erosion and increased flooding resulting in loss of top soil
- **Loss of biodiversity** – habitats change resulting in loss plant and animal species
- **Reduced productivity** – drought and poor soil quality limit food production
- **Poverty in local communities** – farmland disappears and job opportunities decrease

Possible actions to limit desertification

- Use alternatives to burning fossil fuels
- Use improved technology to provide efficient irrigation to crops in dry areas
- Reduced deforestation as forests trap and release water preventing desertification

DEFORESTATION

- Deforestation – the clearing of trees without the intent of replanting causing damage to the environment.
- Trees absorb CO₂ (photosynthesis).
- Trees also absorb atmospheric carbon.
- CO₂ is absorbed into their tissue.
- When the trees die, Carbon stays in the soil and goes into Carbon cycle.
- Deforestation accounts for 20% of global greenhouse gas emissions.
- Deforestation therefore increases CO₂ levels

POSSIBLE CAUSES:

- **Urbanization** – increase in the human population increases a demand for open space
- **Agriculture** – clearing of forests for crops and grazing
- **Wood for fuel** – trees used for fire wood or charcoal
- **Timber** – cut down trees to be used for building materials, furniture and paper products
- **Mineral mining** – forests cleared to make space for mining development
- **Traditional medicines** – increase demand for traditional medicines leads to destruction of trees
- **Increased frequency of forest fires**

Effects of deforestation

- **Soil erosion and degradation** – due to habitat destruction
- **Disruption of the water cycle** – less water is returned to the atmosphere due to deforestation since trees play an important role in water cycle via transpiration and evaporation of rain water
- **Global warming** – trees absorb large amounts of CO₂ therefore deforestation causes an increase in CO₂ in the atmosphere as less CO₂ is removed from the atmosphere. Also trees are carbon sinks and when they are burnt CO₂ is released to the atmosphere.
- **Floods** – trees absorb excess water and when removed there is an increase in water run off after heavy rainfall
- **Loss of biodiversity** – habitat destruction occurs as a result of deforestation

Possible solutions to reduce deforestation

- Recycle
- Create protected forest areas
- Combat illegal logging
- Plant trees to replace those cut down
- Select trees for culling rather than clear cutting
- Create awareness of the negative impact of deforestation

OZONE DEPLETION

- The ozone layer is a gas that is located around the earth in the stratosphere
- Ozone is a highly reactive gas consisting of three oxygen atoms
- The ozone layer absorbs 99% of the sun's harmful ultraviolet rays before they reach the earth

Causes of ozone depletion

- The ozone layer is destroyed by Ozone-depleting substances (ODSs)
- ODSs commonly used are Chlorofluorocarbons (CFCs) which are normally used in refrigerators, air conditioners and aerosol cans.

Effects of ozone depletion

- **Damage to human health** – leads to increase in skin cancer
- **Damage to marine life** – inhibits reproduction of phytoplankton
- **Damage to agriculture** – crops are vulnerable
- **Damage to materials** – plastics and other construction materials

Possible actions to limit ozone depletion

- Reduce use of products containing CFCs
- Stricter legislation to limit the release of ODSs

WATER AVAILABILITY

- Approximately 70% of the earth's surface is covered with water, of which approximately 97% is salt water and the remaining 3% is freshwater
- Of this 3%, less than 1% is available for human life
- Many freshwater resources are increasingly polluted by humans
- Water availability is influenced by:
 - Construction of dams
 - Destruction of wetlands
 - Poor farming practices
 - Droughts and floods
 - Exotic plantations and depletion of water table
 - Boreholes and effects on aquifers
 - Wastage
 - Cost of water

FACTORS	DESCRIPTION	POSSIBLE ACTIONS TO REDUCE EFFECT
Construction of dams	- Dams can cause loss of biodiversity since during construction habitats of plants and animal species. Also migration routes of fish is blocked which can lead to extinction - Water can be lost through evaporation - People and communities are uprooted	
Destruction of wetlands	<u>Wet lands are important because:</u> - They purify water by acting as filters for pollutants - Store water and ensure a reliable water supply in times of drought - Reduce water movement and thus control floods and soil erosion - Replenish the water table - Increase biodiversity as they provide a habitat for large variety of plant and animal species <u>Factors affecting wetlands:</u> - Draining of wetlands for grazing and crops - Overgrazing which results in soil erosion - Incorrect methods of controlled fires resulting in soil erosion - Incorrect placement of dams - Pollution - Mining - Urban development *All of these factors change the flow of water and water quality which results in the destruction of wetlands	
Poor farming practices	Inefficient irrigation methods – Spray irrigation systems cause large quantities of water to be lost through evaporation, drip irrigation system is more efficient since water is released Overgrazing – leaves soil exposed which increases runoff and decreasing the water holding capacity of soil thus decreasing water availability Incorrect ploughing methods – increase water runoff	- Drip irrigation method instead of spray irrigation - Rotational grazing - Crop rotation - Limit deforestation

Droughts and floods	• Due to higher temperatures there is an increase in evaporation rates which cause more droughts • Warmer air can carry more water vapour, leading to extreme rainfall and floods • Droughts reduce water availability as empty water reservoirs are not refilled • Floods reduce water availability because freshwater sources are destroyed	
Exotic/alien plants	• Exotic plants are plants that are imported from another ecosystem and established in a new habitat • Exotic plants normally need more water than natural indigenous plants for survival and thus lead to reduction in the water table • Exotic plants have better developed root systems that cause them absorb groundwater at deep levels and thus deplete the water table	• Create awareness of the negative impact of alien plants • Remove alien vegetation using biological, chemical and mechanical control • Encourage the planting of indigenous plants • Plant plots of indigenous vegetation
Boreholes	• Groundwater can be extracted by sinking a borehole that penetrates the an aquifer (underground layer of permeable rock saturated by water) • Extracted water is replenished naturally but sometimes more water is extracted than is replenished which can decrease the availability of water	
Wastage	• Domestic – leaking pipes, running taps, use of washing machines and watering plants during hottest time of day • Agriculture – poor farming practices • Pollution of freshwater sources such as rivers, lakes and ground water	• Use of technology to reduce water pressure at night • Long term planning for new water schemes • Desalination of sea water • Create awareness of urgency of saving water

WATER QUALITY

ADAPTED BY MR S.J SILAULE

FACTORS	DESCRIPTION	POSSIBLE ACTIONS TO REDUCE EFFECT
Domestic pollutants	- Some detergents are not biodegradable (substances that can be broken down naturally by microorganisms) instead end up in bodies of water - Pathogens and harmful substances from sewage can decrease quality of water and cause disease	Close monitoring and strict measures to regulate pollution
Industrial pollutants	- Industrial waste water, oil and petrol spills end in water bodies - Warmer water pumped into rivers by factories cause a decrease in oxygen in water and algal bloom. This type of pollution is called Thermal pollution	- Close monitoring and strict measures to regulate industry and reduce waste - Recycling of waste water by industries - Cooling of waste water before release by industries
Agricultural pollutants	- Insecticides and pesticides that are sprayed on crops to control insects and pests accumulate in rivers and dams after heavy rainfall - Artificial fertilizers infiltrate groundwater and flows into dams and rivers causing algal bloom	Use biological control instead of pesticides
Effect of mining	- Large quantities of water is used in processing raw materials in mines - Contaminated water can be released and pollute the environment - Acid mine drainage is formed when reactive minerals in rocks are exposed to water in mining activities	- Hold mining companies accountable for damage to the environment - Monitor quality of water during and after mining activities
Alien invasive plants	- These plants grow rapidly and block sunlight from other organisms in deeper layers of water. These organisms die and cause an increase in decomposition bacteria which leads decrease in availability of oxygen. - Alien invasive plants can also block waterways, irrigation pipes and canals which increases the risk of water borne diseases	- Create awareness of the negative impact of alien plants - Remove alien vegetation suing biological, chemical and mechanical control

WATER QUALITY

Algal bloom and eutrophication

- ▶ Artificial fertiliser, which is especially rich in nitrogen, potassium and phosphorus, is constantly mixed into agricultural soil in order to supplement mineral deficiencies.
- ▶ Artificial fertiliser does not cling to soil particles and when exposed to rain, it is washed away by a process called **leaching**.
- ▶ Excess fertiliser on the surface of the soil is washed away by heavy rainfalls.
- ▶ This nutrient-rich water that eventually ends up in rivers and dams, is known as **surface runoff**.
- ▶ Large amounts of minerals in the water cause a drastic increase in the growth of freshwater algae.
- ▶ This is known as **algal bloom**.
- ▶ The dense mass of algae blocks sunlight from other photosynthetic organisms (aquatic plants) in the deeper layers of the water.
- ▶ This results in the death of many of these aquatic plants.
- ▶ The dead plant material decomposes, leading to a drastic increase in decomposition bacteria.
- ▶ Decomposition bacteria use large amounts of oxygen during the process of decomposition.
- ▶ Less oxygen is available for other aquatic organisms which may cause their death.
- ▶ This process is known as **eutrophication**.
- ▶ The release of raw sewage into rivers or dams has a similar effect with more serious and immediate consequences. The more organic material present in the water, the lower the oxygen levels.



Possible actions to prevent algal bloom

- ▶ Use of precise quantities of fertiliser to prevent excess runoff.
- ▶ Inject fertiliser below the soil surface to prevent runoff.
- ▶ Use specific combinations of fertiliser to suit each phase of growth.
- ▶ Install more water treatment plants in affected areas.

THE NEED FOR WATER PURIFICATION AND RECYCLING

- Water is a scarce resource and less than 1% of the water on earth is available for sustaining life
- As the human population increases so does the demand for water

Reasons for water purification

- Many available freshwater sources are contaminated by pathogenic microorganisms and are not suitable for domestic proposes
- Many people in remote, rural areas do not have access to safe, clean drinking water and have to purify their own water
- In some areas there are water shortages

Possible actions to recycle water

- Individuals can make a difference by reusing grey water for watering vegetable gardens

FOOD SECURITY

FACTORS	DESCRIPTION	POSSIBLE ACTIONS TO REDUCE EFFECT
Human exponential growth	The rate at which the human population is growing is higher than the rate of food production	
Droughts and floods	- Climate has a significant impact on food availability, access to food as well as the stability of food systems - Droughts increase the risk of crop failure and massive livestock losses as a result of a shortage of water and pasture - Land without vegetation because of droughts is more vulnerable to soil erosion, which in turn leads to the degradation of valuable agricultural land - During floods fertile topsoil is washed away leaving the land unsuitable for the planting of crops in the future - Frequent floods destroy crops and livestock may drown	- Construction of dams may alleviate some water shortages and control flooding - Reduced levels of deforestation and overgrazing will help restore the topsoil
Poor farming practices	Poor farming practices cause damage to soil, crops and live stock Monoculture – this involves planning a single crop/plant species is planted on the same piece of land for a number of consecutive years. Monoculture is a risk to food security because the same types of nutrients become depleted and this affects the growth and size of the crops and making them susceptible to pests and disease. Pest control – prolonged use of pesticides can decrease soil fertility as the pesticides infiltrate the soil and destroy microorganisms thus decrease decomposition. Loss of topsoil – poor farming practices lead to loss of topsoil which contains organic material by erosion leaving the ground unsuitable for the planting of crops. The need for fertilizers – excessive use of fertilizers can cause eutrophication and change in soil of pH	

Loss of wild varieties	• Modern food crops originated through selective breeding of wild plants and animals • Genetic engineering and selective breeding reduce the gene pool of a species • This weakens the gene pool as a species becomes more susceptible to disease • This can result in crop failure and loss of livestock	
Exotic/alien plants	• Alien invasive plants use more water than indigenous plants affecting crops • They also increase risk of fires • Some alien invasive plants change the pH of the soil making it acidic which makes it unsuitable for agricultural crops • The cost removing alien plants can have a negative effect on crop productivity	
Wastage of food	In developed countries: • Incorrect harvesting methods • Poor storage and cooling facilities • Extreme weather conditions • Infestation by pests • Diseases in animals In developed countries: • Food discarded by 'use-before' date • Food in supermarkets is discarded if not sold by its 'sell-by' date	

GENETICALLY MODIFIED (GM) FOOD

- During genetic modification genes for particular good characteristics are removed from the DNA of one plant and inserted into the DNA of another plant. In this way a plant is produced which may have all impressive characteristics such as high yield, low resistance to disease and short maturity period.
- This type genetic engineering to produce genetically modified food/crops increases food security
-

Advantages of GM food	Disadvantages of GM food
Greater crop yields	Have potential adverse effects on human health
Higher nutritional value	GM seeds have high cost and can affect farmers negatively
Can be drought resistant	Ethical and religious views oppose the mixing of genes
Resistance to pests by producing their own natural insecticides	'New' genes may have adverse effects on organisms in the environment of GM foods
Fruit and vegetables often have longer shelf life	
Animals usually resistant to disease	
Animals can produce more meat, milk and/or eggs	

LOSS OF BIODIVERSITY

IMPORTANCE OF MAINTAINING BIODIVERSITY

Importance	Description
Soil quality (microorganisms and animal species)	• break down organic matter • Release essential nutrients to plants • Recycle crucial elements
Air quality	• Purify the air • Regulate the composition of the atmosphere
Water quality	• Wetlands absorb and recycle essential nutrients
Pest control	• Most pests are controlled by other organisms
Pollination and crop production	• Most of our food crops depend on pollination
Prevention of natural disasters	• Forests and grasslands prevent erosion and landslides • Forests absorbs excess water to prevent flooding
Provision of food security	• Biodiversity provides the vast majority of foodstuffs
Provision of healthcare	• Biodiversity of plant, microbes and animals is crucial to the variety of drugs produced.
Ecotourism	• Depends entirely on biodiversity and forms an important part of the economy

THREATS TO BIODIVERSITY

FACTORS	DESCRIPTION	POSSIBLE ACTIONS TO REDUCE EFFECT
Habitat destruction	• Poor farming practice – monoculture and overgrazing lead to soil degradation which contributes to habitat destruction. When clearing an area to plant crops to plant the same type of crops (monoculture) can cause destruction to a variety of habitats and cause a loss to biodiversity. In an outbreak of disease or significant change in climate monocultures can be susceptible as all crops will be affected in the same way by the change in the environment. Overgrazing is as a result of a drastic increase in livestock in an area where vegetation is lost in short period of time with little fallow (resting) period leading to soil erosion as vegetation cover is lost and this all leads to habitat destruction and a decrease in biodiversity. • Golf estates – they are usually developed in natural environments which destroys natural habitats. Exotic grass species are planted and replace natural habitats. • Mining – during mining development plants and topsoil are removed and this directly leads to destruction of habitats. • Urbanization – in order to provide space for new buildings and roads large scale habitat destruction has to take place. Urbanization also leads to pollution which in turn has negative effect on natural habitats. • Deforestation - Large scale habitat destruction occurs during deforestation which destroys a large variety of plant and animal species. • Destruction of wetlands – wetlands are rich in diversity of plant and animal species and their destruction removes natural habitats of a wide range of species, thus threatening their existence.	• Introduce conservation areas • Rehabilitate the damaged environment when a mine is closed • Town planning should include parks and conservation areas • Conserve and protect areas of high biodiversity • Create awareness of the importance of deforestation • Encourage afforestation

Poaching	• Poaching is the illegal hunting/trapping of animals and illegal removal of plants. • Poaching in South Africa is increasing due to money generated by illegal trade of rhino horns, elephant ivory tusk and wild animals for their meat (bush meat). • Poaching leads to decrease in numbers of species which decreases biodiversity	• Increase security of protected conservation areas (more guards or fencing) • More effective, harsher sentencing of poachers, exporters and buyers • Create awareness in local communities of the negative impact of poaching
Alien plant invasion	• Alien invasive plants are considered a major threat to biodiversity • These plants can outcompete and replace large numbers of indigenous species	• Mechanical control – plants and trees are cut down, ring- barked or burned. This method is labour intensive and time consuming though. • Chemical control – use of chemical herbicides to eradicate invasive plants. This method can adversely affect surrounding plants and animal species. It is also expensive and the chemicals can contribute to water and soil pollution. • Biological control – natural enemies from the alien plant's natural habitat are used to destroy it. This method is cheaper and much less labour intensive than mechanical control. Unlike chemical control it does not adversely affect the environment

SUSTAINABLE USE OF THE ENVIRONMENT

- Sustainable use is the use of the resources to fulfill human needs while ensuring there is a sufficient supply for future generation.
-

Indigenous plant	Reason for use	Measures for sustainable use
Devil's claw	• Reduce pain and fever • Sedative • Assists in digestion	• Populations are regulated regularly • Attempts are made to cultivate the devils claw • To harvest devil's claw one must have permit
African potato	• Used as a laxative • Increase the body's natural resistance to disease (strengthen immune system)	• Control measures such as permits
Rooibos	• Anti-allergenic • Calming effect • Relieves digestive problems	• Sustainable harvesting such as replanting • Strict measures relating to production

SOLID WASTE DISPOSAL

- Solid waste is solid or semi-solid insoluble material such as municipal garbage, sewage sludge, industrial waste and agricultural waste

MANAGEMENT AND REHABILITATION OF DUMP SITES

Strategy	Description
Landfill and burning with energy recovery	• Utilize the heat generated from the burning of landfill sites to generate electricity thus saving on the electricity bill • Investigate methods to collect and utilize methane gas as a fuel • Cover dumpsites with sand and using plants to remove toxic chemicals from the soil (Phytoremediation)

Recovery and recycling	• Encourage citizens of the city to put different types of waste into different waste containers/bins of different colours • Partnership with recycling companies for improved collection of different wastes • Fines for people that do not separate the waste into different bins. This could generate income and reduce the transport cost • Educate people to use organic waste for example to make compost which could fertilize soil, they can plant vegetables
Educate citizens and companies to reuse waste	• Glass containers for milk, cold drinks and alcohol. This will reduce the need to produce more of these items thus saving energy and money
Reducing waste	• Charge/penalties people extra if they generate more waste • Encourage citizens to manage waste more efficiently/renewable

THE USE OF METHANE FROM DUMPSITES

- Decomposition of waste releases 60% Methane and 40% Carbon dioxide
- Methane is a high energy gas that does not emit toxins during combustion

Process of generating electricity from methane

- Methane generated in landfill sites is drawn into pipes embedded in the landfill to prevent it from being released into the atmosphere
- Methane gas is collected and burned
- Burning of the methane component drives a generator that produces electricity

Benefits of using methane for generating electricity

- During combustion is converted into water and carbon dioxide (CO₂ is less harmful as a greenhouse gas than methane)
- Less electricity needs to be generated from coal

SAFE DISPOSAL OF NUCLEAR WASTE

- Nuclear waste is produced by nuclear power plants
- Radioactive waste can remain radioactive for a very long time and releases energy in the form of radiation which damages living tissue which can cause mutations in the genetic material of cells
- Nuclear waste is disposed by:
 - Waste is compressed and stored in steel drums
 - Waste is mixed with sand stored underground in steel drums
 - Waste stored in underwater reservoirs (water cools the nuclear waste)