

Pollution From Wastes

Introduction

Waste is anything that is no longer useful and needs to be got rid of. Waste disposal is the process of getting rid of waste

Since prehistoric times, people have created waste. In early times, people disposed of their own waste. Animal bones, vegetable remains, wood ash and body wastes were burned, thrown into rivers and streams, buried, or dumped on the ground.

However, the waste of early people broke down easily by natural decay processes. In the past, populations were also much smaller and were spread out over large areas. As a result, waste caused few problems.

With the increase in population and the growth of towns, waste disposal began to be a problem. In the thirteenth century, people continued to dispose of waste by putting it on nearby land, but in towns this meant the street. The waste in the street looked ugly, smelled foul, and attracted insects, rats, and other animals that spread disease.

In 1875, a Public Health Act was passed that ordered householders to keep their rubbish in a moveable receptacle - the first dustbin. The Act also made Local Authorities responsible for emptying this receptacle no less than once a week.

Now, local authorities have to empty our dustbins at least once a week - even if the dustbin has only a few breadcrumbs in the bottom. If the waste is left for longer it starts to smell, bugs can breed in it and spread disease.

In the UK, all waste disposal is controlled under the Control of Pollution Act. Under this Act, wastes that might be a danger to public health, such as asbestos, are classified as special waste and have to be handled and treated under specially controlled conditions.

Each year, the average household in the UK produces nearly a tonne of waste. People produce millions of tons of solid wastes each year, and the production is increasing rapidly.

They also produce more and more wastes that are difficult to handle.

- Tin and steel cans that rust and become part of the soil are being replaced by aluminium cans that stay in their original state for years.
- Paper packaging that decays and burns easily is being replaced by plastic that decays slowly and gives off gases when burned.

There also hazardous and toxic wastes which require special treatment. These include arsenic, mercury, cadmium, lead, chromium, pharmaceutical compounds, asbestos, chemicals and radio active substances.

For many years these hazardous wastes were simply dumped in landfills, pumped into rivers, buried in fields or dumped at sea. Legislation in industrialised countries has prevented this happening but this has resulted in hazardous waste being shipped to developing countries where such legislation does not exist.

Sources of waste

The three largest producers of waste are ;

- agriculture
- mining
- industry

Municipal waste contributes only about 12% of total waste.

- **Agriculture**

By far the largest amount of waste comes from agriculture. Only a fraction of most crops is actually used. For example, wheat is grown only for its grains, and sugar beet is grown only for its roots. The rest of the plant is waste and needs to be disposed of.

Animal farming also produces waste. Factory farming produces large quantities of animal slurry. The manure accumulates quickly and is often poured into lagoons which leak into local water courses.

- **Mining and quarrying**

Mining and quarrying both produce large quantities of waste. Most is piled up on the land near the mine or quarry but these mountains of waste scar the landscape. Sometimes they are disguised by planting trees and shrubs to cover them.

- **Industry**

Each year, the western world produces about 1 billion tons of industrial waste. In the USA alone, about 3 million tons of acid and 2 million tons of solvents are disposed of each year. Industrial waste can be solid or liquid. It comes from all types of industrial processes such as steel production, brewing, paper production and many others.

- **Municipal solid waste**

Solid waste from homes, shops, offices, and restaurants is called municipal solid waste. It is the waste that is handled by local authorities. It includes paper, plastic, bottles and cans, food scraps, and garden trimmings.

- **Sewage sludge**

Most sewage is people's body waste. Some liquid waste from industry is allowed to go into the sewage system if it can be treated in the same way as body waste.

Sources of waste

▪ **Hazardous waste**

Hazardous waste is composed of discarded substances that can threaten human health and the environment. A waste is hazardous if it corrodes (wears away) other materials; explodes; ignites easily; reacts strongly with water; or is poisonous.

Sources of hazardous waste include industries, hospitals, and laboratories. Such waste can cause immediate injury when people breathe, swallow, or touch it.

When buried in the ground or left in open dumps, some hazardous waste can pollute ground water and contaminate food crops.

In the UK, all waste disposal is controlled under the Control of Pollution Act. Under this Act, wastes that might be a danger to public health, such as asbestos, are classified as special waste and have to be handled and treated under specially controlled conditions.

The mishandling or accidental release of hazardous waste has caused a number of disasters around the world. In 1984, a leak of poisonous gas from a pesticide plant in Bhopal, India, killed more than 2,800 people and caused eye and respiratory damage to more than 20,000.

Some hazardous waste can seriously harm the health of people, wildlife, and plants. These pollutants include radiation, pesticides, and heavy metals.

▪ **Radioactive waste**

Radioactive waste produced by nuclear power stations and weapons factories pose a potentially serious environmental problem.

Some of this waste will remain radioactive for thousands of years. The safe storage of radioactive waste is both difficult and expensive.

Radioactive waste is divided into three categories:

- low level waste
- intermediate level waste, and
- high level waste.

Low-level waste is only slightly radioactive and includes such waste as hospital x-rays and discarded protective clothing. Most radioactive waste is low-level waste.

Intermediate waste is up to 1000 times more radioactive than low-level waste. It includes the containers in which nuclear fuel is held.

Sources of waste

- **Radioactive waste**

High level waste is up to 1000 times more radioactive than intermediate level waste and includes the old fuel rods from nuclear power stations. Although there is very little of it, it is the most difficult waste to cope with.

Low and intermediate waste will be set in concrete and steel before disposal in specially built underground caverns at least 300 metres deep where the radioactivity is most unlikely to reach the human environment.

High level waste is stored at the surface where its safety is carefully monitored. It will have to be kept for many years

Radiation is an invisible pollutant that can contaminate any part of the environment. Exposure to large amounts of radiation can harm cells and result in cancer.

Methods of waste disposal

Most cities and towns have a waste collecting department that gathers refuse from homes and other buildings. Workers haul the refuse away in trucks.

There are three ways to get rid of solid waste:

- dump it,
- bury it, or
- burn it.

- **Open dumps**

In the past, solid waste was simply piled up in open dumps. Open dumps are a poor method of waste disposal. They look ugly, smell foul and attract insects, and provide a home for rats and other animals that spread disease.

If refuse is exposed, it rots and smells foul. Most dumps allow some burning, which causes smoke and foul-smelling air. In addition, rain water can drain through refuse and carry harmful substances into ground water or into streams and lakes.

- **Landfills**

Most municipal solid waste, MSW, and almost all industrial solid waste, is buried in holes in the ground. This called landfilling, and the site where the waste is buried is known as a landfill.

Landfill sites are usually disused pits where minerals such as sand, gravel, clay or chalk have been extracted.

Methods of waste disposal

▪ Landfills

In the landfill, most of the organic materials (like cabbage leaves, potato peelings, paper) are rotted by bacteria. They eventually turn into carbon dioxide and water, like incinerated waste. But this takes a very long time.

When organic waste rots, it gives off a mixture of gases. If air is not present, the main gas in the mixture is methane, and this can explode if it is not properly controlled. If collected, it can be used as an energy source. It also contributes to global warming.

Non organic materials (like heavy metals, from things like batteries and some inks) can also produce polluting compounds as they corrode and decompose. Many of these pollutants can dissolve in water. If they get into ground water or rivers they can kill fish and other animals and make water unfit for us to drink.

It is very important that the contaminated water in a landfill site, called leachate, is kept in the landfill until the pollutants decompose. Leachate decomposes in the ground into simple compounds including carbon dioxide and methane, or it may be pumped to sewage works to be treated.

Landfill gas is piped to a collection point, usually to be burned off. But sometimes landfill gas is cleaned and used to provide energy for nearby factories or to generate electricity.

The waste is spread in layers on the site by huge earth moving machines with spiked steel wheels. Every night that day's layer is covered with soil to stop smells getting out and flies and rats getting in.

A landfill is usually filled to just above the original ground level (before the minerals were dug out). The site is then capped off with a covering of clay, then layers of soil. It is planted with crops or with plants that grow naturally in the area so that wildlife is encouraged to return.

The site still needs managing because the waste will continue to rot. The ground water, the leachate in the site and the gas produced have to be tested regularly and controlled until the waste stops decomposing - and that can take 50 years or more.

In time, landfill sites become filled up. Many communities then cover the site for a final time and use the area for recreational purposes.

The most significant hazard from a landfill is pollution of ground water or surface water.

If waste is buried in a landfill comes into contact with water percolating down from the surface or with groundwater moving through the refuse, leachate is produced. Leachate is a noxious liquid capable of transporting bacteria.

Methods of waste disposal

▪ **Incineration**

Incineration burns waste products. Incineration reduces the volume of waste by turning about 70% of it into carbon dioxide gas, other gases and water vapour. The rest is left as ash and is landfilled.

Some of the gases are poisonous and must not be allowed to escape into the atmosphere. Pollution control equipment (known as a scrubber) is fitted to incinerators to convert these gases into forms that can be disposed of in other ways.

The temperature that an incinerator works at needs to be kept high enough to make sure that dioxins are not produced.

Dioxins are formed when most things are burned badly. They are organic compounds that contain chlorine. They can be found in the ash and air emissions from garden bonfires, from MSW incinerators, from wood fires and from car exhausts.

There are about 35 incinerators for MSW in the UK. Most of these were built before 1970 and are very expensive. The ash left over after incineration is sometimes used in making roads or buildings.

Incineration is the safest way of breaking down organic materials such as PCBs.

Many large cities use incinerators because they do not have enough vacant areas for land disposal sites nearby. Large numbers of municipal incinerators lack adequate air pollution control devices and many release gases and solid particles that may harm human health, damage property, and kill plants.

▪ **Sewage**

Most sewage is pumped to treatment works where it is filtered and decomposed by bacteria in big tanks that are open to the air. It turns into carbon dioxide, methane, water and a sludge.

The methane is often burned to provide heat to speed up the decomposition. The water is made clean enough to be put into rivers and the sea.

The sludge (grit, dead bacteria and some undecomposed organic matter) is spread on farm land as fertiliser, burned in incinerators, landfilled, or disposed of at sea. Disposal at sea will stop soon because of international regulations. This will mean other disposal methods will be needed more.

▪ **Radioactive waste**

Radioactive waste could be sealed in steel drums or in glass or concrete containers. These could be buried in the ground or in disused mines hundreds of metres below the surface, or buried near the surface in specially constructed pits. Alternatively, the sealed units could be dumped at sea.

Assessment

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Questions 1 to 5 - Select the correct response for the following questions :

1. Which of the following is **not** a hazardous waste ?
 - A radio active substances
 - B asbestos
 - C municipal solid waste
 - D pharmaceutical compounds

2. Which of the following is **not** one of the three largest sources of waste ?
 - A agriculture
 - B mining and quarrying
 - C domestic housing
 - D industry

3. Which of the following is **not** a category of radio active waste ?
 - A low level waste
 - B intermediate level waste
 - C high level waste
 - D weapons grade waste

4. How long does the waste in landfill sites take to decompose ?
 - A under 1 year
 - B about 5 years
 - C about 10 years
 - D 50 years or more

5. What percentage of incinerated waste is converted into carbon dioxide ?
 - A 70%
 - B 50%
 - C 20%
 - D 10%

Questions 6 to 10 - Decide whether each of these statements is True (T) or False (F).

6. i) Each year the average household in the UK produces nearly a tonne of waste.
ii) Local Authorities must empty domestic dustbins at least once a month.

Which option best describes the two statements?

- A i) T ii) T
B i) T ii) F
C ii) F ii) T
D ii) F ii) F

7. i) The largest amount of waste comes from agriculture.
ii) Municipal solid waste makes up over 50% of the total waste produced in the UK.

Which option best describes the two statements?

- A i) T ii) T
B i) T ii) F
C i) F ii) T
D i) F ii) F

8. i) Hazardous waste is composed of discarded substances that can threaten human health and the environment.
ii) In the UK, all waste disposal is controlled under the Control of Pollution Act.

Which option best describes the two statements?

- A i) T ii) T
B i) T ii) F
C i) F ii) T
D i) F ii) F

9. i) Some radioactive waste will remain active for thousands of years.
ii) Intermediate radioactive waste is 100 times more radioactive than low level waste.

Which option best describes the two statements?

- A i) T ii) T
B i) T ii) F
C i) F ii) T
D i) F ii) F

10. i) When organic waste rots in a landfill it can give off a mixture of gases including methane.
ii) The temperature of an incinerator must be high enough to prevent the production of dioxins.

Which option best describes the two statements?

- A i) T ii) T
B i) T ii) F
C i) F ii) T
D i) F ii) F