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Study Session 7 Pollution: Types, Sources and Characteristics



Contents

[Introduction 2](#_Toc17332434)

[7.1 What is pollution? 3](#_Toc17332435)

[7.2 Physical nature of the pollutant 5](#_Toc17332436)

[7.3 Sources of pollution 6](#_Toc17332437)

[7.4 Pathways of pollution 7](#_Toc17332438)

# Introduction

You were introduced to wastes and pollutants in Study Session 1, where we discussed the interactions between humans and our environment. Pollution was defined as the introduction into the environment of substances liable to cause harm to humans and other living organisms. Many human activities pollute our environment, adversely affecting the water we drink, the air we breathe, and the soil in which we grow food.

In this and the next study session we will look more closely at pollution. In this session you will learn about the different types and sources of pollution and the various human activities that can cause pollution. We will also describe the ways pollution can affect different sectors of the environment: water, air and soil. Study Session 8 describes some of the significant effects of pollution on the environment and on human health. It also discusses options for preventing and controlling pollution.

# 7.1 What is pollution?

If you hold up a glass of water in front of you, how can you tell if it’s polluted? You would expect drinking water to be colourless, odourless and transparent (not turbid with suspended particulates). If it was not all of these things, then it could be polluted. If you were looking at water in a river, it is unlikely to be as clear as drinking water in a glass, but you could deduce it was probably not polluted if you observed that the water did not look dirty or smell bad. You might also observe that animals were drinking the water without ill effects and fish were swimming in it. However, if the water was discoloured or had an unpleasant odour, or you could see dead fish floating on the surface you could conclude that pollution was the problem.

Let us consider the human activity that could have caused the pollution. Imagine a river that flows through an area of land on the edges of a town. The water is used by the community for drinking and other domestic uses and also for vegetable farming. Several residents use this water to irrigate small areas of land where they cultivate vegetables and many of the farmers use fertiliser and pesticide to improve productivity (Figure 7.1). Fertilisers are made of chemicals such as nitrogen, potassium and phosphorus, which are essential plant nutrients. Pesticides are chemicals that destroy pests but can be harmful to other forms of life – including humans.



Figure 7.1 Farmers use fertilisers and pesticides on their vegetable crops to improve productivity.

Imagine that one farmer has finished spreading the chemicals on his crop and decides to wash the empty pesticide sack he has been using in the river. Later that day, it rains heavily and rainwater is seen running off the field into the river. What do you think happens? The river is receiving run-off containing fertiliser and pesticide chemicals that had been applied to the crops, which is made worse by the farmer washing his sack that had contained the pesticide. This could harm fish and other organisms living in the water – possibly killing them. The river is also used by the community so the chemicals could get into drinking water that is consumed by humans. The river has been polluted by the careless action of the farmer washing his sack and by the action of rainwater washing the chemicals into the river.

Pollution always has a source and a recipient. The **source** is where the pollution comes from, that is, where the pollution is released into the environment. The **recipient** is where the pollution ends up, which may be a part of the environment or people or animals that become contaminated or damaged.

* In the above example about the farmer washing the pesticide sack in the river, what is the source and what is the recipient of the pollution?
* The pollution source is the activity of urban farming with pesticides and fertilisers and washing sacks so that pollutants get into the river. In this example, the primary recipient is the water body that receives the pollutants. Other recipients are the people who drink the contaminated water and animals such as fish that also are affected.

There are a number of ways of identifying pollution. These include finding symptoms of damage to aquatic plants and animals (such as dead fish), finding chemicals in the water, comparing the previous history of the quality of water with the present quality, and getting complaints from water users. Even when a problem has been found, investigations to identify the source may take time. For example, water samples from several different points upstream and downstream will need to be analysed to locate precisely where the problem originated.

There are several different ways of classifying pollutants. They can be categorised by their physical nature, by their source, by the recipient or by the sector of the environment affected. In the following sections we will look at each of these classification groups

# 7.2 Physical nature of the pollutant

Urban run-off is another type of liquid waste that can cause pollution. Rainwater washes many different types of waste from the land surface into lakes and rivers. Urban run-off can contain a lot of organic matter. This may come from open defecation or inappropriate handling of organic wastes produced from households and businesses. **Organic matter** includes anything that is derived from living organisms, such as human and animal wastes, decaying plants and food wastes.

Pollutants also come in solid form. Plastic bags are one of the most common solid wastes. **Solid waste** is any solid material that is assumed not to be useful and is therefore thrown away. Factories, businesses and households produce different kinds of solid waste such as paper, plastics, metals, chemicals in solid form, pieces of cloth or food and animal remains (Figure 7.2). Sometimes you may have observed faecal matter discarded with solid waste, which adds to the problems.



Figure 7.2 Solid waste is an unsightly problem in many towns.

There is a fourth type of pollution that is common in urban communities. This is energy in the form of noise pollution. Noise pollution means unacceptable levels of noise in work, residential and recreational places. Noise makes it difficult to have a conversation and also irritates and disturbs us and in the long term can damage our hearing. Loud music from music shops and clubs in an urban community is a known source of noise disturbance. Such noise may please some, but it disturbs many other people because it interferes with communication in the daytime and sleeping at night.

# 7.3 Sources of pollution

Another way of classifying pollution is by the sector of human activity that produces it. Before we look at the various sectors, there is an important distinction to be made about pollution sources. Sources of pollution can be categorised as point or non-point sources. **Point sources** are identifiable points or places that you can easily locate. An example is a diesel truck that produces visible black exhaust fumes from its tailpipe. Liquid waste released from a pipe into a river is another example (Figure 7.4). A **non-point source** (also known as ‘diffuse pollution’) is one where it is difficult to identify the exact origin of the pollution. A good example is floodwater that washes all types of waste from the land (possibly including faecal matter) into a river. In this situation you cannot identify the individual or household or establishment that has caused the water pollution (Figure 7.5).



Figure 7.3 Point source: liquid waste entering a small stream.



Figure 7.4 Non-point source: solid waste and faecal matter are distributed all along the banks of the river so no single source can be identified.

* Can you think of examples of point and non-point source pollution from earlier in this study session?
* The farmer washing his sack is an example of a point source because you could identify where he washed his sack. However, the pesticide washing from the field is an example of a non-point source. The pollutant would wash into the river at several places, and could possibly also have come from other fields. This is an example of how difficult it can sometimes be to accurately identify the source.

# 7.4 Pathways of pollution

We said earlier that pollution always has a source and a recipient. The **pathway** of pollution is the way the pollutant moves from the source, enters into the environment, and finally how it reaches the human body or other recipient. The pathway between source and recipient can take several different forms depending on the type of pollutant. Primary recipients for pollution are water, air, and soil. Pollutants usually reach humans through the consumption of contaminated and polluted water and food, and breathing polluted air.

In each case the effect is to reduce the concentration of the pollutant. **Concentration** is a measure of the amount of the substance in a known volume of water or air. The units used for water pollutants are usually milligrams per litre (mg/l, also written as mg l-1), although sometimes you may see **ppm** which stands for ‘parts per million’.

These processes do not apply to all pollutants. There are some **persistent pollutants** which remain intact when released into the environment because they do not break down by natural processes. These are described in Study Session 8.