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## IB ESS

# 1.5 Humans and Pollution

### Significant Ideas:

Pollution is a highly diverse phenomenon of human disturbance in ecosystems

Management strategies can be applied at different levels.



## What is pollution?

1. Define "pollution"

Pollution is the addition of a substance or an agent to the environment through human activity, at a rate greater than that at which it can be rendered harmless by the environment

2. Pollutants can be categorized as "primary" and "secondary" pollutants. Using **examples**, explain the difference between these two terms.

Primary pollutants are pollutants directly created and active on emission - such as carbon monoxide from incomplete combustion  
Secondary pollutants are created by primary pollutants undergoing a chemical or physical change eg when  $\text{SO}_2$  reacts with water it forms sulphuric acid.

3. The table below lists a number of different examples of pollution. From the list, choose the matching pollution type.

light, sound, inorganic substances, organic substances, heat

Pollution Type	Example
Inorganic substances	Sulphur dioxide from a factory entering the air
Organic substances	Manure used as fertilizer on farmland washing into a lake
light pollution	A bright garden light shining into the neighbour's house
sound pollution	Disruptive noise coming from a busy road near a housing estate
heat pollution	Warm water entering a river from a factory

4. a) State one example of point and non-point source pollution

Point source pollution:

Waste disposal pipe of a sewage works into a river

Non-point source pollution:

Gases from the exhaust systems on vehicles

b) Explain how point and non-point source pollution differ

Point source pollution comes from a single clearly identifiable site, it's easy to see who is causing it and generally easier to manage. Non-point source pollution often has many sources and so it is hard to identify where it is coming from.

5. Air quality in Beijing is particularly poor as a result of coal-burning amongst other pollutants. This is an example of **chronic** pollution. Using an example of **acute** pollution to support your answer, explain why Beijing air pollution is an example of chronic pollution.

Beijing air pollution is an example of chronic pollution because it is caused by the release of pollutants over a long period of time and is difficult to clean up as it can spread widely. In contrast an example of acute pollution is the Gulf oil spill which was a single event of a large release of oil causing a lot of harm.

6. Some pollutants are considered **persistent**, while others are **biodegradable**. Using an example of each to support your answer, explain what these terms mean.

Persistent Pollutant

Persistent pollutants are resistant to breaking down and can remain active in the environment for a long time, meaning they can bioaccumulate in animal tissue. An example would be DDT.

Biodegradable Pollutant

Biodegradable pollutants do not persist in the environment and break down quickly often by decomposer organisms or heat and light. Examples of these are biodegradable bags or glyphosate which farmers use as a herbicide.

## DDT

1. State two uses of DDT

DDT was commonly used as an insecticide, it was used to control the spread of malaria by spreading it on walls and furniture.

2. With reference to biomagnification, describe the harmful effects of DDT on birds.

Biomagnification of DDT occurs because when DDT gets into the environment it is then consumed by insects, which are in turn eaten by birds. As birds eat many insects the DDT becomes increasingly concentrated in tissues or organs as you move up the food chain. As DDT is persistent this means it continues to build up within the organism.

3. List some of the potential impacts of DDT on humans.

DDT is an endocrine disruptor and it is likely a carcinogen. It is moderately toxic although indirect exposure is considered non-toxic. As it can build up in fats chronic exposure may affect reproduction and thyroid function.

4. Summarise the effect that Rachel Carson's *Silent Spring* book had on public opinion on DDT use.

There was fierce criticism about the book from much of the chemical industry, however the general public responded well. Public awareness was heightened about the fact nature is vulnerable to human intervention. It led to environmentalism being born.

5. Evaluate the use of DDT, and justify your own opinion on its use.

DDT is a very effective insecticide and is able to kill mosquitoes effectively leading to reductions in deaths in humans from malaria. It is also relatively inexpensive making it accessible to poor countries, who often have the greatest risk of malaria. However, in contrast it has very harmful effects on both the environment and other organisms (including humans). It stays in the environment (persistent) and accumulates causing the near extinction of the bald eagle and health issues in humans. I think it is important we severely limit/stop the use of DDT and aid developing countries with alternative control measures for mosquitoes.

## Pollution management

Plastics are a major source of pollution with many negative consequences, particularly for aquatic organism and marine birds if the plastic enters the oceans (and it often does). Plastic can enter the environment in a number of ways. Poor waste management as well as littering adds plastic to the environment, and drinks bottles in particular are a major problem. Micro-beads, which are tiny balls of plastic added to shower gels and cosmetic products, are washed down the sink and enter water ways directly. Another source is micro-fibers which are degraded from clothes and are washed away in the laundry.

Plastics that enter the ocean can affect some marine birds; the Laysan Albatross, for example, feeds by skimming the surface of the water with its beak, meaning it will scoop up and swallow any plastic that is floating. This often results in the death of young albatrosses, as they are not able to regurgitate the material. Fish can be harmed by ingesting microplastics, which are bioaccumulated and then biomagnified through the food chain to higher organisms such as larger fish, birds and even humans.

1. Using the pollution management model (figure 1.5.6), summarise possible management strategies for plastics at each of the three levels. You're expected to make your own sensible suggestions.

Process of pollution	Level of pollution management	Possible strategy for plastic pollution
Human activity producing pollutant	Altering human activity	+ Educating people + Campaigning + setting up community groups + economic incentives/disincentives + government legislation + recycling initiatives + providing alternatives + free refills of reusable bottles.
Release of pollutant into the environment	Controlling release of pollutant	+ legislating against plastic waste + recycling programs + developing technologies to break down plastics. + using waste plastics vs building materials "plastic bricks"
Impact of pollutant on ecosystem	Clean-up and restoration of damaged systems	+ extracting plastics from ecosystems + beach clean ups + incentivising collection of plastics + education



