

## **TOPIC: CONTAMINATION OF WATER**

### **SUB-TOPIC: PART C: ANTHROPOGENIC-RELATED POLLUTION**

#### **Supporting Transcript**

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*This transcript accompanies associated presentation slides and video content developed for the TIDE project in 2021, with acknowledgements and disclaimer as noted in associated files.*

#### **Slide 1**

Hello, my name is Sam Addison and welcome to this lesson on anthropogenic pollution.

#### **Slide 2**

In this lesson we will have a brief introduction and then look at pollution from human activities. Firstly, we will look at faecal contamination and this will be followed by looking at chemical contamination from a range of human sources. The lesson will end with a learning exercise and further information and references.

#### **Slide 3**

This lesson will investigate how human actions can lead to contamination of drinking water and also identify several types of key contaminants that are generally linked to anthropogenic activity and may be of concern to human health. This lesson will develop on knowledge learnt in “Part A: What is contamination?”

#### **Slide 4**

The objectives of this lesson are to be able to describe how contamination can occur due to human actions and to be able to discuss how different types of contaminants can result from different types of actions.

#### **Slide 5 - Section Break**

#### **Slide 6**

Faecal contamination comes from point sources and this is often caused by improper wastewater management or discharge.

Often the way in which we collect water, can also cause faecal contamination. In tube wells, dug wells and springs, some of the ways contamination can occur are when latrines are uphill or close to the source. If animals have access to sources this can also lead to contamination.

Rainwater harvesting tanks can also be susceptible to contamination. Animals that can access tanks such as birds or small animals can lead to faecal contamination.

Finally, piped systems can also be contaminated. This can occur when pipe systems are improperly sealed, when open defecation occurs near tap stands or even a lack of cleaning of storage tanks and reservoirs.

### **Slide 7**

Often faecal contamination can occur in homes, this can be caused by household water storage. Meaning that even water collected from safe sources can become faecally contaminated. The World Health Organisation even suggest that water stored in homes is often faecally contaminated at levels far above the contamination level at the source.

### **Slide 8**

There are multiple reasons why water quality may deteriorate during the storage and transport of water. This can be due to household practices, poor hygiene knowledge which prevents people from taking basic steps to minimize contamination. It can be inadequate household latrines, hand-washing facilities and poor community environmental sanitation which results in more faeces in and around households. Lastly, commonly used transport and storage containers are easily contaminated and may not be washed properly. Importantly, these are just a few of the reasons that could lead to contamination during transport and storage.

### **Slide 9 – Section Break**

### **Slide 10**

Most chemicals used in agriculture are either pesticides or fertilizers. Contamination of drinking-water resources may result following land application or from improper disposal. Pesticides and fertilizers are one type of emerging organic contaminants and their occurrence in groundwater and surface water sources is the subject of increasing attention and research.

### **Slide 11**

When nitrogen-based fertilizers are applied to crops, nitrate can filter into shallow aquifers or be washed into surface waters. Since nitrate is used in most fertilizers, contamination of water resources in areas heavily impacted by agriculture is common. But nitrate and nitrite can also come from other sources not necessarily linked to agriculture. Examples would be wastewater disposal and from oxidation of nitrogenous waste products in human and animal excreta, including septic tanks.

### **Slide 12**

Pesticides enter water primarily as runoff, inappropriate disposal or accidental release. The potential of a pesticide to contaminate drinking water is affected by its solubility and biodegradability; the method of application; and environmental factors such as soil, weather, season and proximity to water resources. Early pesticides sometimes contained compounds of toxic metals or metalloids such as arsenic, mercury, copper or lead. However, organic pesticides began to be used which were chlorinated hydrocarbons such as DDT which are compounds that are relatively insoluble and tend to concentrate on soil surfaces instead of dissolving in water. However, they are resistant to biodegradation and can accumulate in food supplies. A number of pesticides have serious health impacts on humans and wildlife.

### **Slide 13 - Section Break**

### **Slide 14**

Localized contamination of drinking-water resources can occur when chemicals are used in industries or in private households.

Heavy metals, petroleum products, and chlorinated organic solvents are the main types of chemicals used in both of these settings.

#### **Slide 15**

Cadmium is used in metal plating, plastics, pigments and batteries. It is carcinogenic when inhaled, but there is no evidence that ingestion through drinking water can cause cancer. The WHO Guideline value is set to protect against kidney damage. This is an example of where provisional standards are put in place.

#### **Slide 16**

Cyanide is widely used in metal finishing and the production of plastics such as nylon. Cyanide is acutely toxic, primarily affecting the thyroid and the nervous system. Cyanide can occur naturally in some foods but is rarely found in drinking water except due to industrial contamination.

#### **Slide 17**

Mercury is used in the electrolytic production of chlorine; in electrical appliances such as dry-cell batteries, fluorescent light bulbs and switches; and in thermometers.

Natural contamination can also occur in groundwater but is rare.

#### **Slide 18 – Section Break**

#### **Slide 19**

Disinfectant processes such as chlorination are commonly used to reduce pathogenic risk in drinking water supplies.

However, disinfectants have the potential to produce by-products that may be of health concern, including some chlorination-associated disinfection by-products.

Where a choice must be made between meeting either microbiological guidelines or guidelines for disinfectants/disinfectant by-products, the microbiological quality should take precedence. According to the World Health Organisation, efficient disinfection must not be compromised". Free chlorine is the most commonly used disinfectant and as such chlorination-associated disinfection by products are of particular concern.

#### **Slide 20**

"Some organic compounds and/or heavy metals potentially may be present in pipes and fittings which can leach into drinking water during distribution".

"Natural waters and treated drinking water usually contain almost no lead, but distribution systems can be made of lead and contaminate drinking water", this is particularly in older systems and generally much less common in newer distribution systems. Other contaminants that come from pipes and fittings include copper and nickel.

#### **Slide 21 - Section Break**

#### **Slide 22**

There are a range of human actions that lead to contamination of water. Some chemicals can contaminate water by both natural and human actions, whilst some chemicals only contaminate water

due to human actions. There are different types of activities that are typically associated with different activities as we have seen.

### **Slide 23 - Section Break**

### **Slide 24**

In this lesson's learning exercise, there is an image as can be seen on this slide. In the image are numerous activities that are leading to contamination of water. Try to identify as many sources of pollution as you can in the image and then state the type of contamination it will lead to such as microbial or chemical contamination. Additionally, try to even state the potential type of chemical or microbial that it could be, for example nitrate contamination.

### **Slide 25 – Section Break**

### **Slide 26**

Here are the references for this lesson.

### **Slide 27**

For further reading and resources, the World Health Organisation guideline for drinking water quality will allow you to explore more of the topics that have been discussed in this lesson.

### **Slide 28**

Thank you for watching this lesson and I hope you found this lesson on anthropogenic pollutants, useful and enjoyable.