Heavy Metal Pollution is More Common than You Think

To many people, pollution from heavy metals is only a problem in areas of intensive industry. However, roadways and automobiles are actually one of the largest sources. Zinc, copper, and lead are common heavy metals released from road travel, accounting for at least 90% of the total metals in road runoff. Fortunately, lead concentrations have been decreasing since leaded gasoline is no longer available for purchase. Smaller amounts of many other metals, such as nickel and cadmium, are also found in road runoff.

Some Common Metals in Road Runoff

- **Lead:** leaded gasoline, tire wear, lubricating oil and grease
- **Zinc:** tire wear, motor oil, grease, brake emissions, corrosion of galvanized parts
- **Iron:** auto body rust, engine parts
- **Copper:** bearing wear, engine parts, brake emissions
- **Cadmium:** tire wear, fuel burning, batteries
- **Chromium:** air conditioning coolants, engine parts, brake emissions
- **Nickel:** diesel fuel and gasoline, lubricating oil, brake emissions
- **Aluminum:** auto body corrosion

On the road surface, most heavy metals become bound to the surfaces of road dust or other particulates. During precipitation, the bound metals will either become soluble (dissolved) or be swept off the roadway with the dust. In either case, the metals enter the soil or are channeled into a storm drain. Once into the soil or aquatic environment, metals enter the food web. This process is governed by the chemical nature of metals, the soil, and the pH of the surrounding environment.

Most heavy metals are cations, meaning they carry a positive charge. Zinc and copper, for instance, both carry a 2+ charge. Clay minerals, however, have a net negative charge. The negative charges of these various soil particles tend to attract and bind the metals and prevent them from becoming dissolved in water. The soluble form of metals is thought to be more dangerous because it easily is transported and taken up by plants and animals. By contrast, soil bound metals tend to stay in place and do not enter the urban ecosystem.

Metal chemistry is similar in the aquatic environment (streams, lakes and rivers). Heavy metals tend to be sequestered at the bottom of water bodies where they are bound to the sediment. This is the reason why it is now safe to swim in the Charles River but it is not safe to disturb the bottom of the river because there is pollution in the sediments.

However, the aquatic environment is more susceptible to the harmful effects of heavy metal pollution. The constant flow of water causes even bound metals to be partly soluble and aquatic organisms are in close and prolonged contact with the soluble metals. As a result, some heavy metals accumulate in fish. For example, mercury builds up in some fish and makes them unsafe to eat. You will learn more about this effect in another unit

Lead and other heavy metal pollutants can be found throughout the ecosystem and not just in water. The metal ions bound to the soil can become airborne as dust. Inhaled by humans, they enter the body through the lungs. As dust particles, these metals can also settle on surfaces that humans come in contact with. This is particularly true in very dry climates where rain is scarce and surfaces accumulate large amounts of these heavy metals. Areas around factories and metal smelters can be covered in dust containing metals.

Reflection Questions

1. What are some sources of heavy metal pollution?

2. Think about the data that you collected about your study site. Given what you just read, are you surprised about your findings?

3. Choose 2 or 3 of the pollutants mentioned in the reading and describe how they might flow through a watershed. Consider all three paths: Overland flow, Infiltration, and Groundwater flow.