

## Water in Extreme Environments: Engineering Background for Educators

Hydrologic engineering is a highly interdisciplinary field, requiring collaboration from scientists and engineers from many diverse fields. It has a wide variety of applications to research in agriculture, public health, geography, geology, planetary science, physical science, chemistry, and astrobiology.

In the Engineering pathway, learners discover ways that water can become contaminated. They learn how to engineer solutions to filter and reuse water; such solutions have applications in extreme environments like the International Space Station or Mars. Water conservation and reuse are common problems that astronauts face on missions into space, and they're also problems that many people may face here on Earth.

### Water Quality

Different uses for water require different levels of water quality, which can be measured in a variety of ways.

- **Clarity** is how clear the water is: dirty water that has a lot of sediment in it may be unsuitable for people to drink but may be fine for watering plants. Filters can remove particles from water to improve its clarity.
- **pH** is a measurement of how acidic water is. Most forms of life, including humans, can tolerate only water that has a neutral pH value near 7. Very acidic (low pH) or very basic (high pH) substances can be toxic or can even cause chemical burns.
- **Toxicity.** Some chemicals do not affect pH but can still make water toxic or unsuitable for certain purposes. In the engineering activities, these toxic chemicals are represented by non-toxic substances that have distinctive smells.
- **Salinity**—the amount of salts dissolved in water—can also affect water quality. Salinity is not addressed in the engineering pathway but is discussed in the science pathway.

Poor water quality due to pH and chemical contamination cannot be fixed with ordinary filters. The activities introduce materials such as charcoal and limestone that can improve these aspects of water quality.

### Online Resources

Learners can explore water quality where they live in the U.S. through the [U.S. Geological Survey Water Science School](#). Additional online resources are available to explore water quality where you are and learn more about sources of contamination, water quality sampling techniques used by scientists, and different ways to filter and reuse water. Explore more at [Water Quality Information by Topic | U.S. Geological Survey \(usgs.gov\)](#)