Let's Talk Water – Contamination

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Last week, we discussed water quality. The main point to restate is that water naturally contains a variety of dissolved components and that although this helps us classify the type of water, it doesn't necessarily mean the water quality is poor. In fact, many of the dissolved components in water are useful and beneficial to humans.

Contaminated water, however, is a different story. Contaminated or polluted water occurs when human activity changes the natural water quality making it no longer fit for use as previously intended and utilized. Just like with the discussion of water quality, the key part of the definition concerns quantity or how contaminated is the water. It is extremely rare that any precipitation, surface water, and shallow ground water have no level of human contamination. In fact, snow samples from the surface of Antarctica and Greenland show trace levels of industrial aerosols and tritium (radioactive hydrogen from bomb tests beginning in the 1950s). Rain and snow in the United States typically contains trace amounts of industrial and agricultural chemicals. Does this mean the rain and snow are contaminated? Not necessarily. The precipitation contains contaminants, but usually the levels are low enough to not change how we would use the water.

Contamination of water is related to criteria established by the U.S. Environmental Protection Agency (USEPA). There are different standards for different water uses, such that water quality for fish habitat may be different than that for human drinking water. These standards are based on the potential effects posed by exposure to certain chemicals. Some chemicals at very low levels can be toxic (poisonous) to humans. Other chemicals can have different effects, such as affecting certain organs or inhibiting reproductive systems. Also, some chemicals have adverse effects in small doses or exposures (acute exposure) compared to others which require long-term exposure (chronic exposure), often over many months or years.

Based on the risk of known chemicals, the USEPA has developed drinking water standards as part of the Safe Drinking Water Act. Under this act, many known chemicals have been classified and human exposure quantified by Maximum Contaminant Levels (MCLs). MCLs provide maximum amounts of exposure to any certain chemical above which there is potential human health risk. These standards are based on the best science available, but we need to keep in mind that many chemicals are relatively new to the environment (and to humans) and their long-term health effects may need more research and real-world data collection to better understand how these chemicals actually affects people

There are various sources of contamination of water. In eastern Nevada, potential sources include chemicals in precipitation, agricultural chemicals, urban and domestic contamination, mining practices, and various spills. Chemicals in precipitation can be both industrial and agricultural chemicals carried as dust and particles in clouds that get deposited with rain and snow. Winds can pick up dirt that has chemicals with it and carry

these contaminants to the atmosphere. Industrial and urban (cars) exhaust goes into the atmosphere and can be carried for long distances by the winds before being deposited. An example of this is acid and mercury found in lakes in relatively pristine parts of the Appalachian Mountains that was carried by the wind and deposited in rain and snow. What happens downwind from a location, even hundreds of miles downwind, can ultimately affect the water quality at this location.

Many studies have shown that agricultural chemicals (pesticides, herbicides, and fertilizers) are showing up in surface water and ground water across the country. Often, these chemicals are found in direct association to where they are applied (such as in shallow ground water beneath a farm field). However, rain and snow also carry some levels of agricultural chemicals. One thing scientists are now researching is not only the occurrence of these chemicals in water, but also how these chemicals change in the environment. Agricultural chemicals are designed to break down in the environment. However, they break down into different chemicals. Most of these "break-down products" are typically harmless, but some are now being studied because of potential health risks.

Urban and domestic contamination can be a wide variety of substances. One of the most prevalent in Nevada is nitrate from septic systems. High nitrate levels can be dangerous for all humans, but especially for babies. Other sources of contamination include, but are not limited to, leaky underground storage tanks at gas stations, storm runoff from streets into drains, lawn care products, automotive exhaust, landfills, road salt, cemeteries, car washes, and other potential releases of chemicals. One of the sources of contamination under recent study is what we call emerging contaminants, specifically pharmaceuticals and personal care products. Such things like antibiotics and other medicines are getting into the environment both from human and animal waste discharge and from people dumping extra medicines into sinks and toilets. These products can produce resistive bacteria in the environment. Personal care products, such as skin and hair products, soaps, detergents, and even caffeine from beverages, are being detected in the environment.

Mining practices can be an important source of contamination in eastern Nevada because of the large number of mines. Contaminants, such as arsenic, are associated with mines because of ore processing and exposure of rock debris to weathering. Acid-mine drainage from sites has been shown to affect water quality in runoff and ground water near mines. Mercury has been widely used in Nevada to extract metals such as gold and silver from ores. The mercury can get into the environment and have potential human and aquatic health effects. For example, mercury from mining has contaminated sediments in the Carson River. Mining also uses cyanide for leaching gold and silver from ores. Spills and leaks of cyanide can cause contamination and has been associated with fish kills in some mining areas of the U.S.

Spills are a common occurrence for surface water and ground water contamination. We all are familiar with the Exxon Valdez oil spill. Spills can happen wherever contaminants are stored or transported. Trains and fuel trucks can become damaged (usually through

collision or human error) and leak large quantities of contaminants into streams or into the ground. We often think about these large spills when we talk about contamination, but many spills can be smaller and still quite harmful. Some folks dump old paints and fuels from their homes and farms into drains or into the backyard. These contaminants get into the water supply and cause damage. Some people drain their engines directly onto the ground when doing oil changes. This too can get into drinking water supplies. Often normal human activities can be the cause of many of our spills and degradation of the water supply for a community.

As we see, there are a number of ways water can become contaminated. Some things we can't control locally (such as pollution that gets into the air and carried by the wind). These require State or Federal regulations to control. Other things we do have some control over, such as what we put into the ground, down our drains, or on our yards. The most important thing to keep in mind when considering contamination is that everyone lives downstream (in some form or another, even if we are talking about air contamination) from someone else. What you do to your yard, your land, and your city, can affect many people around you and those downgradient of you.

If you have any questions about contamination, or any other water issues, please write to me in care of the Ely Times or email at mstrobel@usgs.gov. Next week, we will discuss well installation.