Understanding Septic Systems in light of Pharmaceuticals and Personal Care Products

What do we know, now?

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Maine CDC Drinking Water Program
Three very different cases

- Hepatitis A outbreak on Swan’s Island
  a geologic cross-connection

- Southern Maine Water District birth control
detection: influence of one large system on
groundwater

- Surface water testing in drinking water sources.
The site is located on an island, as part of a cottage colony.
CDC and DMR staff investigated a cluster of Hepatitis A which appeared to be centered on this property. Samples were obtained from a number of locations and analyzed using PCR to identify viral particles.
The malfunction to the surface appears to be chronic. The breakout is about 127 feet downslope from the well.
Like most islands, bedrock is shallow and often exposed, as it is near the property.
Contamination of drilled wells generally occurs through poor sealing or broken casing, or through transmission of pollutants through bedrock fractures.

The property’s well is approximately 300 feet deep, and is located in a poorly fractured granite.

The well is located approximately 127 feet upslope of the malfunctioning disposal area.
Findings

- Sampling revealed hepatitis A virus in both the malfunctioning area and in the water in the building.
- Our current working assumption is that there is a fairly direct connection between the septic system and the well.
- While the system is old, it is also typical of many in the area.
Pharmaceuticals and Personal Care Products, and other Emerging Contaminants

- We keep getting better at finding trace amounts of organic chemicals
- We also are very good at producing, distributing, and consuming lots of organic chemicals, including pharmaceuticals and personal care products (PPCP’s)
- Most of these chemicals end up in wastewater, and are sent to systems not designed to treat them.
Estrogenic in Groundwater

- A large subsurface system had served a jail that was seriously overcrowded
- The system was monitored, and high nitrates were found near the system
- The jail was closed
- Water system tested monitoring wells near the system, found several PPCP’s, including some anti-psychotic drugs then tested their wells and found trace Estrogenics (birth control pills)
Thoughts

- Pharmaceuticals and other products pass through the human body relatively unchanged.
- Septic systems are designed to handle sanitary waste, not complex and stable organic compounds.
- Some of these compounds may be adsorbed or otherwise attenuated by soils.
What difference does development make in a public water supply watershed?
Pharmaceuticals are Not Detected in the Bangor Water District’s Drinking Water Supply

How Do Pharmaceuticals Get into Drinking Water?

An important topic receiving media coverage recently is the discovery of pharmaceuticals in certain drinking water supplies. When considering this information, it is important to understand how pharmaceuticals enter a water supply. Many people take prescription and over-the-counter drugs on a regular basis for a variety of reasons. Often, not all of the medicine is absorbed by the body and is excreted as waste into a municipal wastewater system or a private septic system. Flushing unused medication down the toilet or other household drains can also contribute pharmaceuticals to our nation’s wastewater. Trace amounts of pharmaceuticals may remain in wastewater even after it is treated and returned to the environment. The treated wastewater may eventually enter a source of drinking water, and in the process, introduce trace amounts of pharmaceuticals to the drinking water supply.

Floods Pond Watershed

A Source Like No Other

How Important is a Protected Water Supply?

The possibility of pharmaceuticals entering our water supply is unlikely because Floods Pond is exceptionally well protected. Floods Pond does not have any municipal wastewater discharges into the water supply. There are no camps surrounding the pond, and swimming is prohibited to ensure that human waste cannot enter the drinking water supply from inadequate septic systems or from bodily contact.

Through a combination of land purchases and mutual protective easements, the District now controls and protects over 98% of the watershed. This is very important because source water protection is the first barrier in a multi-barrier approach to providing safe drinking water to the public.

What Testing has the District Done?

Although the District is required to test over 120 contaminants with known health effects, there are no regulations requiring the District to test for pharmaceuticals. The District has, however, recently conducted pharmaceutical testing of its drinking water. In April 2007, the source of supply, Floods Pond, was tested for the presence of estrogen, a common pharmaceutical compound. Laboratory results confirm that natural and synthetic forms of estrogen are not present in Floods Pond's water.
Product chemicals detected in Sebago Lake

Maine's biggest drinking water reservoir contains only trace amounts that don't pose any known threat to health.

By JOHN RICHARDSON, Staff Writer

October 8, 2009 Chemicals from a pharmaceutical and other consumer products have been found for the first time in Sebago Lake, the source of the Portland area's drinking water. The trace amounts of a common pain medication, an ingredient in antibacterial soaps and a chemical that prevents carpet stains don't violate any safety standards or pose any known health threat.
Perspective

- Sebago Lake’s watershed is 440 square miles
- Volume is 995 billion gallons
- Detections are low parts per trillion, and were not replicated in later sampling
- Hypothesis: many small discharges from a large number of sources of ibuprofen (painkiller), triclosan (antibacterial) and PFOS (stain repellant).
- Most likely sources are septic systems.
- Loading rate from the watershed of some tens of pounds of each compound, assuming the lake is well-mixed
Waste disposal engineering

- We are in the early exploratory stages in understanding PPCP’s
- Testing and interpretation are expensive
- Well designed, installed and maintained septic systems are an essential public health tool
- Improper use and disposal of chemicals can overwhelm a system’s ability to treat normal sanitary waste.
- The cumulative impact of chemical use may result in effects we can’t yet understand or predict