ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Pharmaceuticals and Personal Care Products in Drinking Water and Aquatic Environments - Answers to Frequently Asked Questions

1) What are considered pharmaceuticals and personal care products?

Pharmaceuticals and personal care products (PPCPs) comprise a diverse group of chemicals including, but not limited to, prescription and over-the-counter human drugs, veterinary drugs, diagnostic agents, nutritional supplements and other consumer products, such as fragrances, cosmetics, bug repellant and sun-screen agents. PPCPs include a broad array of synthetic and naturally occurring compounds that are not commonly monitored or regulated in drinking water or aquatic environments.

2) How do PPCPs enter the environment and why has this recently become a concern?

PPCPs enter both the soil and aquatic environments through a variety of routes, including, but not limited to, wastewater effluent, treated sewage sludge, landfill leachate, industrial effluent, combined sewer overflows, aquaculture, and animal feed lots. Contributions to the environment from these sources remain poorly characterized. Specific examples of releases of PPCPs to the environment include:

- People excreting un-metabolized medications into septic or wastewater collection systems.
- People flushing unused or expired pharmaceuticals down the toilet or sink.
- People washing cosmetics, antibiotic soap, perfumes and sunscreens into water while bathing or swimming.
- Veterinary drugs, including hormones and antibiotics, excreted by farm animals into fields where they run off into surface water or infiltrate to groundwater.
- PPCPs that are discharged from manufacturing processes or improper commercial disposal methods.

The release of these chemicals into the environment has most likely been going on for as long as humans have manufactured and used products containing these chemicals; however the expansion of the number, types, and quantities of these compounds has likely led to an increase in the release of these compounds to the environment. New and improved analytical detection methods have enabled the detection of these chemicals in our waters at lower concentrations.

3) What are the concerns about the occurrence of PPCPs in the environment?

PPCPs are being detected in groundwater, streams, rivers, lakes, and reservoirs in the United States at very low concentrations, and have commonly been detected in combinations of chemicals. Most often, contaminants that we traditionally have looked for in water have only been analyzed for at concentrations above micrograms per liter (parts per billion) or milligrams per liter (parts per million). Research projects focusing on PPCPs have employed more advanced analytical techniques in order to detect PPCPs at nanograms per liter which is approximately equivalent to one part per trillion. To put one part per trillion in perspective, the Water Environment Research Foundation has explained that a part per trillion is about one second in 32,000 years or one inch in 33 round-trips to the moon or 1 penny in $10 billion. On average, pharmaceuticals detected in U.S. drinking water are below 10 parts per trillion, except for caffeine which averages 25 parts per trillion. At that concentration, a person would have to drink more than five million bottles (20 ounces each) of water to have the same amount of caffeine in one cup of coffee (about 75 milligrams). Many experts correctly make the point that just because a substance can be detected does not mean it is harmful to humans.

Although PPCPs have generally been found to occur at very low concentrations, the presence of these chemicals in some water bodies in the United States have been linked to impacts on aquatic species, including changes in fish sex ratios, development of female fish characteristics in male fish, changes in nesting behavior by fish, and adverse effects on invertebrates.

There are many differing perspectives on the potential for human health effects associated with PPCPs in drinking water. Some experts have reasoned that the parts-per-trillion levels of PPCPs in drinking water should not cause a concern for human health because this exposure level is an extremely small fraction of the therapeutic doses of PPCPs that certain people apply to themselves on a routine basis. Other experts believe that the long-term exposure to a mixture of very low concentrations of PPCPs in drinking water is a cause for concern. This concern is based on the fact the many PPCPs are: 1) Specifically designed to achieve a biological response; 2) Associated with causing adverse impacts to aquatic life in certain studies; and 3) Detected as a mixture of chemicals for which the impact to human health associated with long-term exposure has not been definitively determined.

DES believes that many unknowns remain regarding the potential for adverse effects on ecological receptors and humans from exposure to PPCPs in the environment. For this reason, DES strongly supports research on this topic, especially for human health effects on sensitive populations such as children, pregnant women, and those with compromised immune systems. DES shares the same concerns relative to the occurrence of other emerging substances of interest or traditionally monitored contaminants and also supports further research in these areas.

4) Are PPCPs being detected in New Hampshire's water resources? Is your water utility or wastewater utility testing for PPCPs?

These compounds are not routinely monitored for as part of federal or state monitoring programs, and much of the monitoring to date has been part of specific research projects.

Most water and wastewater utilities do not specifically test for PPCPs in the water supply at this time. Over the next few years, the U.S. Environmental Protection Agency (EPA) is requiring that

all water systems serving more than 10,000 people and that a representative sample of water systems serving fewer than 10,000 people collect water samples from their water sources and analyze them for ten common pharmaceuticals. Although pharmaceuticals are not regulated under drinking water regulations, EPA continues to evaluate the occurrence of these compounds in the environment and associated human and aquatic life health effects.

In specific research projects, PPCPs have been detected in groundwater, streams, rivers, lakes, and reservoirs of the Northeast at very low concentrations, and have commonly been detected in combinations of chemicals.

At this time, DES is aware of the following ongoing PPCPs studies in New Hampshire:

- Fish tissue and water samples have been collected downstream of two wastewater treatment facilities in both the Merrimack River and Connecticut River. These samples will be analyzed for PPCPs. This work is being completed by USEPA. The results of this study will be published in 2010 or 2011.
- The University of New Hampshire is conducting PPCP loading analysis in the Merrimack River Watershed. This work includes the collection of water samples at wastewater treatment facilities and at stream gaging locations through out the watershed. The results of this work will be published in 2010.
- The Squam Lake Association has sponsored a PPCP sampling study for Squam Lake and other water bodies in the lakes region. The results of this study will be published in 2010.
- Treated wastewater from a nursing home and prison that is discharged to the Connecticut river was analyzed for pharmaceuticals in 2009.
- A municipal water system collected raw and treated water samples in 2009. The samples are currently being analyzed for PPCPs and the results should be available in the near future.
- DES will be collecting groundwater samples from a nursing home that discharges wastewater to the groundwater. The samples will be analyzed for pharmaceuticals and personal care products. The study will be completed in 2010.
- The United States Geological Survey collected groundwater samples from approximately twelve water systems in the Seacoast region of New Hampshire. The samples have been analyzed for numerous personal care products. The results of the study will be published in 2013.

5) Do drinking water and wastewater treatment processes remove PPCPs from water?

Conventional drinking water and wastewater treatment processes were not designed to remove PPCPs from water. However, many of the conventional treatment processes do reduce the concentrations of PPCPs in water to some extent. The effectiveness of a given treatment process in reducing or removing PPCPs in water is very case specific and depends on the exact design parameters of a given treatment process and the substances requiring removal. The American Water Works Association and Water Environment Research Foundation have completed a substantial amount of research on this topic.

Some laboratory based research studies have shown that reverse osmosis and nanofiltration can be very effective at removing pharmaceuticals from water. Some of these technologies are employed in residential point-of-use systems (point of use means treatment systems that are installed under the counter or at the tap). DES is not aware of any peer-reviewed studies that

assess the effectiveness of commercially available residential point-of-use water treatment systems in removing PPCPs.

Several research studies have assessed the effectiveness of septic systems in removing PPCPs from wastewater discharged to septic systems. In general, traditional sand filtered septic systems significantly reduce the amount of PPCPs that are discharged to groundwater. Septic systems that conform to modern septic system design standards are likely more effective in reducing the amount of PPCPs in wastewater that is discharged to the environment. Groundwater in areas with a high population density and with older septic systems designs is more likely to have detectable concentrations of PPCPs in groundwater. Additionally, groundwater in certain areas with populations likely utilizing a larger number and amounts of PPCPs may be more likely to have detectable levels of PPCPs.

6) What can each of us do to reduce the occurrence of PPCPs in the environment?

The manner in which we handle and dispose of our unused PPCPs can result in the addition of these chemicals into some environmental settings at levels that may contribute to ecological harm. Medicine storage and disposal procedures must also consider poisoning and substance abuse concerns. We can also take pollution prevention measures, such as buying only the amount you will use, to reduce waste associated with PPCPs. For information regarding pollution prevention and proper disposal of PPCPs, please refer to state and federal guidelines, which can be found at www.nh.gov/medsafety .

DES has also coordinated with the New England Interstate Water Pollution Control Commission to ask that federal agencies conduct a more comprehensive environmental impact life cycle analysis on PPCPs as these products seek regulatory approval.

7) Where can I get my water tested for PPCPs?

Regulated water systems in the state must routinely test their water for known health risks and comply with drinking water standards in accordance with state and federal laws and regulations. DES strongly encourages people that obtain water from private wells also routinely sample their wells (see http://des.nh.gov/organization/divisions/water/dwgb/well_testing/index.htm). At this time, DES is not actively encouraging water systems or private well owners to sample their water for PPCP analyses. PPCPs represent only a fraction of substances that are detected in the environment and are being studied by scientists right now. Instead, DES encourages entities to utilize limited resources to sample water for and protect water resources from known health risks.

A small number of commercial laboratories can complete analyses for PPCPs. Laboratories in New Hampshire may have contractual arrangements with national laboratories that can also complete these analyses. Because there is no accreditation process to certify a laboratory's competency in analyzing certain PPCPs, it is important that due diligence be applied to ensure the laboratory's capability to complete the desired analyses.