Update: Control of Toxic Chemicals in Puget Sound

We are improving our understanding of the types of contaminants in polluted stormwater runoff in our state, thanks to a number of historical and ongoing studies by the Washington State Department of Ecology (Ecology) and other organizations.

Polluted stormwater runoff is the leading pollution threat to our lakes, rivers, and Puget Sound.

Broadly, the primary contaminants in polluted stormwater runoff are nutrients, bacteria, sediment, and toxic chemicals.

Nutrients from fertilizers cause algae blooms and can rob oxygen from water. Bacteria from livestock and failing septic systems can make people and animals sick and can make shellfish unhealthy to eat. Fine sediments can smother habitats and carry toxic chemicals. Stormwater scours river channels, which creates muddy runoff and land loss.

Toxic chemicals (toxics) may be our biggest challenge because once released into the environment, they get into stormwater from so many diffuse and hard-to-trace sources. Toxics in stormwater can affect the food chain and can cause both environmental and human health effects.

The Puget Sound Toxics Loading Study

In the state's move to restore and recover Puget Sound, Ecology along with other organizations are studying the loadings, pathways, sources, and impacts of toxics released into the Puget Sound ecosystem. Ecology expects to complete its multi-phased toxic chemical study in the spring of 2011, and to provide some new, more-focused findings related to delivery and impacts of toxic chemicals.

Based on years of study, we already know that toxic chemicals are a problem in our environment. Read more about toxic chemicals and a status of steps our state has taken to deal with them here. (www.ecy.wa.gov/toxics/index.htm)

WHY IT MATTERS

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Web sites

Control of Toxic Chemicals in Puget Sound
www.ecy.wa.gov/programs/wq/pstoxics/index.html

This focus sheet
www.ecy.wa.gov/biblio/1103012.html

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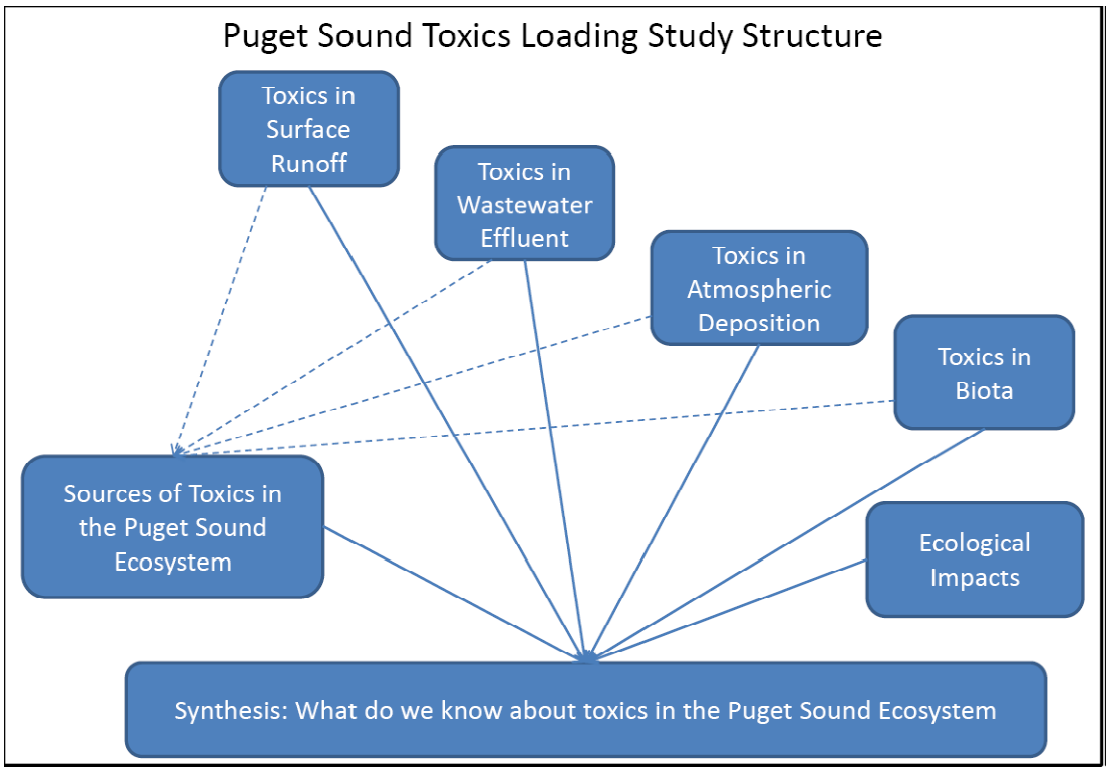
The *Puget Sound Toxics Loading Study* builds on earlier work in Puget Sound helping us know where the toxic chemicals are coming from so we can take actions to control them and help restore Puget Sound and the fresh waters flowing into Puget Sound. When finalized, the overall study findings will help us target the biggest problems with a focus on pollution source control and prevention.

For the monitoring phase of the study, Ecology selected 17 contaminants of concern out of the thousands that are in commerce today. Ecology's selection was based on (1) knowledge of the harm these contaminants represent and (2) at least some data about their distribution in the environment. Since it is impractical to monitor for all of the thousands of chemicals in use today, Ecology's approach is that these 17 contaminants would serve as indicators for larger classes of chemicals. Ecology included a limited evaluation of pharmaceuticals, personal care products, and perfluorinated compounds in its analysis.

Besides looking at the rivers that drain into Puget Sound and surface runoff from the entire watershed, Ecology's *Puget Sound Toxics Loading Study* is looking at wastewater discharges, atmospheric deposition, and concentrations in organisms.



Structure of the Toxics Loading Study, including subtasks

Findings about runoff during storms

Surface water runoff during storm events carries toxics from their source into Puget Sound rivers and streams. Ecology measured toxics in streams during storms and in baseflow. Baseflow is the river flow before it rains.

- Together, storm flows and baseflow represent the largest contributor of these contaminants into Puget Sound waters.
- Contaminants are more prevalent and found at higher levels during storm flows than during non-storm conditions in rivers and streams that drain into the Sound.
- Compared with stormwater from other land use types, urban stormwater contains higher levels and more frequent detections of chemicals.

Streams and rivers may actually be more sensitive to stormwater impacts than Puget Sound because they are closer to sources and support the sensitive life stages of organisms. For example, copper is harmful to the sensory abilities of salmon in fresh water.

Key sources of toxic chemicals in Puget Sound

While it helps to know the major pathways for toxics, we really need to know where they are coming from. What are the major sources? We identified the following key sources for some of the contaminants:

Copper -- Sources include brake pads, pesticides, boat paint, and plumbing.

Petroleum -- Sources include motor oil drips and leaks, minor gasoline spills, improper disposal of used oil, and major petroleum spills.

Polycyclic aromatic hydrocarbons (PAHs) -- Sources include woodstoves and fireplaces, creosote-treated railroad ties/marine pilings/utility poles, and vehicle emissions.

Zinc -- Sources include roofing materials, tire wear, fertilizers, plumbing, brake pads, and industrial/commercial sources.

If we know about contaminant loads, pathways, and sources, we also need to make the connections to impacts for good prioritization of our cleanup and pollution-control efforts. It is important to remember that it is not just about the amount, or load. Lower loads do not necessarily mean less harm. Some contaminants are more toxic than others – "the dose determines the poison."

Impacts of PAHs and copper in Puget Sound stormwater

PAHs are linked to tumors in Puget Sound English sole. Ecology and Washington Department of Fish & Wildlife data show that reducing PAHs in sediment reduces tumors in English sole.

Exposure to PAHs in air is also of concern for human health. Reducing PAHs in air benefits human health and also leaves less to deposit and runoff into Puget Sound waters

Copper has sensory impacts on salmon. Copper inhibits their ability to migrate and avoid predators. Several iconic Northwest salmon species are listed as threatened or endangered species in our state.

Frequently Asked Questions

Q: What was the purpose of the overall toxics loading study?

A: The overall *Puget Sound Toxics Loading Study* was undertaken to identify the **loadings, pathways, sources**, and **impacts** of toxic chemicals released to Puget Sound waters. Phase 3 of the study includes new monitoring data along with an assessment of the primary sources of toxics entering Puget Sound. In addition, this phase will attempt to prioritize these sources by considering their potential to harm the health of Puget Sound.

Q: Did the studies just focus on Puget Sound marine waters?

A: No. While our studies did address loadings to marine (salt) waters, we also studied the streams and rivers that drain into Puget Sound, the nation's second largest marine estuary.

Q: Is surface runoff only stormwater?

A: No. The term "surface runoff" refers to water in rivers and streams that comes from both active stormwater and baseflow. Baseflow means the water in the rivers from groundwater minus storm flows.

Q: What was the purpose of the Phase 3 surface runoff study?

A: The *Toxics in Surface Runoff Phase 3 Study* was designed to determine the relative contribution of toxic chemicals to the Puget Sound ecosystem from various land uses and to distinguish between stormwater and baseflow contributions.

Q: What were the results of the Phase 3 runoff study?

A: We expect to have final, peer-reviewed results in the spring of 2011. We anticipate the Phase 3 study to confirm patterns found in earlier estimates, with higher levels of toxic chemicals in stormwater compared to baseflow and in developed lands compared with undeveloped lands.

Q: What were the most prevalent contaminants you've found in surface runoff?

A: The amount of oil and grease was more than any other contaminant encountered. The next highest amounts were from metals such as zinc, lead, copper, and arsenic. Just because a certain contaminant is the most prevalent does not necessarily mean it is the one that poses the greatest risk to the environment.

Q: What does the study mean when it uses the pollution category "oil and grease"? How much petroleum is in the oil and grease category?

A: Oil and grease represents a group of pollutants that are often measured in stormwater, but it is not exclusively petroleum. Petroleum is a large component of oil and grease in urban areas but less so in undeveloped parts of Puget Sound.

Q: Why have the annual load estimates changed?

A: Loads of the 17 selected contaminants likely will decline in Phase 3 compared with Phase 2. The Phase 1 and 2 estimates included data from around the country collected directly from pavement or stormwater conveyance systems, which represents conditions closer to the sources. Phase 3 sampling focused on Puget Sound rivers and streams, and concentrations of toxic chemicals were generally lower compared with data used in earlier phases. Not all toxic chemicals released within the Puget Sound ecosystem reach streams and downstream water bodies. Lower concentrations could be due to dilution or could indicate that contaminants settled to the sediments, volatilized to the atmosphere, or naturally degraded.

Q: Do you have some general conclusions from all three phases of the overall Puget Sound toxics study?

A: Yes. Not surprisingly, we confirmed that toxic chemicals are being released into the Puget Sound ecosystem. Surface runoff, and particularly during storms, delivers the highest levels of contaminants to our waters. However, other pathways can be important for some contaminants such as pharmaceuticals in wastewater and air deposition of PBDEs.

Most importantly, we have begun to link the pathways by which these toxics get into Puget Sound water with their major sources.

Q: What's next?

A: The study results are being peer reviewed to ensure we have as accurate a picture as possible of the toxic contaminants reaching Puget Sound and potential sources. We anticipate the study will be complete by March 2011. Combined with our knowledge of the risks that these toxics pose to human health and the environment, policymakers can use the study results to target those sources of toxics that pose the biggest threat to Puget Sound.