

Puget Sound Toxics Assessment

In our state's effort to restore and recover Puget Sound, the Washington State Department of Ecology (Ecology), Puget Sound Partnership, and other organizations launched a series of scientific studies in 2006 called the *Puget Sound Toxics Loading Study*.

The study was designed to find out how toxic chemicals (toxics) reach Puget Sound, help set priorities for reducing the harm they cause, and recommend how resources might be directed to more effectively resolve some toxic contamination issues threatening Puget Sound. The *Toxics Loading Study* primarily focused on how toxic pollutants reach Puget Sound through surface water runoff, groundwater discharge, atmospheric deposition, and wastewater treatment discharges.

The study examined:

- Where the toxic chemicals come from.
- How much is being delivered to Puget Sound.
- The delivery pathways that contribute to toxic loads to Puget Sound.
- The relative importance of these chemicals based on their toxicity.

The information collected in the *Toxics Loading Study* is being used to help develop an overall control strategy for reducing toxic chemical threats in Puget Sound. Ecology worked with a team of regional experts and used independent third-party review to ensure that the scientific methods and approaches used in the study were credible.

Assessment report synthesizes four years of work

Researchers have recently published a synthesis of the different components of the toxic chemical study called the *Assessment of Selected Toxic Chemicals in the Puget Sound Basin: 2007-2011*. The Assessment:

- Incorporates new and more complete data about sources, loading, pathways, and hazards.
- Contains recommendations intended to help guide where resources might be directed.

WHY IT MATTERS

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

Broadly speaking, the primary contaminants in stormwater runoff are nutrients, bacteria, sediment, and toxic chemicals:

- Nutrients from fertilizers and animal wastes (manure) cause algae blooms that can rob oxygen from the water.
- Bacteria from animal wastes and failing septic systems can make people sick and shellfish unhealthy to eat.
- Sediments can smother aquatic habitats and carry toxic chemicals. Runoff can scour our river channels, creating erosion and muddy runoff that carries fine sediments.

Toxic chemicals may be our biggest challenge because they come from many scattered, spread out, and hard-to-trace sources. There is no single guilty culprit or an industrial source. Most are used in some way by pretty much all of us.

Once released, toxic chemicals can affect the environment and human health.

Successful strategies that limit toxic chemicals to Puget Sound will improve aquatic habitat conditions and support healthy populations of salmon and other fish.

The Puget Sound Partnership is currently in the process of updating the Puget Sound Action Agenda – the regional plan for restoring the health of Puget Sound. The *Toxics Assessment* will help the Partnership set some of its cleanup priorities and strategies for the Sound. For example, the assessment can be used to identify which sources or pathways of toxic chemicals should receive priority attention.

Assessing chemicals of concern

While there are thousands of chemicals in commerce today, scientists had to narrow the field to a select number of chemicals. The *Toxics Assessment* focuses on 17 toxic chemicals and chemical groups due to their potential to harm the health of people, fish, and the Puget Sound ecosystem, because they are known to be transported to Puget Sound in a variety of pathways. Some of these chemicals also are representative of larger classes of toxic pollutants that are probably present in Puget Sound waters.

The chemicals in the *Toxics Assessment* include:

- Arsenic, cadmium, copper, lead, mercury, and zinc.
- Polycyclic aromatic hydrocarbons (PAHs).
- Flame retardants such as polybrominated diphenyl ethers (PBDEs).
- Phthalates, a family of chemicals commonly found in plastics.
- Petroleum-based contaminants.
- Polychlorinated biphenyls (PCBs) and DDT.
- Triclopyr, a pesticide commonly used in urban areas.
- Nonylphenol, a compound often found when commercial detergents breakdown.

Effects on people, fish, and the Puget Sound ecosystem

There are no simple answers about which chemicals are most dangerous. Different chemicals cause harm in different ways and to different organisms. The hazard posed by any given chemical depends on how toxic it is and how much gets into the Puget Sound environment. We have known for a long time that persistent and bioaccumulative toxics such as **polychlorinated biphenyls (PCBs)** and **mercury** build up in fish and marine mammals and can impact their health. We also know that people who consume fish are exposed to the chemicals.

More recently, scientists in Puget Sound have shown that polluted stormwater can cause salmon to die before they are able to spawn. While we do not exactly know which pollutants cause the most problems, research has shown that:

- Low-levels of **copper** inhibit the ability of salmon to avoid predators and find their way back to spawning streams.
- **Polycyclic aromatic hydrocarbons (PAHs)** can impact early-life stages of fish such as herring.

Managing stormwater and reducing copper and PAHs in our streams, rivers, and marine (saltwater) environment will improve the health and survival of salmon and other fish.

Sources are diffuse and hard to trace

The *Toxics Assessment* found that chemicals are released from many scattered, diffuse, and hard-to-trace sources. There is no single guilty culprit such as a large municipal or industrial source. Most toxic pollutants are used in some way by most everyone. They are found in our homes and gardens, where we work, and in the waste we leave behind. However, the *Toxics Assessment* did point the way to several key sources for some toxic chemicals:

- Copper, cadmium, zinc, and phthalates from roofing materials.
- Copper from pesticide and fertilizer use in urban areas.
- PAHs from creosote-treated wood, wood smoke, and vehicle exhaust.
- Petroleum-related compounds from minor fuel and oil spills, and drips and leaks from our cars and trucks.

Polluted runoff is most common pathway, biggest threat

The most common pathway these chemicals take to reach Puget Sound is through polluted surface runoff – also known as stormwater. Rain hits our roofs, roads, developed areas, and other hard surfaces and runs into our storm drains, and then goes mostly untreated directly into lakes, streams, and rivers that drain to Puget Sound. The heaviest concentrations of toxic pollutants come from developed areas that contain residential, commercial/industrial, and agricultural land uses. These types of land uses also have a large amount of hard surfaces like pavement and roofs which prevent rainwater from soaking directly into the ground. This creates the conditions for these chemicals to be carried away in runoff.

Other pathways include air deposition, wastewater discharges

There are some variations in the ways different chemicals reach Puget Sound. For instance, direct air deposition – chemicals that fall directly onto Puget Sound marine waters from the air – was the most significant pathway for PBDE flame retardants and some PAHs. Wastewater treatment plants were also a major pathway for PBDEs, and appear to transport larger annual quantities to Puget Sound than surface runoff. Public sewage treatment plants, however, generally accounted for less than 10 percent of the chemicals studied that reach Puget Sound.

Making gains toward tackling toxic chemical sources

While cleanup and good management must continue, we can be more effective by reducing toxics at their source.

There has been some important progress already. For instance, the Washington Legislature has already banned or reduced the allowable uses of some pollutants such as PBDEs in flame retardants, lead in motor vehicle wheel weights, bisphenol A (BPA) in baby bottles, coal tar (PAHs) in pavement sealants, and phosphorus in lawn fertilizers. Lawmakers have also passed measures to phase out copper in brake pads and boat paint.

For more than a decade, local, state, and federal agencies have worked to reduce harmful wood smoke and vehicle emissions. Washington has made strides in green development, including on-site treatment of runoff.

Near-term actions

The *Toxics Assessment* pointed to the following near-term actions as a priority to reduce toxic chemical threats in Puget Sound:

- **Find ways to reduce the amount of copper that gets washed into our streams and rivers.** This means learning more about the amount of copper-based pesticides and fertilizers used in both urban and agricultural applications and exploring ways to reduce their use. We also need to keep working to eliminate copper from brake pads and boat paint.
- **Rethink our roofs since roofing materials appear to be a significant source of copper, cadmium, zinc, and phthalates.** We need to evaluate the amount and impacts of these toxic chemicals that wash off various roofing materials. This includes looking for alternative materials that pollute less where available.
- **Increase efforts to remove creosote-treated wood – a significant source of PAH – from Puget Sound.** It will be important to measure the effect of these removals, and find out more about the impact of creosote-treated utility poles and railroad ties located near water – especially our salmon-bearing streams.
- **Keep working on developing strategies to reduce petroleum releases** – particularly chronic spills, drips, and leaks from our cars and trucks as well as our recreational boats and small commercial vessels. This might include increasing education programs like the pilot Automotive Leak Workshops done by Ecology, Seattle Public Utilities, and South Seattle Community College. It also means working with organizations like Puget Soundkeeper Alliance and the Northwest Marine Trade Association to reduce spills from boats through programs such as their Clean Marina Program.

Conclusions

Key findings from the *Toxics Assessment* include:

- Diffuse, hard-to-trace sources account for the majority of toxic chemical releases in the Puget Sound basin. There is no single municipal or industrial source that can be controlled to eliminate the toxic chemical problem. Chemicals are present in a wide variety of products that we all use.
- The most common pathway for toxic chemicals to reach Puget Sound is through polluted stormwater runoff from developed areas. Rain hits our roofs, roads, developed areas, and other hard surfaces and runs into our storm drains, and then goes mostly untreated directly into lakes, streams, and rivers that drain to Puget Sound.
- The *Toxics Assessment* evaluated a short list of 17 chemicals and chemical groups in the Puget Sound basin. Many additional chemicals are in everyday use; these could pose a threat to the Puget Sound ecosystem and need to be evaluated.

Key sources include:

- **Copper, cadmium, zinc, and phthalates** from roofing materials. It is estimated that more than 80 percent of zinc releases come from roofing materials.
- **Copper** from urban and homeowner use of pesticide and fertilizers, brake pads, and boat paint. Urban and homeowner use of pesticides and fertilizers containing copper accounts for up to one-third of the estimated release to the Puget Sound basin. About another one-third was equally divided between brake pad wear, roofing materials, and boat paint.
- **PAHs** from creosote-treated wood, wood smoke, and vehicle exhaust. Wood smoke – fireplaces and woodstoves – accounts for about one-third of the total PAH releases. Another one-third is estimated to be associated with creosote-treated wood such as pilings and bulkheads, railroad ties, and utility poles. Vehicle emissions account for about one-tenth of the estimated total release.
- **Petroleum-related compounds** from motor oil drips, leaks from vehicles, and minor fuel and oil spills. Motor oil drips and leaks account for slightly less than two-thirds of the total estimated release of petroleum-related compounds.

Websites

- Report: *Control of Toxic Chemicals in Puget Sound: Assessment of Selected Toxic Chemicals in the Puget Sound Basin, 2007-2011*. www.ecy.wa.gov/biblio/1103055.html
- Report: *Control of Toxic Chemicals in Puget Sound: Phase 3, Primary Sources of Selected Toxic Chemicals and Quantities Released in the Puget Sound Basin*. www.ecy.wa.gov/biblio/1103024.html
- Webpage: Control of Toxic Chemicals in Puget Sound. www.ecy.wa.gov/programs/wq/pstoxics/index.html

Contacts

Robert Duff
360-407-6699
robert.duff@ecy.wa.gov

Dave Serdar
360-407-7384
dave.serdar@ecy.wa.gov

Special accommodations

If you need this document in a version for the visually impaired, call 360-407-6764.
Persons with hearing loss, call 711 for Washington Relay Service.
Persons with a speech disability, call 877-833-6341.