

Toxic chemicals in roof runoff

The Washington State Department of Ecology (Ecology) conducted a study to evaluate whether roofing materials release toxic chemicals in roof runoff during rain events.

The study evaluated runoff from the most commonly used roofing materials in the Puget Sound basin. Ecology studied only new, un-aged roofing materials.

The study was conducted in collaboration with a Roofing Task Force (RTF) which was made up of manufacturers, their associations, environmental groups, and others. The RTF recommended the roofing types assessed and provided comments on the study design and draft reports.

Roofing types studied

- Asphalt shingle
- Asphalt shingle with algae resistant, copper-containing granules
- Copper
- Manufacturer-painted galvanized steel
- Concrete tile
- Wood shingle
- Wood shake treated with chromated copper arsenate
- Thermoplastic polyolefin (TPO)
- Polyvinyl chloride (PVC)
- Ethylene propylene diene terpolymer (EPDM)
- Zincolume®
- Built-up roof (BUR) with oxidized asphalt granulated cap sheet
- Modified BUR with styrene butadiene styrene (SBS) granulated cap sheet
- Modified BUR with atactic polypropylene (APP) granulated cap sheet
- Steep-slope glass control
- Low-slope glass control

Study methods

Manufacturers and associations donated the roofing materials and installed them on 4-foot by 8-foot test panels in Lacey, Washington.

Why do we care about roofing materials?

Ecology is working to protect and preserve Puget Sound for future generations. We completed a study to learn more about toxic pollutants that may find their way to Puget Sound and where these pollutants come from. Our goal is to reduce or eliminate those sources of pollution to prevent the pollutants from reaching the Sound.

The Puget Sound Toxics Loading Assessment identified roofs as a potential significant source of arsenic, cadmium, copper, and zinc released in the Puget Sound basin. These metals, when deposited in sufficient amounts, can cause harm or death to fish and other aquatic life.

Ecology conducted this study to determine what pollutants might be coming from various roofing materials commonly used in the Puget Sound region.

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The panels represented 14 types of roofing materials. The roofing materials evaluated represent residential and commercial materials commonly used in the area. Glass panels were used as controls.

Between February 2013 and January 2014, Ecology staff collected runoff during 20 rain events. Precipitation landing on each roof panel flowed into a 17-gallon stainless-steel pot. Samples were obtained from the pots and shipped to a laboratory for analysis of total and dissolved metals as well as organic compounds.

Findings

The roofing materials tested released lower concentrations of total metals than anticipated, with the following exceptions:

- The treated wood shake panel released concentrations of arsenic and copper that were significantly higher than the glass control panel. However, these concentrations decreased over the course of the study.
- The PVC panel released concentrations of arsenic that were higher than the glass control. Arsenic likely serves as a biocide in the PVC matrix. Arsenic concentrations declined over the course of the study.
- The copper panel released concentrations of copper that were significantly higher than the glass control.
- The asphalt shingle panels (with algae resistance) released concentrations of copper that were also higher than the glass control but were more than 60 times lower than the copper panel.
- The Zinalume® and EPDM panels released concentrations of zinc that were significantly higher than the glass control. Zinc represents one of two metals in the Zinalume® alloy. Zinc is used as a catalyst in the manufacturing process of EPDM. Zinc in runoff from the EPDM panel decreased over the course of the study.
- Several other panels released concentrations of zinc that were significantly higher than the glass control, but between 2 and 20 times lower than the concentrations of zinc released from the Zinalume® and EPDM panels.

Organic compounds in runoff from the roofing materials were low and generally not distinguishable from the glass control, even in those panels (such as asphalt shingles and built-up roofing) which have asphalt components.

Recommendations

As roofing materials continue to age, the concentrations of metals released may change. Ecology recommends continuing the roofing study over time. Ecology also recommends that other components of roofing systems – for example, flashings, downspouts, gutters, and HVAC systems – be evaluated to assess their releases of metals to runoff.

While the study found zinc coming out of some roofing materials to be a concern, the amount of zinc found does not match higher estimates from the 2011 Puget Sound Toxics Assessment. Ecology recommends more study to identify sources of zinc from other components of roofing systems that are getting into Puget Sound.