Study evaluates roofing materials for toxic chemicals in runoff

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

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

Ecology conducted the study in collaboration with a Roofing Task Force (RTF) of manufacturers, contractors, and others to provide input to the design of the study. The RTF recommended the roofing types assessed and provided comments on the study design and draft report.

Study methods

Manufacturers and associations donated and installed the roofing materials on 18 4-foot by 8-foot roof panels in Lacey, Washington. The panels represented 14 types of roofing materials, replicates of asphalt shingle roofs, and glass controls. The roofing materials evaluated represent residential and commercial materials commonly used in the area.

During February through April 2013, Ecology staff collected runoff from 10 rain events. Precipitation landing on each roof panel flowed into a 56-liter stainless-steel pot. Ecology obtained samples from the pots and shipped them to the laboratory for analysis of total and dissolved metals as well as organic compounds.

Roofing types studied

- Asphalt shingle
- Asphalt shingle with copper-containing granules
- Copper
- Manufacturer-painted galvanized steel
- Concrete tile
- Wood shingle
- Manufacturer-treated wood shake
- Thermoplastic polyolefin (TPO)
- Polyvinyl chloride (PVC)

Why it matters

Ecology is working hard to help protect and preserve Puget Sound for future generations. As part of that work, we completed a study to learn more about specific pollutants that may find their way to Puget Sound and where they come from. The hope is that we can then figure out how to reduce or eliminate those sources of pollution to prevent them from reaching the Sound.

This study, called the Puget Sound Toxics Loading Assessment, identified roofing materials as a significant potential 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.

We 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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Toxic Chemicals in Roof Runoff
www.ecy.wa.gov/programs/eap/toxics/roofing.html

- Ethylene propylene diene monomer (EPDM)
- Zincalume®
- 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

Findings

The new 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.
- The copper panel released concentrations of copper that were significantly higher than the glass control.
- The PVC panel released concentrations of arsenic that were significantly higher than the glass control. Arsenic likely serves as a biocide in the PVC matrix.
- The asphalt shingle panels (with and without algae resistance) released copper concentrations that were also higher than the glass control, but 10 to 100 times lower than the copper panel.
- The Zincalume® and EPDM panels released concentrations of zinc significantly higher than the glass control. Zinc represents one of two metals in the Zincalume® alloy. Zinc is used as a catalyst in the manufacturing process of EPDM.
- Several other panels released concentrations of zinc that were significantly higher than the glass controls, but up to 10 times lower than the zinc released from the Zincalume® and EPDM panels.

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

Recommendations

The results from this initial investigation did not give Ecology enough data to make decisions about future actions such as source control actions. To that end, Ecology continued sampling runoff from the roofing panels for another 10 rain events in the fall and winter of 2013 and 2014.

Ecology recommends that other components of roofing systems (flashings, downspouts, gutters, HVAC) be evaluated to assess releases of metals to runoff. This is because the highest zinc concentrations in runoff from the Zincalume® and EPDM roofs were an order of magnitude lower than the mean concentrations used by Ecology to assess sources of contaminants in Puget Sound from roofing systems.

As roofing materials age, the concentrations of metals released may change. Ecology recommends continuing the study over time.