Brake Pad Partnership Technical Studies
Copper Releases in the San Francisco Bay Watershed

Summary of Findings

The Brake Pad Partnership is conducting a series of technical studies whose purpose is to gain a better understanding of the sources of elevated copper concentrations in the San Francisco Bay. Three environmental modeling efforts that trace the movement of copper in the San Francisco Bay watershed will help to determine whether or not copper from brake pads contributes significantly to copper in the bay. These modeling efforts include an air deposition model, a watershed model, and a bay model. Each of these models uses information about the quantity of copper being released into the environment from natural and/or human sources.

Human sources of copper released to the environment range from anti-fouling coatings on boats to brake pads. The Partnership commissioned Process Profiles to prepare an inventory of releases of copper from brake lining wear and an inventory of releases of copper from non-brake sources in the San Francisco Bay watershed.

The inventory of releases was prepared as follows:

- In order to estimate the releases of copper from brake lining wear, emission factors based on vehicle distance traveled were developed. Air emission factors were created first, using several independent methodologies, and the most appropriate methodology was selected for preparing the estimates of copper releases. Emission factors for releases to roadway are based on the air emission factors coupled with brake wear partitioning information.
- The methodologies for estimating non-brake sources of copper depended on the type of source. Estimates were prepared for architectural copper, copper in pesticides (including pesticides applied to land in urban areas, agricultural land applications of pesticides, algaecide treatment of surface waters, pressure-treated wood preservatives, antifouling coatings on boats, and pool, spa, and fountain algaecides), copper in fertilizer, copper releases from industrial facilities (including releases in runoff), and copper in domestic water discharged to storm drains.
- In order to meet the needs of the modelers, releases were categorized as occurring to air, to storm drains and surface waters, to impervious land surfaces, to pervious agricultural land surfaces, to pervious developed land surfaces, and directly to bay waters.
- Release estimates for each of 23 sub-watersheds within the San Francisco Bay watershed were prepared. In general, estimates were prepared for the smallest geographic unit possible and then apportioned to the sub-watersheds based on an appropriate factor such as population or land cover, depending on the type of release.
- Estimates were prepared for the year 2003.

Key findings from the source inventory are:

- An estimated 240,000 kg (540,000 lb) of copper were released due to human activity in the San Francisco Bay watershed in 2003. Of this amount, 87,000 kg (36%) was copper released from brakes.
- About half of the estimated copper released is released directly to pervious land surfaces where it is less likely to become entrained in runoff and reach bay waters. Copper in pesticides applied to urban land is the single largest source of copper releases to the environment in the San Francisco Bay watershed, with 100,000 kg released in 2003. This is 42% of the total human sources of copper released in the bay area.
- While brake pads on new cars tend to have a higher concentration of copper than replacement brake pads, more cars have replacement brake pads installed and the amount of copper released from replacement pads is not minor. The BPP's inventory of copper releases from brake lining wear in the San Francisco Bay area indicates that a substantial amount of the copper released from brake pads on passenger cars is released from replacement pads.
- Nearly all of the copper released from brake lining material wear is from brake pads on passenger cars.
- A substantial portion (30% to 70%) of copper released from brakes is transported through air.