

FACTS & FIGURES: TRACE ELEMENTS

TRACE ELEMENTS OVERVIEW

- Bioaccumulative
- Chemical element mercury (Hg)
  - Metabolized by fish, birds, mammals and humans
  - Found at multiple sites in the estuary
- Have sublethal effects on salmon behavior and health
- Neurological impairment in humans
- Toxicity can be synergistic (more than the sum of the parts)
- Industrial and mining activities are sources of concern

WHAT ARE TRACE ELEMENTS?

Trace elements are metals and similar substances that occur naturally at fairly low levels and many are necessary for growth and health. Higher levels, and the synergistic impact of multiple elements, can be toxic. Examples include arsenic, copper, chromium, lead, mercury, nickel, iron, and zinc. Trace elements are used in a variety of industrial uses and may be particularly associated with past and present mining activities.

IMPACTS ON FISH & WILDLIFE & THE ENVIRONMENT

Trace elements can have synergistic effects when they occur together, meaning that their combined toxicity is more than would be predicted based on the sum of the elements present. This is a possibility when copper is found with mercury, aluminum, iron, or certain pesticides. Most trace elements can bioaccumulate in fish and wildlife.

Several trace elements can be toxic or have sublethal effects on salmon behavior and health:

- **Arsenic**: Reduced growth, disrupted smoltification, physical/developmental abnormalities
- **Chromium**: Disrupted feeding, reduced response to stimuli, suppressed immune function, reduced growth, disrupted reproduction, cellular damage
- **Copper**: Less frequent spawning, reduced olfactory function, suppressed immune function, reduced growth, disrupted reproduction, cellular damage
  - Copper in the water in the estuary has been measured at levels high enough (up to 3.8 micrograms per liter) to impair juvenile salmon's olfaction, or sense of smell.
- **Lead**: Reduced swimming ability, reduced growth, cellular damage, physical/developmental abnormalities
- **Nickel**: Cellular damage

IMPACTS ON HUMAN HEALTH

In small doses, trace elements are essential for healthy human functioning. Short- and long-term impacts with more acute exposure are harmful.

- **Mercury**: Impacts brain, liver, and kidney functions; immune system; neurological development in-utero and in young children; causes neuropathy, anxiety, fatigue, tremors, or anexoria in humans. Impairs the nervous system and brain and impairs the physical and mental development of human fetuses and infants exposed via the mothers' diet.
- **Lead:** Another neurotoxin used in building construction, lead-acid batteries, bullets and shot, weights, as part of solders, pewters, fusible alloys, and radiation shields. Impairs nervous system, causes nephropathy, increases in blood pressure, damages the brain and kidneys, and ultimately causes death. In pregnant women, may cause miscarriage and reduces fertility in males. Also damages nervous connections (especially in young children) and causes blood and brain disorders.

SOURCES OF EXPOSURE

Trace elements can be introduced to the environment through the atmosphere, soil, groundwater, or surface water as a result of human activities. In the Columbia River estuary, juvenile salmon are exposed to arsenic, chromium, copper, and lead through river water.

Mercury is found in many rocks including coal. When coal is burned, mercury is released into the environment. Coal-burning power plants are the largest human-caused source of mercury emissions to the air in the United States, accounting for over 50 percent of all domestic human-caused mercury emissions.

Mercury enters the Columbia Basin through multiple pathways, including atmospheric deposition, runoff, wastewater discharges, industrial discharges, mines and incineration from coal burning facilities. It also was used widely (and still is) in thermometers, barometers, manometers, float valves, fluorescent lamps, cosmetics, and tooth fillings.

Mercury poses a special challenge in the estuary because much of the mercury pollution comes from sources outside of the estuary via atmospheric deposition. Once deposited, microrganisms can change it into methylmercury, an even more toxic form of mercury. Fish and shellfish are the most common sources of methylmercury to humans because they are higher up on the food chain than other species.

TRACE ELEMENTS IN THE ESTUARY

EPA estimates that the total mercury air deposition in the Columbia River Basin is 11,500 pounds per year.

Mercury concentrations in osprey eggs had increased through 1996, and high mercury levels have been measured in livers and other organs of white sturgeon from the Lower Columbia River. Fish consumption advisories for mercury continue to be issued throughout the estuary's feeding and breeding grounds.

Trace elements such as arsenic, chromium, copper, lead, mercury, and nickel are present in the water in the Columbia River estuary—many of them at sites throughout the estuary. Concentrations of most trace elements were found to be higher near the mouth of the Columbia River than at upstream sites.

References

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