



# Understanding Toxic Chemicals and Developing a Strategy for Reduction in the Columbia River Basin

Tanya Williams, Columbia River Restoration Lead



## Toxics, Toxins, Toxicants, etc...



- Toxins products **produced naturally** by organisms or chemical reactions
  - Examples: cyanotoxins, toxic mushrooms
- Toxicant a toxic substance (can be natural or synthetic) that is in the environment because of human activity
  - Examples: PCBs, mercury
- <u>Toxics</u> mostly refers to toxicants, but some jurisdictions may include toxins in toxics programs



# Potential to cause harm

- To a person, plant, or animal
  - Quantity: How much exposed to?
  - **Time**: How long did the exposure occur (ex. one time for 30 seconds or routinely for 20 years)?
  - Route of exposure: How did the chemical enter the organism?
    - Inhalation, skin, ingestion, root uptake



# Toxicity

- How toxic is a substance?
- Acute toxicity causes direct, immediate effects such as illness or death
- Chronic toxicity causes long-term health complications or ecosystem impacts; impacts are often sub-lethal
- The toxicity of a substance is often characterized by a <u>lethal concentration</u> or lethal dose



Graph by Niranjana Krishnan, File:Concentration-response curve.png - Wikimedia Commons

### **Species-Specific Acute Toxicity to 6PPDQ**



Species	LC <sub>50</sub> (µg/L)	Test duration (h)
Coho salmon (Oncorhynchus kisutch)	0.08 (median)	24
White-spotted char (Salvelinus leucomaenis pluvius)	0.51	24
Lake trout (Salvelinus namaycush)	0.51	24
Brook trout (Salvelinus fontinalis)	0.59	24
Rainbow trout/steelhead (Oncorhynchus mykiss)	1.0 (median)	96
Chinook salmon (Oncorhynchus tshawytscha)	82.1	24
Sockeye salmon (Oncorhynchus nerka)	Not acutely toxic up to 50	24
Atlantic salmon (Salmo salar)	Not acutely toxic up to 12.2	48
Brown trout (Salmo trutta)	Not acutely toxic up to 12.2	48
Arctic char (Salvelinus alpinus)	Not acutely toxic up to 12.7	24
Pink Salmon (Oncorhynchus gorbuscha)	Not acutely toxic	<b>48</b> 5

\*Not acutely toxic to: White sturgeon, zebrafish, medaka, fathead minnow, *Daphnia, Hyallela* 

ITRC Guidance Document Table 1-1



### **Bio...concentration**, accumulation, magnification

- **Bioconcentration** toxics are absorbed from water into organisms (e.g. biofilms)
- Bioaccumulation toxics accumulate in tissue faster than they are removed (through absorption, diet, any mechanism)
- **Biomagnification** Toxic concentrations increase at higher trophic levels



Photo from NPS



# **Priority Toxic Chemicals**

- The "worst of the worst" or "PBTs"
- **Persistence** Stick around in the environment for a long time.
- **Bioaccumulative** Accumulate over time in plants, animals, and people are a threat because they build up through the food chain.
- **Toxic** Exposure has been linked to a wide range of toxic effects in fish, wildlife, and humans.
  - Immediate effects: damage to the lungs.
  - Long-term effects: increasing the risk of cancer.

# DDT



#### Exposure symptoms

#### Nausea, dizziness, and tremors

Liver damage, reproductive issues, and possibly cancer

Potential impacts on fetal development and childhood neurodevelopment

Found in human breast milk, posing risks to infants

- Synthetic pesticide.
- Developed in 1940s: insect control, malaria.
- 1972: Banned in the U.S.
- Remains in the environment for decades.
- Accumulates in fatty tissues of organisms.
- Concentrates as it moves up the food chain.
- Thinning of eggshells.
- Decline in fish and amphibian populations.

### **Ranking of Toxics in the Columbia River Basin**



Tier I (highest priority)	Tier II	Tier III
DDT (and metabolites)	PAHs	Organochlorines (including alpha BHC, aldrin, dieldrin, chlordane)
PCBs	Arsenic	Trace elements
Mercury (including methylmercury)	Dioxins/furans	Current use pesticides (including carbamates, triazine herbicides, fipronil)
PBDEs	Lead	Pharmaceuticals and Personal Care Products
	Organophosphate Insecticides	Other wastewater compounds (plasticizers,
	(azinphos methyl, chlorpyrifos, diazinon)	detergents, surfactants)
	Copper	Hormones
	Estrogenic compounds (Bisphenol A, AHTN, natural and synthetic estrogens, Nonylphenol)	Synthetic pyrethroids
		Phthalates



# **Toxic chemicals in your home**

Product	Possible chemical(s)
Cleaning products and disinfectants	PFAS, phthalates
Clothing	PFAS
Cookware	PFAS, lead
Cosmetics	PFAS, formaldehyde, lead, mercury
Fragrances and perfume	Phthalates
Furniture and textiles	PFAS, flame retardants





# **Route to the Environment**

- Toxics can be concentrated and transported to water bodies by a combination of processes
  - Erosion
  - Stormwater runoff
  - Wastewater discharges



Toxics Harm Fish & Wildlife

Photo: Clear Creek coho (Wild Fish Conservancy, 2021)

- Anadromous fish, native, and nonnative species (e.g., rainbow trout, cutthroat trout, bass, walleye) face exposure to harmful pollutants.
- Contaminants in fish pose risks to both human and wildlife consumers.
- Health advisories recommend limited/no consumption of certain polluted species.

# Columbia River Basin Restoration Act

#### Section 123 of the CWA

- Eliminating or reducing pollution.
- Cleaning up contaminated sites.
- Improving water quality.
- Reducing runoff through agricultural BMPs.
- Protecting habitat.
- Promoting citizen engagement.





# **Toxics Reduction Lead Entity Grant**

**Project period**: 10/1/23 – 9/30/29

- 1. Develop a toxics reduction strategy for the CRB
- 2. Administer a **subaward** program
- 3. Increase capacity to provide **technical assistance**

EPA Funding	Mandatory Cost Share (25%)	Total Cost
\$6,909,000	\$2,303,000	\$9,212,000

# Ecology's Focus Area





# **Toxics Reduction Strategic Planning**

- Represent the interests of all Basin communities.
- Strategize for integration across Ecology programs and other agencies.
- Create a **framework** for useability across the state.
- Identify **funding and resource needs** for implementation and sustainability of program.
- Develop a web-based, dynamic strategic planning tool.



# **Technical Assistance**

- Quality Assurance
- Monitoring
- Natural Resource Science
- Ecotoxicology
- Project development and review
- Mentoring





The Department of Ecology is committed to providing people with disabilities access to information and services by meeting or exceeding the requirements of the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and Washington State Policy #188.

To request an ADA accommodation, contact Ecology by phone at 360-407-6831 or email at <u>ecyadacoordinator@ecy.wa.gov</u>. For Washington Relay Service or TTY call 711 or 877-833-6341. Visit <u>Ecology's website</u> for more information.

#### For more information:

Tanya Williams Columbia River Restoration Lead tanya.williams@ecy.wa.gov