Columbia River Basin Restoration Program Working Group – Contaminants of Concern Subgroup: Background & Introduction to the Updated Contaminants of Concern Framework

Background:

In 2007, the Columbia River Toxics Reduction Working Group (Working Group[1]) developed a list of priority contaminants of concern in the Columbia River Basin. At the May 2019 Working Group meeting, individuals recognized the need for an updated list of key contaminants of concern (CoC). A new subgroup was formed to develop a CoC list and supplemental materials with information on priority toxic pollutants in the Columbia River Basin based on consideration factors and existing data.

Intended Audience: The primary audience for the updated Contaminants of Concern framework is the Columbia River Basin Restoration Program Working Group and other entities working to assess, reduce, and/or clean up toxics in the watershed.

Intended Use: The primary intended use for the CoC framework is to guide collaboration and implementation of toxics monitoring and reduction efforts across the Columbia River Basin. However, the CoC framework is a Working Group product that is separate from the Columbia River Basin Restoration Program's competitive grant program. The Framework does not define the contaminants (or classes of contaminants) that may be eligible to be addressed through the competitive grant program.

Development of an Updated Contaminants of Concern Framework

Ashley Zanolli, a Senior Water Quality Specialist at the U.S. Environmental Protection Agency (EPA) Region 10, and Jennifer Morace, a U.S. Geological Survey Hydrologist, co-led the subgroup of approximately two dozen volunteers with relevant expertise who participated in this effort from August 2019 to March 2020. Feedback was solicited from the broader Working Group before finalizing the document. The CoC framework and supplemental materials support Working Group members and other entities working collaboratively to monitor, prevent, and clean-up toxics from the environment while increasing awareness of toxic pollutants and the types of actions that have environmental benefits.

Scope: The toxic pollutants within the scope of this project include synthetic organic chemicals, metals and other inorganic chemicals, and relevant pesticide degradants based on existing data and knowledge. Other types of pollutants that may be considered toxic, such as fertilizers/nutrients, pH, temperature, microplastics, or other similar contaminants were not included in scope of the framework.

Functionality and Practical Applications: The CoC framework is dynamic and should be considered a "living" document. The framework includes supplemental consideration factors and background data on each CoC. The consideration factors and columns in the supplemental background data spreadsheet can be used to consider whether contaminants should be added or removed from the framework as additional data and information becomes available; new contaminants are developed and enter the market; or the use of particular contaminants is expanded or restricted based on regulations, pollution prevention/green chemistry efforts, or through market-forces or voluntary choices. The consideration factors build upon criteria that was originally used to identify priority pollutants in the 2009 State of the River Report.

The framework is structured to facilitate action by on-the-ground practitioners. Pollutants are grouped by different pathways into the environment (e.g., agriculture) and by the types of actions that could potentially be taken to address particular contaminants or classes of contaminants (e.g., keeping sediment in place). The framework does not prioritize

[1] In 2016, Congress amended the Clean Water Act, creating the Columbia River Basin Restoration Act under Section 123. The legislation directed EPA to launch a competitive grant program to address toxics in the Basin and to form a voluntary Working Group, building on the existing Columbia River Toxics Reduction Working Group that EPA jointly established with state and tribal governments, other federal agencies, industry groups, and non-governmental organizations in 2005. In 2019, Congress allocated $1 million to EPA to implement the Act.

contaminants based on ecological or human health risks. A contaminant may be listed in more than one pathway and may be addressed by more than one type of action. The actions provided are intended to connect to more specific best management practice (BMP) guides readily available through the governmental and non-governmental organizations.

The CoC framework can be used to:

- Align basin-wide contaminants of concern with state priority toxic lists
- Help guide and prioritize monitoring, outreach, reduction, or clean-up projects
- Communicate to internal management, external organizations, and/or the public about key toxic pollutants and potential strategies to address them
- Facilitate collaboration between entities on toxics or pesticide reduction projects
- Compliment traditional restoration project considerations that could have co-benefits for toxics reduction
- Connect to Total Maximum Daily Load (TMDL) development and implementation efforts
- Identify current data/knowledge gaps

Contaminants of Concern Subgroup Members:

Name	Organization	Role	Email
Ashley Zanolli	U.S. EPA Region 10	Co-lead	zanolli.ashley@epa.gov
Jennifer Morace	U.S. Geological Survey	Co-lead	jlmorace@usgs.gov
Michelle Wilcox	U.S. EPA Region 10	Back-up Co-lead	wilcox.michelle@epa.gov
David Gruen	U.S. EPA Region 10 [ORISE Fellow]	Lead Support	gruen.david@epa.gov
Dianne Barton	Columbia River Inter-Tribal Fish Commission	Contributor	bard@critfc.org
Peter Brumm	U.S. EPA Region 8	Contributor	brumm.peter@epa.gov
Catherine Corbett	Lower Columbia Estuary Partnership	Contributor	ccorbett@estuarypartnership.org
Alix Danielsen	Hood River Watershed Group	Contributor	alix@hoodriverwatershed.org
Scott Hauser	Upper Snake River Tribes Foundation	Contributor	scott.hauser@usrtf.org
Andy James	University of Washington	Contributor	jamesca@uw.edu
Lon Kissinger	U.S. EPA Region 10	Contributor	kissinger.lon@epa.gov
Darrin Kron	Montana Dept. of Environmental Quality	Contributor	dkron@mt.gov
Jessica Lundin	NOAA Fisheries	Contributor	jessica.lundin@noaa.gov
Kevin Masterson	Oregon Dept. of Environmental Quality	Contributor	kevin.masterson@state.or.us
James Mc Ateer	QA/QC Solutions, LLC	Contributor	jjmcateer@msn.com
Dave McBride	Washington Dept. of Health	Contributor	dave.mcbride@doh.wa.gov
Jim Medlin	Washington Dept. of Ecology	Contributor	jmed461@ecy.wa.gov
Elena Nilsen	U.S. Geological Survey	Contributor	enilsen@usgs.gov
Karl Rains	Washington Dept. of Ecology	Contributor	krai461@ecy.wa.gov
Nat Scholz	NOAA Fisheries	Contributor	nathaniel.scholz@noaa.gov
Bert Shephard	U.S. EPA Region 10	Contributor	shephard.bert@epa.gov
Laura Shira	Yakama Nation	Contributor	shil@yakamafish-nsn.gov

Contaminants of Concern Framework:

NOTE: For organic compounds, the environmental metabolites and breakdown products should be considered as well. For some, these breakdown products can be even more toxic than the parent compounds.

	Action				
	Manage sediment & soil erosion	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction[2]**	**Clean-up contamination[3]**	**Other?[4]**
Agriculture	2,4-D and Mecoprop *(and other Phenoxy herbicides)*	2,4-D and Mecoprop *(and other Phenoxy herbicides)*	2,4-D and Mecoprop *(and other Phenoxy herbicides)*		
	Atrazine and Simazine *(and other Triazine herbicides)*	Atrazine and Simazine *(and other Triazine herbicides)*	Atrazine and Simazine *(and other Triazine herbicides)*		
	Bifenthrin *(and other Pyrethroid insecticides)*	Bifenthrin *(and other Pyrethroid insecticides)*	Bifenthrin *(and other Pyrethroid insecticides)*		
	Carbaryl *(and other Carbamate insecticides)*	Carbaryl *(and other Carbamate insecticides)*	Carbaryl *(and other Carbamate insecticides)*		
	Chlorpyrifos, malathion and diazinon *(and other Organophosphate insecticides)*	Chlorpyrifos, malathion and diazinon *(and other Organophosphate insecticides)*	Chlorpyrifos, malathion and diazinon *(and other Organophosphate insecticides)*		
	Dacthal *(herbicide)*	Dacthal *(herbicide)*	Dacthal *(herbicide)*		
	DDT *(and other legacy organochlorine pesticides,* e.g. Dieldrin and Chlordane*)*	DDT *(and other legacy organochlorine pesticides,* e.g. Dieldrin and Chlordane*)*	DDT *(and other legacy organochlorine pesticides,* e.g. Dieldrin and Chlordane*)*		
	Dichlobenil (*herbicide)*	Dichlobenil *(herbicide)*	Dichlobenil *(herbicide)*		
	Diuron (*herbicide*)	Diuron (*herbicide*)	Diuron (*herbicide*)		
	Glyphosate (*herbicide*)	Glyphosate (*herbicide*)	Glyphosate (*herbicide*)		
	Imidacloprid *(and other Neonicotinoid insecticides)*	Imidacloprid *(and other Neonicotinoid insecticides)*	Imidacloprid (*and other Neonicotinoid insecticides*)		
	Oxyfluorfen (*herbicide*)	Oxyfluorfen (*herbicide*)	Oxyfluorfen (*herbicide*)		
	Pendimethalin, Metolachlor, and Dimethenamid-p *(and other Anilide herbicides)*	Pendimethalin, Metolachlor, and Dimethenamid-p *(and other Anilide herbicides)*	Pendimethalin, Metolachlor, and Dimethenamid-p *(and other Anilide herbicides)*		

[2] Defined as using a safer alternative or reducing the total amount of the chemical used or chemical pollution generated.

[3] Clean up actions expected to be based on existing sediment, soil, groundwater, and surface-water criteria.

[4] This column was intentionally left blank to portray that this list is ever evolving and can be modified as scientific knowledge evolves.

	Action				
	Manage sediment & soil erosion	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
Agriculture (continued)	Propiconazole, Chlorothalonil, Fludioxonil, Boscalid *(fungicides)*	Propiconazole, Chlorothalonil, Fludioxonil, Boscalid *(fungicides)*	Propiconazole, Chlorothalonil, Fludioxonil, Boscalid *(fungicides)*		
	Sodium Fluoroacetate	Sodium Fluoroacetate	Sodium Fluoroacetate	Sodium Fluoroacetate	
		Arsenic	Arsenic		
	Lead-arsenate (*insecticide*)	Lead-arsenate (*insecticide*)		Lead-arsenate (*insecticide*)	
	Mercury (including Methylmercury)			Mercury (including Methylmercury)	
	Metals (other than Mercury)	*Metals* (other than Mercury)	*Metals* (other than Mercury)	*Metals* (other than Mercury)	
	2,4-D and Mecoprop *(and other Phenoxy herbicides)*	2,4-D and Mecoprop *(and other Phenoxy herbicides)*	2,4-D and Mecoprop *(and other Phenoxy herbicides)*		
	Atrazine and Simazine *(and other Triazine herbicides)*	Atrazine and Simazine *(and other Triazine herbicides)*	Atrazine and Simazine *(and other Triazine herbicides)*		

	Action				
	Manage sediment & soil erosion	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
Forestry	2,4-D *(and other Phenoxy herbicides)*	2,4-D *(and other Phenoxy herbicides)*	2,4-D *(and other Phenoxy herbicides)*		
	Atrazine and Simazine *(and other Triazine herbicides)*	Atrazine and Simazine *(and other Triazine herbicides)*	Atrazine and Simazine *(and other Triazine herbicides)*		
	Clopyralid (*herbicide*)	Clopyralid (*herbicide*)	Clopyralid (*herbicide*)		
	Glyphosate (*herbicide*)	Glyphosate (*herbicide*)	Glyphosate (*herbicide*)		
	Hexazinone (*herbicide*)	Hexazinone (*herbicide*)	Hexazinone (*herbicide*)		
	Imazapyr (*herbicide*)	Imazapyr (*herbicide*)	Imazapyr (*herbicide*)		
	Metsulfuron methyl (*herbicide*)	Metsulfuron methyl (*herbicide*)	Metsulfuron methyl (*herbicide*)		
	Sulfometuron-methyl (*herbicide*)	Sulfometuron-methyl (*herbicide*)	Sulfometuron-methyl (*herbicide*)		
	Triclopyr (*herbicide)*	Triclopyr (*herbicide)*	Triclopyr (*herbicide)*		
	Triclopyr BEE (*herbicide*)	Triclopyr BEE (*herbicide*)	Triclopyr BEE (*herbicide*)		
	Dioxins/furans	*Dioxins/furans*	*Dioxins/furans*		
	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*			
	Metals (other than Mercury)	*Metals* (other than Mercury)			

	Action				
	Manage sediment & soil erosion	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
Mining		*PCBs*		*PCBs*	
	Arsenic	Arsenic		Arsenic	
	Cadmium	Cadmium		Cadmium	
	Copper	Copper	Copper	Copper	
	Cyanide	Cyanide	Cyanide	Cyanide	
	*Heavy metals (*e.g. Cobalt*)*	*Heavy metals (*e.g. Cobalt*)*		*Heavy metals (*e.g. Cobalt*)*	
	Lead	Lead		Lead	
	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	
	Metals (other than Mercury)	*Metals* (other than Mercury)	*Metals* (other than Mercury)	*Metals* (other than Mercury)	
	Selenium	Selenium		Selenium	
	Zinc	Zinc	Zinc	Zinc	

	Action				
	Manage sediment & soil erosion	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
Urban/Stormwater (including contaminant sediment)		2,4-D *(and other Phenoxy herbicides)*	2,4-D *(and other Phenoxy herbicides)*		
		Bifenthrin *(and other Pyrethroid insecticides)*	Bifenthrin *(and other Pyrethroid insecticides)*		
		Carbaryl *(and other Carbamate insecticides)*	Carbaryl *(and other Carbamate insecticides)*		
		Dichlobenil *(herbicide)*	Dichlobenil *(herbicide)*		
		Diuron *(herbicide)*	Diuron *(herbicide)*		
		Fipronil (*insecticide*)	Fipronil (*insecticide*)		
	Fungicides (e.g., Propiconazole, Chlorothalonil, and others*)*	*Fungicides* (e.g., Propiconazole, Chlorothalonil, and others*)*	*Fungicides* (e.g., Propiconazole, Chlorothalonil, and others*)*		
		Glyphosate (*herbicide*)	Glyphosate (*herbicide*)		
		Imidacloprid *(and other Neonicotinoid insecticides)*	Imidacloprid *(and other Neonicotinoid insecticides)*		
		Metolachlor (*herbicide*)	Metolachlor (*herbicide*)		
	Flame retardants (e.g., PBDEs, TCEP, TDCPP, TCPP*)*	*Flame retardants* (e.g., PBDEs, TCEP, TDCPP, TCPP*)*	*Flame retardants* (e.g., PBDEs, TCEP, TDCPP, TCPP*)*		
	PAHs	*PAHs*		*PAHs*	
		PCBs	*PCBs*	*PCBs*	
		PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*		
	*PHCs (*e.g., Lube Oil*)*	*PHCs (*e.g., Lube Oil*)*	*PHCs (*e.g., Lube Oil*)*	*PHCs (*e.g., Lube Oil*)*	
		Phthalates and other Plasticizers	*Phthalates and other Plasticizers*		
	Cadmium	Cadmium	Cadmium	Cadmium	
	Copper	Copper	Copper	Copper	
	Zinc	Zinc	Zinc	Zinc	
	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*		
			Metals (other than Mercury)		
	Tire Wear Particulate	Tire Wear Particulate		Tire Wear Particulate	

	Action				
Wastewater Treatment Plants (WWTPs) & Water Reclamation Facilities (WRF)	**Manage sediment & soil erosion**	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
	Estrogenic Compounds	*Estrogenic Compounds*	*Estrogenic Compounds*		
		Flame retardants (e.g., PBDEs, TCEP, TDCPP, TCPP*)*	*Flame retardants* (e.g., PBDEs, TCEP, TDCPP, TCPP*)*		
		Mercury			
		Metals (other than Mercury)			
		PCBs	*PCBs*	*PCBs*	
	PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*		
	Pharmaceuticals and Personal Care Products		*Pharmaceuticals and Personal Care Products*		
		Phthalates and other Plasticizers	*Phthalates and other Plasticizers*	*Phthalates and other Plasticizers*	
		Surfactants/detergents (e.g., nonylphenol ethoxylates)	*Surfactants/detergents* (e.g., nonylphenol ethoxylates)		

	Action				
Industrial Use	**Manage sediment & soil erosion**	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
		Aldehydes (e.g., acetaldehyde, formaldehyde)	*Aldehydes* (e.g., acetaldehyde, formaldehyde)		
	Chlorinated Solvents (e.g., TCE, PCE)	*Chlorinated Solvents* (e.g., TCE, PCE)	*Chlorinated Solvents* (e.g., TCE, PCE)		
	Dioxins/furans	*Dioxins/furans*	*Dioxins/furans*	*Dioxins/furans*	
		Metals	*Metals*	*Metals*	
	PAHs	*PAHs*	*PAHs*	*PAHs*	
		PCBs	*PCBs*	*PCBs*	
		PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*	
	Phthalates and other Plasticizers	*Phthalates and other Plasticizers*	*Phthalates and other Plasticizers*		
		Surfactants/detergents (e.g., nonylphenol ethoxylates)	*Surfactants/detergents* (e.g., nonylphenol ethoxylates)		
	Trichloroethylene (*industrial solvent*)	Trichloroethylene (*industrial solvent*)	Trichloroethylene (*industrial solvent*)		

	Action				
Air Deposition	**Manage sediment & soil erosion**	**Reduce impacts from run-off, discharges, or off-target movement**	**Implement source reduction**	**Clean-up contamination**	**Other?**
		Dioxins/furans	*Dioxins/furans*		
		Fungicides (e.g., Propiconazole, Chlorothalonil, and others*)*	*Fungicides* (e.g., Propiconazole, Chlorothalonil, and others*)*		
	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	Mercury *(including Methylmercury)*	
		Metals (other than Mercury)	*Metals* (other than Mercury)		
		PAHs	*PAHs*		
			PCBs	*PCBs*	
	PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*	PFAS *(including PFOA and PFOS)*		

Consideration Factors:

Consideration Factors[5]	**1. Is it listed as a potential pollutant of concern in Clean Water Act rules or state laws/rules?** (See "Evidence of the Problem" column in the Supplemental Spreadsheet) Is it listed on the 303(d) list in any state within the Basin? Does a TMDL exist for this contaminant? Is a toxics reduction/management action plan being developed? Have concentrations of concern (i.e., above numeric benchmarks, screening levels or criteria) been detected in the Columbia River Basin? Is emerging science identifying this contaminant as a "new" concern?
	2. Is it an ecological threat, a human health threat, or both? (See "Biological Effects" column in the Supplemental Spreadsheet) Are there fish advisories associated with this contaminant? Is there evidence of this contaminant in fish and wildlife? Is it identified as persistent, bioaccumulative and toxic? Is the contaminant a suspected or known carcinogen? Is the contaminant identified as a suspected or known endocrine disrupter? Are noncancer effects associated with this contaminant?
	3. Is there an implementation plan/reduction strategy in place? (See "Reduction Strategies" column in the Supplemental Spreadsheet) Does a TMDL exist for this contaminant? Is there a Pesticide Stewardship Program in place to address it? Has the contaminant been addressed through specific rules or other actions under EPA's Toxic Substances Control Act (TSCA)? Is this contaminant included in EPA's National Strategic Plan for the Columbia River? Are there other implementation/reduction strategies taking place for this contaminant?

[5] Builds upon criteria used to identify priority pollutants in the 2009 State of the River Report.

Best Management Practices Resources:

Resource	Location	Notes
Chemical Hazards and Alternatives Toolbox (ChemHat)	http://chemhat.org/en	Designed to answer the question, "is there a way to get this job done without using dangerous chemicals?"
Cleaner Solutions Database	https://www.turi.org/Our_Work/Cleaning_Laboratory/Laboratory_Testing/CleanerSolutions_Database	Alternatives to industrial and janitorial cleaners
EPA 2017 Construction General Permit for Stormwater Discharges	https://www.epa.gov/sites/production/files/2019-05/documents/final_2017_cgpfact_sheet.pdf	BMPs for reducing source loads to stormwater required by EPA's 2017 construction general permit
EPA Polychlorinated Biphenyls (PCBs) Webpage	https://www.epa.gov/pcbs	EPA homepage with information and resources related to PCBs
EPA Safer Choice	https://www.epa.gov/saferchoice	Find products that perform and contain ingredients that are safer for human health and the environment.
Green Screen List Translator	https://www.greenscreenchemicals.org/learn/greenscreen-list-translator	Provides "list of lists" of chemicals of high concern from 40 authoritative lists
Interstate Chemicals Clearinghouse Alternatives Assessment Library	http://www.theic2.org/aa_library	Available publications and guides on chemical alternatives assessment
Interstate Chemicals Clearinghouse Chemical Hazard Assessment Database	http://www.theic2.org/hazard-assessment	Publicly available chemical hazard assessments
Interstate Technology & Regulatory Council	https://itrcweb.org/Guidance	ITRC produced documents ranging from technical overviews and case studies to technical and regulatory guidance documents for applying cleanup technologies
Interstate Technology & Regulatory Council	https://stormwater-1.itrcweb.org/	Stormwater BMP performance evaluation
Pesticide Properties DataBase (University of Hertfordshire)	https://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm	The PPDB is a comprehensive relational database of pesticide approvals, physicochemical properties, environmental fate, human health and ecotoxicological data
Pesticide Risk Tool (OSU)	https://test.pesticiderisk.org/	Estimates the risk of negative impacts of pesticide applications
Pollution Prevention Options Assessment System (P2OASys)	https://www.turi.org/Our_Work/Research/Alternatives_Assessment/Tools_and_Methods/P2OASys_Tool_to_Compare_Materials	A tool to help companies determine whether the toxics use reduction (TUR) options they are considering improve upon their existing process when looking at environmental, health and safety topics

Resource	Location	Notes
Selection of Pesticides to Reduce Human and Environmental Risks: Global Guideline and Minimum Pesticides List	https://doi.org/10.1016/S2542-5196(19)30266-9	A February 2020 publication co-authored by two OSU faculty
Technologies for Cleaning Up Contaminated Sites	https://www.epa.gov/remedytech	Information for technical staff, regulators, site owners and researchers to help identify contaminants and assess their potential threats, characterize and investigate sites, and treat or remove contaminants.
UMASS Lowell Toxics Use Reduction Institute	https://www.turi.org/	Provides resources and tools to help find safer alternatives to toxic chemicals
Washington Department of Ecology Quick Chemical Assessment Tool (QCAT)	https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Preventing-hazardous-waste-pollution/Safer-alternatives/Quick-tool-for-assessing-chemicals	A tool to identify the hazards associated with the chemicals used products and processes
Washington's Alternative Assessment Guide	https://fortress.wa.gov/ecy/publications/SummaryPages/1504002.html	The purpose of this document is to provide alternatives assessment guidance for small-to medium-sized businesses
Western IPM Center	http://westernipm.org/	Resource on integrated pest management and pesticide risk reduction (including water quality)

Supplemental Spreadsheet: Too large to display; refer to the Excel file available on EPA's Columbia River Website.

Human Health Risk: In addition to the list of chemicals address in cleanup programs presented here, state and federal environmental regulatory agencies may address a much broader range of chemicals associated with toxic waste cleanup sites. Agencies do this by estimating the human health risks posed by chemicals. Risk is the product of a chemical's dose dependent toxicity to humans and the degree of exposure to the chemical (i.e., dose). If unacceptable risks are found, remedial action may be taken to reduce risks to acceptable levels.

EPA's Integrated Risk Information System[6] is the general source for chemical specific estimates of the toxic effects (either cancer or non-cancer) that occur as the dose or exposure to a chemical increases. EPA's Superfund program also specifies appropriate toxicity information sources for chemicals that do not have IRIS toxicity metrics[7].

Humans may be exposed to chemicals via direct contact (e.g., skin contact with contaminated sediment during shore activities, ingestion of contaminated water, etc.) or indirect contact (e.g., consumption of fish that have acquired contaminants from the environment). Assessing exposure to chemicals, or dose, requires determining how individuals interact with contaminated media. Sample questions to be answered in assessing exposure, for example contaminant exposure via fish consumption, might include:

1. How much and what types of fish with contaminant body burdens does an individual eat in a day?
2. What are the concentrations of chemicals in the different types of fish that a person might consume?

[6] https://www.epa.gov/iris

[7] https://semspub.epa.gov/work/HQ/136.pdf

3. For how many years does an individual consume fish from a contaminated water body?
4. What is the body weight of individual's consuming fish?
5. Are children, adults, or both consuming fish and how do fish consumption rates, body weights, and length of exposure vary for adults and children?

Remedial actions may also require an examination of how chemicals move from sediment and water into aquatic biota consumed by humans.

EPA has compiled a large amount of guidance on exposure assessment[8]. Additionally, exposure information for specific geographic locations may also be relevant. For example, the Columbia River Intertribal Fish Commission developed a report on Native American fish consumption rates[9] that has been used to determine risks for Native Americans consuming fish with chemical contaminants that harvested from the Columbia River.

EPA's Superfund program frequently assesses exposure on a site specific basis, as has been the case for the Portland Harbor Superfund site[10]. State environmental programs frequently specify exposure assumptions in developing acceptable levels of chemicals in the environment (e.g., Washington State Department of Ecology's sediment cleanup guidance[11], Oregon Department of Environmental Quality guidance on cleanup standards for bioaccumulative chemicals[12]).

[8] https://www.epa.gov/risk/risk-assessment-guidelines
[9] https://www.critfc.org/blog/reports/a-fish-consumption-survey-of-the-umatilla-nez-perce-yakama-and-warm-springs-tribes-of-the-columbia-river-basin/
[10] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Stayup&id=1002155
[11] https://fortress.wa.gov/ecy/publications/documents/1209057.pdf
[12] https://www.oregon.gov/deq/FilterDocs/GuidanceAssessingBioaccumulative.pdf