

Click here for
[DISCLAIMER](#)

Document starts on next page

Priority Pollutant Ranking System

Patrick H. Tobin, Director
Criteria and Standards Division (WH-585)

Steven Schatzow, Director
Water Regulations and Standards (WH-551)

A ranking system for establishing priorities for pollutants of interest to the Office of Water has been developed at your request.

The system evaluates three basic areas of concern: 1) potential for effects on aquatic life, 2) potential for human health effects, and 3) exposure potential. A set of ranking factors are scored for each area based on available data. In addition, some subjective areas are included, for example, public concern for the pollutant, to add weight to the final decision. Thus management would not be restricted to an absolute numerical system.

The ranking factors are patterned after the peer reviewed methodology for developing water quality criteria. They are more quantitative and precise than the previous ranking factors published in 1979 by EPA as guidance to be addressed in petitions to revise section 307(a)(1) of the Clean Water Act.

The development of this priority ranking system was a joint project between CSD and the other Divisions in OWS (EGC, WSD, OAE) and the Permits Division in OWE. CSD has been responsible for providing the available data on the ranking factors for two of the three areas of concern: 1) aquatic life effects and 2) human health effects. Information on the ranking factors for the third area of concern, exposure, was provided by WSD. The Permits Division provided specific information in the "other factors" category.

We have completed the ranking of 86 chemicals and chemical series, which include the priority pollutants plus chemicals of Regional and State interest. The chemicals are ranked according to potential exposure and effect on: (1) human health, (2) aquatic life, and (3) both human health and aquatic life combined. The highest rated chemicals have been shown to have serious effects and a high exposure potential. The lowest ranked chemicals may be so because of an inadequate data base, not because they are safe. Increased information may place them higher on the list.

6/21/84

WH-585:CH:TPurcell:nw:rm2818:x245-

If you would like to discuss the details of this ranking system, please let me know.

Attachments

cc- Erich Hretthauer (RD-682)
Elizabeth Anderson (RD-689)
Ned Notzon (WH-553)
Jeff Denit (WH-552)
Peter Wise (WH-586)
Bill Jordan (EN-336)

ATTACHMENT A

List of 86 chemicals, chemical series or parameters ranked according to potential exposure and effect on human health.

Chemical	Effect	Exposure	Other Factors				Final Score
			1	2	3	4	
Mercury	H	M	Y	Y		Y	9
Beryllium	H	M	Y	Y			9
Dioxin (2,3,7,8-TCDD)	H	M			Y	Y	9
D.E.H.P.	M	H	Y	Y	Y	Y	7
Aldrin/Dieldrin	M	M	Y	Y		Y	7
Arsenic	M	H	Y	Y		Y	7
Chloroform	M	H	Y	Y			7
Tetrachloroethylene	M	M	Y	Y	Y	Y	6
Antimony	M	M	Y	Y		Y	6
Cadmium	M	M	Y	Y		Y	6
Chlordane	M	M	Y	Y		Y	6
Chromium (trivalent)	M	M	Y	Y		Y	6
Pentachlorophenol	M	M	Y		Y	Y	6
Cyanides	M	M	Y	Y			6
DDT	M	M	Y			Y	6
Endrin	M	M	Y			Y	6
Thallium	M	M	Y	Y			6
Ethylbenzene	M	M		Y			5
Acrylonitrile	M	L	Y	Y		Y	5
Heptachlor	M	L	Y	Y		Y	5
P.A.H.s	M	L		Y	Y	Y	5
Selenium	M	L	Y	Y		Y	5
Chlorinated ethers	M	L		Y		Y	5
2,4-dimethylphenol	M	L	Y	Y			5
Hexachlorobutadiene	M	L		Y		Y	5
Nitrophenols	M	L	Y			Y	5
Nitrosamines	M	L		Y		Y	5
Acrolein	M	L		Y			5
Chlorinated ethanes	M	L				Y	5
Dinitrotoluene	M	L				Y	5
2,3,4,6-tetrachlorophenol	M	L	Y				5
Diamino toluene*	M	L			Y		5
Endosulfan	M	L					5
Chlorinated naphthalene	M	L					4
Halomethanes	M	L					4
Hexachlorocyclohexane	M	L					4
Tetramethyl lead	M	L					4
Aluminum	L	H	Y	Y	Y	Y	4
Ammonia	L	H	Y	Y	Y	Y	4
Butylbenzylphthalate	L	H	Y	Y		Y	4
Nickel	L	H	Y	Y		Y	4
Dibenzofurans	L	H				Y	4
Benzene	L	M	Y	Y	Y	Y	3

Chemical	Effect	Exposure	Other Factors				Final Score
			1	2	3	4	
Silver	L	M	Y	Y	Y	Y	3
2,4,5-trichlorophenol	L	M	Y	Y	Y	Y	3
Phenol	L	M	Y	Y		Y	3
Toluene	L	M		Y	Y	Y	3
Toxaphene	L	M	Y	Y		Y	3
1,2,3-trichlorobenzene	L	M	Y	Y			3
p-dioxane	L	M			Y	Y	3
Fluoranthene	L	M		Y			3
P.C.B.s	L	L	Y	Y		Y	2
Styrene *	L	L	Y	Y	Y	Y	2
Napthalene	L	L	Y	Y		Y	2
Nitrobenzene	L	L	Y	Y		Y	2
Trichloroethylene	L	L	Y	Y		Y	2
Zinc	L	L	Y	Y		Y	2
Asbestos	L	L		Y		Y	2
Carbon tetrachloride	L	L	Y			Y	2
Dichlorobenzenes	L	L	Y	Y			2
2,4-dichlorophenol	L	L	Y			Y	2
2,3,6-trichlorophenol	L	L	Y			Y	2
Halomethanes	L	L	Y			Y	2
Hexachlorocyclopentadiene	L	L		Y		Y	2
Isophorone	L	L		Y		Y	2
Trichlorobenzene	L	L	Y	Y			2
Carbazole	L	L				Y	2
Dimethyl sulfoxide	L	L	Y				2
1,3-dichloropropene	L	L	Y				2
1,2,4,5-tetrachlorobenzene	L	L	Y				2
Acenaphthene	L	L					1
Dichlorobenzidine	L	L					1
Dichloroethylenes	L	L					1
1,3-Dinitrobenzene	L	L					1
p-nitroaniline	L	L					1
Copper	i.d.	H	Y	Y		Y	i.d.
Lead	i.d.	H	Y	Y		Y	i.d.
Aniline *	i.d.	H	Y	Y		Y	i.d.
Organotins	M.	i.d.	Y	Y		Y	i.d.
Vinyl chloride	i.d.	M		Y		Y	i.d.
Xylene *	L	i.d.	Y	Y	Y	Y	i.d.
Benzidine	i.d.	L	Y	Y		Y	i.d.
2-chlorophenol	i.d.	L	Y				i.d.
Polychlorinated diphenyl ethers *	i.d.	L			Y		i.d.
Bis 2-chloroethoxy methane *	i.d.	L			Y		i.d.
Diphenylhydrazine	i.d.	L					i.d.

ATTACHMENT B

List of 86 chemicals, chemical series or parameters ranked according to potential exposure and effect on aquatic life.

Chemical	Effect	Exposure	Other Factors				Final Score
			1	2	3	4	
Aldrin/Dieldrin	H	H	Y	Y		Y	10
Chlordane	H	M	Y	Y		Y	9
Mercury	H	M	Y	Y		Y	9
Toxaphene	H	M	Y	Y		Y	9
DDT	H	M	Y			Y	9
Dioxin (2,3,7,8-TCDD)	H	M			Y	Y	9
Endrin	H	M	Y			Y	9
P.C.B.s	H	L	Y	Y	Y	Y	8
Heptachlor	H	L	Y	Y		Y	8
Tetramethyl lead	H	L					7
Aluminum	M	H	Y	Y	Y	Y	7
Ammonia	M	H	Y	Y	Y	Y	7
Aniline *	M	H	Y		Y	Y	7
Butylbenzylphthalate	M	H	Y		Y	Y	7
Copper	M	H	Y	Y		Y	7
Pentachlorophenol	M	M	Y	Y	Y	Y	6
Silver	M	M	Y	Y	Y	Y	6
2,4,5-trichlorophenol	M	M	Y	Y	Y	Y	6
Cadmium	M	M	Y	Y		Y	6
1,2,3-trichlorobenzene	M	M		Y		Y	6
Beryllium	M	M	Y	Y			6
Thallium	M	M	Y	Y			6
Fluoranthene	M	M		Y			6
P.A.H.s	M	L	Y	Y	Y		5
Endosulfan	M	L	Y				5
Hexachlorobutadiene	M	L		Y			5
Hexachlorocyclopentadiene	M	L		Y			5
Acrolein	M	L		Y			5
2,3,4,6-tetrachlorophenol	M	L	Y				4
Chlorinated naphthalene	M	L					4
1,3-dinitrobenzene	M	L					4
Haloethers	M	L					4
Hexachlorocyclohexane	M	L					4
D.E.H.P.	L	H	Y	Y	Y	Y	4
Arsenic	L	H		Y	Y	Y	4
Lead	L	H	Y	Y		Y	4
Nickel	L	H	Y	Y		Y	4
Chloroform	L	H	Y	Y			4
Dibenzofuran	L	H				Y	4
Benzene	L	M	Y	Y	Y	Y	3
Tetrachloroethylene	L	M	Y	Y	Y	Y	3
Antimony	L	M	Y	Y		Y	3
Chromium (trivalent)	L	M	Y	Y		Y	3

Chemical	Effect	Exposure	Other Factors				Final Score
			1	2	3	4	
Cyanides	L	M	Y	Y		Y	3
Phenol	L	M	Y	Y		Y	3
Toluene	L	M		Y	Y	Y	3
p-dioxane	L	M			Y	Y	3
Ethylbenzene	L	M					2
Acrylonitrile	L	L	Y	Y		Y	2
Benzidine	L	L	Y	Y		Y	2
Napthalene	L	L	Y	Y		Y	2
Nitrobenzene	L	L	Y	Y		Y	2
Selenium	L	L	Y	Y		Y	2
Trichloroethylene	L	L	Y	Y		Y	2
Zinc	L	L	Y	Y		Y	2
Carbon tetrachloride	L	L	Y			Y	2
Chlorinated ethanes	L	L		Y		Y	2
Dichlorobenzenes	L	L	Y	Y			2
2,4-dichlorophenol	L	L	Y			Y	2
2,4-dimethylphenol	L	L	Y	Y			2
Halomethanes	L	L	Y			Y	2
Isophorone	L	L		Y		Y	2
Nitrophenols	L	L	Y			Y	2
Nitrosamines	L	L		Y		Y	2
2,3,6-trichlorophenol	L	L	Y			Y	2
Trichlorobenzene	L	L	Y	Y			2
Chlorinated ethers	L	L				Y	2
2-chlorophenol	L	L	Y				2
1,3-dichloropropene	L	L	Y				2
Dimethyl sulfoxide	L	L	Y				2
Dinitrotoluene	L	L				Y	2
Carbazole	L	L				Y	2
1,2,4,5-tetrachlorobenzene	L	L	Y				2
Acenaphthene	L	L					1
Dichloroethylene	L	L					1
p-nitroaniline	L	L					1
Organotins	H	i.d.			Y		i.d.
Vinyl chloride	i.d.	M		Y			i.d.
Styrene *	i.d.	L	Y	Y	Y	Y	i.d.
Xylene *	L	i.d.	Y	Y	Y	Y	i.d.
Asbestos	i.d.	L		Y		Y	i.d.
Polychlorinated							
Diphenyl ethers *	i.d.	L			Y		i.d.
Diamino toluene *	i.d.	L			Y		i.d.
Bis 2-chloroethoxy methane *	i.d.	L			Y		i.d.
Dichlorobenzidine	i.d.	L					i.d.
Diphenylhydrazine	i.d.	L					i.d.

* Indicates Regional or State interest.

ATTACHMENT C

List ranking chemicals using combined scores for Human Health and Aquatic Life effects.

<u>Chemical</u>	<u>Combined Score</u>
Dioxin	18
Mercury	18
Aldrin/Dieldrin	17
Beryllium	15
Chlordane	15
DDT	15
Endrin	15
Heptachlor	14
Cadmium	12
Pentachlorophenol	12
Thallium	12
Toxaphene	12
Aluminum	11
Ammonia	11
Arsenic	11
Butylbenzylphthalate	11
Chloroform	11
DEHP	11
Tetramethyl lead	11
Endosulfan	10
Hexachlorobutadiene	10
PAHs	10
PCBs	10
Tetrachloroethylenes	10
Acrolein	9
Antimony	9
Chromium (trivalent)	9
Cyanides	9
Silver	9
2,3,4,6-tetrachlorophenol	9
1,2,3-trichlorobenzene	9
2,4,5-trichlorophenol	9
Chlorinated naphthalene	8
Copper	8
Fluoranthane	8
Haloethers	8
Hexachlorocyclohexane	8
Nickel	8
Aniline*	8
Acrylonitrile	7
Chlorinated ethanes	7
Chloralkyl ethers	7
Dimethyl phenol	7
Dinitrotoluene	7

<u>Chemical</u>	<u>Combined Score</u>
Ethylbenzene	7
Hexachlorocyclopentadiene	7
Nitrophenol	7
Nitrosamines	7
Selenium	7
Benzene	6
Dibenzofurans	6
p-dioxane	6
Phenol	6
Toluene	6
Diamino toluene*	6
Lead	5
Carbon tetrachloride	4
Dichlorobenzenes	4
2,4-dichlorophenol	4
Dimethylsulfoxide	4
Halomethanes	4
Isophorone	4
Napthalene	4
Nitrobenzene	4
1,2,4,5-tetrachlorobenzene	4
Trichlorobenzene	4
Trichloroethylene	4
Zinc	4
Asbestos	3
Benzidine	3
Chlorophenol	3
1,3-dichloropropene	3
2,3,6-trichlorophenol	3
Styrene *	3
Acenaphthene	2
Carbazole	2
Dichlorobenzidine	2
Dichloroethylene	2
1,3-dinitrobenzene	2
Diphenylhydrazine	2
Nitroaniline	2
Organotins	2
Vinyl chloride	2
Xylene*	2
Polychlorinated diphenyl ethers*	2
Bis 2-chloroethoxy methane*	2

* Indicates Regional or State interest.

Attachment D

Methodology

A) Areas of Concern - The following are the 4 areas of concern for which a "final score" will be developed. Exposure and effects are evaluated together. The "final score" combines the effects and exposure components. The final scores for different combinations are subjective decisions. Additional weight is provided to the "final score" by factors which are not in the effects or exposure categories, such as the presence of a pollutant in standards or in permits. An example of how the "final score" might be compiled is provided below.

1. Aquatic Life

<u>Effects</u>	<u>Exposure</u>	<u>Other Factors</u>	<u>Final Score: Aquatic Life</u>
High	High	Yes	10
High	High	No	9
Medium	High	Yes	9
Medium	Medium	Yes	8
etc.	etc.	etc.	etc.

2. Human Health

3. Exposure

4. Other Factors

B) Ranking Factors - The following are ranking factors identified within each of the areas of concern. These factors, when scored, provide the basis for the "high", "medium", and "low" components for the "final score".

1. Effects on Aquatic Life

1. Acute toxicity to aquatic animals

<u>Score^c</u>	<u>Effects</u>	<u>Definition</u>
10	At very low concentrations	LC50 ^a < 1 ug/L
8	At low concentrations	1-10 ug/L
6	At moderate concentrations	10-100 ug/L
4	At high concentrations	100-1000 ug/L
2	At very high concentrations	1-10 mg/L
0	At extremely high concentrations	> 10 mg/L

2. Chronic toxicity to aquatic animals

<u>Score</u>	<u>Effects</u>	<u>Definition</u>
10	At very low concentrations	MATC ^a < 0.1 ug/L
8	At low concentrations	0.1-1 ug/L
6	At moderate concentrations	1-10 ug/L
4	At high concentrations	10-100 ug/L
2	At very high concentrations	100-1000 ug/L
0	At extremely high concentrations	> 1-10 mg/L

3. Toxicity to plants

<u>Score</u>	<u>Effects</u>	<u>Definition</u>
10	At very low concentrations	EC50 ^b < 0.1 ug/L
8	At low concentrations	0.1-1 ug/L
6	At moderate concentrations	1-10 ug/L
4	At high concentrations	10-100 ug/L
2	At very high concentrations	100-1000 ug/L
0	At extremely high concentrations	> 1-10 mg/L

4. Bioconcentration

<u>Score</u>	<u>Effects</u>	<u>Definition</u>
10	Very high BCF	BCF > 10,000
8	High BCF	1000-10,000
5	Moderate BCF	333-1000
2	Low BCF	100-333
0	Very low BCF	< 100

a. For a sensitive species.

b. For an important species.

c. Score of (8-10) = "High", (7-4) = "Medium" (3-0) = "Low" (Patterned after the Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Life and Its Uses and aquatic toxicological data in the water quality criteria documents).

2. Human Health Effects

1. Acute Toxicity

<u>Score</u>	<u>Criteria</u>
10	LD ₅₀ (Oral) <0.1 ^a LD ₅₀ (Dermal) <.04 LD ₅₀ (Inhalation) < .04 ^b
6	LD ₅₀ (Oral) .1 < 1 LD ₅₀ (Dermal) .04 < .4 LD ₅₀ (Inhalation) .4 < 4
4	LD ₅₀ (Oral) 1 < 10 LD ₅₀ (Dermal) .4 < 4 LD ₅₀ (Inhalation) 4 < 40
3	LD ₅₀ (Oral) 10 < 100 LD ₅₀ (Dermal) 4 < 40 LD ₅₀ (Inhalation) 40 < 400
1	LD ₅₀ (Oral) 150 < 500 LD ₅₀ (Dermal) 40 < 200 LD ₅₀ (Inhalation) 400 < 2000

a = mg/kg

b = ppm

c = score of (6-10) = "High", (3-5) = "Medium", (1-2) = "Low",
(0) = "negligible"

Source: Regulatory Impact Analysis of RQ adjustments under
Section 102 and 103 of CERCLA.

2. Chronic Toxicity

Dose Rating - Minimum Effective Dose (MED) (mg/kg/day)

<u>Score</u>	<u>Criteria</u>
1	10,000 to 100,000 mg/kg/day
2	1000 to 10,000 mg/kg/day
3	100 to 1000 mg/kg/day
4	10 to 100 mg/kg/day
5	1 to 10 mg/kg/day
6	.1 to 1 mg/kg/day
7	.01 to .1 mg/kg/day
8	.001 to .01 mg/kg/day
9	.0001 to .001 mg/kg/day
10	.0001 to .001 mg/kg/day

Effect Rating - Type of Effect

- 1 Enzyme induction or other biochemical change with no pathologic changes and no change in organ weights.
- 2 Enzyme induction and subcellular proliferation or other changes in organelles but no other apparent effects.
- 3 Hyperplasia, hypertrophy or atrophy but no change in organ weights.
- 4 Hyperplasia, hypertrophy, or atrophy with changes in organ weights
- 5 Reversible cellular changes: cloudy swelling, hydropic change, or fatty changes.
- 6 Necrosis, or metaplasia with no apparent decrement or organ function. Any neuropathy without apparent behavioral, sensory, or physiologic changes.
- 7 Necrosis, atrophy, hypertrophy, or metaplasia with a detectable decrement of organ functions. Any neuropathy with a measurable change in behavioral, sensory, or physiologic activity.
- 8 Necrosis, atrophy, hypertrophy, or metaplasia with definitive organ dysfunction, any neuropathy with gross changes in behavior, sensory, or motor performance. Any decrease in reproductive capacity. Any evidence of fetotoxicity.
- 9 Pronounced pathologic change with severe organ dysfunction. Any neuropathy with loss of behavioral or motor control or loss or sensory ability. Reproductive dysfunction. Any teratogenic effect with maternal toxicity.
- 10 Death or pronounced life shortening. Any teratogenic effect without signs of maternal toxicity.

Composite Score - (Dose Score x Effect Score = Composite Score)

Score^a Composite Score

1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

a = Score of (7-10) = "High", (3-6) = "Medium", (1-2) = "Low"

(Patterned after the Methodology and Guidelines for Ranking Chemicals based on Chronic Toxicity, ECAO-Cin, January 1984).

3. Exposure Potential

<u>Score^a</u>	<u>Criteria</u>
10 >10,000	1. Amount discharged, Mt/yr
7 1,000 - 10,000	
3 100 - 1,000	
0 < 100	
10 > 10,000	2. Number of sites of discharge having detectable concentrations
7 50 - 1,000	
3 5 - 50	
0 < 5	
10 > 50%	3. Frequency of detection in ambient waters
7 10 - 50%	
3 1 - 10%	
0 < 1%	
10 > 50%	4. Frequency of detection in aquatic bed sediment
7 10 - 50%	
3 1 - 10%	
0 < 1%	
10 > 50%	5. Frequency of detection in industrial or municipal effluents
7 10 - 50%	
3 1 - 10%	
0 < 1%	
10 half-life > 1 yr	6. Resistant to degradation (Excluding Volatilization)
7 half-life 1 mo - 1 yr	
3 half-life 1 day - 1 mo	
0 half-life < 1 day	
10 H < 10 ⁻⁴	7. Resistance to Volatilization, as determined by air/water partition coefficient (Henry's Law Constant, H)
7 H 10 ⁻⁴ - 10 ⁻³	
3 H 10 ⁻³ - 10 ⁻²	
0 H > 10 ⁻²	

a = Score of (8-10) = "High", (4-7) = "Medium", (1-3) = "Low", (0) = "negligible"

4. Other Factors - these factors would add weight to the overall decision

- a. Is the pollutant present in State WQS?
Yes/No
- b. Is the pollutant present in NPDES permit applications?
Yes/No
- c. Is there federal/public concern for the pollutant?
Yes/No
- d. Are other programs in the Agency affected/impacted?
Yes/No

5. The Final Score would be based on the following combinations:

<u>Effects</u>	<u>Exposure</u>	<u>Other Factors</u>	<u>Final Score</u>
High	High	Yes	10
High	High	No	9
High	Medium	Yes	9
High	Medium	No	8
High	Low	Yes	8
High	Low	No	7
Medium	High	Yes	7
Medium	High	No	6
Medium	Medium	Yes	6
Medium	Medium	No	5
Medium	Low	Yes	5
Medium	Low	No	4
Low	High	Yes	4
Low	High	No	3
Low	Medium	Yes	3
Low	Medium	No	2
Low	Low	Yes	2
Low	Low	No	1

For the final score:

High, Medium, Low are defined as averages of the numerical scores given the ranking factors.