

Appendix M. SCRAM Ranking: Chemical, Uncertainty, Composite Scores, Ranking, and Weightings

M-1. SCRAM Ranking Results

Table M-1. COPC Ranking via SCRAM

Chemical Name	Chemical Score	Uncertainty Score ¹	Composite Score	Ranking
Benz(a)anthracene	41	30	71	1
Dibenzo(a,h)anthracene	42	28	70	2
p,p-DDD	48	19	67	3
Ethion	45	22	67	3
p,p-DDE	53	10	63	4
Hexachlorobenzene	53	9	62	5
Toxaphene	53	9	62	5
PCBs	53	8	61	6
Chlordane	52	8	60	7
p,p-DDT	53	7	60	7
2-Methylnaphthalene	27	30	57	8
Anthracene	36	18	54	8
Heptachlor epoxide	40	13	53	10
Hexachloro-1,3-butadiene	37	16	53	10
Mercury	45	7	52	11
Chlorobenzene	26	26	52	11
Dibromochloromethane	18	34	52	11
1-Methylnaphthalene	29	23	52	11
Aldrin	37	13	50	12
2,3,7,8-TCDD	45	4	49	13
Fluoranthene	32	16	48	14
Acenaphthylene	8	40	48	14
Trifluralin	36	12	48	14
Bromodichloromethane	20	28	48	14
p,p-Methoxychlor	36	11	47	15
Hydrazine	27	19	46	16
1,1,2-Trichloroethane	21	25	46	16
Endrin	37	9	46	16
1,3-Dichlorobenzene	30	16	46	16
Di-n-octylphthalate	30	16	46	16
1,2,3-Trichlorobenzene	30	16	46	16
Bromoform	18	27	45	17
Fluorene	24	20	44	18

¹ Uncertainty is taken into account in all SCRAM scores. The type of information that is available for scoring determines an uncertainty score. For example, in SCRAM, bioaccumulation is scored on the basis of bioaccumulation factors (BAF), bioconcentration factors (BCF), or octanol/water partition coefficients (K_{ow}). A bioaccumulation chemical score is assigned according to the range of the variable used. For example, measured values for bioaccumulation are given priority over predicted values. If a measured BAF is available, no uncertainty points are assigned. If the value available is a BCF, 1 uncertainty point is assigned: a BCF gives less information for higher trophic levels, where effects of bio-accumulative chemicals are generally greater. If only surrogate information in the form of a K_{ow} is available, 2 uncertainty points are assigned. If only an estimated BAF is available, a factor of 4 is assigned; if only an estimated BCF is available, a factor of 5 is assigned.

Chemical Name	Chemical Score	Uncertainty Score ¹	Composite Score	Ranking
Heptachlor	38	6	44	18
Hexachloroethane	33	11	44	18
Dieldrin	38	5	43	19
Phenanthrene	30	12	42	20
Toluene	31	10	41	21
Endosulfan	30	11	41	21
Pyrene	26	15	41	21
Lindane	38	3	41	21
Styrene	18	23	41	21
1,2,4-Trichlorobenzene	30	11	41	21
Trichloroethylene (TCE)	22	16	38	22
1,2-Dichlorobenzene	22	16	38	22
Benzidine	22	15	37	23
Benzene	19	17	36	24
Furan	13	23	36	24
Pentachlorophenol	29	7	36	24
Beryllium	23	12	35	25
Bis(2-ethylhexyl)phthalate (DEHP)	26	8	34	26
Di-n-butylphthalate	21	13	34	26
N-Nitrosodimethylamine	13	20	33	27
Benz(a)pyrene	19	14	33	27
Silvex	19	14	33	27
Perchlorate	8	24	32	28
Biphenyl	17	15	32	28
Butylbenzylphthalate	18	14	32	28
Phenol	21	9	30	29
Carbon tetrachloride	18	12	30	29
Ethylbenzene	10	20	30	29
Molybdenum	21	9	30	29
Selenium	23	7	30	29
Carbofuran	20	10	30	29
1,1-Dichloroethane (DCA)	8	21	29	30
Silver	18	11	29	30
Tetrahydrofuran	7	22	29	30
Arsenic	22	6	28	31
Chromium	23	5	28	31
1,2-DCA	19	9	28	31
Cyanide	12	16	28	31
Manganese	19	9	28	31
1,2-Dichloropropane	15	13	28	31
1,2-Dichloroethane	19	9	28	31
Chloroform	17	10	27	32
Trans-1,2-DCE	15	12	27	32
Trichlorotrifluoromethane (freon-113)	15	12	27	32
Copper	21	6	27	32
Nickel	21	6	27	32
Vanadium	18	9	27	32
Alachlor	19	8	27	32
Antimony	16	11	27	32
Atrazine	22	5	27	32
2,4,6-Trichlorophenol	20	7	27	32

Chemical Name	Chemical Score	Uncertainty Score ¹	Composite Score	Ranking
Tetrachloroethene	16	10	26	33
Barium	16	10	26	33
Cadmium	23	3	26	33
1,4-Dichlorobenzene	15	11	26	33
Dichloromethane	17	12	26	33
Hexachlorocyclopentadiene	15	11	26	33
Cobalt	15	10	25	34
Xylene	9	16	25	34
Vinyl chloride	15	10	25	34
Methylene chloride	15	10	25	34
Strontium	11	14	25	34
Naphthalene	13	12	25	34
1,3-Dichloropropene	11	14	25	34
Lead	23	1	24	35
Titanium	15	9	24	35
1,1,1-Trichloroethane (TCA)	12	12	24	35
Acrylonitrile	11	12	23	36
1,1,2,2-Tetrachloroethane	12	10	22	37
Diethylphthlate	11	10	21	38
Isophorone	7	11	18	39

Notes: The composite score was the sum of the final chemical score and the final uncertainty score. The SCRAM model preserves the final chemical and uncertainty scores as separate values because they are useful in the interpretation of the final composite scores and rankings.

Example of Site-Specific SCRAM Weightings

(See Section 2.2 for other site-specific weightings and ranking results)

Table M-2. Air Contaminant Rankings: SCRAM Score Weighted by (Air Emissions / Inhalation Reference Concentrations × Daily Inhalation Rates)

Contaminant	Emissions (lbs/yr)	Inhalation RfC (mg/m ³)	Emissions/ (RfC × I)	SCRAM Composite	Weighted Rank	Revised Ranking
Benzene	107.86	0.03	180	36	6472	1
Beryllium	0.03	0.00002	75	35	2625	2
Toluene	144	0.4	14	22	312	3
Chromium	0.0019	0.000008	74	28	208	4
Mercury	0.02	0.0003	3	52	173	5
Vinyl chloride	0.02	0.1	0.01	25	0.25	6

Table M-3. Air Contaminant Rankings: SCRAM Scores Weighted by Emissions

Chemical Name	SCRAM Composite Score	SCRAM Ranking	Air Emission Rate Estimates (1990–1992) (lbs/year)	Ranking × Emissions	Emission-Weighted Ranking	Chemicals in Order of Ranking
PCBs	61	1	1×10^{-5}	6.3×10^{-4}	20	Hydrazine
Mercury	52	2	0–0.02	1.04	18	1,1,1-TCA (methylchloroform)
Hydrazine	46	3	*170,570	7.8×10^6	1	TCE
Trichloroethylene (TCE)	38	4	4,305.32–7,756.61	294,751	3	1,2-DCA
Benzene	36	5	107.86–92.1	3,883	8	Methylene chloride (dichloromethane)
Beryllium	35	6	0.03	1.05	17	Carbon tetrachloride
Carbon tetrachloride	30	7	304.56–0.04	9,137	6	Xylene
Selenium	30	7	0.07–0.04	2.1	14	Benzene
Arsenic	28	8	0.07	1.96	15	Toluene
Chromium	28	8	$\dagger 1.19 \times 10^{-3}$	0.0333	19	Manganese
1,2-DCA	28	8	6,770	189,560	4	Nickel
Manganese	28	8	$\dagger 3.7 \times 10^{-1}$	10.36	10	Lead
1,1,1-Trichloroethane (TCA)	27	9	37,399.95	1,009,799	2	Cadmium
Nickel	27	9	0.44–0.56	15.12	11	Selenium
Cadmium	26	10	0.15	3.9	13	Arsenic
Xylene	25	11	215.95–49.53	5,399	7	Vinyl chloride
Vinyl chloride	25	11	0.02–0.05	1.25	16	Beryllium
Methylene chloride	25	11	1,732.23–1,070.54	43,306	5	Mercury
Lead	24	12	0.23–0.30	7.2	12	Chromium
Toluene	22	13	144–71.25	3,168	9	PCBs

Notes: SCRAM ranks chemicals based on toxicity, persistence, mobility, and bioaccumulation. Contaminants with the same SCRAM ranking had the same SCRAM composite score. The composite score is the sum of the final chemical score and the final uncertainty score.

Sources: RD Hot Spots Emission Reports for 1990–1992;

* 1955–1961 RD average yearly use reports; [†] 1996 RD TRI Report (lb/year).