APPENDIX A

ODOR THRESHOLDS, HEALTH LIMITS, AND EFFECTS SCREENING LEVELS

Table A-1. Odor Thresholds, Health Limits, and Effects Screening Levels *(Source: Siegell,[6] ACGIH,[7] and TNRCC[8])*

Compound	Odor Threshold[6] ppm	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Description[6]
		TWA	STEL	µg/m³	ppb	
Acetaldehyde	0.067	200	25	90	50	Pungent/Fruity
Acrylic acid	0.09	2		60	20	Rancid/Acrid
Acrylonitrile***	1.6	2	10	43	20	Onion/Garlic
Ammonia***	17	50	35	170	250	Pungent/Irritating
Amyl mercaptan	0.0003			0.1	0.02	Unpleasant/Putrid
Benzyl chloride	0.041	1		50	10	Pungent
Benzyl mercaptan	0.0002					Unpleasant/Strong
Butadiene	0.45	1	5	110	50	Aromatic/Rubber
Butyl acrylate		2		183	35	Odor[7]
n-Butylamine	0.080	5				Sour/Ammonia
Carbon disulfide***	0.0081	20	30	30	10	Medicinal/Sulfur
Carbon tetrachloride	250	10	25	126	20	Sweet
Carbonyl sulfide	0.1			8	3	Sulfide
Chlorine***	0.01	0.5	1	15	5	Pungent Bleach
Chlorobenzene	1.3	75		460	100	Almond/Shoe Polish
Chloroform***	192	10	50	98	20	Sweet
Cumene	0.032	50		500	100	Sharp
Dibutylamine	0.016			65	-	Fishy
Diisopropylamine	0.13	5		210	50	Fishy
Dimethylamine	0.34	10	15	37	20	Fishy/Putrid
Dimethyl sulfide	0.001			3	-	Decayed Cabbage
Diphenyl sulfide	0.0001					Unpleasant

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Compound	Odor Threshold[6] ppm	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Description[6]
		TWA	STEL	µg/m³	ppb	
Dowtherm****						Aromatic, Geranium like[9]
73% Diphenyl oxide		1[6]	2[6]	8.0[7]	1.1[7]	
27% Biphenyl		0.2[6]	0.2[6]	2.3[7]	0.36[7]	
Ethyl acrylate	1[8]	25	15	5	1.25	Acrid[9]
Ethylamine	0.27	10	15	92	50	Ammoniacal
Ethyl mercaptan***	0.0003	0.5	10	0.8	-	Decayed Cabbage
Ethylene dichloride	25	50	100	160	40	Chloroform
Ethylene oxide***	257	1	5	18	10	Sweet
Hydrogen sulfide	0.0005	10	20	TNRCC Reg. 11		Rotten Eggs
Methanol	100	200	250	2,620	2,000	Sour/Sweet
Methyl acrylate	208	10		58	17	Unpleasant/Acrid[9]
Methylamine***	4.7	10	15	64	50	Putrid/Fishy
Methyl chloroform	385	350	450	10,800	2,000	Sweet
Methyl ethyl ketone	10	200	300	3,900	1,320	Sweet/Sharp
Methyl isobutyl ketone	0.47	100	75	2,050	500	Sweet/Sharp
Methylene chloride	144	25	125	260	75	Sweet
Methyl mercaptan***	0.0005	0.5	10	2	1	Rotten Cabbage
Naphthalene	0.027	10	15	440	85	Tar/Creosote
Nitrobenzene	0.0047	1		24	5	Almond/Shoe Polish
Phenol	0.047	5		154	40	Medicinal/Acid
Phenyl mercaptan	0.0003	0.5		4	0.9	Putrid/Garlic
Propylene oxide***	35	100		210	84	Sweet
Propyl mercaptan	0.0005			2.3	0.7	Unpleasant

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Compound	Odor Threshold[6] ppm	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Description[6]
		TWA	STEL	µg/m³	ppb	
Styrene	0.047	100	200	110	25	Sweet/Aromatic
Styrene oxide	0.06			309	-	Sweet/Pleasant
Sulfur dioxide***	2.7	5	5	TNRCC Reg. 11		Pungent/Irritating
Toluene	2.8	200	300	1,880	500	Sour/Burnt
Trichloroethylene	82	100	200	1,350	250	Ether/Solvent
Xylene	0.73	100	150	2,079	480	Sweet

* Health Limits (Taken from ACGIH; ISBN: 1-882417-41-0):

- OSHA Permissible Exposure Limits (PELs) - Taken from the *Guide to Occupational Exposure Values* OSHA PELs are shown if available; if not ACGIH TLVs are shown.
- Time-Weighted Average (TWA) exposure concentration for a conventional 8-hour (TLV, PEL).
- Short Term Exposure Limit (STEL) - Usually a 15-minute time-weighted average. Values shown are Ceiling Concentrations (CEILC) - The concentration that shall not be exceeded during any part of the working exposure.

** ESLs are based on data concerning health effects, odor nuisance potential, effects with respect to vegetation, and corrosion effects. If ambient levels **do not exceed** the screening level, adverse health or welfare effects would not be expected to result. If ambient levels **do exceed** the screening levels, it does not necessarily indicate a problem, but the need for a more in-depth review. "Short-term" ESLs generally indicates a one-hour averaging period. "Long-term" indicates an annual averaging period.[6] [Long-term ESLs are not listed, but they are generally one-tenth of the Short-term ESLs.]

*** Classified as Potential Disaster Compounds by TNRCC[8].

**** Courtesy, Dale E. Webster, Steering Committee Member.

Table A-2. Potential Disaster Compounds, Health Limits, Effects Screening Levels (ESLs) and Odor *(Sources: TNRCC[8] and Thompson[9])*

Compounds	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Comments on Odor
	TWA	STEL	µg/m³	ppb	
Acrolein	0.1	0.1	2.3	1	
Allyl alcohol	2	-	48	20	Pungent odor detectable below 1 ppm[9]
Allyl chloride	1	2	30	10	Pungent odor barely detectable at 3-6 ppm[9]
Allylamine			12	5	
Arsine	0.05	-	1.6	0.5	
Bis (chloromethyl) ether			0.047	0.01	
Boron trichloride			5	-	
Boron trifluoride (as HF, 3 hr)	-	1	4.9	5.6	
Bromine	0.1	0.2	6.6	1	
Carbonyl chloride	0.1	-	4	1	
Chlorine dioxide	0.1	0.3	2.8	1	
Chlorine trifluoride (also evaluate HF)	-	0.1	1.9	0.5	
Chloro-1,3-butadiene, 2-	25	-	36	10	
Chloro-2,3-epoxypropane	5	-	19	5	Irritating, chloroform-like odor detectable at around 10 ppm[9]
Chloroethylmethyl ether	-	-	0.5	0.16	
Chloroprene, β-	25	-	36	10	
Crotonaldehyde	2	0.3	8.6	3	Pungent odor[9]
Cyanogen chloride	-	0.3	6	3	
Cyclohexylamine	10	-	80	20	
Diaminoethane, 1,2-	10	-	250	100	Ammoniacal odor detectable at 10 ppm[9]

Table A-2. Potential Disaster Compounds, Health Limits, Effects Screening Levels (ESLs) and Odor *(Sources: TNRCC[8] and Thompson[9])*

Compounds	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Comments on Odor
	TWA	STEL	µg/m³	ppb	
Diazomethane	0.2	-	3.4	2	
Diborane	0.1	-	1.1	1	
Dichloromethyl ether			0.047	0.01	
Dimethyl hydrazine,1,1-	-	-	0.25	0.1	
Epichlorohydrin	5	-	19	5	Irritating, chloroform-like odor detectable at around 10 ppm[9]
Epoxypropane	100	-	210	84	Ethereal odor detectable at 200 ppm[9]
Ethyl cyanide			140	60	
Ethylenediamine			250	100	Ammoniacal odor detectable at 10 ppm[9]
Ethyleneimine			8.8	5	Ammoniacal odor
Fluorine	0.1	2	2	1	
Formaldehyde	0.75	0.3	15	12	Dissection operations of biology lab***
Formalin			30	-	
Furan			280	100	
Hydrazine	1	-	0.13	0.1	
Hydrogen bromide	3	3	99	30	
Hydrogen chloride	-	5	75	50	
Hydrogen cyanide	10	4.7	50	4.7	
Hydrogen fluoride (3 hr)	3	3	4.9	5.6	
Hydrogen selenide	0.05	-	1.6	0.5	
Iron pentacarbonyl (as Fe)	0.1	0.2	8	1	
Isobutyronitrile	-	-	220	80	

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Compounds	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Comments on Odor
	TWA	STEL	µg/m³	ppb	
Isophorone diisocyanate	0.005	-	0.45	0.05	
Methacrylonitrile			27	10	
Methanethiol	0.5	10	2	1	Strong, objectionable odor[9]
Methyl bromide	1	20	117	30	Almost odorless, no warning properties[9]
Methyl chloroformate			2	0.52	
Methyl hydrazine	0.01	0.2	0.19	0.1	
Methyl isocyanate	0.02	-	0.47	0.2	
Methyl trichlorosilane			14	2.3	
Methyl-2-propenenitrile,2-			27	10	
Methylacrylonitrile	1	-	27	10	
Methylaziridine	2	-	50	20	Ammoniacal odor[9]
Nickel carbonyl	0.001	-	0.15	-	
Nitric acid	2	4	52	20	
Nitric oxide	25	-	310	250	
Nitrogen dioxide	3	5	must meet NAAQS		
Oxygen difluoride (also evaluate HF)	0.05	0.05	0.55	0.25	
Ozone	0.1	-	must meet NAAQS		
Pentaborane	0.005	0.015	0.13	0.05	
Perchloromethyl mercaptan	0.1	-	7.5	1	
Perchloryl fluoride (as HF, 3hr)	3	6	4.9	5.6	
Phosgene	0.1	-	4	1	

Table A-2. Potential Disaster Compounds, Health Limits, Effects Screening Levels (ESLs) and Odor *(Sources: TNRCC[8] and Thompson[9])*

Compounds	Health Limits* OSHA PELs ACGIH TLVs ppm		Short Term Effects Screening Levels, ESLs**		Comments on Odor
	TWA	STEL	µg/m³	ppb	
Phosphine	0.3	1	4.2	3	
Phosphorus oxychloride	0.1	-	6.3	1	
Phosphorus trichloride	0.5	0.5	11	2	
Piperidine			36	10	
Propionitrile	-	-	140	60	
Propylene imine	2	-	47	20	Ammoniacal odor[9]
Selenium hexafluoride (as Se, also evaluate total HF)	0.05	-	1.6	0.5	
Stibine	0.1	-	5	1	
Sulfur pentafluoride (also evaluate HF)	0.025	0.01	0.5	0.1	
Sulfur tetrafluoride (also evaluate HF)	-	0.1	2.2	0.5	
Sulfur trioxide			10	-	
Tellurium hexafluoride (as Te)	0.02	-	2	0.2	
Tetramethyl lead	-	-	0.75	-	
Tetranitromethane	1	-	0.4	0.05	
Titanium tetrachloride			10	-	
Trichloromethane	10	50	98	20	
Vinyl acetate	10	15	150	40	
Vinyl cyanide	2	10	43	20	Pungent odor detectable below 1ppm ammoniacal odor[9]

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*** Courtesy, Steanson B. Parks, Steering Committee Member.