ODOR THRESHOLDS for Chemicals with Established Occupational Health Standards

American Industrial Hygiene Association
Fairfax, Virginia

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TABLE 5.3 REPORTED ODOR THRESHOLDS FROM ALL CODE SOURCES

Compound Name Synonyms	Source	Code	Type of Threshold	Odor Thresholds mg/m³	Odor Thresholds ppm
Ethylene Oxide	Phase I Rejected/Unreviewed Sources				
1,2-Epoxyethane	No C–E Codes	—	—	—	—
Oxirane					
	Phase II Critiqued Sources				
	Jacobson 1956	**A**	**d**	**1260**	**690**
	Yuldashev 1965	B2		1.5	0.82
	Hellman 1974	**A**	**d**	**470**	**257**
	Hellman 1974	**A**	**r**	**900**	**493**
Ethylenimine	Phase I Rejected/Unreviewed Sources				
	Carpenter 1948	C4		3.6	2.0
	Phase II Critiqued Sources				
	Berzins 1967	B5		1.25–3.5	0.68–1.9
Ethyl Formate	Phase I Rejected/Unreviewed Sources				
	Backman 1917	E1	r	54–61	18–20
	Phase II Critiqued Sources				
	No A or B Codes	—	—	—	—
Ethyl Mercaptan	Phase I Rejected/Unreviewed Sources				
Ethanethiol	Blanchard 1976	E2		0.016	0.0063
	Selyuzhitskii 1976	E1		0.000095	0.000037
	Thomas 1943	C2		0.005	0.0020
	Stuiver 1958	E2	d	0.0001	0.0004
	Sales 1958	E2		0.0025–0.0045	0.00098–0.0018
	Endo 1967	E2		0.00065	0.00026
	Phase II Critiqued Sources				
	Whisman 1978	**A**	**d**	**0.00025–0.0005**	**0.000098–0.00020**
	Allison 1919	B5		46	18
	Katz 1930	**A**	**d**	**0.00066–0.0076**	**0.00026–0.0030**
	Blinova 1965	B2		0.006–0.03	0.002–0.01
	Leonardos 1969	B	r	0.0025	0.0098
	Wilby 1969	**A**	**r**	**0.001**	**0.0004**
N-Ethylmorpholine	Phase I Rejected/Unreviewed Sources				
4-Ethylmorpholine	No C–E Codes	—	—	—	—
	Phase II Critiqued Sources				
	Hellman 1974	**A**	**d**	**0.4**	**0.085**
	Hellman 1974	**A**	**r**	**1.2**	**0.25**
Ethyl Silicate	Phase I Rejected/Unreviewed Sources				
Tetraethyl Silicate	Smyth 1940	C4	d	<720	85
	Phase II Critiqued Sources				
	Hellman 1974	**A**	**d**	**31**	**3.6**
	Hellman 1974	**A**	**r**	**43**	**5**

Compound Name Synonyms	Source	Code	Type of Threshold	Odor Thresholds mg/m³	Odor Thresholds ppm
Methyl Isopropyl Ketone (Cont.)	Phase II Critiqued Sources				
	No A or B Codes	—	—	—	—
Methyl Mercaptan	Phase I Rejected/Unreviewed Sources				
Methanethiol	Freudenberg 1955	C4		0.0005	0.00025
	Endo 1967	E2		1.1	0.56
	Hamanabe 1969	E1		0.0002	0.00010
	Bozza 1949	E2		1	0.51
	Guadagni 1966	D2		0.0002	0.00010
	Selyuzhitskii 1972	E1		0.0005	0.00025
	Blanchard 1976	E2		0.003	0.0015
	Bedborough 1979	E2	d	0.00016	0.000081
	Anon. 1980	D3	d	0.00024	0.00012
	Anon. 1980	D3	r	0.0013	0.00066
	Phase II Critiqued Sources				
	Katz 1930	A	d	**0.081**	**0.041**
	Leonardos 1969	B	r	0.0042	0.0021
	Wilby 1969	A	r	**0.002**	**0.0010**
	Sanders 1970	B		0.0019	0.00097
	Williams 1977	A	d	**0.0000003**	**0.0000002**
	Nishida 1979	A	d	**0.038**	**0.019**
Methyl Methacrylate	Phase I Rejected/Unreviewed Sources				
Methyl 2-Methyl-2-propenoate	Holland 1974	D2		0.057	0.014
	Anon. 1980	D3	d	0.62	0.15
	Anon. 1980	D3	r	1.9	0.46
	Phase II Critiqued Sources				
	Filatova 1962	B2		0.2	0.049
	Leonardos 1969	B	r	0.85	0.21
	Hellman 1973a, 1974	A	d	**0.2**	**0.049**
	Hellman 1973a, 1974	A	r	**1.4**	**0.34**
Methyl Parathion	Phase I Rejected/Unreviewed Sources				
o,o-Dimethyl o,p-Nitrophenyl Phosphorothioate	No C–E Codes	—	—	—	—
Nitrox	Phase II Critiqued Sources				
Partron M	Akhmedov 1968	B2		0.0125	0.0012
Wofatos					
Methyl Propyl Ketone	Phase I Rejected/Unreviewed Sources				
2-Pentanone	Backman 1917	E1	r	11–15	3.1–4.3
Ethyl Acetone					
MPK					
	Phase II Critiqued Sources				
	May 1966	A	d	**27**	**7.7**
	May 1966	A	r	**48**	**13.6**

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MANUAL ON DISPOSAL OF REFINERY WASTES

VOLUME ON ATMOSPHERIC EMISSIONS

AMERICAN PETROLEUM INSTITUTE
REFINING
1801 K Street, N.W.
Washington, D.C. 20006

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MANUAL ON DISPOSAL OF REFINERY WASTES
VOLUME ON ATMOSPHERIC EMISSIONS

CHAPTER 16 – ODOR

AMERICAN PETROLEUM INSTITUTE
REFINING DEPARTMENT
2101 L Street, N.W.
Washington, D.C. 20037

Price $2.00

Table 16-1—Properties of Odorous Compounds Encountered in Refineries

Compound	Formula	Molecular Weight	Quality	Hedonic Tone	Odor Detection Threshold (ppm)* Low	50%	100%	Odor Index (100% Recognition)†	Diffusivity in Air at Zero Degrees Centigrade‡ (cm^2/sec)	Solubility in Water§ (g/100 ml)
Acetone	CH_3CCH_3	58.05	Sweet, fruity	Pleasant to neutral	20 1.29	32.5	140	1,742	0.083	—
ACIDS										
Acetic	CH_3COOH	60.03	Pungent, sour	Neutral to unpleasant	<0.14	0.36	0.36	65,731	0.106	—
Hydrogen chloride	HCl	36.47	Pungent		—	—	10	Gas	0.128	—
Hydrogen fluoride	HF	20.01						Gas	0.149	—
ALCOHOLS										
Methyl	CH_3OH	32.03	Sour, sharp	Neutral	4.26	53.3	53.3	2,393	0.133	—
Ethyl	CH_3CH_2OH	45.04	Fragrant				10	5,644	0.094	—
Propyl	$CH_3CH_2CH_2OH$	60.06	Sweet, alcohol	Pleasant	<0.03	0.08	0.13	246,625	0.085	—
Isopropyl	$(CH_3)_2CH\ OH$	60.06	Sharp, musty	Unpleasant	3.20	7.50	28.2	1,539	0.082	—
n-Butyl	$CH_3(CH_2)_3OH$	74.08	Rancid, sweet	Neutral to Pleasant	0.30 0.012	1.0	2 25.3	2,630	0.070	9 (15)
Isobutyl	$(CH_3)_2CH\ CH_2OH$	74.08	Sweet, musty	Unpleasant	0.68	1.80	2.05	5,131	0.073	10 (15)
Amyl	$CH_3(CH_2)_4OH$	88.10	Sweet	Pleasant	0.12	1.0	1.0	13,150	0.063	2.7 (22)
Acetaldehyde	CH_3CHO	44.03	Pungent, fruity		<1	—	0.21	4.73×10^6	0.100	
Ammonia	NH_3	17.03	Sharp, pungent		—	—	46.8	Gas	0.216	72.7
Chlorine	Cl_2	70.91	Pungent, irritating		—	—	0.314	Gas	0.093	0.9
Ethyl ether	$C_2H_5OC_2H_5$	74.08			—	0.23	—	2.55×10^6	0.078	7.5
HYDROCARBONS										
Methane	CH_4	16.04				Not detectable		—	0.158	0.4 cc
Ethane	C_2H_6	30.07				Not detectable		—	0.108	4.7 cc
Propane	$CH_3CH_2CH_3$	44.09				Not detectable		—	0.088	6.5 cc (18)
n-Butane	$CH_3(CH_2)_2CH_3$	58.12				Not detectable		—	—	i
Gasoline	$CH_3(CH_2)_4CH_3$	114.22	Aromatic		—	—	—	—	0.051	0.002 (16)
AROMATICS										
Benzene	C_6H_6	78.05	Solvent		1.50	—	4.68	21,648	0.077	0.007 (22)
Toluene	$C_6H_5CH_3$	92.06	Sour, burnt	Unpleasant to neutral	0.17	1.74	1.74	16,609	0.071	0.05 (16)
o-Xylene	$C_6H_4(CH_3)_2$	106.08	Sweet	Neutral to pleasant	0.08	0.27	0.27	29,222	0.062	i
Naphthalene	$C_{10}H_8$	128.16	Aromatic						0.051	0.003 (25)
MERCAPTANS										
Methyl	CH_3SH	48.10	Decayed cabbage	Unpleasant	—	—	0.0021	Gas	0.095	s
Ethyl	C_2H_5SH	62.11	Garlic-like	Unpleasant	0.00025	—	0.0010	589×10^6	0.094	36
n-Propyl	C_3H_7SH	76.13			0.0016	—	0.024		0.071	v.sl.s
n-Butyl	$CH_3(CH_2)_2CH_2SH$	90.14	Skunk-like	Unpleasant	0.004	—	0.049		0.064	v.sl.s
t-Butyl	$C_4H_{10}S$	90.14	Skunk-like	Unpleasant	—	—	—		0.064	i
Isoamyl	$(CH_3)_2CH(CH_2)_2SH$	104.16			—	—	0.00043		0.059	i
PHENOLS										
Phenol	C_6H_5OH	94.05	Distinctive, medicinal		0.016	—	0.047		0.068	8.2 (15)
Cresol	$CH_3C_6H_4OH$	108.06	Phenol-like		—	—	0.19		0.062	2.5
Thiophenol	C_6H_5SH	110.17			2.05	13.5	32.8	49	—	v.sl.s
Thiocresol	$CH_3C_6H_4SH$	124.13			—	—	0.0027		0.055	—
Pyridine	C_5H_5N	102.08	Burnt, pungent, diamine		0.007	0.82	7.7 to 10	2,092	—	—
SULFIDES										
Hydrogen	H_2S	34.08	Rotten eggs	Unpleasant	—	—	0.00047	Gas	0.122	312
Methyl	$(CH_3)_2S$	62.13	Vegetable sulfide		—	—	0.0010	562×10^6	0.094	i
Ethyl (diethyl)	$(C_2H_5)_2S$	90.14	Garlic, foul	Unpleasant	—	—	0.0010	65.2×10^6	0.064	0.31
Propyl	$(C_3H_7)_2S$	118.18			0.011	—	0.017		0.054	—
n-Butyl	$(C_4H_9)_2S$	146.20			0.001	0.006	0.019		0.048	—
Thiophene	C_4H_4S	84.14	Garlic-like		—	—	0.0047	16.8×10^6	—	i
Sulfur dioxide	SO_2	64.07	Pungent, sour		—	—	0.47	Gas	0.102	15.5

*Note that 50 and 100 percent detection levels can be equal.

†Odor index = $\frac{\text{vapor pressure (in ppm)}}{\text{100 percent detection limit (in ppm)}}$

‡These values were obtained from reference 7.

§Values at temperatures shown were obtained from reference 8. (Numbers in parentheses are temperatures in degrees Centigrade.)
Legend is as follows:
i = insoluble
v.sl.s = very slightly soluble
s = slightly soluble