Table 6 .... Maximum Allowable Concentration of Gases and Vapors

| Substance | ASA Standards MAC ppm[b] by volume | Threshold Limit Values ACGIH[a] 1959 ppm[b] | Threshold Limit Values ACGIH[a] 1959 g/cu m or oz/1000 cu ft |
|---|---|---|---|
| Acetaldehyde | | 200 | 0.360 |
| Acetic acid | | 10 | 0.025 |
| Acetic anhydride | | 5 | 0.020 |
| Acetone | | 1000 | 2.400 |
| (x) Acetylene tetrabromide | | 1 | 0.014 |
| Acrolein | | 0.5 | 0.0012 |
| Acrylonitrile | | 20 | 0.045 |
| Allyl alcohol | | 5 | 0.012 |
| Allyl chloride | | 5 | 0.015 |
| Allyl propyl disulfide | | 2 | 0.012 |
| Ammonia | | 100 | 0.070 |
| Amyl acetate | | 200 | 1.050 |
| Amyl alcohol (iso) | | 100 | 0.360 |
| Aniline | | 5 | 0.019 |
| Arsine | | 0.05 | 0.0002 |
| Benzene (benzol) | 100 | 25 | 0.080 |
| Benzyl chloride | | 1 | 0.005 |
| * Bromine | | 0.1 | 0.0007 |
| Butadiene (1,3-butadiene) | | 1000 | 2.200 |
| Butanone (methyl ethyl ketone) | | 250 | 0.740 |
| Butyl acetate (n-butyl acetate) | | 200 | 0.950 |
| Butyl alcohol (n-butanol) | | 100 | 0.300 |
| Butylamine | | 5 | 0.015 |
| Butyl cellosolve (2-butoxyethanol) | | 50 | 0.240 |
| Carbon dioxide | | 5000 | 9.000 |
| Carbon disulfide | 20 | 20 | 0.060 |
| Carbon monoxide | 100 | 100 | 0.110 |
| Carbon tetrachloride | | 25 | 0.160 |
| Cellosolve (2-ethoxyethanol) | | 200 | 0.740 |
| Cellosolve acetate (2-ethoxyethyl acetate) | | 100 | 0.540 |
| Chlorine | | 1 | 0.003 |
| Chlorine trifluoride | | 0.1 | 0.0004 |
| Chlorobenzene (monochlorobenzene) | | 75 | 0.350 |
| * Chloroform (trichloromethane) | | 50 | 0.240 |
| 1-Chloro-1-nitropropane | | 20 | 0.100 |
| * Chloropicrin | | 0.1 | 0.0007 |
| Chloroprene (2-chloro-1,3-butadiene) | | 25 | 0.090 |
| Cresol (all isomers) | | 5 | 0.022 |
| Cyclohexane | | 400 | 1.400 |
| Cyclohexanol | | 100 | 0.410 |
| Cyclohexanone | | 100 | 0.400 |
| Cyclohexene | | 400 | 1.350 |
| Cyclopropane | | 400 | 0.690 |
| Decaborane | | 0.05 | 0.0003 |
| Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone) | | 50 | 0.240 |
| Diborane | | 0.1 | 0.0001 |
| o-Dichlorobenzene | | 50 | 0.300 |
| (x) p-Dichlorobenzene | | 75 | 0.450 |
| Dichlorodifluoromethane | | 1000 | 4.95 |
| 1,1-Dichloroethane | | 100 | 0.400 |
| 1,2-Dichloroethane (ethylene dichloride) | | 100 | 0.400 |
| 1,2-Dichloroethylene | | 200 | 0.790 |
| Dichloroethyl ether | | 15 | 0.090 |
| Dichloromonofluoromethane | | 1000 | 4.200 |
| 1,1-Dichloro-1-nitroethane | | 10 | 0.060 |
| Dichlorotetrafluoroethane | | 1000 | 7.00 |
| Diethylamine | | 25 | 0.075 |
| Difluorodibromomethane | | 100 | 0.860 |
| Diisobutyl ketone | | 50 | 0.290 |
| Dimethylaniline (N-dimethylaniline) | | 5 | 0.025 |
| Dimethylsulfate | | 1 | 0.005 |
| Dioxane (diethylene dioxide) | | 100 | 0.360 |
| Ethyl acetate | | 400 | 1.400 |
| Ethyl acrylate | | 25 | 0.100 |
| Ethyl alcohol (ethanol) | | 1000 | 1.900 |
| Ethylamine | | 25 | 0.045 |
| Ethyl benzene | | 200 | 0.870 |
| Ethyl bromide | | 200 | 0.890 |
| Ethyl chloride | | 1000 | 2.600 |
| Ethyl ether | | 400 | 1.200 |
| Ethyl formate | | 100 | 0.300 |
| Ethyl silicate | | 100 | 0.850 |
| Ethylene chlorhydrin | | 5 | 0.016 |
| Ethylenediamine | | 10 | 0.030 |
| Ethylenedibromide (1,2-dibromoethane) | | 25 | 0.190 |
| Ethylene imine | | 5 | 0.009 |
| Ethylene oxide | | 50 | 0.090 |
| Fluorine | | 0.1 | 0.0002 |
| Fluorotrichloromethane | | 1000 | 5.600 |
| Formaldehyde | 10 | 5 | 0.006 |
| Furfural | | 5 | 0.020 |
| Gasoline | | 500 | 2.000 |
| Heptane (n-heptane) | | 500 | 2.000 |
| Hexane (n-hexane) | | 500 | 1.80 |
| Hexanone (methyl butyl ketone) | | 100 | 0.410 |
| Hexone (methyl isobutyl ketone) | | 100 | 0.410 |
| Hydrazine | | 1 | 0.0013 |
| Hydrogen bromide | | 5 | 0.017 |
| Hydrogen chloride | | 5 | 0.007 |
| Hydrogen cyanide | | 10 | 0.011 |
| Hydrogen fluoride | | 3 | 0.002 |
| Hydrogen peroxide, 90% | | 1 | 0.0014 |
| Hydrogen selenide | | 0.05 | 0.0002 |
| Hydrogen sulfide | 20 | 20 | 0.030 |
| Iodine | | 0.1 | 0.001 |
| Isophorone | | 25 | 0.140 |
| Isopropylamine | | 5 | 0.012 |
| Mesityl oxide | | 25 | 0.100 |
| Methyl acetate | | 200 | 0.610 |
| Methyl acetylene | | 1000 | 1.650 |
| Methyl acrylate | | 10 | 0.035 |
| Methyl alcohol (methanol) | 200 | 200 | 0.260 |
| Methyl bromide | | 20 | 0.080 |
| Methyl cellosolve (2-methoxyethanol) | | 25 | 0.080 |
| Methyl cellosolve acetate (ethylene glycol monomethyl ether acetate) | | 25 | 0.120 |
| Methyl chloride | 100 | 100 | 0.210 |
| Methylal (dimethoxymethane) | | 1000 | 3.100 |

[a] ACGIH = American Conference of Governmental Industrial Hygienists. Reprinted by permission of the ACGIH Committee on Threshold Limits.
[b] Parts of vapor or gas per million parts of air by volume.

(x) These values added to the list in 1959.
* These items include changes made by ACGIH Committee on Threshold Limits in 1959.



Table 6 .... Maximum Allowable Concentration of Gases and Vapors (Concluded)

| Substance | ASA Standards MAC ppm[b] by volume | Threshold Limit Values ACGIH[a] 1959 ppm[b] | Threshold Limit Values ACGIH[a] 1959 g/cu m or oz/1000 cu ft |
|---|---|---|---|
| Methyl chloroform (1-1-1 trichloroethane) | | 500 | 2.700 |
| Methylcyclohexane | | 500 | 2.000 |
| Methylcyclohexanol | | 100 | 0.470 |
| Methylcyclohexanone | | 100 | 0.460 |
| Methyl formate | | 100 | 0.250 |
| Methyl isobutyl carbinol (methylamyl alcohol) | | 25 | 0.100 |
| (x) Methyl styrene | | 100 | 0.480 |
| Methylene chloride (dichloromethane) | | 500 | 1.750 |
| (x) Monomethyl aniline | | 2 | 0.009 |
| Naphtha (coal tar) | | 200 | 0.800 |
| Naphtha (petroleum) | | 500 | 2.000 |
| Nickel carbonyl | | 0.001 | 0.000007 |
| Nitric acid | | 10 | 0.025 |
| p-Nitroaniline | | 1 | 0.006 |
| Nitrobenzene | | 1 | 0.005 |
| Nitroethane | | 100 | 0.310 |
| Nitrogen dioxide | | 5 | 0.009 |
| Nitroglycerine | | 0.5 | 0.005 |
| Nitromethane | | 100 | 0.250 |
| 2-Nitropropane | | 50 | 0.180 |
| Nitrotoluene | | 5 | 0.030 |
| Octane | | 500 | 2.350 |
| Ozone | | 0.1 | 0.0002 |
| Pentane | | 1000 | 2.950 |
| Pentanone (methyl propyl ketone) | | 200 | 0.700 |
| Perchlorethylene (tetrachloroethylene) | | 200 | 1.350 |
| Phenol | | 5 | 0.019 |
| Phenylhydrazine | | 5 | 0.022 |
| Phosgene (carbonyl chloride) | | 1 | 0.004 |
| Phosphine | | 0.05 | 0.00007 |
| Phosphorus trichloride | | 0.5 | 0.003 |
| Propyl acetate | | 200 | 0.840 |
| Propyl alcohol (isopropyl alcohol) | | 400 | 0.980 |
| Propyl ether (isopropyl ether) | | 500 | 2.100 |
| Propylene dichloride (1,2-dichloropropane) | | 75 | 0.350 |
| Propylene imine | | 25 | 0.060 |
| (x) Propylene oxide | | 100 | 0.240 |
| Pyridine | | 10 | 0.030 |
| Quinone | | 0.1 | 0.0004 |
| Stibine | | 0.1 | 0.0005 |
| Stoddard solvent | | 500 | 2.90 |
| Styrene monomer (phenylethylene) | 400 | 100 | 0.420 |
| Sulfur dioxide | | 5 | 0.013 |
| Sulfur hexafluoride | | 1000 | 6.000 |
| Sulfur monochloride | | 1 | 0.006 |
| Sulfur pentafluoride | | 0.025 | 0.00025 |
| (x) Tertiary butyl alcohol | | 100 | 0.300 |
| p-Tertiarybutyltoluene | | 10 | 0.060 |
| 1,1,2,2-Tetrachloroethane | | 5 | 0.035 |
| Tetrahydrofuran | | 200 | 0.590 |
| Tetranitromethane | | 1 | 0.008 |
| Toluene (toluol) | 200 | 200 | 0.750 |
| o-Toluidine | | 5 | 0.022 |
| (x) Tolylene-2,4-diisocyanate | | 0.1 | 0.0007 |
| Trichloroethylene | 200 | 200 | 1.050 |
| (x) Triethylamine | | 25 | 0.100 |
| Trifluoromonobromomethane | | 1000 | 6.100 |
| Turpentine | | 100 | 0.560 |
| Vinyl chloride (chloroethylene) | | 500 | 1.30 |
| (x) Vinyl toluene | | 100 | 0.480 |
| Xylene (xylol) | | 200 | 0.870 |
| (x) Xylidine | | 5 | 0.025 |

Table 7 .... Limits for Mineral Dusts

| Substance | Threshold Limit Values ACGIH 1958 mppcf[a] |
|---|---|
| Aluminum oxide | 50 |
| Asbestos | 5 |
| Cement, Portland | 50 |
| Dust (nuisance, no free silica) | 50 |
| Mica (below 5% free silica) | 20 |
| Silica—high (above 50% free $SiO_2$) | 5 |
| Silica—medium (5 to 50% free $SiO_2$) | 20 |
| Silica—low (below 5% free $SiO_2$) | 50 |
| Silicon carbide | 50 |
| Soapstone (below 5% free $SiO_2$) | 20 |
| Talc | 20 |

[a] mppcf—million particles per cubic foot of air, standard light field count.
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ous process. However, it is not possible to apply a reasonable safety factor to the ventilation estimate without consideration of the concentrations of gases or vapors that approach the danger point. Safety engineers prefer to limit the concentration to ¼ or ½ of the lower explosive limit, and this fact should be given full weight in determining the capacity and design of ventilating equipment. Rarely should consideration be given to *operation above the upper explosive limit* in the open areas of buildings or rooms—even though unoccupied—because the danger of temporary drop of gas concentration to a point within the explosive range is too great.

Ability of a flammable liquid to form explosive mixtures is determined largely by its vapor pressure, volatility, or rate of evaporation. *Flash point* is a convenient method of expressing this property in terms of the temperature scale. It may be defined as the temperature to which a combustible liquid must be heated to produce a flash when a small flame is passed across the surface of the liquid. The higher the flash point, the more safely can the liquid be handled. Liquids with flash points under 70 F should be regarded as highly flammable.

Upper and lower limits of flammability of gases and vapors,