

MACT

Maximum Achievable Control Technology

Available Compounds for
HAZARDOUS AIR POLLUTANTS



AIR LIQUIDE

SPECIALTY GASES



Scott™

MACT Hazardous Air Pollutants (HAPs)

COMPOUND	AVAILABILITY	COMMENTS
Acetaldehyde	10 ppb – 3.6%	
Acetamide	No	Vapor pressure too low to make gas mixture.
Acetonitrile	10 ppb – 3400 ppm	
Acetophenone	1 ppm – 18 ppm	
2-Acetylaminofluorene	No	Vapor pressure too low to make gas mixture.
Acrolein	10 ppb – 1%	
Acrylamide	No	Vapor pressure too low to make gas mixture.
Acrylic Acid	No	Polymerizes readily. Cannot make gas mixture.
Acrylonitrile	10 ppb – 3400 ppm	
Allyl Chloride	10 ppb – 1.3%	
4-Aminobiphenyl	No	Boiling point too high (576°F/302°C) to make gas mixture.
Aniline	100 ppb – 8 ppm	
o-Anisidine	No	Very toxic. Too dangerous to handle.
Asbestos	No	Fibrous solid. Cannot make gas mixture.
Benzene	10 ppb – 3000 ppm	
Benzidine	No	Boiling point too high (754°F/401°C) to make gas mixture.
Benzotrichloride	No	Too toxic.
Benzyl Chloride	10 ppb – 26 ppm	Stability is problematic.
Biphenyl	No	Vapor pressure too low to make gas mixture.
Bromoform	10 ppb – 150 ppm	
1,3-Butadiene	10 ppb – 10%	
Calcium Cyanamide	No	Vapor pressure too low to make gas mixture.
Caprolactam	No	Boiling point too high (959°F/515°C) to make gas mixture.
Captan	No	Vapor pressure too low to make gas mixture.
Carbaryl	No	Boiling point too high (599°F/315°C) to make gas mixture.
Carbon Disulfide	100 ppb – 1.5%	
Carbon Tetrachloride	10 ppb – 3900 ppm	
Carbonyl Sulfide	100 ppb – 3%	
Catechol	No	Boiling point too high (885°F/474°C) to make gas mixture.
Chloramben	No	Vapor pressure too low to make gas mixture.
Chlordane	No	Vapor pressure too low to make gas mixture.
Chlorine	5 ppm – 10%	
Chloroacetic Acid	No	Vapor pressure too low to make gas mixture.
2-Chloroacetophenone	No	Vapor pressure too low to make gas mixture.
Chlorobenzene	10 ppb – 290 ppm	
Chlorobenzilate	No	Vapor pressure too low to make gas mixture.
Chloroform	10 ppb – 6900 ppm	
bis-(Chloromethyl)-Ether	100 ppb – 1400 ppm	
Chloromethyl Methyl Ether	100 ppb – 8900 ppm	
Chloroprene	100 ppb – 8700 ppm	Inhibitor present to retard polymerization.
Chrysilic Acid (isomers & mixture)	No	Boiling point too high (745°F/396°C) to make gas mixture.
m-Cresol	10 ppb – 23 ppm	
o-Cresol	10 ppb – 23 ppm	
p-Cresol	10 ppb – 23 ppm	
Cumene	10 ppb – 65 ppm	
DDE	No	Vapor pressure too low to make gas mixture.
Diazomethane	No	Explosive, poisonous.
Dibenzofurans	No	Vapor pressure too low to make gas mixture.
1,2-Dibromo-3-Chloropropane	No	Very toxic. Too dangerous to handle
Dibutylphthalate	No	Vapor pressure too low to make gas mixture.
1,4-Dichlorobenzene	10 ppb – 32 ppm	
3,3-Dichlorobenzidine	No	Boiling point too high (729°F/387°C) to make gas mixture.
Dichloroethyl Ether (bis-(2-Chloroethyl)-Ether)	100 ppb – 72 ppm	
2,4-Dichlorophenoxy Acetic Acid	No	Very toxic. Vapor pressure too low to make gas mixture.
1,2-Dichloropropane	10 ppb – 1400 ppm	
1,3-Dichloropropene	10 ppb – 1400 ppm	
Dichlorvos	No	Vapor pressure too low to make gas mixture.
Diethanolamine	No	Vapor pressure too low to make gas mixture.
Diethyl Sulfate	No	Corrosive, poisonous.

COMPOUND	AVAILABILITY	COMMENTS
Dimethyl Carbamoyl Chloride	No	Insufficient data available to evaluate manufacture.
Dimethyl Formamide	10 ppb – 85 ppm	
Dimethyl Phthalate	No	Vapor pressure too low to make gas mixture.
Dimethyl Sulfate	No	Corrosive, poisonous.
Dimethylaminoazobenzene	No	Vapor pressure too low to make gas mixture.
3,3-Dimethoxybenzidine	No	Boiling point too high (673°F/356°C) to make gas mixture.
3,3-Dimethylbenzidine	No	Vapor pressure too low to make gas mixture.
1,1-Dimethylhydrazine	No	Too dangerous to handle — considered a carcinogen, teratogen, mutagen.
4,6-Dinitro-o-Cresol	No	Boiling point too high (712°F/378°C) to make gas mixture.
2,4-Dinitrophenol	No	Vapor pressure too low to make gas mixture.
2,4-Dinitrotoluene	No	Boiling point too high (572°F/300°C) to make gas mixture.
1,4-Dioxane	10 ppb – 920 ppm	
1,2-Diphenylhydrazine	No	Boiling point too high (588°F/309°C) to make gas mixture.
Epichlorohydrin	2 ppm – 760 ppm	
1,2-Epoxybutane	2 ppm – 8400 ppm	
Ethyl Acrylate	10 ppb – 1800 ppm	
Ethyl Carbamate (Urethane)	No	Insufficient data available to evaluate manufacture.
Ethyl Chloride (Chloroethane)	10 ppb – 4.8%	
Ethylbenzene	10 ppb – 210 ppm	
Ethylene Dibromide (1,2-Dibromoethane)	10 ppb – 270 ppm	
Ethylene Dichloride (1,2-Dichloroethane)	10 ppb – 8200 ppm	
Ethylene Glycol	No	Cannot recover from cylinder.
Ethylene Imine (Aziridine)	No	Acute toxicity.
Ethylene Oxide	500 ppb – 2%	
Ethylene Thiourea	No	Boiling point too high (657°F/347°C) to make gas mixture.
bis-(2-Ethylhexyl)-Phthalate	No	Vapor pressure too low to make gas mixture.
Ethylidene Dichloride	10 ppb – 8200 ppm	
Formaldehyde	100 ppb – 100 ppm	100 ppb – 30 ppm gas mixtures are certified. >30 ppm are non-certified.
Heptachlor	No	Very toxic. Vapor pressure too low to make gas mixture.
Hexachlorobenzene	No	Very toxic. Vapor pressure too low to make gas mixture.
Hexachlorobutadiene	10 ppb – 9.7 ppm	
Hexachlorocyclopentadiene	1 ppm – 2.4 ppm	
Hexachloroethane	10 ppb – 10%	
Hexamethylene-1,6-Diisocyanate	No	Very toxic. Vapor pressure too low to make gas mixture.
Hexamethylphosphoramide	No	Vapor pressure too low to make gas mixture.
Hexane	10 ppb – 5200 ppm	
Hydrazine	No	Too dangerous to handle — considered a carcinogen, teratogen, mutagen.
Hydrogen Chloride	5 ppm – 5%	
Hydrogen Fluoride	100 ppm – 5%	100 ppm is the lowest concentration considered stable in a cylinder.
Hydrogen Sulfide	250 ppb – 3%	
Hydroquinone	No	Vapor pressure too low to make gas mixture.
Isophorone	1 ppm – 19 ppm	
Lindane	No	Very toxic. Vapor pressure too low to make gas mixture.
Maleic Anhydride	No	Very toxic. Too dangerous to handle.
Methanol	100 ppb – 3500 ppm	
Methoxychlor	No	Very toxic. Vapor pressure too low to make gas mixture.
Methyl Bromide	10 ppb – 7%	
Methyl Chloride	10 ppb – 22%	
Methyl Chloroform	10 ppb – 4000 ppm	
Methyl Ethyl Ketone (2-Butanone)	10 ppb – 5200 ppm	
Methyl Hydrazine	No	Too dangerous to handle — considered a carcinogen, teratogen, mutagen.
Methyl Iodide	2 ppm – 1.2%	
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	10 ppb – 60 ppm	
Methyl Isocyanate	No	Very toxic. Too dangerous to handle.
Methyl Methacrylate	10 ppb – 1100 ppm	

COMPOUND	AVAILABILITY	COMMENTS
Methyl t-Butyl Ether	10 ppb – 1.1%	
4,4'-Methylene-bis-Benzenamine	No	Boiling point too high (750°F/399°C) to make gas mixture.
4,4'-Methylene-bis-(2-Chloroaniline)	No	Very toxic. Vapor pressure too low to make gas mixture.
Methylene Diphenyl Diisocyanate	No	Vapor pressure too low to make gas mixture.
N,N-Diethyl Aniline (N,N-Dimethyl Aniline)	Potential	Call about mixture with other amides & amines.
Naphthalene	100 ppb – 2 ppm	
Nitrobenzene	1 ppm – 10 ppm	
4-Nitrophenyl	No	Boiling point too high (644°F/340°C) to make gas mixture.
4-Nitrophenol	No	Vapor pressure too low to make gas mixture.
2-Nitropropane	10 ppm – 800 ppm	
N-Nitroso-N-Methylurea	No	Vapor pressure too low to make gas mixture.
N-Nitrosodimethylamine	No	Insufficient data available to evaluate manufacture.
N-Nitrosomorpholine	No	Insufficient data available to evaluate manufacture.
Parathion	No	Very toxic. Vapor pressure too low to make gas mixture.
PCBs	No	Vapor pressure too low to make gas mixture.
Pentachloronitrobenzene	No	Boiling point too high (622°F/328°C) to make gas mixture.
Pentachlorophenol	No	Vapor pressure too low to make gas mixture.
Phenol	1 ppm – 15 ppm	
Phosgene	10 ppm – 2%	
Phosphine	10 ppm – 2%	
Phosphorus	No	Ignites spontaneously in air. This chemical is stored below water.
Phthalic Anhydride	No	Vapor pressure too low to make gas mixture.
1,4-Phenylenediamine	No	Vapor pressure too low to make gas mixture.
1,3-Propane Sulfone	No	Boiling point too high (572°F/300°C) to make gas mixture.
β-Propiolactone	No	Toxic, too unstable.
Propionaldehyde	10 ppb – 1.2%	
Propoxur	No	Vapor pressure too low to make gas mixture.
Propylene Oxide	500 ppb – 2%	
1,2-Propylenimine	Potential	Call about mixture with other amides & amines.
Quinoline	No	Air and water reactive.
Quinone	No	Boiling point too high (559°F/293°C) to make gas mixture.
Styrene	10 ppb – 120 ppm	
Styrene Oxide	100 ppb – 17 ppm	
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	No	Boiling point too high (932°F/500°C) to make gas mixture.
1,1,2,2-Tetrachloroethane	10 ppb – 74 ppm	
Tetrachloroethylene	10 ppb – 470 ppm	
Titanium Tetrachloride	Yes	Call about mixture ranges.
Toluene	10 ppb – 785 ppm	
Toluene-2,4-Damine	No	Boiling point too high (558°F/292°C) to make gas mixture.
Toluene-2,4-Diisocyanate	No	Boiling point too high (483°F/251°C) to make gas mixture.
o-Toluidine	No	Vapor pressure too low to make gas mixture.
Toxaphene	No	Very toxic. Vapor pressure too low to make gas mixture.
1,2,4-Trichlorobenzene	10 ppb – 20 ppm	
1,1,2-Trichloroethane	10 ppb – 4000 ppm	
Trichloroethylene	10 ppb – 2300 ppm	
2,4,5-Trichlorophenol	No	Boiling point too high (478°F/248°C) to make gas mixture.
2,4,6-Trichlorophenol	No	Boiling point too high (478°F/248°C) to make gas mixture.
Triethylamine	500 ppb – 2000 ppm	
Trifluralin	No	Vapor pressure too low to make gas mixture.
2,2,4-Trimethylpentane	10 ppb – 1500 ppm	
Vinyl Acetate	10 ppb – 3400 ppm	
Vinyl Bromide	10 ppb – 1.2%	
Vinyl Chloride	10 ppb – 1.2%	
Vinylidene Chloride	10 ppb – 1.2%	
m-Xylene	10 ppb – 180 ppm	
o-Xylene	10 ppb – 140 ppm	
p-Xylene	10 ppb – 1%	
Xylenes	10 ppb – 140 ppm	



Toxic Industrial Chemicals (TICs) GAS MIXTURES

COMPOUND	AVAILABILITY	COMMENTS
Acrolein	10 ppb – 1%	
Acrylonitrile	10 ppb – 3400 ppm	
Allyl Alcohol	10 ppb – 440 ppm	
Ammonia	1 ppm – 34%	
Arsine	5 ppm – 2%	
Benzene	10 ppb – 3000 ppm	
Boron Trichloride	10 ppm – 10%	Mixtures >5% are gravimetrically prepared without a confirming analysis.
Boron Trifluoride	10 ppm – 10%	Mixtures are gravimetrically prepared without a confirming analysis.
Bromine	No	A safe manufacturing method has not been identified.
n-Butylamine	5 ppm – 3500 ppm	
Carbon Disulfide	100 ppb – 1.5%	
Carbonyl Sulfide	100 ppb – 3%	
Chlorine	5 ppm – 10%	
2-Chloroethyl Ethyl Sulfide (CEES)	5 ppm – 100 ppm	100 ppm is the highest concentration available as a gas mixture due to the calculated vapor pressure restriction.
Chloropicrin	No	A safe manufacturing method has not been identified.
Cyanogen Chloride	10 ppm – 5%	
Diborane	20 ppm – 5%	
Dibutylamine	5 ppm – 100 ppm	
Diethyl Ethyl Phosphonate (DEEP)	1 ppm – 5 ppm	5 ppm is the highest concentration available as a gas mixture due to the calculated vapor pressure restriction.
Diethyl Methyl Phosphonate (DEMP)	1 ppm – 5 ppm	5 ppm is the highest concentration available as a gas mixture due to the calculated vapor pressure restriction.
Diisopropyl Fluorophosphate	No	A safe manufacturing method has not been identified.
Diisopropyl Methylphosphonate (DIMP)	0.5 ppm – 6 ppm	6 ppm is the highest concentration available as a gas mixture due to the calculated vapor pressure restriction.
Dimethyl Amine	500 ppb – 2000 ppm	
Dimethyl Methyl Phosphonate (DMMP)	0.5 ppm – 6 ppm	6 ppm is the highest concentration available as a gas mixture due to the calculated vapor pressure restriction.
Dipropylene Glycol Methyl Ether	No	A safe manufacturing method has not been identified.
Ethylene Oxide	500 ppb – 2%	
Fluorine	20 ppm – 5%	
Formaldehyde	100 ppb – 100 ppm	100 ppb – 30 ppm gas mixtures are certified. >30 ppm are non-certified.
Hydrazine	No	A safe manufacturing method has not been identified.
Hydrogen Bromide	100 ppm – 5%	
Hydrogen Chloride	5 ppm – 5%	
Hydrogen Cyanide	5 ppm – 1%	
Hydrogen Fluoride	100 ppm – 5%	100 ppm is the lowest concentration considered stable in a cylinder.
Hydrogen Selenide	100 ppm – 1%	
Hydrogen Sulfide	250 ppb – 3%	
Isopropyl Chloroformate	No	No commercial source identified for procurement of raw material.
Methyl Bromide	10 ppb – 7%	

List continues on back.



Toxic Industrial Chemicals (TICs) GAS MIXTURES continued

COMPOUND	AVAILABILITY	COMMENTS
Methyl Chloride	10 ppb – 22%	
Methyl Hydrazine	No	A safe manufacturing method has not been identified.
Methyl Isocyanate	No	A safe manufacturing method has not been identified.
Methyl Mercaptan	0.1 ppm – 6%	
Methyl Salicylate	1 ppm – 2 ppm	2 ppm is the highest concentration available due to the low vapor pressure of this component.
Methyl Trichlorosilane	No	Highly reactive with water. Reacts with atmospheric humidity.
Nitric Acid	No	Very corrosive compound and unstable as gas mixture.
Nitrogen Dioxide	0.1 ppm – 1%	
Parathion	No	Vapor pressure for this compound is too low to manufacture as a gas mixture.
Phosgene	10 ppm – 10%	
Phosphine	5 ppm – 2%	
Phosphorus Oxychloride	No	Highly corrosive and water reactive compound.
Phosphorus Trichloride	10 ppm – 5000 ppm	
Propionitrile	10 ppb – 1370 ppm	
Sulfur Dioxide	0.25 ppm – 11%	
Sulfuric Acid	No	Highly corrosive compound. Gas mixtures are not feasible due to 554°F/290°C boiling point.
Sulfuryl Fluoride	100 ppm – 1%	
Titanium Tetrachloride	No	Gas mixtures are not feasible due to 543°F/284°C melting point.
Toluene	10 ppb – 785 ppm	
Toluene-2,4-Diisocyanate	No	Boiling point too high (483°F/251°C) to make gas mixture.
Triethyl Phosphate (TEP)	0.5 ppm – 8 ppm	8 ppm is the highest concentration available due to the low vapor pressure of this component.
Tungsten Hexafluoride	10 ppm – 5%	.
Vinyl Chloride	10 ppb – 1.2%	

Interferent GAS MIXTURES

STANDARD	AVAILABILITY	COMMENTS
Diesel Exhaust Interferent	Yes	Please call for additional information.
Gasoline Exhaust Interferent	Yes	Please call for additional information.
JP5/JP8 Vapor Interferent	Potential	Please call for additional information.
Second Hand Smoke Interferent	Yes	Please call for additional information.

Our manufacturing capabilities are not limited to the compounds included in these lists. Please contact our Solutions Center (800-217-2688 or solutions.center@airliquide.com) to discuss your specific application requirements.

