Cyan Ink Room

Air Chapter Addendums

Table of Contents for Cyan Ink Room

CI - 1 Hazardous Air Pollutant List

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Acetaldehyde	75-07-0	Yes	A, E
Acetamide	60-35-5	Yes	No
Acetic acid	64-19-7		A
Acetic anhydride	108-24-7		A
Acetonitrile	75-05-8	Yes	A
Acetophenone	98-86-2	Yes	A
2-Acetylaminofluorene	53-96-3	Yes	No
Acrolein	107-02-8	Yes	A, E
Acrylamide	79-06-1	Yes	A, E
Acrylic acid	79-10-7	Yes	A, E
Acrylonitrile	107-13-1	Yes	A, E
Adipic Acid	124-04-9		A
Adiponitrile	111-69-3		A
Adriamycin	23214-92-8		C
Aflatoxins	1402-68-2		A
Aldrin	309-00-2		B
Allyl alcohol	107-18-6		A
Allyl chloride	107-05-1	Yes	A
Allyl glycidyl ether	106-92-3		A
Aluminum alkyls and soluble salts, as Al	7429-90-5		A
Aluminum pyro powders, as Al	7429-90-5		A
o-Aminoazotoluene (2-Aminoazotoluene)	97-56-3		A
4-Aminobiphenyl	92-67-1	Yes	A
Amitrole	61-82-5		B
Ammonia	7664-41-7		A, E
Ammonium perfluorooctanoate	3825-26-1		A
Aniline	62-53-3	Yes	A
o-Anisidine and o-anisidine hydrochloride (mixtures and isomers)	29191-52-4	Yes	A
Antimony and compounds, as Sb	7440-36-0	Yes *	A
Antimony hydride (Stibine)	7803-52-3	Yes *	B only
Antimony trioxide	1309-64-4	Yes *	A
ANTU	86-88-4		B
Arsenic, elemental and inorganic compounds, as As	7440-38-2	Yes *	A, E
Arsine	7784-42-1		A, E
Asbestos, all forms	1332-21-4	Yes	A
Atrazine	1912-24-9		B
Azathioprine	446-86-6		C
Azinphos-methyl	86-50-0		B
Aziridine (Ethylenimine)	151-56-4	Yes	A only
Barium, soluble compounds, as Ba	7440-39-3		A
Baygon (Propoxur)	114-26-1	Yes	B only
Benomyl	17804-35-2		B

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Benz(a)anthracene	56-55-3		A
Benzene	71-43-2	Yes	A, E
Benzidine	92-87-5	Yes	A
Benzo(b)fluoranthene	205-99-2		A
Benzo(j)fluoranthene	205-82-3		A
Benzo(k)fluoranthene	207-08-9		A
Benzo(a)pyrene	50-32-8		A, E
Benzotrichloride	98-07-7	Yes	A
Benzoyl chloride	98-88-4		A
Benzoyl peroxide	94-36-0		A
Benzyl acetate	140-11-4		A
Benzyl chloride	100-44-7	Yes	A
Beryllium and beryllium compounds, as Be	7440-41-7	Yes *	A, E
Biphenyl	92-52-4	Yes	A
Bis(2-chloroethyl)ether (Dichloroethyl ether)	111-44-4	Yes	A only
Bischloroethyl nitrosourea	154-93-8		C
N,N-Bis (2-chloroethyl)-2-naphthylamine (Chlornaphazine)	494-03-1		C
Bis(chloromethyl) ether (BCME) and technical grade	542-88-1	Yes	C
Bis(2-dimethylaminoethyl) ether (DMAEE)	3033-62-3		A
Bis(2-ethyl hexyl) phthalate (Diethyl hexyl phthalate)	117-81-7	Yes	A only
Bismuth telluride, as Bi2Te3: Se-Doped	1304-82-1		A
Borates, tetra, sodium salts, decahydrate	1303-96-4		A
Borates, tetra, sodium salts, pentahydrate	1303-96-4		A
Boron tribromide	10294-33-4		A
Boron trifluoride	7637-07-2		A
Bromacil	314-40-9		B
Bromine	7726-95-6		A, E
Bromine pentafluoride	7789-30-2		A, E
Bromodichloromethane	75-27-4		A
Bromodiphenyls (Polybrominated biphenyls; PBBs)	59536-65-1		A only
Bromoform	75-25-2	Yes	A
Bromomethane (Methyl bromide)	74-83-9	Yes	B only
1,3-Butadiene	106-99-0	Yes	A, E
1,4-Butanediol dimethanesulphonate (Myleran; busulphan)	55-98-1		C only
2-Butoxyethanol (Ethylene glycol monobutyl ether; EGBE; butyl cellosolve)	111-76-2		A only
n-Butyl alcohol (n-Butanol)	71-36-3		A
Butyl Cellosolve (2-Butoxyethanol; ethylene glycol monobutyl ether; EGBE)	111-76-2		A only
n-Butyl acrylate	141-32-2		A
n-Butylamine	109-73-9		A
Butylated hydroxyanisole (BHA)	25013-16-5		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
tert-Butyl chromate, as Cr	1189-85-1		A
n-Butyl glycidyl ether (BGE)	2426-08-6		A
n-Butyl lactate	138-22-7		A
o-sec-Butylphenol	89-72-5		A
p-tert-Butyltoluene	98-51-1		A
C.I. Basic Red 9 monohydrochloride	569-61-9		A
Cadmium and cadmium compounds, as Cd	7440-43-9	Yes *	A, E
Calcium cyanamide	156-62-7	Yes	A
Calcium hydroxide	1305-62-0		A
Calcium oxide	1305-78-8		A
Camphor (synthetic)	76-22-2		A
Caprolactam (aerosol and vapor)	105-60-2	Yes	A
Captafol	2425-06-1		B
Captan	133-06-2	Yes	B
Carbaryl	63-25-2	Yes	B
Carbofuran	1563-66-2		B
Carbon black	1333-86-4		A
Carbon disulfide	75-15-0	Yes	A
Carbon tetrabromide	558-13-4		A
Carbon tetrachloride	56-23-5	Yes	A, E
Carbonyl fluoride	353-50-4		A
Carbonyl sulfide	463-58-1	Yes	No
Catechol (Pyrocatechol)	120-80-9	Yes	A
Cellosolve (2-Ethoxyethanol; EGEE)	110-80-5		A only
Cellosolve acetate (2-Ethoxyethyl acetate; EGEEA)	111-15-9		A only
Cesium hydroxide	21351-79-1		A
Chloramben	133-90-4	Yes	No
Chlorambucil	305-03-3		C
Chlordane	57-74-9	Yes	B
Chlordecone (Kepone)	143-50-0		A only
Chlorendic acid	115-28-6		A
Chlorinated camphene (Toxaphene)	8001-35-2	Yes	B
Chlorinated diphenyl oxide	55720-99-5		A
Chlorinated paraffins (C12; 60% chlorine)	108171-26-2		A
Chlorine	7782-50-5	Yes	A, E
Chlorine dioxide	10049-04-4		A, E
Chlorine trifluoride	7790-91-2		A, E
Chlornaphazine (N,N-Bis (2-chloroethyl)-2-naphthylamine)	494-03-1		C only
Chloroacetic acid	79-11-8	Yes	No
2-Chloroacetophenone	532-27-4	Yes	A
Chlorobenzene (Monochlorobenzene)	108-90-7	Yes	A
Chlorobenzilate	510-15-6	Yes	No
o- Chlorobenzylidene malononitrile	2698-41-1		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
1-Chloro-1,1-difluoroethane (Hydrochlorofluorocarbon-142b; HCFC-142b; R-142b)	75-68-3		A
Chlorodifluoromethane (Hydrochlorofluorocarbon-22; HCFC-22; R-22)	75-45-6		A
Chlorodiphenyls (Polychlorinated biphenyls; PCBs)	1336-36-3	Yes	A only
1-Chloro-2,3-epoxypropane (Epichlorohydrin)	106-89-8	Yes	A only
Chloroethane (Ethyl chloride)	75-00-3	Yes	A only
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)	13010-47-4		C
Chloroform	67-66-3	Yes	A, E
Chloromethane (Methyl chloride)	74-87-3	Yes	A only
Chloromethyl methyl ether (CMME)	107-30-2	Yes	C
1-Chloro-1-nitropropane	600-25-9		B
Chloropicrin (Trichloronitromethane)	76-06-2		B
beta-Chloroprene	126-99-8	Yes	A
o-Chlorostyrene	2039-87-4		A
o-Chlorotoluene	95-49-8		A
Chlorpyrifos	2921-88-2		B
Chromium (metal) and compounds other than Chromium (VI)	7440-47-3	Yes *	A
Chromium (VI): Chromic acid mists and dissolved Cr (VI) aerosols, as Cr	7440-47-3	Yes *	A, E
Chromium (VI): compounds and particulates	7440-47-3	Yes *	A, E
Chromyl chloride, as Cr	14977-61-8	Yes *	A
Cobalt, elemental, and inorganic compounds, as Co	7440-48-4	Yes *	A, E
Coke oven emissions		Yes *	A
Copper and compounds, dusts and mists, as Cu	7440-50-8		A
Copper and compounds, fume, as Cu	7440-50-8		A
p-Cresidine	120-71-8		A
Cresol (mixtures and isomers)	1319-77-3	Yes *	A
Crotonaldehyde	4170-30-3		A
Crufomate	299-86-5		B
Cumene (Isopropyl benzene)	98-82-8	Yes	A
Cyanamide	420-04-2		A
Cyanides, (inorganics), as CN	143-33-9	Yes *	A
Cyanogen	460-19-5		A
Cyanogen chloride	506-77-4		A
Cyclohexanol	108-93-0		A
Cyclohexanone	108-94-1		A
Cyclohexylamine	108-91-8		A
Cyclonite	121-82-4		A
Cyclopentadiene	542-92-7		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Cyclophosphamide	50-18-0		C
Cyhexatin	13121-70-5		B
2,4-D, salts and esters	94-75-7	Yes	No
Dacarbazine	4342-03-4		C
Danthron (1,8-Dihydroxyanthroquinone)	117-10-2		A only
DBCP (1,2-Dibromo-3-chloropropane)	96-12-8	Yes	A only
DDE	72-55-9	Yes	No
DDT (Dichlorodiphenyltrichloroethane)	50-29-3		A only
Demeton	8065-48-3		B
Diacetone alcohol	123-42-2		A
2,4-Diaminoanisole sulfate	39156-41-7		A
2,4-Diaminotoluene (Toluene-2,4-diamine)	95-80-7	Yes	A
Diazinon	333-41-5		B
Diazomethane	334-88-3	Yes	A
Dibenz(a,h)acridine	226-36-8		A
Dibenz(a,j)acridine	224-42-0		A
Dibenz(a,h)anthracene	53-70-3		A
7H-Dibenzo(c,g)carbazole	194-59-2		A
Dibenzofurans	132-64-9	Yes	No
Dibenzo(a,e)pyrene	192-65-4		A
Dibenzo(a,h)pyrene	189-64-0		A
Dibenzo(a,i)pyrene	189-55-9		A
Dibenzo(a,l)pyrene	191-30-0		A
Diborane	19287-45-7		A, E
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	Yes	A
1,2-Dibromoethane (Ethylene Dibromide; EDB)	106-93-4	Yes	A, E
2-N-Dibutylaminoethanol	102-81-8		A
Dibutylphenyl phosphate	2528-36-1		A
Dibutyl phthalate (Di-n-butyl phthalate)	84-74-2	Yes	A
o-Dichlorobenzene (1,2-Dichlorobenzene)	95-50-1		A
p-Dichlorobenzene (1,4-Dichlorobenzene)	106-46-7	Yes	A
3,3'-Dichlorobenzidine	91-94-1	Yes	A
1,3-Dichloro-5,5-dimethyl hydantoin	118-52-5		A
Dichlorodiphenyltrichloroethane (DDT)	50-29-3		A
1,1-Dichloroethane (Ethylidene dichloride)	75-34-3	Yes	A
1,2-Dichloroethane (Ethylene dichloride; EDC)	107-06-2	Yes	A, E
Dichloroethyl ether (Bis(2-chloroethyl)ether)	111-44-4	Yes	A
1,1-Dichloroethylene (Vinylidene chloride)	75-35-4	Yes	A only
1,2-Dichloroethylene	540-59-0		A
Dichloromethane (Methylene chloride)	75-09-2	Yes	A only, E
1,1-Dichloro-1-nitroethane	594-72-9		A
1,2-Dichloropropane (Propylene dichloride)	78-87-5	Yes	A only, E
1,3-Dichloropropene	542-75-6	Yes	B
2,2-Dichloropropionic acid	75-99-0		B

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Dichlorvos	62-73-7	Yes	B
Dicrotophos	141-66-2		B
Dicyclopentadiene	77-73-6		A
Dieldrin	60-57-1		B
Diethanolamine	111-42-2	Yes	A
Diethylamine	109-89-7		A
2-Diethylaminoethanol	100-37-8		A
Diethylene triamine	111-40-0		A
Diethyl hexyl phthalate (Bis(2-ethyl hexyl) phthalate; Di-sec-octyl phthalate; DEHP)	117-81-7	Yes	A
Diethyl phthalate	84-66-2		A
Diethylstilbestrol (DES)	56-53-1		C
Diethyl sulfate	64-67-5	Yes	A
1,4-Diethylene oxide (1,4-Dioxane)	123-91-1	Yes	A only
1,1-Difluoroethane	75-37-6		A
Diglycidyl ether (DGE)	2238-07-5		A, E
Diglycidyl resorcinol ether	101-90-6		A
1,8-Dihydroxyanthroquinone (Danthron)	117-10-2		A
Diisobutyl ketone	108-83-8		A
Diisopropylamine	108-18-9		A
N,N-Dimethyl acetamide	127-19-5		A
Dimethylamine	124-40-3		A
4-Dimethylaminoazobenzene	60-11-7	Yes	A
Dimethyl benzene (Xylene(mixtures and isomers); Xylol)	1330-20-7	Yes	A only
3,3'-Dimethylbenzidine (o-Tolidine)	119-93-7	Yes	A
Dimethyl carbamoyl chloride	79-44-7	Yes	A
Dimethylethoxysilane	14857-34-2		A
N,N-Dimethylformamide	68-12-2	Yes	A
1,1-Dimethylhydrazine	57-14-7	Yes	A
Dimethylphthalate	131-11-3	Yes	A
Dimethyl sulfate	77-78-1	Yes	A
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	Yes	A
Dinitolmide	148-01-6		A
Dinitrobenzene (mixtures and isomers)	528-29-0		A
Dinitro-o-cresol (4,6-Dinitro-o-cresol)	534-52-1	Yes	B
2,4-Dinitrophenol	51-28-5	Yes	No
Dinitrotoluene (mixtures and isomers)	25321-14-6	Yes	A
1,4-Dioxane (1,4-Diethylene oxide)	123-91-1	Yes	A
Dioxathion	78-34-2		B
Dioxins and Furans, chlorinated (2,3,7,8-Tetrachlorodibenzo-p-dioxin), as equivalents	1746-01-6	Yes	A only
Diquat, respirable dust (various compounds) (Diquat dibromide)	2764-72-9		B
Diquat, total dust (various compounds) (Diquat dibromide)	2764-72-9		B
Direct black 38 (Benzidine-based dye)	1937-37-7		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Direct blue 6 (Benzidine-based dye)	2602-46-2		A
Disperse Blue 1	2475-45-8		A
Disulfiram	97-77-8		A
Disulfoton	298-04-4		B
Divinyl benzene (mixtures and isomers)	1321-74-0		A
EGBE (2-Butoxyethanol; Ethylene glycol monobutyl ether; butyl cellosolve)	111-76-2		A only
EGEE (2-Ethoxyethanol; Ethylene glycol monoethyl ether; cellosolve)	110-80-5		A only
EGEEA (2-Ethoxyethyl acetate; Ethylene glycol monoethyl ether acetate; Cellosolve acetate)	111-15-9		A only
EGME (2-Methoxyethanol; MethylCellosolve)	109-86-4		A only
EGMEA (2-Methoxyethyl acetate; MethylCellosolve acetate)	110-49-6		A only
Endosulfan	115-29-7		B
Endrin	72-20-8		B
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	106-89-8	Yes	A
EPN	2104-64-5		B
1,2-Epoxybutane (1,2-Butylene oxide)	106-88-7	Yes	A
Erionite (Zeolites)	66733-21-9		A only
Ethanamine (Ethylamine)	75-04-7		A only
Ethanolamine	141-43-5		A
Ethion	563-12-2		B
2-Ethoxyethanol (Ethylene glycol monoethyl ether; EGEE; cellosolve)	110-80-5		A
2-Ethoxyethyl acetate (Ethylene glycol monoethyl ether acetate; EGEEA; cellosolve acetate)	111-15-9		A
Ethyl acrylate	140-88-5	Yes	A
Ethylamine (Ethanamine)	75-04-7		A
Ethyl amyl ketone	541-85-5		A
Ethyl benzene	100-41-4	Yes	A
Ethyl bromide	74-96-4		A
Ethyl tert-butyl ether (ETBE)	637-92-3		A
Ethyl butyl ketone	106-35-4		A
Ethyl carbamate (Urethane)	51-79-6	Yes	A only
Ethyl chloride (Chloroethane)	75-00-3	Yes	A
Ethyl cyanoacrylate	7085-85-0		A
Ethylene chlorohydrin	107-07-3		A
Ethylenediamine	107-15-3		A
Ethylene dibromide (EDB; 1,2-Dibromoethane)	106-93-4	Yes	A only, E
Ethylene dichloride (EDC; 1,2-Dichloroethane)	107-06-2	Yes	A only, E
Ethylene glycol monobutyl ether (2-Butoxyethanol; EGBE; butyl cellosolve)	111-76-2		A only

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Ethylene glycol monoethyl ether (2-Ethoxyethanol; EGEE; cellosolve)	110-80-5		A only
Ethylene glycol monoethyl ether acetate (2-Ethoxyethyl acetate; EGEEA; Cellosolve Acetate)	111-15-9		A only
Ethylene glycol vapor and aerosol	107-21-1	Yes	A
Ethylene oxide	75-21-8	Yes	A, E
Ethylene thiourea	96-45-7	Yes	A
Ethylenimine (Aziridine)	151-56-4	Yes	A
Ethylidene dichloride (1,1-Dichloroethane)	75-34-3	Yes	A only
Ethylidene norbornene	16219-75-3		A
N-Ethylmorpholine	100-74-3		A
Ethyl silicate	78-10-4		A
Fenamiphos	22224-92-6		A
Fensulfothion	115-90-2		B
Fenthion	55-38-9		B
Flour Dust (inhalable fraction)			A
Fluorides, (inorganics), as F			A
Fluorine	7782-41-4		A, E
Fonofos	944-22-9		B
Formaldehyde	50-00-0	Yes	A, E
Formamide	75-12-7		A
Formic acid	64-18-6		A
Furan	110-00-9		A
Furfural	98-01-1		A
Furfuryl alcohol	98-00-0		A
Germanium tetrahydride	7782-65-2		A
Glutaraldehyde	111-30-8		A
Glycidol	556-52-5		A
Glycol ethers		Yes *	No
Graphite (all forms except graphite fiber)	7782-42-5		A
Heptachlor and heptachlor epoxide	76-44-8	Yes	B
Hexachlorobenzene (HCB)	118-74-1	Yes	A, E
Hexachlorobutadiene	87-68-3	Yes	B
Hexachlorocyclohexane and isomers (Lindane and isomers)	58-89-9	Yes	B only
Hexachlorocyclopentadiene	77-47-4	Yes	B
Hexachloroethane	67-72-1	Yes	A
Hexachloronaphthalene	1335-87-1		A
Hexamethyl phosphoramide	680-31-9	Yes	A
Hexamethylene-1,6-diisocyanate (HDI)	822-06-0	Yes	A, E
n-Hexane	110-54-3	Yes	A
1,6- Hexanediamine	124-09-4		A
1-Hexene	592-41-6		A
Hexone (Methyl isobutyl ketone; MIBK)	108-10-1	Yes	A only
sec-Hexyl acetate	108-84-9		A
Hexylene glycol	107-41-5		A

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Hydrazine and hydrazine sulfate	302-01-2	Yes	A, E
Hydrochloric acid (Hydrogen chloride; Muriatic acid)	7647-01-0	Yes	A only
Hydrogenated terphenyls	61788-32-7		A
Hydrogen bromide	10035-10-6		A, E
Hydrogen chloride (Hydrochloric acid; Muriatic acid)	7647-01-0	Yes	A, E
Hydrogen cyanide	74-90-8		A, E
Hydrogen fluoride (Hydrofluoric acid)	7664-39-3	Yes	A, E
Hydrogen peroxide	7722-84-1		A, E
Hydrogen sulfide	7783-06-4	Yes	A, E
Hydroquinone	123-31-9	Yes	A
2-Hydroxypropyl acrylate	999-61-1		A
Indeno(1,2,3-cd)pyrene	193-39-5		A
Indium	7440-74-6		A, E
Iodine	7553-56-2		A, E
Iodomethane (Methyl iodide)	74-88-4	Yes	A only
Iron dextran complex	9004-66-4		C
Iron oxide dust and fume, as Fe	1309-37-1		A
Iron salts, soluble, as Fe			A
Isobutyl alcohol	78-83-1		A
Isooctyl alcohol	26952-21-6		A
Isophorone	78-59-1	Yes	A
Isophorone diisocyanate	4098-71-9		A, E
Isoprene	78-79-5		A
2-Isopropoxyethanol	109-59-1		A
Isopropylamine	75-31-0		A
Isopropyl benzene (Cumene)	98-82-8	Yes	A only
Isopropyl glycidyl ether	4016-14-2		A
N-Isopropylaniline	768-52-5		A
Kaolin	1332-58-7		A
Kepone (Chlordecone)	143-50-0		A
Ketene	463-51-4		A
Lead Acetate, as Pb	301-04-2	Yes *	A, E
Lead compounds	7439-92-1	Yes *	No
Lead Phosphate, as Pb	7446-27-7	Yes *	A, E
Lindane and other hexachlorocyclohexane isomers	58-89-9	Yes	B
Maleic anhydride	108-31-6	Yes	A, E
Manganese, elemental and inorganic compounds, as Mn	7439-96-5	Yes *	A, E
Melphalan	148-82-3		C
Mercury, as Hg, alkyl compounds	7439-97-6	Yes *	A, E
Mercury, as Hg, aryl compounds	7439-97-6	Yes *	A, E
Mercury, as Hg, inorganic forms including metallic mercury	7439-97-6	Yes *	A, E

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Mesityl oxide	141-79-7		A
Mestranol	72-33-3		C
Methacrylic acid	79-41-4		A
Methanol	67-56-1	Yes	No
Methomyl	16752-77-5		B
Methoxychlor	72-43-5	Yes	No
2-Methoxyethanol (Methyl Cellosolve; EGME)	109-86-4		A
2-Methoxyethyl acetate (MethylCellosolve acetate; EGMEA)	110-49-6		A
4-Methoxyphenol	150-76-5		A
Methyl Cellosolve (2-Methoxyethanol; EGME)	109-86-4		A only
Methyl Cellosolve acetate (2-Methoxyethyl acetate; EGMEA)	110-49-6		A only
Methyl chloroform (1,1,1-Trichloroethane; TCA)	71-55-6	Yes	No
Methyl acrylate	96-33-3		A
Methylacrylonitrile	126-98-7		A
Methylamine	74-89-5		A
Methyl n-amyl ketone	110-43-0		A
N-Methyl aniline	100-61-8		A
2-Methyl aziridine (Propylenimine; Propylene imine)	75-55-8	Yes	A only
Methyl bromide (Bromomethane)	74-83-9	Yes	B
Methyl n-butyl ketone	591-78-6		A
Methyl chloride (Chloromethane)	74-87-3	Yes	A
5-Methyl chrysene	3697-24-3		A
Methyl 2-cyanoacrylate	137-05-3		A
Methylcyclohexanol	25639-42-3		A
o-Methylcyclohexanone	583-60-8		A
Methyl demeton	8022-00-2		B
Methylene bisphenyl isocyanate (Methylene diphenyl isocyanate; MDI)	101-68-8	Yes	A, E
Methylene chloride (Dichloromethane)	75-09-2	Yes	A, E
4,4'-Methylene bis(2-chloroaniline) (MOCA)	101-14-4	Yes	A
Methylene bis(4-cyclohexylisocyanate)	5124-30-1		A
4,4'-Methylenedianiline (and dihydrochloride)	101-77-9	Yes	A
Methyl ethyl ketone peroxide	1338-23-4		A
Methyl formate	107-31-3		A
Methyl hydrazine	60-34-4	Yes	A, E
Methyl iodide (Iodomethane)	74-88-4	Yes	A
Methyl isoamyl ketone	110-12-3		A
Methyl isobutyl carbinol	108-11-2		A
Methyl isobutyl ketone (MIBK; Hexone)	108-10-1	Yes	A
Methyl isocyanate	624-83-9	Yes	A, E

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Methyl methacrylate	80-62-6	Yes	A
N-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)	70-25-7		C
Methyl parathion	298-00-0		B
alpha-Methyl styrene	98-83-9		A
Methyl tert-butyl ether (MTBE)	1634-04-4	Yes	A
Metribuzin	21087-64-9		B
Mevinphos (Phosdrin)	7786-34-7		B
MIBK (Methyl isobutyl ketone; Hexone)	108-10-1	Yes	A only
Mirex	2385-85-5		A
Molybdenum, as Mo, metal and insoluble compounds	7439-98-7		A
Molybdenum, as Mo, soluble compounds	7439-98-7		A
Monochlorobenzene (chlorobenzene)	108-90-7	Yes	A only
Monocrotophos	6923-22-4		B
Morpholine	110-91-8		A
MTBE (Methyl tert-butyl ether)	1634-04-4	Yes	A only
Muriatic acid (Hydrogen chloride; Hydrochloric acid)	7647-01-0	Yes	A only
Mustard gas	505-60-2		A
Myleran (1,4-Butanediol dimethanesulphonate; busulphan)	55-98-1		C
Naled	300-76-5		B
Naphthalene	91-20-3	Yes	A
2-Naphthylamine	91-59-8		A
Nickel and compounds, as Ni	7440-02-0	Yes *	A, E
Nickel carbonyl, as Ni	13463-39-3	Yes *	A
Nickel subsulfide, as Ni	12035-72-2	Yes *	A
Nitric acid	7697-37-2		A, E
Nitrilotriacetic acid	139-13-9		A
p-Nitroaniline	100-01-6		A
Nitrobenzene	98-95-3	Yes	A
4-Nitrobiphenyl	92-93-3	Yes	No
p-Nitrochlorobenzene	100-00-5		A
Nitroethane	79-24-3		A
Nitrogen mustards (2,2'-Dichloro-N-methyldiethylamine)	51-75-2		A
Nitromethane	75-52-5		A
4-Nitrophenol	100-02-7	Yes	No
1-Nitropropane	108-03-2		A
2-Nitropropane	79-46-9	Yes	A
1-Nitropyrene	5522-43-0		A
N-Nitrosodi-n-butylamine	924-16-3		A
N-Nitrosodiethanolamine	1116-54-7		A
N-Nitrosodiethylamine	55-18-5		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
N-Nitrosodimethylamine	62-75-9	Yes	A
N-Nitrosodi-n-propylamine	621-64-7		A
N-Nitroso-N-ethylurea	759-73-9		A
N-Nitroso-N-methylurea	684-93-5	Yes	A
N-Nitrosomethylvinylamine	4549-40-0		A
N-Nitrosomorpholine	59-89-2	Yes	A
N'-Nitrosonornicotine	16543-55-8		A
N-Nitrosopiperidine	100-75-4		A
N-Nitrosopyrrolidine	930-55-2		A
N-Nitrososarcosine	13256-22-9		A
Nitrotoluene (mixtures and isomers)	88-72-2		A
Nitrous oxide	10024-97-2		A
Octachloronaphthalene	2234-13-1		A, E
Oestradiol (Estradiol)	50-28-2		C
Oxalic acid	144-62-7		A, E
P,p'-Oxybis(benzenesulfonyl hydrazide)	80-51-3		A
Paraquat (respirable sizes) (Paraquat chloride)	1910-42-5		B
Parathion	56-38-2	Yes	B
Pentachloronaphthalene	1321-64-8		A, E
Pentachloronitrobenzene (Quintobenzene; PCNB)	82-68-8	Yes	A
Pentachlorophenol (PCP)	87-86-5	Yes	A, E
Pentyl Acetate (mixtures and isomers)	628-63-7		A
Perchloroethylene (Tetrachloroethylene)	127-18-4	Yes	A, E
Perchloromethyl mercaptan	594-42-3		A
Perfluoroisobutylene	382-21-8		A
Persulfates (Ammonium, Potassium, Sodium)	7727-54-0		A
PGME (Propylene glycol monomethyl ether)	107-98-2		A only
Phenazopyridine and phenazopyridine hydrochloride	136-40-3		C
Phenol	108-95-2	Yes	A
Phenolphthalein	77-09-8		A
Phenothiazine	92-84-2		B
Phenylenediamine (mixtures and isomers)	106-50-3	Yes	A, E
Phenyl ether vapor	101-84-8		A
Phenyl glycidyl ether (PGE)	122-60-1		A
Phenylhydrazine	100-63-0		A
Phenyl mercaptan	108-98-5		A
Phenytoin and sodium salt of phenytoin	57-41-0		C
Phorate	298-02-2		B
Phosgene	75-44-5	Yes	A
Phosphine	7803-51-2	Yes	A, E
Phosphoric acid	7664-38-2		A, E
Phosphorus (yellow)	7723-14-0	Yes	A, E

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Phosphorus oxychloride	10025-87-3		A
Phosphorus pentachloride	10026-13-8		A, E
Phosphorus pentasulfide	1314-80-3		A
Phosphorus trichloride	7719-12-2		A
Phthalic anhydride	85-44-9	Yes	A
Picric acid	88-89-1		A
Pindone	83-26-1		B
Platinum (metal)	7440-06-4		A
Platinum, soluble salts, as Pt	7440-06-4		A, E
Polybrominated biphenyls (PBBs; Bromodiphenyls)	59536-65-1		A
Polychlorinated biphenyls (PCBs; Chlorodiphenyls; Arochlor)	1336-36-3	Yes	A
Polycylic organic matter (POM)		Yes *	No
Potassium hydroxide	1310-58-3		A
Procarbazine and procarbazine hydrochloride	366-70-1		C
1,3-Propane sultone	1120-71-4	Yes	A
Propargyl alcohol	107-19-7		A
beta-Propiolactone	57-57-8	Yes	A
Propionaldehyde	123-38-6	Yes	No
Propionic acid	79-09-4		A
Propoxur (Baygon)	114-26-1	Yes	B
Propylene dichloride (1,2-Dichloropropane)	78-87-5	Yes	A, E
Propylene glycol monomethyl ether (PGME)	107-98-2		A
Propylene oxide	75-56-9	Yes	A
Propylenimine (2-Methyl aziridine; propylene imine)	75-55-8	Yes	A
Propylthiouracil	51-52-5		C
Pyrethrum	8003-34-7		B
Pyridine	110-86-1		A
Pyrocatechol (Catechol)	120-80-9	Yes	A only
Quinoline	91-22-5	Yes	No
Quinone	106-51-4	Yes	B
Quintobenzene (Pentachloronitrobenzene)	82-68-8	Yes	A only
Resorcinol	108-46-3		A
Rhodium (metal) and insoluble compounds, as Rh	7440-16-6		A
Rhodium, soluble compounds, as Rh	7440-16-6		A, E
Rotenone (commercial)	83-79-4		B
Safrole	94-59-7		A
Selenium and compounds, as Se	7782-49-2	Yes *	A, E
Silicon tetrahydride (Silane)	7803-62-5		A
Sodium Azide, as sodium azide or hydrazoic acid vapor	26628-22-8		A
Sodium bisulfite	7631-90-5		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Sodium fluoroacetate	62-74-8		B
Sodium hydroxide	1310-73-2		A
Sodium metabisulfite	7681-57-4		A
Stibine (Antimony hydride)	7803-52-3		B
Stoddard solvent (Mineral spirits)	8052-41-3		A
Streptozotocin	18883-66-4		C
Strong inorganic acid mists containing sulfuric acid (>35% by weight)	7664-93-9		A
Strychnine	57-24-9		B
Styrene oxide	96-09-3	Yes	No
Styrene, monomer	100-42-5	Yes	A
Sulfometuron methyl	74222-97-2		A
Sulfotep (TEDP)	3689-24-5		B
Sulfur monochloride	10025-67-9		A
Sulfur tetrafluoride	7783-60-0		A
Sulfuric acid	7664-93-9		A, E
Sulfuryl fluoride	2699-79-8		B
Sulprofos	35400-43-2		A
Talc, containing no asbestos fibers	14807-96-6		A
Tantalum, metal and oxide dusts, as Ta	7440-25-7		A
TCDD (2,3,7,8-Tetrachlorodibenzo-p-dioxin), as equivalents	1746-01-6	Yes	A only
Tellurium and compounds, except hydrogen telluride, as Te	13494-80-9		A, E
TEPP	107-49-3		B
Terphenyls	26140-60-3		A
2,3,7,8-Tetrachlorodibenzo-p-dioxin (Dioxin; 2,3,7,8-TCDD), as dioxin equivalents	1746-01-6	Yes	A
1,1,2,2-Tetrachloroethane	79-34-5	Yes	A
Tetrachloroethylene (Perchloroethylene)	127-18-4	Yes	A only, E
Tetrachloronaphthalene	1335-88-2		A
1,1,1,2-Tetrafluoroethane	811-97-2		A
Tetrafluoroethylene	116-14-3		A, E
Tetrahydrofuran	109-99-9		A
Tetranitromethane	509-14-8		A
Thallium, elemental and soluble compounds, as Tl	7440-28-0		A, E
Thionyl chloride	7719-09-7		A
Thiotepa (Tris(1-aziridinyl)phosphine sulfide)	52-24-4		C only
Thiourea	62-56-6		A
Thiram	137-26-8		B
Tin organic compounds, as Sn	7440-31-5		A, E
Tin, metal, oxides and inorganic compounds, except tin hydride, as Sn	7440-31-5		A
Titanium tetrachloride	7550-45-0	Yes	No
o-Tolidine (3,3'-Dimethylbenzidine)	119-93-7	Yes	A only

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Toluene (Toluol)	108-88-3	Yes	A
2,4-/2,6-Toluene diisocyanate (mixtures and isomers) (TDI)	584-84-9	Yes	A, E
Toluene-2,4-diamine (2,4-Diaminotoluene)	95-80-7	Yes	A only
m- and p-Toluidine	108-44-1		A
o-Toluidine and o-toluidine hydrochloride and mixed isomers	95-53-4	Yes	A
Toluol (Toluene)	108-88-3	Yes	A only
Toxaphene (Chlorinated camphene)	8001-35-2	Yes	B only
Tributyl phosphate	126-73-8		A
1,2,4-Trichlorobenzene	120-82-1	Yes	A
1,1,2-Trichloroethane	79-00-5	Yes	A
Trichloroethylene (Trichloroethene)	79-01-6	Yes	A, E
Trichloronaphthalene	1321-65-9		A
Trichloronitromethane (Chloropicrin)	76-06-2		B only
2,4,5-Trichlorophenol	95-95-4	Yes	No
2,4,6-Trichlorophenol	88-06-2	Yes	A
1,2,3-Trichloropropane	96-18-4		A
Triethanolamine	102-71-6		A
Triethylamine	121-44-8	Yes	A
Trifluralin	1582-09-8	Yes	No
1,3,5-Triglycidyl-s-triazinetrione	2451-62-9		A
Trimellitic anhydride	552-30-7		A, E
Trimethyl benzene (mixtures and isomers)	25551-13-7		A
Trimethylamine	75-50-3		A
2,2,4-Trimethylpentane	540-84-1	Yes	No
2,4,6-Trinitrotoluene (TNT)	118-96-7		A
Triorthocresyl phosphate	78-30-8		A, E
Triphenyl phosphate	115-86-6		A
Tris(1-aziridinyl)phosphine sulfide (Thiotepa)	52-24-4		C
Tris(2,3-dibromopropyl phosphate)	126-72-7		A
Tungsten, as W, metal and insoluble compounds	7440-33-7		A
Tungsten, as W, soluble compounds	7440-33-7		A, E
Uranium (natural), soluble and insoluble compounds, as U	7440-61-1		A
Urethane (Ethyl carbamate)	51-79-6	Yes	A
n-Valeraldehyde	110-62-3		A
Vanadium pentoxide, as V2O5, respirable dust and fume	1314-62-1		A
Vinyl acetate	108-05-4	Yes	A
Vinyl bromide	593-60-2	Yes	A
Vinyl chloride	75-01-4	Yes	A, E
Vinyl cyclohexene dioxide (4-vinyl-1-cyclohexene diepoxide)	106-87-6		A
4-Vinyl cyclohexene	100-40-3		A

Chemical Name	CAS #	Federal HAP?	State HAP? (Table A-E in NR 445 or No)
Vinyl fluoride	75-02-5		A
Vinylidene chloride (1,1-Dichloroethylene)	75-35-4	Yes	A
Vinyl toluene	25013-15-4		A
Warfarin	81-81-2		B
Xylene (mixtures and isomers) (Xylol; Dimethyl Benzene)	1330-20-7	Yes	A
m-Xylene-alpha,alpha'-diamine	1477-55-0		A, E
Xylidine (mixtures and isomers)	1300-73-8		A
Yttrium metal and compounds, as Y	7440-65-5		A
Zeolites (Erionite)	66733-21-9		A
Zirconium and compounds, as Zr	7440-67-7		A

CI – 2 VOC Content and Vapor Pressure Calculations

Fountain Solution VOC Content Monthly Average

As a Medium Printer, you may elect to use alcohol, alone or in combination with alcohol substitutes, in your fountain solution for heatset web or sheetfed presses. Sheetfed fountain solutions containing alcohol must not contain more than 5% VOC by weight for solutions not refrigerated, 8.5% VOC by weight for refrigerated solutions, or 13.5% if printing on metal, metal foil, or plastic and using restricted alcohol. For heatset web presses, the limit is 1.6% VOC by weight for fountain solutions not refrigerated and 3% by weight for refrigerated.

Printers using sheetfed fountain solutions can demonstrate compliance by using monthly averaging. Monthly averaging is only allowed at an individual press that occasionally requires higher VOC content in the fountain solution.

If you elect to use this monthly averaging method at an individual press, you must use the following formula:

$$VOCW = \frac{W1VOC + W2VOC + W3VOC}{WT}$$

Where:
VOCW = Weight percent of VOCs (must be less than the 5% or 8.5% limits)
W1VOC = Weight of VOCs in concentrate per week
W2VOC = Weight of VOCs in additive per week
W3VOC = Weight of VOCs added per week (usually alcohol, if any)
WT = Total weight of fountain solution per week (incl. water, concentrate & additives)

VOC Composite Partial Pressure is calculated as follows:

$$PPc = \sum_{i=1}^{N} \frac{(Wi) * (VPi) / (Mwi)}{(Ww/Mww) + (We/Mwe) + (\sum_{i=1}^{n} Wi/Mwi)}$$

Where:
Wi = Weight of the “i” th VOC compound in grams
Ww = Weight of water in grams
We = Weight of exempt compounds in grams
Mwi = Molecular weight of the “i” th VOC compound, in g-mole
Mww = Molecular weight of water, in g-mole
Mwe = Molecular weight of exempt compound, in g-mole
PPc = VOC composite partial pressure in mm
HgVPi = Vapor pressure of the “i” th compound, in mm Hg
n = The number of VOC compounds

CI –3 Cold Cleaner Design Criteria if not exempt

An individual cold cleaner is not exempt because it uses more than 1.5 gallons of solvent per day. The following requirements apply based on location and size of the unit:

❑ If located outside of Kenosha, Kewaunee, Manitowoc, Milwaukee, Ozaukee, Racine, Sheboygan, Washington and Waukesha counties and has an open area smaller than 1.1 square feet, it is exempt from all of the requirements listed below except number 1. The open area is considered to be the drain opening if the drain opening is smaller than the entire opening of a cleaning sink.

❑ If located outside of Kenosha, Kewaunee, Manitowoc, Milwaukee, Ozaukee, Racine, Sheboygan, Washington and Waukesha counties but opening is at least 1.1 square feet, then it is exempt from the requirements listed in items 8 to 10 below, but must meet the requirements in items 1 through 7.

❑ If located in Kenosha, Kewaunee, Manitowoc, Milwaukee, Ozaukee, Racine, Sheboygan, Washington and Waukesha counties, then all requirements apply.

Requirements in rule:

1. Equip the cleaner with a cover.
2. Design the cover so that it can be easily operated with one hand if any of the following applies:
    - The solvent volatility is greater than 0.3 psia measured at 100 ^{o}F.
    - The solvent is agitated.
    - The solvent is heated.
3. Equip the cleaner with a facility for draining cleaned parts. The drainage facility must be constructed internally so that parts are enclosed under the cover while draining if the solvent volatility is greater than 0.6 psia measured at 100 ^{o}F, except that the drainage facility may be external for applications where an internal type cannot fit into the cleaning system.
4. Install one of the following control devices if the solvent volatility is greater than 0.6 psia measured at 100 ^{o}F, or if the solvent is heated 120 ^{o}F:
    a. Freeboard that gives a freeboard ratio greater than or equal to 0.70.
    b. Water cover (solvent must be insoluble in and heavier than water).
    c. Other systems of equivalent control, such as refrigerated chiller or carbon adsorption, approved by the department.
5. If used, supply a solvent spray that is a solid fluid stream (not a fine, atomized or shower type spray) at a pressure that does not cause extensive splashing.
6. Provide a permanent, conspicuous label, summarizing the operating requirements.
7. Provide supervision or instruction adequate to ensure that the operation is conducted in accord with all of the following:
8. Close the cover whenever parts are not being handled in the cleaner.
9. Drain the cleaned parts for at least 15 seconds or until dripping ceases.
10. Store waste solvent only in covered containers and not dispose of waste solvent or transfer it to another person in such a way as to cause greater than 15% of the waste

solvent, by weight, to evaporate into the ambient air during the ozone season, s. NR 419.04 notwithstanding.

11. Repair solvent leaks immediately, or shut down the degreaser until the leaks are repaired.
12. Design the cover so that it is either a roll-top cover, a canvas curtain cover, a guillotine (biparting) cover, or any other type of cover that slides off the degreaser in a horizontal motion and is designed such that it can be opened or closed without disturbing the vapor layer or the solvent surface if any of the following applies:
    - The solvent volatility is greater than 0.3 psia measured at 100 ^{o}F.
    - The solvent is agitated.
    - The solvent is heated.
13. If freeboard is chosen as a control device under item 4. above, design or modify the freeboard to give a freeboard ratio greater than or equal to 1.0.
14. If a system of equivalent control is chosen under 4.c. above the level of control shall be equivalent to that achieved under a freeboard ratio of 1.0.

CI – 4 PM Emissions Calculations for Heatset Web Offset Press

The following is the calculation method that DNR has approved for use in determining particulate matter emissions from a heatset web offset press. An Excel worksheet is also available to run these calculations. Go to …(ERP Web page) for the active worksheet and download it to your hard drive. To use the worksheet you will need to know

- variables in the ink oil characteristics for all of your inks
  - the mole weight (**M**i, in grams per mole)
  - vapor pressure (**p**, in mmHg)
- the air flow in your press dryer (SCFM)

Actual Emissions of Condensible PM

This calculation method estimates the mass rate of the condensed liquid fraction of an emission stream that contains nonvolatile ink solvents and that has been cooled and pressurized to standard conditions.

Given: A single ink solvent, **i**, contained in an ink that is used on a press at a fixed steady rate of **w** pounds per hour.

(Note: If all other factors are equal, as **w** rises or falls during production or is different between presses, then the calculated PM emissions would change proportionally. If more than one type of ink solvent is present, then use the worst-case (lowest) $\mathbf{c_V}$ or a weighted average for $\mathbf{c_V}$, after calculating $\mathbf{c_V}$ for each solvent **i**.)

Assumptions:

1. Metric units (meters, not feet; grams, not pounds) will be used. Temperature is given below in Fahrenheit and pressure in atmospheres, but conversions may be necessary, in order to use consistent metric units.
2. After passing through a control device, the remaining (undestroyed) VOCs (particularly, the ink solvents) have not decomposed into other chemical compounds.

Step 1. Verify that the ink solvent, i, has a melting point that is higher than 68°F.

- If the melting point is higher than 68°F, then continue to Step 2.
- If the melting point is lower than 68°F, that means the solvent would solidify when brought to standard conditions and that the vapor-liquid equilibrium approach taken by the Hubbard Method does not apply to this ink solvent. In this case, assume that 100% of the ink solvent is emitted as condensible particulate matter, and skip the rest of the steps below for that solvent. If there are other ink solvents in use, then analyze each of them, beginning at Step 1 again.

Step 2. Obtain equilibrium data that relates vapor pressure to temperature for your solvent, and determine the vapor pressure, **p**, at 68°F.

- Since it is improbable that other ink solvents would correlate to Magiesol 47's equilibrium properties (even Magiesol 52 had quite different properties), this data should be obtained from tests performed by the solvent's manufacturer, tests performed by the facility or its trade association, or test results that are tabulated in chemical reference books.

Step 3. Obtain data that relates equilibrium vapor pressure to vapor-phase concentration at standard temperature, $\mathbf{c_V}$, for your solvent or solve the ideal gas law for $\mathbf{c_V}$, and determine the solvent's vapor-phase concentration, $\mathbf{c_V}$, at **p**. Use units of mg/m^3 for $\mathbf{c_V}$.

The Hubbard memo relied on an empirical correlation for this quantity. Following is a theoretical equation derived from the ideal gas law (for partial pressures):

$$p\,V = n_i\,R\,T \qquad \text{(eq. 3-1)}$$

Now,
$n_i = m_i / M_i$

So,
$p\,V = (m_i / M_i)\,R\,T$

This can be rearranged as

$$p = \left(\frac{m_i}{V}\right)\left(\frac{RT}{M_i}\right) = k\,\mathbf{c_V} \qquad \text{(eq. 3-2)}$$

where $\mathbf{c_V}$ is the vapor-phase concentration of the solvent **i**

and where $k = (RT/M_i)$ and $c_V = m_i/V$.

Thus, $\boxed{\mathbf{c_V} = (1/k)\,\mathbf{p}}$ (eq. 3-3)

Since $(1/k) = (M_i/RT) = (1 / RT)\,M_i$, then

$$\boxed{\mathbf{c_V} = (1 / RT)\,\mathbf{M_i\,p}} \qquad \text{(eq. 3-4)}$$

Units for M_i	**Units for p**	**R**
g/mol	atm	82.057 atm cm^3 / mol K
g/mol	mmHg	62.361 mmHg L / mol K
lb / lb-mol	psi	10.73 (lb$_f$/in^2) ft^3 / lb-mol °R
g/mol	Pa = (N/m^2)	8.314 Pa m^3 / mol K
g/mol	mmHg	0.1122 (mmHg) m^3 / mol °R

Note: y (°R) = x (°F) + 459.69

Thus, for units of mmHg and g/mol and for T= 68°F =527.69°R =20°C = 293.15K, and noting that 1 m^3 = 1000 L, the equation may be written as

$\mathbf{c_V}$ = [0.05470 mol / (mmHg) m^3] $\mathbf{M_i\,p}$

(where R = 62.361 mmHg L / mol K and T = 293.15 K)

If a units conversion for grams to milligrams is added, then this results:

$\mathbf{c_V}$ = [.05470 (mol) / (mmHg) (m^3)] (1000 mg / 1g) $\mathbf{M_i\,p}$

$$\mathbf{c_V} = 54.7\ \mathbf{M}_i\ \mathbf{p} \qquad \text{(eq. 3-5)}$$

If **p** is in mmHg and $\mathbf{M_i}$ is in grams per mole, then a calculation of $\mathbf{c_V}$ will have units of mg/m^3, using the formula above.

Given this formula, the ideal gas equation can be tested for its agreement with the correlation in the Hubbard memo for solvent concentration and vapor pressure (Figure 1). That correlation was written, as follows:

$c_V = (11216.51)\ p + .052$

Disregarding the term 0.052 as negligible, the constant in the correlation from Figure 1 equals 11216.51 and would be equal to 54.7 M_i. This implies $M_i = 11216.51 / 54.7 = 205$ g / mol

The molecular weight of Magiesol 47 is 206 g/mol, as reported on the MSDS attached to the Hubbard memo. Thus, the ideal gas equation and the experimental results agree within <1%.

It should be noted that Figure 1 was based on composite data from several tests on different presses and not necessarily conducted with only Magiesol 47-containing inks. However, as noted below, it appears highly likely that only Magiesol 47 was used.

The following table contains the data used to plot Figure 1 of the Hubbard memo and to derive its formula for the vapor pressure-concentration correlation.

Vapor pressure (mmHg)	Concentration (mg/m3)
0.0339	380
0.0316	355
0.025	280
0.0251	292
0.0202	227
0.0198	222

When a linear regression is performed on this data, with the intercept set to zero (using the ideal gas law as the model and common sense that at zero pressure there would be zero concentration), then the proportionality constant changes [from 11217] only slightly, to equal 11280 [(mg) / (m^3) (mm Hg)], which results in an estimated M_i of 206.2 g/mol--a deviation of only 0.1%.

This close agreement suggests that the tests indeed were conducted using Magiesol 47 and that the correlation in Figure 1 should not be used to calculate the concentration of other nonvolatile ink solvents, particularly as their molecular weight deviates further from 206.

Instead, use of Equation 3-4 or 3-5, as derived from the ideal gas law, is recommended for use in all cases, for the following reasons:

- it accounts for differences between solvents (molecular weight), which allows the variability of solvents in use to be accounted for.
- it predicts the amount of condensible particulate matter emissions within 0.1% of a linear, zero-intercept correlation of the data from the Hubbard example.
- it derives from an established law of physics for ideal gases.
- it reduces to a simple formula that is easy to use.

Step 4. Determine the total actual volumetric flow rate, $\mathbf{F_A}$, of the exhaust gas (including air and VOCs). Convert $\mathbf{F_A}$ to a dry standard flue gas volumetric flowrate, $\mathbf{F_S}$, in standard cubic meters per minute (m^3/min), where standard conditions are 68°F and 1 atm.

- It is relatively common and inexpensive for facilities to test the volumetric flow rate, $\mathbf{F_A}$, from their stacks. This is usually measured in acfm, actual cubic feet per minute, and is easily converted to standard cubic meters per minute, using stack temperature and atmospheric pressure data that was recorded during the stack test.
- $\mathbf{F_S}$ may be calculated using the following equation (assuming actual atmospheric pressure was 760 mmHg, or 1 atm):

  $$\mathbf{F_S} = \mathbf{F_A} * 527.69°R / \mathbf{T_{actual}} \quad \text{(eq. 4-1)}$$

  where $\mathbf{T_{actual}}$ has been converted to the Rankine temperature scale: T (Rankine) = T (Fahrenheit) + 459.69
- If atmospheric pressure was measured and recorded during the measurement of $\mathbf{F_A}$, then use this equation to adjust to standard temperature and pressure:

  $$\mathbf{F_S} = \mathbf{F_A} * \frac{P_{actual}(527.69°R)}{T_{actual}(760mmHg)} \quad \text{(eq. 4-2)}$$

Step 5. Determine the total loading (vapor concentration) of organic compounds in the stack exhaust, $\mathbf{c_T}$, in units of mg/m^3, where m^3 is standard cubic meters (e.g. at 68°F and 1 atm), not actual cubic meters.

- Control devices reduce the amount of VOCs (and condensible PM) that are exhausted from the stack:

  $$\mathbf{c_{T,actual}} = (1 - \%\ \text{control efficiency}) * \mathbf{c_P} \quad \text{(eq. 5-1)}$$

  where $\mathbf{c_P}$ is the total loading (vapor concentration) that is measured entering the control device from the process (the press's drying oven) and $\mathbf{c_{T,actual}}$ is the total loading in milligrams per actual cubic meter. This must be converted to standard cubic meters (see below) in order to determine $\mathbf{c_T}$, unless $\mathbf{c_P}$ was measured using standard cubic meters. In that case, $\mathbf{c_T} = \mathbf{c_{T,actual}}$, and no further conversion would be necessary.
- There may be several ways to determine the total loading, including the use of stack or control device efficiency test data when the process was operating at maximum throughput using worst-case materials. Alternately, if a mass balance is possible, then the results of step 4 can be used in combination with the total mass of organic compounds calculated in the stack exhaust, $\mathbf{m_T}$:

  $$\mathbf{c_T} = \mathbf{m_T} / \mathbf{F_S} \quad \text{(eq. 5-2)}$$

  For more detail on how to make this mass balance, see below (Case 5) in the section titled "How to Handle Variations on Example 1".
- If the total loading was determined by a test or other method but did not measure the loading in terms of standard conditions, then convert $\mathbf{c_{T,actual}}$ to standard conditions, using this equation (based on the ideal gas law and assuming constant atmospheric pressure at 1 atm, or 760 mmHg.):

  $$\mathbf{c_T} = \mathbf{c_{T,actual}} * \mathbf{T_{actual}} / 527.69°R, \quad \text{(eq. 5-3)}$$

where $\mathbf{T_{actual}}$ has been converted to the Rankine temperature scale: T (Rankine) = T (Fahrenheit) + 459.69

- However, if atmospheric pressure during the measurement of $\mathbf{c_{T,actual}}$ was measured and recorded, then use this equation to adjust to standard temperature and pressure:

$$\mathbf{c_T} = \mathbf{c_{T,actual}} * \frac{T_{actual}(760 mmHg)}{P_{actual}(527.69°R)} \qquad \text{(eq. 5-4)}$$

where P_{actual} is measured in or converted to mmHg.

Step 6. Calculate the amount, $\mathbf{c_{CPM}}$, of this loading that would condense to liquid at standard conditions by subtracting $\mathbf{c_V}$ from $\mathbf{c_T}$.

$$\mathbf{c_{CPM}} = \mathbf{c_T} - \mathbf{c_V}$$

Step 7. Calculate the emissions rate, $\mathbf{E_{CPM}}$, for condensible particulate matter by multiplying $\mathbf{F_S}$ by $\mathbf{c_{CPM}}$ and converting to lb/hr or other desired units.

$$\mathbf{E_{CPM}} = \mathbf{F_S} * \mathbf{c_{CPM}}$$

CI –5 HAP Calculations for NR 445 Determination

Do you need to do additional calculations for HAP emissions to determine if you comply with the state HAP rule?

1. If you find that the table of HAPs Usage Caps in Chapter 1 of the ERP does not include some of the HAPS found on the MSDS for materials used at your facility, you will need to confirm whether your emissions of those HAPs can meet the thresholds in the state HAP rule. Refer to DNR's web page for an Excel spreadsheet that shows all the regulated chemicals and their thresholds: http://dnr.wi.gov/org/aw/air/HEALTH/airtoxics/toxics_nr445_list.htm
2. If your material usage is above the amounts provided in the HAPs Usage Caps table, you may still comply with the requirements if you calculate your actual emissions of each HAP in the state HAPs rule. Refer to the table in CI-A for the full list of state HAPs.

Note that there are four stack height categories with different thresholds for each category. When calculating emissions and comparing them against the thresholds, you can take the total emissions from all stacks within ONE category and compare against the threshold for that stack height. Do the same for all the stacks that fit in another stack height category.

To calculate emissions, follow these instructions for **each** of the chemicals not listed in the table of HAPs Usage Caps:

- Find the NR 445 Table threshold for the chemical (thresholds are in a measure of pounds emitted for a unit of time – either a single hour (lb/hr c), hourly over a 24 hour average, or annual)
- Measure your normal usage of the materials containing that chemical for the unit of time in the table, and determine the total for the whole facility
- Calculate the HAP content for each chemical in those materials following this equation:
    - HAP content = (% HAP by weight/100) x Density of Material (lb/gal)
- Using the HAP content, calculation HAP emissions in one of two ways – the first one applies if you measure your usage in pounds rather than gallons:
    - HAP emissions = (% HAP by weight/100) x Usage of Material (lbs/unit time)
    - HAP emissions = HAP content (lb/gal) x Usage of Material (gal/unit time)

If the HAP emissions calculated are LESS THAN the threshold in NR 445 for that chemical, then you do not need to do anything more to comply with the rule.

CI – 6 Sample Recordkeeping Format

See next page for one possible example of a monthly record keeping format.

Facility Name: Company

Facility ID Number: 123456789 Date:

Monthly Product Purchase/Usage Tracking Calendar Year: **2006**

SOURCE: ***Sheetfed Operation***	Starting Inventory	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Ending Inventory	Purchase / Usage Total
Inks & Coatings (lbs):															
Inks & Varnish															0
PMS															0
Aqueous Coatings															0
															0
															0
															0
															0
															0
Fountain Solutions (gal):															
ABC Alcohol Sub.															0
ABC Fountain Additive															0
															0
															0
															0
															0
															0
Cleanup Solvent (gal):															
Acme Press Wash															0
Acme Blanket Wash															0
Acme Roller Cleaner															0
															0
															0
															0

Please indicate products "no longer in use" by entering NIU into the data block for each subsequent month

Please indicate products available, but not used during the month, by entering a "0" in the data block

CI –7 Calculations:

VOC AND HAP EMISSIONS DETERMINATION WORKSHEETS

The following worksheets are provided to assist you in determining your VOC and HAP air pollution emissions. The Worksheets are organized to make the assembly of the necessary information and data from purchasing/use records and Material Safety Data Sheets (MSDSs) as easy as possible.

Step 1: Assemble list of products currently used, purchase records, MSDSs, and other information such as VOC/HAP content test data.

Be sure to include:

- Blanket wash/roller wash/press wash/type wash
- Parts cleaner (solvent)
- Inks
- Varnishes
- Coatings
- Cleaning solvents, including screen reclamation chemicals
- Adhesives
- Alcohol or alcohol substitutes (including fountain solution concentrate)
- Laminates
- Any other VOC/HAP -containing products you use in excess of 25 gal/product/year, such as film cleaner

Step 2: Complete worksheets for VOC and HAP emissions. Either complete one VOC and HAP emissions worksheet for the year to calculate annual emissions or one VOC and HAP emissions worksheet for each month or total all previous twelve months to determine annual emissions.

For the VOC Emissions Worksheet, the data required for Columns A, B, and C is general information that can be obtained from either purchase or use records, Material Safety Data Sheets (MSDSs) or your supplier. It may be necessary to contact the supplier for additional information. Column D is the quantity of VOC used as calculated by multiplying Column B times Column C. The emission factors that are appropriate for specific type of printing process are included in Column E. Column F represents the VOC emissions in pounds and is the result of multiplying Column D by Column E. Column G represents the VOC emissions in tons, which is the result of dividing Column F by 2000 (i.e., the number of pounds in a ton).

For the HAP Emissions Worksheet, the data required for Columns A, B, C, and D is general information that can be obtained from either purchase or use records, Material Safety Data Sheets (MSDSs) or your supplier. It may be necessary to contact the supplier for additional information. Column E is the quantity of HAP used as determined by multiplying Column C times Column D. The emission factors that are appropriate for specific type of printing process are included in Column F. Column G represents the HAP emissions in pounds and is the result of multiplying Column E by Column F. Column H represents the HAP emissions in tons, which is the result of dividing Column F by 2000 (i.e., the number of pounds in a ton).

VOC AIR EMISSIONS

Col. A		Col. B		Col. C		Col. D		Col. E	Col. F		Col. G
Product Name Company (optional)	Usage (Gal Or Lbs)	X	VOC Content Lbs/Gal Or Lbs/Lb (wt%)	=	VOCs (Lbs.)	X	Emission Factor ***(See Below)***	**Total VOC Emissions (Lbs)**	÷	2000 lbs. Per Ton	=	**Total VOC Emissions (Tons)**
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
		X		=		X			÷	**2000**	=	
Total For All Products			_____		_____			_____				

Col. A: Enter product name.

Col. B: Enter total amount used either per month or for the year, either in gallons or for inks, coatings, adhesives and other materials purchased by weight, enter pounds (lbs.). To make the calculations easier, the purchase amount can be used. However, if the calculations indicate that you exceed a threshold, then it is advised to “sharpen your pencil” by determining the exact amount of material used. This is accomplished by adding the beginning inventory to the yearly purchase amount and subtracting the ending inventory and any waste shipped off-site.

Col. C: From Section III (Physical and Chemical Properties), enter value for "VOC content”. Ideally, the results should be based on a "Method 24" test. Do not include exempt VOCs such as Methylene Chloride, 1,1,1 Trichloroethane, Methyl Acetate, Acetone, or t-Butyl Acetate. For ink VOC content, you can determine the VOC emissions for each ink or use the highest VOC containing ink in each category (e.g., sheetfed, heatset, web, and nonheatset web).

If VOC content is provided in pounds of VOC per gallon, the quantity in Column B should be in gallons. If VOC content is provided in weight percent (wt% or pound VOC per pound material), the quantity in Column B should be in pounds. If weight percent of ingredients is given and the quantity in Column B is in gallons, total the weight percentage of the ingredients and multiply by the density of the material. The density can be determined by multiplying the specific gravity (found in Section III of the MSDS) by 8.33 lbs./gal.

If no value is given and/or cannot be determined, contact your supplier and request the information.

Col. D: Multiply Column B by Column C to obtain value for VOCs in each product and write the answer in Column D.

Col. E: Multiply Column D by the emission factor in Column E and write the answer in Column F.

Col. G: Divide Column F by 2000 (lbs./ton) to convert to tons per year and write answer in Column G.

HAP AIR EMISSIONS

Col. A	Col. B	Col. C		Col. D		Col. E		Col. F	Col. G				Col. H
Product Name Company (optional)	Name Of HAP	Usage (Gal or Lbs)	X	HAP Content Lbs/Gal Or Lbs/Lb (wt%)	=	HAPs (Lbs)	X	Emission Factor ***(See Below)***	**Total HAP Emissions (Lbs)**	÷	2000 lbs. Per Ton	=	**Total HAP Emissions (Tons)**
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
			X		**=**		**X**			÷	**2000**	**=**	
Total For All Products ______________						______________			______________				

Col. A: Enter product name.

Col. B: If Section II of the MSDS (Hazardous Ingredients) includes any of the state or EPA specific Hazardous Air Pollutants (HAPs), listed above in CI-A, enter the name of the HAP. For the list of common HAPs found at printers, go back to the Air Chapter starting on page A-XX.

Col. C: Enter total amount used either per month or for the year, either in gallons or for inks, coatings, adhesives and other materials purchased by weight, enter pounds (lbs.). To make the calculations easier, the purchase amount can be used. However, if the calculations indicate that you exceed a threshold, then it is advised to "sharpen your pencil" by determining the exact amount of material used. This is accomplished by adding the beginning inventory to the yearly purchase amount and subtracting the ending inventory and any waste shipped off-site.

Col. D: From Section III (Physical and Chemical Properties), enter value for "HAP content" in lbs. per gal. Ideally, the results should be based on a "Method 24" or Method 311 test. Do not include 2-butoxyethanol (aka, butyl cellusolve or ethylene glycol monobutyl ether) or methyl ethyl ketone. For ink HAP content, you can determine the HAP emissions for each ink or use the highest HAP containing ink in each category (e.g., sheetfed, heatset, web, and nonheatset web).

If HAP content is provided in pounds of HAP per gallon, the quantity in Column C should be in gallons. If HAP content is provided in weight percent (wt% or pound HAP per pound material), the quantity in Column C should be in pounds. If weight percent of ingredients is given and the quantity in Column C is in gallons, total the weight percentage of the ingredients and multiply by the density of the material. The density can be determined by multiplying the specific gravity (found in Section III of the MSDS) by 8.33 lbs/gal.

If no value is given and/or can not be determined, contact your supplier and request the information.

Col. E: Multiply Column C by Column D to obtain value for HAPs in each product and write the answer in Column E.

Col. F: Multiply Column E by the emission factor (listed on the next few pages) in Column F and write the answer in Column G.

Col. H: Divide Column G by 2000 (lbs./ton) to convert to tons per year and write answer in Column H.

Emission Factors - Use The Following Emission Factors

Emission Factors For Sheetfed and Nonheatset Web Offset Lithographic Printing Operations

Ink	0.05*	Coatings:	
Fountain Solution Concentrate	1.00	UV	1.00
Fountain Solution Additive	1.00	Water-based	1.00
Cleaning Solution	0.50**	Conventional Varnish	0.05***
Automatic Blanket Wash	1.00		
Adhesives	1.00		

* ***Conventional Nonheatset Offset Lithographic Inks Have A 95% VOC Retention Factor.***

** ***Only If VOC Composite Vapor Pressure Of Cleaning Solution Is 10 mm Hg Or Less At 20 ^{o}C. (68 ^{o}F.) and Used Shop Towels Kept In Closed Containers. Otherwise, use 1.00.***

*** ***Conventional Varnish Is Virtually Identical To Conventional Offset Lithographic Inks.***

Emission Factors For Heatset Web Offset Lithographic Printing Operations Without Controls

Ink	0.80*	Coatings:	
Fountain Solution Concentrate	1.00	UV	1.00
Fountain Solution Additive	1.00	Water-based	1.00
Cleaning Solution	0.50**	Conventional Before Dryer	0.80***
Automatic Blanket Wash	1.00	Conventional After Dryer	0.05***
Adhesives	1.00		

* ***Conventional Heatset Offset Lithographic Inks Have a 20% Retention Factor and 100% Capture efficiency Is Assumed If Airflow Into Dryer Is Demonstrated To Be Negative.***

** ***Only If VOC Composite Vapor Pressure Of Cleaning Solution Is 10 mm Hg Or Less At 20 ^{o}C. (68 ^{o}F.) and Used Shop Towels Kept In Closed Containers. Otherwise, use 1.00.***

*** ***Conventional Varnish Is Virtually Identical To Conventional Offset Lithographic Inks.***

Emission Factors For Screen Printing Operations

Ink	1.00	Coatings:	
Cleaning Solution	0.50*	UV	1.00
Adhesives	1.00	Water-based	1.00
		Solvent-based	1.00

**** Only If VOC Composite Vapor Pressure Of Cleaning Solution Is 10 mm Hg Or Less At 20 °C. (68 °F.) and Used Shop Towels Kept In Closed Containers. Otherwise, use 1.00***

Emission Factors For Digital Printing Operations

Ink	1.00	Coatings:	
Cleaning Solution	0.50*	UV	1.00
Adhesives	1.00	Water-based	1.00
		Solvent-based	1.00

**** Only If VOC Composite Vapor Pressure Of Cleaning Solution Is 10 mm Hg Or Less At 20 °C (68 °F.) and Used Shop Towels Kept In Closed Containers. Otherwise, use 1.00.***

Emission Factors For Flexographic and Rotogravure Printing Operations Without Controls

Ink	1.00	Coatings:	
Diluents	1.00*	UV	1.00
Cleaning Solution	0.50**	Water-based	1.00
Adhesives	1.00	Solvent-based	1.00

**** Diluents Includes Ink, Coating, and Adhesive Dilution Solvents.***

***** Only If VOC Composite Vapor Pressure Of Cleaning Solution Is 10 mm Hg Or Less At 20 °C (68 °F.) and Used Shop Towels Kept In Closed Containers. Otherwise, use 1.00.***