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DPMC EXPOSURE GUIDELINE

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PREPARED BY THE INDUSTRIAL
HYGIENE DEPARTMENT
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DPMC-14977

DPMC INDUSTRIAL HYGIENE EXPOSURE GUIDELINES

JANUARY 1985

Basis

Acceptable levels of employee exposure to chemical substances have been established in recent years by various regulatory and scientific groups. This includes the Occupational Safety and Health Administration, (OSHA); the American Conference of Governmental Industrial Hygienists, (ACGIH); and the National Institute for Occupational Safety and Health (NIOSH). Recommendations on acceptable levels of employee exposure for individual chemical substances often vary between these groups due to 1) differences in data interpretation, or 2) a review of new health hazard information not previously considered. Where existing acceptable limits of exposure are determined to be inadequate, Shell may establish a Shell Internal Limit, for example, epichlorohydrin.

To provide an updated listing of recommended acceptable limits of employee exposure, the attached summary of "DPMC Exposure Guidelines" was prepared.

DPMC Exposure Guidelines represent target control levels for employee protection. At the minimum, precautionary workpractices, respiratory protection and where indicated protective clothing should be used to reduce exposure to or below the DPMC Exposure Guideline. For many chemical substances, two guidelines have been set 1) a short term @ 15 minutes and 2) an 8 hour TWA.

DPMC Exposure Guidelines reflect reasonably current health hazard and toxicological information and will be updated annually. DPMC Exposure Guidelines are as strict as those established by OSHA and incorporate Shell Internal Limits where these have been established. Guidelines have been established for those substances with greater exposure potential or in more frequent use.

Respiratory Protection

For each DPMC Exposure Guideline listed, the minimum type of respiratory protection recommended for use has been identified. Respirators affording a higher level of protection may be used if determined to be appropriate, e.g. a full-face mask may be used to avoid eye irritation instead of a half facepiece; an air supplied respirator may be used instead of a cartridge respirator, etc.

Protective Clothing

Certain chemical substances have the capacity to cause a toxic effect by being absorbed through the skin. This may occur with or without any local skin effect (reddening, rash, burn, etc). Of those substances which can be absorbed, the capacity or rate in which absorption will occur may vary significantly (slightly, moderately, readily absorbed). Each chemical substance reported to have this capacity has been identified on the listing of DPMC

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Exposure Guidelines. It is generally recommended that uncontaminated PVC gloves be used for protection against chemical substances which may be absorbed through the skin.

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ABBREVIATIONS USED

A.C.G.I.H.	American Conference of Governmental Industrial Hygienists - A professional standard setting organization.
A.M. Cartridge	Ammonia Respirator Cartridge
E.N.T.	Eyes, Nose and Throat.
Health Data and Comments	Basic information concerning known toxicity is presented without regard to exposure level, frequency of exposure required to cause health effect, etc.
mg/m ³	Milligram dust per cubic meter of air (weight/volume).
NIOSH	The National Institute for Occupational Safety and Health. This is the research branch of OSHA located under H.E.W.
O.V. Cartridge	Organic Vapor Cartridge - Black in color.
ppm	Parts Per Million (Volume/Volume) - Usually used for gases and vapors.
STEL	Short Term Exposure Limit - Generally referred to as the upper exposure level allowed over a short duration.
Suspect Embryo fetus hazard	Toxicity information and exposures to this chemical are currently being reviewed; has not yet been categorized under the Shell Embryo-Fetus Hazard Program.
Type N Canister	Red canister suitable for carbon monoxide
TWA	Time-Weighted Average - The usual term referred to for 8 hour exposures.
3M 9900	Disposable 3M paper respirator which is suitable for some dusts.
3M 9920	Disposable 3M welding fume respirator which is suitable for some fumes and welding circumstances
I.D.L.R.	Immediately Dangerous to Life or Health - maximum concentration which would permit escape within a 30 minute period.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES		UNITS	MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL		SELECTION	AND COMMENTS
(Requirements)					
<u>A Section</u>					
Acetone	1000.0	1000.0	ppm	Above 750 ppm & up to 2000 ppm half-face mask w/black dual organic vapor cartridge.	Mild ENT irritant at conc. below 1000 ppm; may be narcosis producing above 1000 ppm. Odor threshold 13-100 ppm.
Acetonitrile	40.0	60.0	ppm	Above 40 ppm & up to 400 ppm half-face mask w/yellow dual O.V. acid gas cartridge.	Colorless liquid. Acute toxicity due to cyanide, ether-like odor detected 40-170 ppm. <u>Skin absorption possible.</u> Possible respiratory tract effects. Hydrogen cyanide gas may be formed in a fire.
Acetophenone (Phenyl Methyl Ketone)	None Available			Full facepiece mask w/dual black O.V. cartridges for anticipated exposure to vapors of heated material.	Skin irritation, mild burns and transient eye injury possible. Persistent pleasant sweet, almond odor colorless liquid. Low acute toxicity but potentially narcotic at high concentrations. Odor detection less than 1 ppm.
Acrolein	0.1	0.3	ppm	Above 0.1 ppm & up to 1 ppm full-face mask w/dual O.V. black cartridges.	Vapors extremely irritating at 0.3-1.0 ppm. <u>Skin absorption possible.</u>

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR SELECTION (Requirements)	HEALTH DATA AND COMMENTS
	TWA	STEL	UNITS		
A Section (Cont'd.)					
Allyl Chloride	1.0	2.0	ppm	Above 1 ppm & up to 50 ppm half-face mask w/dual O.V. black cartridge.	Unpleasant pungent odor. Odor detected at 0.2 ppm. Possible liver and kidney effects.
Allyl Glycidyl Ether	5.0	10.0	ppm	Above 5 ppm & up to 50 ppm half-face mask w/black dual O.V. cartridge.	<u>Skin absorption possible.</u> Eye, nose, throat & resp. irritant.
Aluminum Metal Dust	10.0		mg/m ³	Disposable 3M 9920 mask for operations which may exceed 10 mg/m ³ .	Considered an inert or nuisance dust.
Aluminum Metal Fumes	5.0		mg/m ³	Disposable 3M 9920 mask for operations which may exceed 10 mg/m ³ .	-
Ammonia	25.0	35.0	ppm	Above 25 ppm & up to 250 ppm full-face mask w/green dual cartridge.	Odor detected 1-55 ppm; marked E.N.T. irritant; irritating at 50 ppm. Skin burns may occur with liquid contact.
Aniline	2.0	5.0	ppm	Above 2 ppm & up to 50 ppm half-face mask w/dual O.V. black cartridge.	<u>Skin absorption possible.</u> Odor threshold 1.0 ppm. Causes blood effects, headaches, dizziness, etc.
Asbestos	2.0	10.0	Fibers per cc	Disposable 3M 9920 dust mask for all exposure potential i.e. insulation removal, etc. Protective clothing also required.	Recognized lung carcinogen; may also cause asbestosis (lung scarring).

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
A Section (Cont'd.)					
Asphalt Fumes (mineral pitch, petroleum pitch, mixture of poly- cyclic aromatic and paraffinic hydrocarbons)	5.0	10.0	mg/m ³	Half-face mask w/dual black O.V. cartridge & dust covers for opera- tions which may exceed 5 mg/m ³ .	Respiratory & skin irritant; contact can cause acne-like sores or dermatitis.
B Section					
Benzene	10.00	-	ppm	Above 10 ppm & up to 50 ppm half-face mask with dual O.V. black cartridge.	<u>Skin absorption possible</u> ; Suspect human carcinogen; odor threshold 2-3 ppm. Category "A" Embryo Fetus hazard.
Bisphenol A(BPA)	5.0	-	mg/m ³	Disposable 3M 9920 dust mask for opera- tions which may exceed 5 mg/m ³ eg. debagging, cleanup.	Considered an irri- tant dust; possible skin sensitization.
1,3 Butadiene	25.0 DPMC Guideline	-	ppm	Above 25 ppm & up to 500 ppm half-face mask with black O.V. cartridge.	Moderate irritant eye, nose and throat. Narcosis producing at high concentrations. Suspect carcinogen.
n-Butyl Alcohol	100.0	-	ppm	Above 100 ppm & up to 1000 ppm half-face mask with dual O.V. black cartridges.	<u>Skin absorption possible</u> ; odor threshold 10 ppm; reported effect on hearing ability
Butane	800.0	-	ppm	Above 800 ppm airline respirator required.	Odor threshold 500 ppm.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR SELECTION (Requirements)	HEALTH DATA AND COMMENTS
	TWA	STEL	UNITS		
<u>B Section (Cont'd.)</u>					
n-Butyl Glycidyl Ether (BGE)	25.0	-	ppm	Above 25 ppm & up to 250 ppm half-face mask w/dual O.V. black cartridges.	Sensitization possible. Alleged reproductive carcin- ogen and mutagenic effects. Irritant. Odor detected at 0.02 ppm. NIOSH recommends 4 ppm ceiling limit.
sec-Butyl Alcohol	150.0	-	ppm	Above 150 ppm & up to 1000 ppm half-face mask w/dual O.V. black cartridges.	Some irritative and narcotic effects. Odor detected at 0.4 ppm.
tert-Butyl Alcohol	100.0	150.0	ppm	Above 100 ppm & up to 1000 ppm half-face mask with dual O.V. black cartridges.	Narcotic effect (dizziness, head- ache). Odor detec- ted at 0.7 ppm.
<u>C Section</u>					
Cadmium Oxide Fume	-	0.05	mg/m ³	Half-face mask with efficiency filter or airline mask for all fume generating activities.	Kidney, lung and possible long-term chronic effect. Category "A" Embryo Fetus hazard.
Carbon Disulfide	0.5	15.0	ppm	Above 0.5 ppm and up to 50 ppm full-face mask with dual O.V. cartridges (Black).	<u>Skin absorption</u> <u>possible.</u> Category "A" Embryo Fetus hazard. Systemic effects possible. Odor detected .1-8.0 ppm.
		Shell developed guideline.			
Carbon Monoxide	50.0	400.0	ppm	Air supplied respira- tors or Type N red canister mask.	Odorless chemical asphyxiant, suspect Embryo Fetus hazard.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
C Section (Cont'd.)					
Carbon Tetrachloride	5.0	-	ppm	Above 5 ppm and up to 50 ppm O.V. Black cartridge respirator required.	Suspect cancer agent. Category "A" Embryo Fetus hazard. <u>Skin absorption possible.</u>
		Shell developed guideline.			
Catalyst Dust (Excluding toxic metals)	10.0	-	mg/m ³	Disposable 3M 9920 dust mask w/goggles or full-face mask w/dual purple filter high efficiency cartridges or airline mask.	Toxicity dependent on components; visual dust emissions to be controlled.
Chlorine	1.0	1.0	ppm	Above 1 ppm & up to 25 ppm full-face mask w/orange & white canister. Air supplied mask for levels above 25 ppm or unknown concentrations.	Eyes, nose and throat irritant; pulmonary irritation. I.D.L.H. is 25 ppm.
Chloroform	50.0	-	ppm	Above 50 ppm air supplied respirator required.	Suspect cancer agent. Category "A" Embryo-Fetus hazard.
Chromium Fume (metal and insoluble salts as Cr)	0.5Cr III 0.05 CrVI	-	mg/m ³	High efficiency fume mask (purple cartridges or 3M 9920), or airline mask as required depending on welding process and ventilation.	Chronic lung hazard.
Coal Tar Pitch Volative. (Benzene Soluble Fraction analyzed for specific PCAs)	0.2	-	mg/m ³	Half-face mask w/dual black O.V. cartridge and dust covers for operations which may exceed .2 mg/m ³ .	Polycyclic Aromatic (PCA) containing; respiratory & skin irritant; possible cancer association.
Cobalt Fume or Dust (as Co)	0.05	0.1	mg/m ³	Half-face mask w/dual purple filter high efficiency cartridge or airline mask.	Long term lung effects possible.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR SELECTION (Requirements)	HEALTH DATA AND COMMENTS
	TWA	STEL	UNITS		
C Section (Cont'd.)					
Copper Dust (as Cu)	1.0	-	mg/m ³	Disposable 3M 9900 dust mask.	Possible long term lung effects.
Copper Fume (as Cu)	0.1	-	mg/m ³	High efficiency fume mask (purple cartridge or 3M 9920), or airline mask as required depend- ing on welding process and ventilation.	Metal fume fever possible from fume, an irritant to the upper respirator tract.
Cresol	5.0	-	ppm	Above 5 ppm & up to 50 ppm full-face mask w/dual O.V. black cartridges.	<u>Skin absorption possible.</u> Dermal irritant. Toxicity similar to phenol.
ene	50.0	75.0	ppm	Above 50 ppm & up to 500 ppm half-face mask w/dual O.V. black cartridges.	<u>Skin absorption possible.</u> Narcotic & irritative effects possible.
Curing Agent Y [4,4' - Methylene dianiline (MDA) & 2,4-diaminotoluene	0.1	0.5	ppm	Above 0.1 ppm & up to 1.0 ppm half-face mask with dual O.V. black cartridges.	<u>Skin absorption possible,</u> suspect cancer agent.
Cyclohexane	300.0	375.0	ppm	Above 300 ppm & up to 1000 ppm half- face mask w/dual O.V. black cartridges.	Pungent odor detect- able near 300 ppm. Skin, eye & respira- tory irritant.
1,3 Cyclo- pentadiene	75.0	150.0	ppm	Above 75 ppm & up to 750 ppm half-face mask w/dual O.V. black cartridges.	Vapors irritating near 200 ppm.
Cellosolve Acetate (Ethoxyethyl Acetate)	5.0	15.0	ppm	Above 5 ppm & up to 50 ppm half-face mask w/dual black O.V. cartridges.	<u>Skin absorption possible.</u> "A" category Embryo Fetus hazard.
	Shell developed guideline				

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
<u>D Section</u>					
Diacetone Alcohol	50.0	75.0	ppm	Above 50 ppm & up to 500 ppm half-face mask w/dual black O.V. cartridges.	Vapors irritating near 100 ppm. Narcotic effect possible.
1,3 Dichloropropene (D-D® soil fumigant) CHCL = CH-CH2CL	1.0	3.0	ppm	Above 1 ppm & up to 50 ppm half-face mask w/dual black O.V. cartridges.	Respiratory irritant, kidney & liver effects.
Dicyclopentadiene (DCPD)	5.0	-	ppm	Above 5 ppm & up to 50 ppm half-face mask w/dual black O.V. cartridges.	Odor detected at .02 .02 ppm. Disagreeable odor at 0.2 ppm and irritating below 10 ppm. Possible chronic effects.
Diethanolamine	3.0	-	ppm	Above 3 ppm & up to 50 ppm full-face mask w/dual green AM cartridges.	Colorless, liquid with slight ammonia odor; may cause irritation to E.N.T.
Diethylamine	25.0	-	ppm	Above 25 ppm & up to 100 ppm half-face mask w/dual green AM cartridges.	Eye and upper respiratory tract irritant. Odor detected at 0.05 ppm.
Diethylenetriamine	1.0	-	ppm	Above 1 ppm & up to 50 ppm full-face mask w/dual green AM cartridges.	<u>Skin absorption possible.</u> Eye and respiratory irritation.
Diglycidyl Ether	-	0.5	ppm	Supplied air respirator <u>only</u> for all exposure potential which may exceed 0.5 ppm.	Causes CNS depression, severe eye irritant. Odor threshold is above 5 ppm.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
<u>E Section</u>					
Ethanolamine	3.0	6.0	ppm	Above 3 ppm & up to 50 ppm full-face mask w/dual green AM cartridges.	Acute systemic toxicity. Odor threshold 3-4ppm. Irritant to skin & eyes. CNS stimulant.
Epichlorohydrin	1.0	3.0 15 min. peak	ppm	Above 1 ppm & up to 50 ppm full-face mask w/dual black O.V. cartridges.	<u>Skin absorption possible.</u> Suspect human carcinogen. IDLH is 100 ppm.
Ethyl Alcohol	1000.0	-	ppm	Above 1000 ppm & up to 2000 ppm full-face mask w/red type N canister mask.	Narcotic effects above guideline. Odor detected at 5 ppm.
Ethyl Benzene	100.0	-	ppm	Above 100 ppm & up to 500 ppm full-face mask w/dual black O.V. cartridges.	Skin irritant, irritating to U.R.T. systemic toxicity.
Ethyl Chloride	1000.0	-	ppm	Above 1000 ppm & up to 2000 ppm full-face mask w/red type N canister.	Narcotic effects above guideline.
Ethylene Dichloride	50.0	100.0	ppm	Above 50 ppm & up to 500 ppm an airline respirator for VCM & EDC. Half-face mask w/dual O.V. black cartridges permitted for exposures involving only EDC.	<u>Skin absorption possible.</u> Toxic to liver, narcotic effects, suspect carcinogen. "A" category Embryo-Fetus hazard. IDLH is 1000 ppm. Odor threshold is 40 ppm.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
<u>E Section (Cont'd.)</u>					
Ethylene Dibromide	10.0	15.0	ppm	Up to 10 ppm full face mask w/dual black O.V. cartridges. Air supplied above 10 ppm.	<u>Skin absorption possible.</u> Suspect carcinogen. 130 ppb ceiling standard used by California "A" category Embryo Fetus hazard. Odor threshold 26 ppm.
Ethylene Glycol m-Butyl Ether (Butyl Oxitol®)	25.0	40.0	ppm	Above 50 ppm & up to 500 ppm half-face mask w/dual O.V. black tridges. Odor unpleasant at 75 ppm.	<u>Skin absorption possible.</u> Irritation and acute car-systemic effects possible including red blood cells.
		Shell developed guideline			
Ethylene Glycol m-Ethyl Ether (Ethyl Oxitol®, or 2-Ethoxyethanol)	5.0	15.0	ppm	Above 5 ppm & up to 50 ppm half-face mask w/dual O.V. black cartridges.	<u>Skin absorption possible.</u> Acute systemic toxicity "A" category Embryo Fetus hazard.
		Shell developed guideline			
Ethylene Glycol m-Methyl Ether (Methyl Oxitol)	2.0	6.0	ppm	Above 2 ppm & up to 50 ppm half-face mask w/dual O.V. black cartridges.	<u>Skin absorption possible.</u> Acute systemic toxicity "A" Category Embryo Fetus hazard.
		Shell developed guideline			
Ethylene Glycol Vapor	-	50.0	ppm	Half face mask with dual black O.V. cartridges required for mists.	Odor threshold is 25 ppm.
<u>G Section</u>					
Gasoline (Bulk Handling)	300.0	500.0	ppm	Above 300 ppm & up to 1000 ppm half-face mask w/dual O.V. black cartridges.	Anesthetic effect above guideline; irritating to mucous membranes.
<u>H Section</u>					
n-Heptane	500.0	-	ppm	Above 500 ppm & up to 1000 ppm half-face mask w/black O.V. cartridges.	Narcosis producing at high concentrations.

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
<u>H Section (Cont'd.)</u>					
n-Hexane	50.0	-	ppm	Above 50 ppm & up to 500 ppm half-face mask w/black O.V. cartridge.	Polyneuropathy & (nervous system effects) narcosis effects.
Hydrazine	0.01	-	ppm	Above 0.01 ppm & up to 1.0 ppm full-face mask w/green AM cartridges.	<u>Skin absorption possible</u> ; respiratory irritant; suspect cancer hazard; Suspect Embryo Fetus hazard.
		Shell developed guideline			
Hydrogen Chloride	-	5.0	ppm	Above 5 ppm & up to 50 ppm full-face mask w/dual white chlorine cartridges.	Eyes, nose, and respiratory irritant.
Hydrogen Sulfide	10.0	20.0	ppm	Air supplied respirator for exposure potential above 300 ppm. Type GMC-SS-1 canister (yellow) for escape.	Marked irritant to eyes, lung; loss of smell, highly toxic. Odor threshold .004 ppm. Immediate unconsciousness above 600 ppm.
		50 for 10 min. (If no other exposure occurs that shift)			
Hydroquinone	2.0	4.0	mg/m ³	Disposable 3M 9920 dust mask for operations which may reasonably exceed 2 mg/m ³ .	White crystals; may cause dermatitis, sensitization, eye injury & systemic toxicity.
<u>I Section</u>					
Inorganic Lead Dust and Fume (as Pb)	0.05	-	mg/m ³	Half-face mask w/dual purple dust filter cartridges, disposable 3M 9920 dust mask or airline mask.	Chronic toxicity from inhalation or ingestion. Good personal hygiene required. OSHA action level is 0.03 mg/m ³ . Suspect Embryo Fetus hazard.

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
				(Requirements)	
I Section (Cont'd.)					
Iron Oxide (as Fe)	10.0	-	mg/m ³	Disposable 3M 9900 dust mask.	Long term minor lung hazard.
Isoprene (2 Methyl, 1-3 Butadiene)	None Available		ppm	Full facepiece mask w/black O.V. cartridges. For protection against odor or if irritation occurs.	Vapors irritating to eyes, nose and throat.
Isobutyl Alcohol	50.0	-	ppm	Above 50 ppm and up to 1000 ppm, full-facepiece mask with black organic vapor cartridges. Supplied air required at concentrations above 1000 ppm.	Irritation of eyes and upper respira- tory tract. May cause headaches, drowsiness, skin irritation and ski cracking.
Isopropyl Alcohol	400.0	-	ppm	Above 400 ppm & up to 1000 ppm half-face mask w/black O.V. cartridges.	<u>Skin absorption possible.</u>
Isopropyl Ether	250	310	ppm	Above 250 ppm & up to 1000 ppm half-face mask w/black O.V. cartridges.	More toxic than ethyl ether. Vapor irritating above 250 ppm.
M Section					
Magnesium Oxide Fume (as Mg)	10.0	-	mg/m ³	High efficiency fume mask (purple cartridges or 3M 9920), or airline mask as required depending on welding process and ventilation.	Long term minor lung hazard.
Manganese (as Mn) Fume or Dust	1.0	3.0	mg/m ³	High efficiency fume mask (purple cartridges or 3M 9920), or airline mask as required depending on welding process and ventilation.	Central nervous system disorders.

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DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
M Section (Cont'd.)					
Mercury (inorganic)		0.1	mg/m ³	Airline respirator only.	Central nervous system disorders; Category "A" Embryo Fetus hazard.
Mesityl Oxide	25.0	-	ppm	Above 25 ppm & up to 250 ppm half-face mask w/black cartridges.	Irritating above 25 ppm, more toxic toxic than other ketones. Causes narcosis and systemic injury.
Methacrylic Acid (Glacial Methacrylic Acid or Alpha Methyl Acrylic Acid)	20.0	30.0	ppm	Above 30 ppm & up to 200 ppm full-face mask w/dual black O.V. cartridges.	Corrosive to skin & eyes sensitization possible. Sharp odor. Liver & kidneys affected.
Methanol (Methyl Alcohol)	200.0		ppm		
Methyl Ethyl Ketone	-	100.0	ppm	Above 200 ppm & up to 1000 ppm half-face mask w/dual black O.V. cartridges.	Irritant to eyes, nose and throat. Narcosis producing. Category "A" Embryo Fetus hazard. Odor detected at 5-10 ppm.
		Shell developed guideline			
Methyl Isobutyl Carbinol	25.0	40.0	ppm	Above 25 ppm & up to 250 ppm full-face mask with dual black O.V. cartridges.	<u>Skin absorption</u> possible. Eye & skin irritant.
Methyl Isobutyl Ketone	100.0	-	ppm	Above 50 ppm & up to 1000 ppm half-face mask w/dual black O.V. cartridges.	Irritation to eyes, nose and throat; Narcosis producing.
Methyl Mercaptan	0.5	10.0	ppm	Air supplied respirator <u>only</u> for all exposure potential.	Toxicity similar to but less than hydro- gen sulfide but odorless tolerable. IDLH is 400 ppm; odor threshold is .8 ppm.

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR SELECTION (Requirements)	HEALTH DATA AND COMMENTS
	TWA	STEL	UNITS		
<u>M Section (Cont'd.)</u>					
Molybdenum (as Mo) Soluble	5.0	10.0	mg/m ³	Disposable 3M 9900 dust mask or half-face mask with dual purple dust cartridges for catalyst handling.	Long term lung effects possible.
(Alpha) Methyl Styrene	50.0	100.0	ppm	Above 50 ppm full face mask with dual black O.V. cartridges.	IDLH is 1000 ppm; Odor threshold is .12 ppm.
<u>N Section</u>					
Naphthalene	10.0	15.0	ppm	Above 10 ppm & up to 50 ppm full-face dual black O.V. cartridges.	Eye irritant and narcotic effects possible at high concentrations.
Nickel Subsulfide	15.0		UG/m ³	Welding-Respirator use dependent on process used and ventilation. Catalyst - 3M 9920 mask, or full face mask with dual purple dust cartridges or airline mask for catalyst handling.	
Nickel Oxide	300.0		UG/m ³		
Nickel Chloride	25.0		UG/m ³		
Nickel Carbonyl, (as Ni)	0.001	-	ppm	Air supplied respirator <u>only</u> for all exposure potential.	Suspect lung cancer agent; high concentrations may cause pulmonary edema. Delayed respiratory system effects possible.
<u>O Section</u>					
Organic Lead (Tetra Ethyl or Tetra Methyl)	.075	-	mg/m ³	Air supplied respirator <u>only</u> for all exposure potential.	<u>Skin absorption possible.</u> "A" Embryo-Fetus hazard category.

LAM 013723

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES		UNITS	MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL		SELECTION	AND COMMENTS
(Requirements)					
O Section (Cont'd.)					
Ozone	0.1	0.3	ppm	Air supplied respirator only.	Lethal gas at low concentrations, odor threshold est. 2 ppm.
P Section					
para-Benzoquinone	0.1	0.3	ppm	Above 0.1 ppm & up to 10 ppm full-face mask with dual Black O.V. cartridges.	Vapor/dust irritating to corrosive to eyes.
Pentane	1000.0	1000.0	ppm	Above 1000 ppm & up to 2000 ppm full-face mask w/red canister.	Irritant to eyes, respiratory system CNS depressant.
Phenol	5.0	10.0	ppm	Above 5 ppm & up to 50 ppm full-face mask w/dual black O.V. cartridges.	<u>Skin absorption possible.</u> Odor threshold .02-.05 ppm. Skin burns and systemic toxicity possible. IDLH is 100 ppm.
Phenyl Glycidyl Ether	10.0	15.0	ppm	Above 10 ppm & up to 50 ppm full-face mask w/dual black O.V. cartridges.	May cause Central Nervous System depression. Skin & eye irritant.
S Section					
Sulfur Dioxide	2.0	-	ppm	Above 5 ppm & up to 50 ppm half-face mask w/dual white cartridges.	Colorless with strong suffocating odor. Respiratory irritant.
Sulfuric Acid Mist	1.0	-	mg/m ³	Full-face mask w/dual white AG cartridges w/dust covers above 1 mg/m ³ .	Eyes, nose, throat and pulmonary irritation.

LAM 013724

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
<u>S Section (Cont'd.)</u>					
Styrene, Monomer	100.0	200.0	ppm	Above 100 ppm & up to 500 ppm half-face mask w/dual black O.V. cartridges.	Odor threshold 0.047 - 0.1 ppm. Eyes, nose and respiratory irritant. CNS depressant. Category "A" Embryo Fetus hazard.
<u>T Section</u>					
Teflon (FEP) Welding Fumes (Fluoroethylene- pylene)	No Detectable Level Permitted			Air supplied respirators <u>only</u> for all exposure potential.	Respiratory irritation, FEP decomposes to Hydrogen Fluoride.
Titanium Fume/Dust	10.0	-	mg/m ³	Disposable 3M 9920 fume mask for operations which may exceed 10 mg/m ³ .	Considered a nuisance dust hazard.
Toluene	100.0	150.0	ppm	Above 100 ppm & up to 1000 ppm half-face mask with black O.V. cartridges.	<u>Skin absorption possible.</u> E.N.T. irritant. Odor threshold approx. 2-15 ppm. "A" category Embryo-Fetus hazard.
Total (Nuisance , Dust)	10.0		mg/m ³	Disposable 3M 9900 Dust mask for operations which may exceed 10 mg/m ³ .	Long term lung effects suspected
1,1,1, Trichloro- ethane (Methyl Chloroform or Shell Blend 100)	350.0	450.0	ppm	Above 350 ppm and up to 1000 ppm half-face mask with black O.V. cartridge.	Mild chloroform odor. No flash point. CNS depressant and dermatitis.
Trichloroethylene	50.0	200.0	ppm	Above 50 ppm & up to 1000 ppm half-face mask w/black O.V. cartridges.	Chronic liver hazard, narcotic effects.

LAM 013725

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
T Section (Cont'd.)					
Trimethylamine	10.0	15.0	ppm	Above 10 ppm & up to 500 ppm full-face mask with green ammonia cartridges.	
1,2,3-Trichloro-Propane	5.0	7.5	ppm	Above 5 ppm & up to 50 ppm full face mask with black O.V. cartridges.	Chloroform odor colorless, liquid, irritant, mild skin sensitizer.
V Section					
Vanadium (Fume)	0.05 (as V)	-	mg/m ³	High efficiency fume mask (purple cartridges or 3M 9920), or airline mask as required depending on welding process and ventilation.	Oxides of Vanadium are acutely toxic possibly resulting in delayed respiratory system effects.
Vinyl Chloride Monomer	1.0 (No time limit associated with STEL.)	5.0	ppm	Air supplied respirator only for all exposure potential.	Suspect human carcinogen. "A" category Embryo Fetus hazard.
W Section					
Welding Fume	5.0	-	mg/m ³	High efficiency fume mask (purple cartridges or 3M 9920), or airline mask as required depending on welding process and ventilation.	Metal fume fever from galvanized metal; possible long term lung effects.
Wood Dust:					
Hard Woods	1.0	-	mg/m ³	3M 9920 required above limit.	Possible lung effect.
Soft Woods	5.0	10.0	mg/m ³	3M 9920 required above limit.	Possible lung effect.

LAM 013726

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DPMC-15000

DPMC EXPOSURE GUIDELINES

SUBSTANCE	DPMC GUIDELINES			MINIMUM RESPIRATOR	HEALTH DATA
	TWA	STEL	UNITS	SELECTION	AND COMMENTS
(Requirements)					
<u>X Section</u>					
Xylene	100.0	150.0	ppm	Above 100 ppm & up to 1000 ppm half-face mask w/dual black O.V. cartridges.	<u>Skin absorption possible.</u> "A" category Embryo-Fetus-hazard. Odor detected at 1.1 ppm.
<u>Z Section</u>					
Zinc Oxide Fume	5.0	10.0	mg/m ³	High efficiency fume mask (purple cartridges or 3M 9920), or airline mask as required depending on welding process and ventilation.	Metal fume fever from inhalation of fumes.

LAM 013727

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DPMC-15001

DPMC EXPOSURE GUIDELINES

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES		UNITS
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL	
Acetone	1,000.0	-	750.0	1,000.0	1,000.0	1,000.0	ppm
Acetonitrile	40.0	-	40.0	60.0	40.0	60.0	ppm
Acetophenone (Phenyl Methyl Ketone)	-	-	-	-	-	-	-
Acrolein	0.1	-	0.1	0.3	0.1	0.3	ppm
Allyl Chloride	1.0	-	1.0	2.0	1.0	2.0	ppm
Allyl Glycidyl Ether	-	10.0	5.0	10.0	5.0	10.0	ppm
Aluminum Metal Dust Fume	15.0 -	- -	10.0 5.0	20.0 -	10.0 5.0	- -	mg/m ³ mg/m ³
Ammonia	50.0	-	25.0	35.0	25.0	35.0	ppm
Aniline	5.0	-	2.0	5.0	2.0	5.0	ppm
Asbestos	2.0	10.0	2.0	-	2.0	10.0	f/cc
Asphalt Fumes	-	-	5.0	10.0	5.0	10.0	mg/m ³
Benzene	10.0	25.0	10.0	25.0	10.0	-	ppm

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DPMC-15002

LAM 013728

DPMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES		UNITS
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL	
Bisphenol A (BPA)	-	-	See Total Nuisance Dust	-	5.0 (total wt.)	-	mg/m ³
1,3-Butadiene	1,000.0	-	1,000.0	1250.0	25.0	-	ppm
Butane			800.0	-	800.0	-	ppm
Butyl Oxide	-	-	-	-	50.0	-	ppm
Butyl Oxitol® (Ethylene Glycol m-Butyl Ether)	50.0	-	50.0	150.0	25.0	40.0	ppm
n-Butyl Alcohol	100.0	-	50.0	-	100.0	-	ppm
n-Butyl Glycidyl Ether (BGE)	50.0	-	25.0	-	25.0	-	ppm
sec-Butyl Alcohol	150.0	-	100.0	150.0	150.0	-	ppm
tert-Butyl Alcohol	100.0	-	100.0	150.0	100.0	150.0	ppm
Cadmium Oxide Fume	0.1	0.3	0.05	-	-	0.05	mg/m ³
Carbon Disulfide	20.0	30.0	10.0	-	0.5 Shell Internal Limit	15.0	ppm
Carbon Monoxide	50.0	-	50.0	400.0	50.0	400.0	ppm
Carbon Tetrachloride CHBT8501101 0027.0.0	10.0	-	5.0	20.0	5.0	-	ppm

DPMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES		UNITS
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL	
Catalyst Dust	See Total Nuisance Dust		-	-	10.0	-	mg/m ³
Chlorine	-	1.0	1.0	3.0	1.0	1.0	ppm
Chloroform	50(c)	-	10.0	50.0	50.0	-	ppm
Chromium Fume (Metal and insoluble salts as Cr)	1.0	-	0.5 CrIII	-	0.5 CrIII	-	mg/m ³
	-	-	0.05 CrVI	-	0.05 CrVI	-	mg/m ³
Coal Tar Pitch Volatile (Benzene Soluble Fraction analyzed for specific PCAs)	0.2	-	.2	-	0.2	-	mg/m ³
Cobalt Fume or Dust (as Co)	0.1	-	0.1	-	0.05	0.10	mg/m ³
Copper Fume (as Cu)	0.1	-	0.2	-	0.1	-	mg/m ³
Dust (as Cu)	1.0	-	1.0	2.0	1.0	-	mg/m ³
Cresol	5.0	-	5.0	-	5.0	-	ppm
Cumene	50.0	-	50.0	75.0	50.0	75.0	ppm
Curing Agent Y [4, 4' - Methylene dianiline (MDA) & 2-4-diaminotoluene]			0.1	0.5	0.1	0.5	ppm

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DPMC-15004

DPMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES	
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL
Cyclohexane	300.0	-	300.0	375.0	300.0	375.0
1,3-Cyclopentadiene	75.0	-	75.0	150.0	75.0	150.0
Cellosolve Acetate (Ethoxyethyl Acetate)	-	-	5.0	-	5.0	15.0
Diacetone Alcohol	50.0	-	50.0	75.0	50.0	75.0
1,3-Dichloropropene (D-D® soil fumigant) CHCL = DH-CH ₂ CL	-	-	1.0	10.0	1.0	3.0 (1 Hr.)
Dicyclopentadiene (DCPD)	-	-	5.0	-	5.0	-
Diethanolamine	-	-	3.0	-	3.0	-
Diethylamine	25.0	-	10.0	25.0	25.0	-
Diethylenetriamine	-	-	1.0	-	1.0	-
Diglycidyl Ether	-	0.5	0.1	-	-	0.5
Ethanolamine	3.0	-	3.0	6.0	3.0	6.0
Epichlorohydrin	5.0	-	2.0	5.0	1.0	3.0

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DPMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES		UNITS
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL	
Ethyl Alcohol	1,000.0	-	1,000.0	-	1,000.0	-	ppm
Ethyl Benzene			100.0	125.0	100.0	-	ppm
Ethyl Chloride	1,000.0	-	1,000.0	1,250.0	1,000.0	-	ppm
Ethylene Dibromide			-	-	10.0	15.0	ppm
Ethylene Dichloride	50.0	100.0	10.0	15.0	50.0	100.0	ppm
Ethylene Glycol Vapor			50.0	-	-	50.0	ppm
Ethyl Oxitol® (Ethylene Glycol m-Ethyl Ether)	200.0	-	5.0	-	5.0	15.0	ppm
Gasoline (Bulk Handling)	-	-	300.0	500.0	300.0	500.0	ppm
n-Heptane	500.0	-	400.0	500.0	500.0	-	ppm
n-Hexane	500.0	-	50.0	-	50.0	-	ppm
Hydrazine	1.0	-	0.1	-	0.01	-	ppm
Hydrogen Chloride	-	5.0	5.0	-	-	5.0	ppm
Hydrogen Sulfide	-	20.0	10.0	15.0	10.0	20.0	ppm
Hydroquinone CHBT8501101 0030.0.0	2.0	-	2.0	4.0	2.0	4.0	mg/m ³

LAM 013732

DPMC-15006

DFMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES	
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL
Inorganic Lead Dust and Fume (as Pb)	0.05	-	0.15	-	0.05	-
Iron Oxide (as Fe)	10.0	-	5.0	10.0	10.0	-
Isoprene (2 Methyl, 1-3 Butadiene)	----- None Available -----					
Isobutyl Alcohol			50.0	75.0	50.0	-
Isopropyl Alcohol	400.0	-	400.0	500.0	400.0	-
Isopropyl Ether	500.0	-	250.0	310.0	250.0	310.0
Magnesium Oxide Fume (as Mg)	15.0	-	10.0	-	10.0	-
Manganese (as Mn) fume or dust	-	5.0	1.0	3.0	1.0	3.0
Mercury (Inorganic)	-	0.1	0.1	-	-	0.1
Mesityl Oxide	25.0	-	15.0	25.0	25.0	-
Methanol (Methyl Alcohol)			200.0	250.0	200.0	-
Methyl Ethyl Ketone	200.0	-	200.0	300.0	-	100.0

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DPMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES	
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL
Methyl Isobutyl Carbinol	25.0	-	25.0	40.0	25.0	40.0
Methyl Isobutyl Ketone	100.0	-	50.0	75.0	100.0	-
Methyl Mercaptan	-	10.0	0.5	-	0.5	10.0
Methyl Oxitol® (Ethylene Glycol m-Methyl Ether)	25.0	-	5.0	-	2.0	6.0
Methacrylic Acid	-	- Rohm & Haas	20.0 2.0	- 5.0	20.0	30.0
(Alpha) Methyl Styrene			50.0	100.0	50.0	100.0
Molybdenum (as Mo soluble)	5.0	-	5.0	10.0	5.0	10.0
Naphthalene	10.0	-	10.0	15.0	10.0	15.0
Nickel Carbonyl	0.001	-	0.05 (as Ni)	-	0.001	-
Nickel Subulfide					15.0	-
Nickel Oxide					300.0	-
Nickel Chloride					25.0	-

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DPMC EXPOSURE GUIDELINES (Cont'd.)

SUBSTANCE	OSHA		1986 ACGIH		SHELL DPMC GUIDELINES		UNITS
	PEL-TWA	PEL-CEILING	TLV-TWA	TLV-STEL	TWA	STEL	
Organic Lead	0.075	-	TEL 0.1 TML 0.15	0.3 0.5	0.075	-	mg/m ³
Ozone	0.1	-	0.1	0.3	0.1	0.3	ppm
Para-Benzoquinone	0.1	-	0.1	0.3	0.1	0.3	ppm
Pentane	1,000.0	-	600.0	750.0	1,000.0	1,000.0	ppm
Phenol	5.0	-	5.0	10.0	5.0	10.0	ppm
Phenyl Glycidyl Ether	10.0	-	1.0	-	10.0	15.0	ppm
Sulfur Dioxide	5.0	-	2.0	5.0	2.0	-	ppm
Sulfuric Acid Mist	1.0	-	1.0	-	1.0	-	mg/m ³
Styrene, Monomer	100.0	200.0	50.0	100.0	100.0	200.0	ppm
Teflon (FEP Welding Fumes) (Fluoroethylene Propylene)	----- No Detectable Level Permitted -----						
Titanium Fume or Dust	15.0	-	-	-	10.0	-	mg/m ³
Toluene	200.0	300.0	100.0	150.0	100.0	150.0	ppm
Total (Nuisance) Dust	15.0	-	10.0	-	10.0	-	mg/m ³

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DPMC-15009

IH Operations Procedures
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LAM 013702

DPMC 14976.1