APPENDIX A

Contaminants of Concern (COC)
Chemical Property Summaries

1,2,3-Trichloropropane	Formula: $CH_2ClCHClCH_2Cl$	CAS#: 96-18-4	RTECS#: TZ9275000	IDLH: Ca [100 ppm]
Conversion: 1 ppm = 6.03 mg/m^3	DOT:			

Synonyms/Trade Names: Allyl trichloride, Glycerol trichlorohydrin, Glyceryl trichlorohydrin, Trichlorohydrin

Exposure Limits:
NIOSH REL: Ca
TWA 10 ppm (60 mg/m^3) [skin]
See Appendix A
OSHA PEL†: TWA 50 ppm (300 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless liquid with a chloroform-like odor.

Chemical & Physical Properties:
MW: 147.4
BP: 314°F
Sol: 0.1%
Fl.P: 160°F
IP: ?
Sp.Gr: 1.39
VP: 3 mmHg
FRZ: 6°F
UEL(302°F): 12.6%
LEL(248°F): 3.2%
Class IIIA Combustible Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Chemically-active metals, strong caustics & oxidizers

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, nose, throat; CNS depres; in animals: liver, kidney inj; [carc]
TO: Eyes, skin, resp sys, CNS, liver, kidneys [in animals: forestomach, liver & mammary gland cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash
Breath: Resp support
Swallow: Medical attention immed

Trichloroethylene	**Formula:** $ClCH=CCl_2$	**CAS#:** 79-01-6	**RTECS#:** KX4550000	**IDLH:** Ca [1000 ppm]
Conversion: 1 ppm = 5.37 mg/m^3	**DOT:** 1710 160			

Synonyms/Trade Names: Ethylene trichloride, TCE, Trichloroethene, Trilene

Exposure Limits:
NIOSH REL: Ca
See Appendix A
See Appendix C
OSHA PEL†: TWA 100 ppm
C 200 ppm
300 ppm (5-minute maximum peak in any 2 hours)

Measurement Methods (see Table 1):
NIOSH 1022, 3800
OSHA 1001

Physical Description: Colorless liquid (unless dyed blue) with a chloroform-like odor.

Chemical & Physical Properties:
MW: 131.4
BP: 189°F
Sol: 0.1%
Fl.P: ?
IP: 9.45 eV
Sp.Gr: 1.46
VP: 58 mmHg
FRZ: -99°F
UEL(77°F): 10.5%
LEL(77°F): 8%
Combustible Liquid, but burns with difficulty.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin; head, vis dist, lass, dizz, tremor, drow, nau, vomit; derm; card arrhy, pares; liver inj; [carc]
TO: Eyes, skin, resp sys, heart, liver, kidneys, CNS [in animals: liver & kidney cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Ethylene dichloride	Formula: $ClCH_2CH_2Cl$	CAS#: 107-06-2	RTECS#: KI0525000	IDLH: Ca [50 ppm]
Conversion: 1 ppm = 4.05 mg/m^3	DOT: 1184 131			

Synonyms/Trade Names: 1,2-Dichloroethane; Ethylene chloride; Glycol dichloride

Exposure Limits:
NIOSH REL: Ca
TWA 1 ppm (4 mg/m^3)
ST 2 ppm (8 mg/m^3)
See Appendix A,
See Appendix C (Chloroethanes)
OSHA PEL†: TWA 50 ppm
C 100 ppm
200 ppm [5-minute maximum peak in any 3 hours]

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 3

E

Physical Description: Colorless liquid with a pleasant, chloroform-like odor. [**Note:** Decomposes slowly, becomes acidic & darkens in color.]

Chemical & Physical Properties:
MW: 99.0
BP: 182°F
Sol: 0.9%
Fl.P: 56°F
IP: 11.05 eV
Sp.Gr: 1.24
VP: 64 mmHg
FRZ: -32°F
UEL: 16%
LEL: 6.2%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers & caustics; chemically-active metals such as magnesium or aluminum powder, sodium & potassium; liquid ammonia [**Note:** Decomposes to vinyl chloride & HCl above 1112°F.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Abs, Con
SY: Irrit eyes, corn opac; CNS depres; nau, vomit; derm; liver, kidney, CVS damage; [carc]
TO: Eyes, skin, kidneys, liver, CNS, CVS [in animals: forestomach, mammary gland & circulatory sys cancer]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Vinyl chloride	Formula: CH_2=CHCl	CAS#: 75-01-4	RTECS#: KU9625000	IDLH: Ca [N.D.]
Conversion: 1 ppm = 2.56 mg/m^3	**DOT:** 1086 116P (inhibited)			

Synonyms/Trade Names: Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

Exposure Limits:	Measurement Methods (see Table 1):
NIOSH REL: Ca See Appendix A **OSHA PEL:** [1910.1017] TWA 1 ppm C 5 ppm [15-minute]	**NIOSH** 1007 **OSHA** 4, 75

Physical Description: Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [**Note:** Shipped as a liquefied compressed gas.]

V

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 62.5 **BP:** 7°F **Sol(77°F):** 0.1% **Fl.P:** NA (Gas) **IP:** 9.99 eV **RGasD:** 2.21 **VP:** 3.3 atm **FRZ:** -256°F **UEL:** 33.0% **LEL:** 3.6% Flammable Gas	**Skin:** Frostbite **Eyes:** Frostbite **Wash skin:** N.R. **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Frostbite wash	**NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFS/ScbaE **See Appendix E** (page 351)

Incompatibilities and Reactivities: Copper, oxidizers, aluminum, peroxides, iron, steel [**Note:** Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Con (liquid) **SY:** Lass; abdom pain, GI bleeding; enlarged liver; pallor or cyan of extremities; liquid: frostbite; [carc] **TO:** Liver, CNS, blood, resp sys, lymphatic sys [liver cancer]	**Eye:** Frostbite **Skin:** Frostbite **Breath:** Resp support

P **Propylene dichloride**	**Formula:** $CH_3CHClCH_2Cl$	**CAS#:** 78-87-5	**RTECS#:** TX9625000	**IDLH:** Ca [400 ppm]
Conversion: 1 ppm = 4.62 mg/m^3	**DOT:** 1279 130			

Synonyms/Trade Names: Dichloro-1,2-propane; 1,2-Dichloropropane

Exposure Limits:	**Measurement Methods (see Table 1):**
NIOSH REL: Ca See Appendix A **OSHA PEL†:** TWA 75 ppm (350 mg/m^3)	**NIOSH** 1013 **OSHA** 7
Physical Description: Colorless liquid with a chloroform-like odor. [pesticide]	

Chemical & Physical Properties:	**Personal Protection/Sanitation (see Table 2):**	**Respirator Recommendations (see Tables 3 and 4):**
MW: 113.0 **BP:** 206°F **Sol:** 0.3% **Fl.P:** 60°F **IP:** 10.87 eV **Sp.Gr:** 1.16 **VP:** 40 mmHg **FRZ:** -149°F **UEL:** 14.5% **LEL:** 3.4% Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Eyewash Quick drench	**NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong acids, active metals

Exposure Routes, Symptoms, Target Organs (see Table 5):	**First Aid (see Table 6):**
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, resp sys; drow, dizz; liver, kidney damage; in animals: CNS depres; [carc] **TO:** Eyes, skin, resp sys, liver, kidneys, CNS [in animals: liver & mammary gland tumors]	**Eye:** Irr immed **Skin:** Soap wash prompt **Breath:** Resp support **Swallow:** Medical attention immed

1,1-Dichloroethane	Formula: $CHCl_2CH_3$	CAS#: 75-34-3	RTECS#: KI0175000	IDLH: 3000 ppm
Conversion: 1 ppm = 4.05 mg/m^3	DOT: 2362 130			

Synonyms/Trade Names: Asymmetrical dichloroethane; Ethylidene chloride; 1,1-Ethylidene dichloride

Exposure Limits:
NIOSH REL: TWA 100 ppm (400 mg/m^3)
See Appendix C (Chloroethanes)
OSHA PEL: TWA 100 ppm (400 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless, oily liquid with a chloroform-like odor.

Chemical & Physical Properties:
MW: 99.0
BP: 135°F
Sol: 0.6%
Fl.P: 2°F
IP: 11.06 eV
Sp.Gr: 1.18
VP: 182 mmHg
FRZ: -143°F
UEL: 11.4%
LEL: 5.4%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
1000 ppm: Sa
2500 ppm: Sa:Cf
3000 ppm: ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong caustics

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit skin; CNS depres; liver, kidney, lung damage
TO: Skin, liver, kidneys, lungs, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap flush prompt
Breath: Resp support
Swallow: Medical attention immed

1,2-Dichloroethylene	Formula: ClCH=CHCl	CAS#: 540-59-0	RTECS#: KV9360000	IDLH: 1000 ppm
Conversion: 1 ppm = 3.97 mg/m^3	DOT: 1150 130P			

Synonyms/Trade Names: Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

Exposure Limits:
NIOSH REL: TWA 200 ppm (790 mg/m^3)
OSHA PEL: TWA 200 ppm (790 mg/m^3)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 7

Physical Description: Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

Chemical & Physical Properties:
MW: 97.0
BP: 118-140°F
Sol: 0.4%
Fl.P: 36-39°F
IP: 9.65 eV
Sp.Gr(77°F): 1.27
VP: 180-265 mmHg
FRZ: -57 to -115°F
UEL: 12.8%
LEL: 5.6%
Class IB Flammable Liquid

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet (flamm)
Change: N.R.

Respirator Recommendations (see Tables 3 and 4):
NIOSH/OSHA
2000 ppm: Sa:Cf£/PaprOv£/CcrFOv/GmFOv/ScbaF/SaF
§: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers, strong alkalis, potassium hydroxide, copper [**Note:** Usually contains inhibitors to prevent polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Ing, Con
SY: Irrit eyes, resp sys, CNS depres
TO: Eyes, resp sys, CNS

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

Tetrachloroethylene	**Formula:** $Cl_2C=CCl_2$	**CAS#:** 127-18-4	**RTECS#:** KX3850000	**IDLH:** Ca [150 ppm]
Conversion: 1 ppm = 6.78 mg/m^3	**DOT:** 1897 160			

Synonyms/Trade Names: Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

Exposure Limits:
NIOSH REL: Ca
Minimize workplace exposure concentrations.
See Appendix A
OSHA PEL†: TWA 100 ppm
C 200 ppm
300 ppm (5-minute maximum peak in any 3-hours)

Measurement Methods (see Table 1):
NIOSH 1003
OSHA 1001

Physical Description: Colorless liquid with a mild, chloroform-like odor.

Chemical & Physical Properties:
MW: 165.8
BP: 250°F
Sol: 0.02%
Fl.P: NA
IP: 9.32 eV
Sp.Gr: 1.62
VP: 14 mmHg
FRZ: -2°F
UEL: NA
LEL: NA
Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Personal Protection/Sanitation (see Table 2):
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contam
Remove: When wet or contam
Change: N.R.
Provide: Eyewash
Quick drench

Respirator Recommendations (see Tables 3 and 4):
NIOSH
¥: ScbaF:Pd,Pp/SaF:Pd,Pp:AScba
Escape: GmFOv/ScbaE

Incompatibilities and Reactivities: Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Exposure Routes, Symptoms, Target Organs (see Table 5):
ER: Inh, Abs, Ing, Con
SY: Irrit eyes, skin, nose, throat, resp sys; nau; flush face, neck; dizz, inco; head, drow; skin eryt; liver damage; [carc]
TO: Eyes, skin, resp sys, liver, kidneys, CNS [in animals: liver tumors]

First Aid (see Table 6):
Eye: Irr immed
Skin: Soap wash prompt
Breath: Resp support
Swallow: Medical attention immed

B	Benzene	Formula: C_6H_6	CAS#: 71-43-2	RTECS#: CY1400000	IDLH: Ca [500 ppm]
	Conversion: 1 ppm = 3.19 mg/m^3	**DOT:** 1114 130			

Synonyms/Trade Names: Benzol, Phenyl hydride

Exposure Limits:		Measurement Methods (see Table 1):
NIOSH REL: Ca TWA 0.1 ppm ST 1 ppm See Appendix A	**OSHA PEL:** [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F	**NIOSH** 1500, 1501, 3700, 3800 **OSHA** 12, 1005

Physical Description: Colorless to light-yellow liquid with an aromatic odor. [**Note:** A solid below 42°F.]

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 78.1 **BP:** 176°F **Sol:** 0.07% **Fl.P:** 12°F **IP:** 9.24 eV **Sp.Gr:** 0.88 **VP:** 75 mmHg **FRZ:** 42°F **UEL:** 7.8% **LEL:** 1.2% Class IB Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Eyewash Quick drench	**NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE **See Appendix E** (page 351)

Incompatibilities and Reactivities: Strong oxidizers, many fluorides & perchlorates, nitric acid

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, resp sys; dizz; head, nau, staggered gait; anor, lass; derm; bone marrow depres; [carc] **TO:** Eyes, skin, resp sys, blood, CNS, bone marrow [leukemia]	**Eye:** Irr immed **Skin:** Soap wash immed **Breath:** Resp support **Swallow:** Medical attention immed

Vinylidene chloride	Formula: $CH_2=CCl_2$	CAS#: 75-35-4	RTECS#: KV9275000	IDLH: Ca [N.D.]
Conversion:	DOT: 1303 130P (inhibited)			

Synonyms/Trade Names: 1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride

Exposure Limits:	Measurement Methods (see Table 1):
NIOSH REL: Ca See Appendix A **OSHA PEL†:** none	**NIOSH** 1015 **OSHA** 19

Physical Description: Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor.

Chemical & Physical Properties:	Personal Protection/Sanitation (see Table 2):	Respirator Recommendations (see Tables 3 and 4):
MW: 96.9 **BP:** 89°F **Sol:** 0.04% **Fl.P:** -2°F **IP:** 10.00 eV **Sp.Gr:** 1.21 **VP:** 500 mmHg **FRZ:** -189°F **UEL:** 15.5% **LEL:** 6.5% Class IA Flammable Liquid	**Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Eyewash Quick drench	**NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE

Incompatibilities and Reactivities: Aluminum, sunlight, air, copper, heat
[**Note:** Polymerization may occur if exposed to oxidizers, chlorosulfonic acid, nitric acid, or oleum. Inhibitors such as the monomethyl ether of hydroquinone are added to prevent polymerization.]

Exposure Routes, Symptoms, Target Organs (see Table 5):	First Aid (see Table 6):
ER: Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, throat; dizz, head, nau, dysp; liver, kidney dist; pneu; [carc] **TO:** Eyes, skin, resp sys, CNS, liver, kidneys [in animals: liver & kidney tumors]	**Eye:** Irr immed **Skin:** Soap flush immed **Breath:** Resp support **Swallow:** Medical attention immed

Dioxane	**Formula:** $C_4H_8O_2$	**CAS#:** 123-91-1	**RTECS#:** JG8225000	**IDLH:** Ca [500 ppm]
Conversion: 1 ppm = 3.60 mg/m^3	**DOT:** 1165 127			
Synonyms/Trade Names: Diethylene dioxide; Diethylene ether; Dioxan; p-Dioxane; 1,4-Dioxane				
Exposure Limits: **NIOSH REL:** Ca C 1 ppm (3.6 mg/m^3) [30-minute] See Appendix A **OSHA PEL†:** TWA 100 ppm (360 mg/m^3) [skin]			**Measurement Methods (see Table 1):** **NIOSH** 1602 **OSHA** 7	
Physical Description: Colorless liquid or solid (below 53°F) with a mild, ether-like odor.				
Chemical & Physical Properties: **MW:** 88.1 **BP:** 214°F **Sol:** Miscible **Fl.P:** 55°F **IP:** 9.13 eV **Sp.Gr:** 1.03 **VP:** 29 mmHg **FRZ:** 53°F **UEL:** 22% **LEL:** 2.0% Class IB Flammable Liquid	**Personal Protection/Sanitation (see Table 2):** **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contam **Remove:** When wet (flamm) **Change:** N.R. **Provide:** Eyewash Quick drench		**Respirator Recommendations (see Tables 3 and 4):** **NIOSH** **¥:** ScbaF:Pd,Pp/SaF:Pd,Pp:AScba **Escape:** GmFOv/ScbaE	
Incompatibilities and Reactivities: Strong oxidizers, decaborane, triethynyl aluminum				
Exposure Routes, Symptoms, Target Organs (see Table 5): **ER:** Inh, Abs, Ing, Con **SY:** Irrit eyes, skin, nose, throat; drow, head; nau, vomit; liver damage; kidney failure; [carc] **TO:** Eyes, skin, resp sys, liver, kidneys [in animals: lung, liver & nasal cavity tumors]			**First Aid (see Table 6):** **Eye:** Irr immed **Skin:** Water wash prompt **Breath:** Resp support **Swallow:** Medical attention immed	