

XI. APPENDIX III - MATERIAL SAFETY DATA SHEET

General instructions for preparing a Material Safety Data Sheet (MSDS) are presented in this chapter. The examples used in the text are for illustrative purposes and are not intended to apply to any specific compound or product. Applicable information about a specific product or material shall be supplied in the appropriate block of the MSDS.

The product designation is inserted in the block in the upper left corner of the first page to facilitate filing and retrieval. Print in upper case letters as large as possible. It should be printed to read upright with the sheet turned sideways. The product designation is that name or code designation which appears on the label, or by which the product is sold or known by employees. The relative numerical hazard ratings and key statements are those determined by the guidelines in Chapter V, Part B, of the NIOSH publication, An Identification System for Occupationally Hazardous Materials. The company identification may be printed in the upper right corner if desired.

(a) Section I. Product Identification

The manufacturer's name, address, and regular and emergency telephone numbers (including area code) are inserted in the appropriate blocks of Section I. The company listed should be a source of detailed backup information on the hazards of the material(s) covered by the MSDS. The listing of suppliers or wholesale distributors is discouraged. The trade name should be the product designation or common name associated with the material. The synonyms are those commonly used for the product, especially formal chemical nomenclature. Every known chemical designation or

competitor's trade name need not be listed.

(b) Section II. Hazardous Ingredients

The "materials" listed in Section II shall be those substances which are part of the hazardous product covered by the MSDS and individually meet any of the criteria defining a hazardous material. Thus, one component of a multicomponent product might be listed because of its toxicity, another component because of its flammability, while a third component could be included both for its toxicity and its reactivity. Note that a MSDS for a single component product must have the name of the material repeated in this section to avoid giving the impression that there are no hazardous ingredients.

Chemical substances should be listed according to their complete name derived from a recognized system of nomenclature. Where possible, avoid using common names and general class names such as "aromatic amine," "safety solvent," or "aliphatic hydrocarbon" when the specific name is known.

The "%" may be the approximate percentage by weight or volume (indicate basis) which each hazardous ingredient of the mixture bears to the whole mixture. This may be indicated as a range or maximum amount, ie, "10-40% vol" or "10% max wt" to avoid disclosure of trade secrets.

Toxic hazard data shall be stated in terms of concentration, mode of exposure or test, and animal used, ie, "100 ppm LC50 rat," "25 mg/kg LD50-skin-rabbit," "75 ppm LC man," or "permissible exposure from 29 CFR 1910.1000," or, if not available, from other sources of publications such as the American Conference of Governmental Industrial Hygienists or the American National Standards Institute Inc. Flammable or reactive data

could be flash point, shock sensitivity, or other brief data indicating nature of the hazard.

(c) Section III. Physical Data

The data in Section III should be for the total mixture and should include the boiling point and melting point in degrees Fahrenheit (Celsius in parentheses); vapor pressure, in conventional millimeters of mercury (mm Hg); vapor density of gas or vapor (air = 1); solubility in water, in parts/hundred parts of water by weight; specific gravity (water = 1); percent volatiles (indicated if by weight or volume) at 70 degrees Fahrenheit (21.1 degrees Celsius); evaporation rate for liquids or sublimable solids, relative to butyl acetate; and appearance and odor. These data are useful for the control of toxic substances. Boiling point, vapor density, percent volatiles, vapor pressure, and evaporation are useful for designing proper ventilation equipment. This information is also useful for design and deployment of adequate fire and spill containment equipment. The appearance and odor may facilitate identification of substances stored in improperly marked containers, or when spilled.

(d) Section IV. Fire and Explosion Data

Section IV should contain complete fire and explosion data for the product, including flash point and autoignition temperature in degrees Fahrenheit (Celsius in parentheses); flammable limits, in percent by volume in air; suitable extinguishing media or materials; special firefighting procedures; and unusual fire and explosion hazard information. If the product presents no fire hazard, insert "NO FIRE HAZARD" on the line labeled "Extinguishing Media."

(e) Section V. Health Hazard Information

The "Health Hazard Data" should be a combined estimate of the hazard of the total product. This can be expressed as a time-weighted average (TWA) concentration, as a permissible exposure, or by some other indication of an acceptable limit. Other data are acceptable, such as lowest LD50 if multiple components are involved.

Under "Routes of Exposure," comments in each category should reflect the potential hazard from absorption by the route in question. Comments should indicate the severity of the effect and the basis for the statement if possible. The basis might be animal studies, analogy with similar products, or human experiences. Comments such as "yes" or "possible" are not helpful. Typical comments might be:

Skin Contact--single short contact, no adverse effects likely; prolonged or repeated contact, irritation, and cracking. Readily absorbed through the skin with severe systemic effects.

Eye Contact--some pain and mild transient irritation; no corneal scarring.

"Emergency and First Aid Procedures" should be written in lay language and should primarily represent first aid treatment that could be provided by paramedical personnel or individuals trained in first aid.

Information in the "Notes to Physician" section should include any special medical information which would be of assistance to an attending physician including required or recommended preplacement and periodic medical examinations, diagnostic procedures, and medical management of overexposed workers.

(f) Section VI. Reactivity Data

The comments in Section VI relate to safe storage and handling of hazardous, unstable substances. It is particularly important to highlight instability or incompatibility to common substances or circumstances such as water, direct sunlight, steel or copper piping, acids, alkalies, etc. "Hazardous Decomposition Products" shall include those products released under fire conditions. It must also include dangerous products produced by aging, such as peroxides in the case of some ethers. Where applicable, shelf life should also be indicated.

(g) Section VII. Spill or Leak Procedures

Detailed procedures for cleanup and disposal should be listed with emphasis on precautions to be taken to protect workers assigned to cleanup detail. Specific neutralizing chemicals or procedures should be described in detail. Disposal methods should be explicit including proper labeling of containers holding residues and ultimate disposal methods such as "sanitary landfill," or "incineration." Warnings such as "comply with local, state, and federal anti-pollution ordinances" are proper but not sufficient. Specific procedures should be identified.

(h) Section VIII. Special Protection Information

Section VIII requires specific information. Statements such as "Yes," "No," or "If Necessary" are not informative. Ventilation requirements should be specific as to type and preferred methods. Specify respirators as to type and NIOSH or US Bureau of Mines approval class, ie, "Supplied air," "Organic vapor canister," "Suitable for dusts not more toxic than lead," etc. Protective equipment must be specified as to type and materials of construction.

(i) Section IX. Special Precautions

"Precautionary Statements" shall consist of the label statements selected for use on the container or placard. Additional information on any aspect of safety or health not covered in other sections should be inserted in Section IX. The lower block can contain references to published guides or in-house procedures for handling and storage. Department of Transportation markings and classifications and other freight, handling, or storage requirements and environmental controls can be noted.

(j) Signature and Filing

Finally, the name and address of the responsible person who completed the MSDS and the date of completion are entered. This will facilitate correction of errors and identify a source of additional information.

The MSDS shall be filed in a location readily accessible to workers potentially exposed to the hazardous material. The MSDS can be used as a training aid and basis for discussion during safety meetings and training of new employees. It should assist management by directing attention to the need for specific control engineering, work practices, and protective measures to ensure safe handling and use of the material. It will aid the safety and health staff in planning a safe and healthful work environment and suggesting appropriate emergency procedures and sources of help in the event of harmful exposure of employees.



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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION		
MANUFACTURER'S NAME	REGULAR TELEPHONE NO.	
	EMERGENCY TELEPHONE NO.	
ADDRESS		
TRADE NAME		
SYNONYMS		
II HAZARDOUS INGREDIENTS		
MATERIAL OR COMPONENT	%	HAZARD DATA
III PHYSICAL DATA		
BOILING POINT, 760 MM HG		MELTING POINT
SPECIFIC GRAVITY (H₂O=1)		VAPOR PRESSURE
VAPOR DENSITY (AIR=1)		SOLUBILITY IN H₂O, % BY WT
% VOLATILES BY VOL		EVAPORATION RATE (BUTYL ACETATE=1)
APPEARANCE AND ODOR		

IV FIRE AND EXPLOSION DATA				
FLASH POINT (TEST METHOD)		AUTOIGNITION TEMPERATURE		
FLAMMABLE LIMITS IN AIR, % BY VOL.	LOWER		UPPER	
EXTINGUISHING MEDIA				
SPECIAL FIRE FIGHTING PROCEDURES				
UNUSUAL FIRE AND EXPLOSION HAZARD				
V HEALTH HAZARD INFORMATION				
HEALTH HAZARD DATA				
ROUTES OF EXPOSURE				
INHALATION _____				
SKIN CONTACT _____				
SKIN ABSORPTION _____				
EYE CONTACT _____				
INGESTION _____				
EFFECTS OF OVEREXPOSURE				
ACUTE OVEREXPOSURE _____				
CHRONIC OVEREXPOSURE _____				
EMERGENCY AND FIRST AID PROCEDURES				
EYES _____				
SKIN _____				
INHALATION: _____				
INGESTION _____				
NOTES TO PHYSICIAN				

VI REACTIVITY DATA	
CONDITIONS CONTRIBUTING TO INSTABILITY	
INCOMPATIBILITY	
HAZARDOUS DECOMPOSITION PRODUCTS	
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION	
VII SPILL OR LEAK PROCEDURES	
STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	
NEUTRALIZING CHEMICALS	
WASTE DISPOSAL METHOD	
VIII SPECIAL PROTECTION INFORMATION	
VENTILATION REQUIREMENTS	
SPECIFIC PERSONAL PROTECTIVE EQUIPMENT	
RESPIRATORY (SPECIFY IN DETAIL)	
EYE	
GLOVES	
OTHER CLOTHING AND EQUIPMENT	

IX SPECIAL PRECAUTIONS

**PRECAUTIONARY
STATEMENTS**

**OTHER HANDLING AND
STORAGE REQUIREMENTS**

PREPARED BY _____

ADDRESS _____

DATE _____

XII. TABLES

TABLE XII-1

PHYSICAL PROPERTIES OF TETRACHLOROETHYLENE

Chemical Abstract's serial number	000127184
Synonyms	Tetrachloroethylene Perchloroethylene Tetrachloroethene Ethylene tetrachloride
Molecular formula	$CCl_2 = CCl_2$
Molecular weight	165.84
Boiling point	121.2 C (250 F) (760 mm Hg)
Melting point	-22.35 C (-8 F)
Vapor density	5.76 (air = 1)
Specific gravity	1.623 (20 C), (water = 1.000 at 4 C)
Solubility	0.015g/100g water at 25 C; soluble in ethyl ether, ethyl alcohol, benzene chloroform
Density of saturated air	1.12 (air = 1)
Concentration of saturated air	2.43% by volume at 25 C
Flammable (explosive) limits	None
Flash point	"
Autoignition temperature	"

TABLE XII-1 (CONTINUED)

PHYSICAL PROPERTIES OF TETRACHLOROETHYLENE

Vapor pressure	Temp F	Temp C	mm Hg
	50	10	8
	68	20	14
	77	25	19
	86	30	25
	104	40	41

Conversion factors, 25 C
760 mm Hg

1 mg/liter = 1 g/cu m = 147.4 ppm
1 ppm = 6.78 mg/cu m = 6.78 µg/liter

Adapted from references 5,6,7

TABLE XII-2

EXPOSURE DATA FOR PARTICIPANTS IN A STUDY OF NEUROLOGICAL
AND BEHAVIORAL EFFECTS OF TETRACHLOROETHYLENE

POSITION	No.	AVERAGE TWA CONCENTRATION		AVERAGE PEAK CONCENTRATION		AVERAGE BREATH SAMPLE CONCENTRATION	
		ppm		ppm		ppm	
		MEAN	SD	MEAN	SD	MEAN	SD
Machine Operator	5	37.2	+ 24.96	214.90	+ 179.44	20.47	+ 18.21
Presser	2	11.43	+ 6.82	51.85	+ 64.56	4.48	+ .39
Counter	5	1.32	+ .97	2.61	+ 1.87	.95	+ .62
Miscellaneous	7	3.03	+ 2.09	27.45	+ 46.02	2.04	+ 2.29

Adapted from Tuttle et al [50]

TABLE XII-3
BREATH CONCENTRATION OF TETRACHLOROETHYLENE
AFTER EXPOSURE FOR 7.5 HOURS AT 100 ppm

Four Male Subjects Week 4					
	<u>1</u>	<u>2</u>	<u>DAY</u> <u>3</u>	<u>4</u>	<u>5</u>
	Mean and standard deviations in ppm				
<u>Preexposure</u>	2.90 <u>+0.94</u>				
<u>Postexposure</u>					
1 minute	36.43 <u>+4.01</u>	35.24 <u>+1.52</u>	37.18 <u>+4.17</u>	37.55 <u>+2.92</u>	38.77 <u>+2.16</u>
10 minutes	30.10 <u>+3.36</u>	29.43 <u>+1.41</u>	32.33 <u>+1.65</u>	30.52 <u>+3.35</u>	32.55 <u>+2.61</u>
20 minutes	27.79 <u>+2.90</u>	23.92 <u>+2.42</u>	29.31 <u>+2.66</u>	27.10 <u>+3.92</u>	29.59 <u>+2.63</u>
30 minutes	22.90 <u>+0.71</u>	23.33 <u>+2.31</u>	27.05 <u>+1.67</u>	25.67 <u>+2.19</u>	26.12 <u>+2.52</u>
1 hour	17.48 <u>+0.74</u>	19.49 <u>+2.07</u>	22.42 <u>+1.54</u>	21.48 <u>+0.66</u>	24.49 <u>+2.43</u>
3 hours	10.26 <u>+2.64</u>	11.95 <u>+2.37</u>	11.10 <u>+3.57</u>	10.56 <u>+0.71</u>	12.92 <u>+7.15</u>
16-1/2 hours	5.76 <u>+0.45</u>	6.37 <u>+0.27</u>	7.76 <u>+0.75</u>	7.96 <u>+0.76</u>	9.76 <u>+1.00</u>

Adapted from Stewart et al [41]

TABLE XII-4

24-HOUR MEDIAN LETHAL AND EFFECTIVE
DOSES OF TETRACHLOROETHYLENE
(mg/kg)

Species	LD50	BSP Retention	SGPT	PSP Retention
Mouse	2.9	2.9	2.9	Not Determined
Dog	2.1	Not Determined	0.74	1.4

Adapted from Klaassen and Plaa [79,80]

TABLE XII-5

SUMMARY OF EFFECTS OF TETRACHLOROETHYLENE

Exposure Concentration and Reference	Exposure Variables	Effects
<u>Human Data</u>		
20-70 ppm [70]	Intermittent daily exposures	4-20 mg/liter trichloroethanol and 4-35 mg/liter trichloroacetic acid in urine
75-80 ppm [39]	1-4 minutes	Very slight eye irritation and mild burning sensation
83-130 ppm 106 ppm average [55]	4 hours	Slight eye irritation
100 ppm [41]	7-1/2 hours/day	EEG indicated preliminary signs of narcosis in most subjects
100-120 ppm [38]	4-6 minutes	Dryness and irritation of soft palate
150 ppm [69]	7-1/2 hours/day	Impaired coordination
10-400 ppm [69]	8 hours/day, 5 days/week	Urine concentrations of trichloroacetic acid and trichloroethanol proportional to exposure concentrations up to 100 ppm
216 ppm [38]	2 hours	Responses similar to those at 280 ppm, but less severe
50-250 ppm [56]	Drycleaning plant	Central nervous symptom disorders in 3 workers
50-250 ppm [56]	Drycleaning plant 4 months	Urinary trichloroacetic acid 20, 23 and 25 mg/liter loss of appetite

TABLE XII-5 (CONTINUED)

SUMMARY OF EFFECTS OF TETRACHLOROETHYLENE

Exposure Concentration and Reference	Exposure Variables	Effects
<u>Human Data</u>		
50-250 ppm [56] (continued)	Drycleaning plant 5 months	Respiratory distress, coughing, vomiting, cardiac failure and death with hepatic necrosis and fatty degeneration of the heart
210-244 ppm [39]	30 minutes	Slight lightheadedness, increased effort to maintain normal Romberg test
280 ppm [38]	2 hours	Burning eyes, congestion of frontal sinus, lightheadedness, mental effort required for motor coordination
232-385 ppm [51]	8 hours twice weekly	Liver injury in 7 degreaser operators
200-400 ppm [70]	Intermittent daily exposures	21-100 mg/liter trichloroethanol and 32-97 mg/liter trichloroacetic acid in urine
25-1,470 ppm average 393 ppm 70-425 ppm of Stoddard solvent [60]	3-1/2 hours	Marked eye irritation, light headedness, dizziness, unconsciousness, rapid recovery, evidence of liver injury 9 days later
475-680 ppm average 500 ppm [37]	1/2 hour	Increased salivation, metallic taste, slight eye irritation, increased perspiration of the hands, tightness of frontal sinuses

TABLE XII-5 (CONTINUED)

SUMMARY OF EFFECTS OF TETRACHLOROETHYLENE

Exposure Concentration and Reference	Exposure Variables	Effects
<u>Human Data</u>		
513-690 ppm [38]	10 minutes	Eye and respiratory tract irritation, dizziness, tightness and numbness around mouth, loss of some inhibitions, increased mental effort required to maintain motor ability
930-1,185 ppm [38]	1-2 minutes	Markedly irritating to eyes and upper respiratory tract
934-1,140 ppm average 1,000 ppm [37]	95 minutes	Lassitude, stinging sensation in eyes, tightness of the frontal sinuses, definite exhilaration after 45 minutes
2,000 ppm [37]	7-1/2 minutes	Light narcosis
<u>Animal Data</u>		
15 ppm [73]	4 hours/day 5 months	Rats, EEG changes and protoplasmal swelling of cerebral cortical cells, some vacuolated cells and signs of karyolysis
70 ppm [37]	8 hours/day 5 days/week 150 exposures	Rats, no pathological findings
73 and 147 ppm [73]	4 hours/day 4 weeks	Rats, EEG and electro-myogram changes: decreased acetylcholinesterase activity

TABLE XII-5 (CONTINUED)

SUMMARY OF EFFECTS OF TETRACHLOROETHYLENE

Exposure Concentration and Reference	Exposure Variables	Effects
<u>Animal Data</u>		
100 ppm [38]	7 hours/day, 5 days/week 132 exposures	Guinea pigs, increased liver weights in females
200 ppm [38]	7 hours/day, 5 days/week	Guinea pigs, increased liver weights with some fatty degeneration in both males and females
200 ppm [75]	4 hours single exposure	Mice, moderate liver fatty infiltration 1 day after exposure but not 3 days after
230 ppm [37]	8 hours/day, 5 days/week 150 exposures	Rats, similar but less severe pathological findings as with 470 ppm
300 ppm [84]	7 hours/day, days 6-15 of gestation	Rats, decreased maternal weight gains, increased fetal resorptions
300 ppm [84]	7 hours/day, days 6-15 of gestation	Mice, maternal liver weights increased relative to body weight; increased incidences of fetal subcutaneous edema, delayed ossification of skull bones, and split sternebrae
100-400 ppm [38]	7 hours/day, 5 days/week 6 months	Rats, rabbits, monkeys, no abnormal growth, organ function or histopathologic findings

TABLE XII-5 (CONTINUED)
SUMMARY OF EFFECTS OF TETRACHLOROETHYLENE

Exposure Concentration and Reference	Exposure Variables	Effects
<u>Animal Data</u>		
400 ppm [38]	7 hours/day, 5 days/week 169 exposures	Guinea pigs, more pronounced liver changes than at 200 ppm, slight cirrhosis was observed
470 ppm [37]	8 hours/day, 5 days/week 150 exposures	Rats, congested livers, no evidence of fatty degeneration or necrosis: evidence of kidney injury
1,000 ppm [88]	6 hours 3 exposures	Rats, no increase in liver lipid
3,000 ppm [34,35]	4 hours	Cats, no anesthesia
4,000-15,000 ppm [93]	2-6 hours single exposures with and without ethanol pretreatment	Rats, ethanol did not potentiate effects of tetrachloroethylene
5,000 and 10,000 ppm [83]	10 minutes	Dogs, tetrachloroethylene did not sensitize the hearts to epinephrine
9,000 ppm [31]	5-6 hours	Dogs, anesthesia
14,600 ppm [34,35]	1-2 hours	Cats, anesthesia
2,750-9,000 ppm [37]	Single exposure	Rats, no deaths
19,000 ppm [37]	30-60 minutes	Rats, congested livers with granular swelling, some deaths

TABLE XII-6

CONCENTRATIONS OF TETRACHLOROETHYLENE IN COMMERCIAL DRYCLEANING PLANTS

Establishment No.	Date	Mean Concentration, ppm	Concentration Range, ppm	Sampling Time, Minutes
10	9-15-71	270	32-808	490
6	12-18-71	239	55-514	242
10	12-15-71	166	19-990	493
15	9-13-71	120	32-689	328
11	12-20-71	107	19-428	519
10	7-28-71	106	9-514	482
12	9-8-71	103	24-514	402
7	12-16-71	76	13-416	501
3	7-20-71	72	9-440	353
1	9-17-71	64	9-689	444
3	7-12-71	54	9-428	485
1	6-24-71	54	19-514	321
22	7-30-71	54	5-514	484
9	7-27-71	50	13-122	554
4	7-21-71	47	9-416	417
9	8-16-71	46	13-150	441
4	7-13-71	44	0-404	482
2	7-15-71	36	9-188	400
2	7-1-71	31	9-141	239

Adapted from Kerr [98]

TABLE XII-7

TETRACHLOROETHYLENE CONCENTRATIONS AROUND COIN-OPERATED DRYCLEANERS

Establishment No.	Date	Concentrations, ppm		
		Composite Sample	Maintenance Area	Customer Area
23	12-22-71	264	378	121
23	8-24-71	155	260	82
18	9-7-71	139	178	40
18	8-23-71	126	195	35
5	9-10-71	111	155	33
5	9-6-71	110	195	39
18	8-10-71	104	176	31
21	9-9-71	97	153	51
21	9-14-71	93	150	34
21	8-2-71	87	93	39
5	8-31-71	87	144	28

Adapted from Kerr [98]

TABLE XII-8

PROPORTION OF SAMPLING TIME DURING WHICH CONCENTRATIONS EXCEEDED
200 ppm, COMMERCIAL PLANTS

Establishment No.	Date	Proportion of Sampling Time >200 ppm	Mean Sample Concentration, ppm
10	9-15-71	89.2%	270
6	12-18-71	79.7%	239
10	12-15-71	44.8%	166
10	7-28-71	36.5%	106
15	9-13-71	32.9%	120
12	9-8-71	29.3%	103
3	7-20-71	22.1%	72
11	12-20-71	19.1%	107
1	9-17-71	16.4%	64
7	12-16-71	14.6%	76
22	7-30-71	13.6%	54
3	7-12-71	12.6%	54
4	7-21-71	11.8%	47
1	6-24-71	10.6%	54
4	7-13-71	9.7%	44

Adapted from Kerr [98]

TABLE XII-9

PROPORTION OF SAMPLING TIME DURING WHICH CONCENTRATIONS EXCEEDED
200 ppm, COIN-OPERATED MAINTENANCE AREAS

Establishment No.	Date	Proportion of Sampling Time >200 ppm	Mean Sample Concentration, ppm
23	12-22-71	70.5%	378
23	8-24-71	51.8%	260
18	8-23-71	47.2%	195
5	9-6-71	42.1%	195
18	8-10-71	40.7%	176
18	9-7-71	39.4%	178
21	9-14-71	33.5%	150
5	9-10-71	30.8%	155
5	8-31-71	28.5%	144
21	9-9-71	28.1%	153
21	8-2-71	6.5%	93

Adapted from Kerr [98]

TABLE XII-10

PROPORTION OF SAMPLING TIME DURING WHICH CONCENTRATIONS EXCEEDED
300 ppm, COMMERCIAL PLANTS

Establishment No.	Date	Proportion of Sampling Time >300 ppm	Mean Sample Concentration, ppm
10	9-15-71	39.2%	270
6	12-18-71	35.9%	239
10	12-15-71	20.5%	166
10	7-28-71	16.8%	106
15	9-13-71	13.4%	120
12	9-8-71	10.9%	103
1	9-17-71	6.5%	64
3	7-20-71	6.5%	72
11	12-20-71	5.6%	107
4	7-13-71	5.2%	44
7	12-16-71	4.7%	76

Adapted from Kerr [98]

TABLE XII-11

PROPORTION OF SAMPLING TIME DURING WHICH CONCENTRATIONS EXCEEDED
300 ppm, COIN-OPERATED MAINTENANCE AREAS

Establishment No.	Date	Proportion of Sampling Time >300 ppm	Mean Sample Concentration, ppm
23	12-22-71	58.9%	378
23	8-24-71	38.4%	260
18	8-23-71	26.9%	193
5	9-6-71	26.0%	195
18	8-10-71	23.9%	176
5	9-10-71	19.6%	155
18	9-7-71	19.1%	178
5	8-31-71	17.4%	144

Adapted from Kerr [98]

TABLE XII-12

CONCENTRATIONS OF TETRACHLOROETHYLENE AND TRICHLOROETHYLENE FOUND IN
DEGREASING OPERATIONS

Range of Concentration ppm	Ventilated Tanks		Nonventilated Tanks		Noncondensing Tanks*	
	No.	%	No.	%	No.	%
0 - 50	69	46.9	29	15.4	11	16.9
51 - 100	29	19.7	58	30.8	10	15.1
101 - 150	15	10.2	47	24.8	6	9.0
151 - 200	10	6.8	17	8.9	9	13.8
201 - 300	20	13.6	25	13.2	14	21.2
• 301 - 400	4	2.8	7	3.8	8	12.1
401 - 500	-	-	2	1.0	3	4.5
501 - 600	-	-	1	0.5	2	3.0
601 - 700	-	-	0	-	2	3.0
701 - 800	-	-	1	0.5	0	-
801 - 900	-	-	2	1.1	1	1.4

* Noncondensing tanks usually contain tetrachloroethylene
Adapted from Morse and Goldberg [99]

