

# Oklahoma State University

## Chemical Guide

By:

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Environmental Health and Safety

Date:

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# memorandum

To: Dr. E.J. Eisenbraun, Chairman, OSU Chemistry Dept. Safety Committee

cc: Greg Fox, Environmental Hazards Coordinator

From: Theron Becker, Hazardous Materials Inspector

Date: 4/13/98

Subject: Chemical Guide and Permeation Chart

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A few months ago Dr. Eisenbraun asked Greg Fox for information on which glove to use to protect against Dimethylmercury in light of a recent fatality from mercury exposure. Mr. Fox forwarded the question to Theron Becker. After looking in all available manufacturers' permeation tables and even calling and emailing some companies, Mr. Becker found the information for Dr. Eisenbraun.

As chairman of OSU's Chemistry Dept. Safety Committee, Dr. Eisenbraun asked Mr. Becker for copies of the manufacturer's charts for future reference. Since it was such an ordeal for Mr. Becker to find information among all the sources, he decided to condense the information into one table.

While Mr. Becker was doing this Mr. Fox asked him to make a table of chemicals and the four codes associated with them for use as a quick reference guide for Emory Mosely as he picks up chemicals around campus. The four codes to be included are: the National Fire Protection Association's (NFPA) 704 diamond numbers; the US Department of Transportation's (DOT) classification; the Resource, Conservation, and Recovery Act's (RCRA) waste codes; and OSU's category.

Mr. Becker decided to make one table for use as a permeation chart and a chemical quick reference guide. The following report describes how Mr. Becker made this chart and some of its uses.

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## **1.0 Executive summary**

Theron Becker created a chemical guide to solve two problems: ← The Oklahoma State University (OSU) Chemistry Department needed a chart to determine the best glove material for handling given chemicals. ↑ The OSU Safety Officers needed a quick reference guide for determining chemical classifications.

This guide contains the following information for several chemicals: NFPA 704 Fire, Health, and Reactivity numbers; US DOT classification; RCRA waste codes; OSU category; and permeation data on the following materials: Nitrile, 4-H / Silver Shield; Neoprene, Latex, TyChem™ 9400, and Saranex.

## **2.0 Introduction**

A few months ago Dr. Eisenbraun asked Greg Fox for information on which glove to use to protect against Dimethylmercury in light of a recent fatality from mercury exposure. Mr. Fox forwarded the question to Theron Becker. After looking in all available manufacturers' permeation tables and even calling and emailing some companies, Mr. Becker found the information for Dr. Eisenbraun.

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### **3.0 Objectives and expected benefits**

This project should produce a document that can be used by Safety Officers for chemical pick ups and for laboratory personnel for protective glove selection. It must be in a form that is printable and in an electronic form to be accessed by anyone.

### **4.0 Description of alternatives**

In the past, Safety Officers carry several permeation charts for glove selection and categorize the chemicals after pick up back at the office. The result of this is that instead of consulting the charts (which is time consuming), the officers use whatever glove they think will protect them. Also, all of the hazards associated with some chemicals are not known until after the pick up.

### **5.0 Solution proposal**

Theron Becker consulted several manufactures' permeation tables and condensed that information into one chart. This chart also includes the classifications from NFPA 704, DOT, RCRA, and OSU. This chart is in color and can be printed by the Safety Department for its use. It was also put on the Internet by the Training Coordinator and Web Master, Leslie Miller. The electronic format can be accessed and used by everyone.

### **6.0 Project description**

Mr. Becker found permeation data from the following sources:

- ↓ 4H ® Chemical Protection Guide, Nov '97
- ↓ American Conference of Governmental Industrial Hygienists Guidelines for the Selection of Chemical protective Clothing 3<sup>rd</sup> ed., Feb '87
- ↓ Ansell Edmont ® Chemical Resistance Guide 5<sup>th</sup> ed., '90
- ↓ Best ® Intermittent Chemical Exposure Guide for Best ® N-Dex Nitrile Glove, '94
- ↓ DuPont ® TyFax Data Service TyChem 9400, May '94
- ↓ Fisher Scientific Catalog, '95/'96
- ↓ TRI / Environmental Inc., Permeation Test Report J113T01, Sep '97

- ↓ <http://www.inform.umd.edu/CampusInfo/Departments/EnvirSafety/Is/gloves.html>, Oct '97
- ↓ <http://pp.okstate.edu/ehs/links/atsdr.htm>, Nov '97
- ↓ <http://www.safety4.com/guide.htm>, Nov '97

From these tables Mr. Becker entered the breakthrough time of the material while it is totally immersed at room temperature in minutes. If he found conflicting data, he entered the lowest number in the chart to be safe. Then he color coded the chart using the following convention: If the breakthrough time is less than 14.9 minutes, then the color is **red**. If the breakthrough is greater than 15 minutes and less than 179.9 minutes, then the color is **yellow**. If the breakthrough time is greater than 180 minutes, then the color is **green**.

After the permeation part of the chart was done, Mr. Becker consulted the following sources to find the four categories (NFPA 704, DO, RCRA, and OSU):

- Driver's Guide to Hazardous Materials, Am Trucking Assoc., '96
- Fire Protection Guide on Hazardous Materials 10<sup>th</sup> ed., '91
- Hazardous Materials 181, J.J. Keller & Assoc., '92
- Sorenson, Brenda; Senior Hazardous Materials Technician, OSU-EHS

Obviously, there will not be information on every chemical and every material, so Mr. Becker made due with what he had and left blanks for future inclusion.

### **6.1 Budget**

The chart took two weeks for Theron Becker to initially compile and will continue to take time to update. The time for Leslie Miller to post the chart on the Internet initially took a couple days, and will take small amounts of time with each revision.

The bulk of the cost will come from printing the document. This requires a color printer. The sign shop has a color ink-jet printer and will let the Safety Department use it if the

ink cartridges are replaced. Each cartridge costs about eight dollars. A rough estimate is about 20 copies before the four cartridges need to be replaced.

## **7.0 Conclusion**

This chart has been in use by the Safety Department for several weeks now and cuts the time down on looking up chemical properties. It does not take the place of a Chemical Dictionary or other such reference materials. The chemistry department keeps a printed copy in each chemical store room to determine glove suitability. Mr. Becker has been contacted by two other universities (including UC Davis) requesting permission to use this chart.

The OSU Chemical Guide seems to fulfill a small role in providing a safer environment for the students, faculty, and staff of Oklahoma State University.

## **8.0 Appendices**

### **8.1 Glossary**

NFPA - National Fire Protection Association

OSU - Oklahoma State University

RCRA - Resource, Conservation, and Recovery Act

US DOT - United States Department of Transportation

### **8.2 OSU Chemical Guide**

Chemical	NFPA 704				DOT Class	Waste Codes	Total Immersion PPE breakthrough time in minutes				Tychem (TM) 9400	Saranex
	Fire	Health	Reactivity	Other			Gloves					
							Nitrile	Film	Neoprene	Latex		
Acetaldehyde	4	2	2	N	3	U001, D001	4	>480	9	4	>480	
Acetic Acid	2	2	0	N	8	D002	3	53	360	21	172	>4000.2
Acetic Anhydride	2	2	1	N	8	D002		>480	210	3	>480	
Acetone	3	1	0		3	U002, F003, D001	3	1440	2.4	2.4	>480	33
Acetonitrile (Methyl Cyanide)	3	3	0	N	3	D001	3	1440	<10.8	<0.8	>480	>480
Acetophenone	2	1	0	N		U004	50	>480	50	60		
Acetoxyacetyl Chloride							30		130	13		
Acetyl Chloride	3	3	2	WR	3	U006, D001, D002, D003					160	37.2
Acrolein	3	3	3	N	6.1	P003, D001	4.2	>480			>480	
Acrylamide	2	3	2	N	6.1	U007	>240	>240	>240	>240	>480	
Acrylic Acid	2	3	2	N	8	U008, D001	75	210	67	80	79	>480
Acrylonitrile	3	4	2	N	3	U009, D001	3	>480	16	16	>480	22.8
Aldehyde					3	D001	4	>360				
Allyl Alcohol	3	3	1	N	6.1	P005	16	>480	20	19	>480	>480
Allylamine	3	3	1	N	6.1	D001		15		<1.3		
Allyl Chloride	3	3	1	N	3	D001		>480			0	
Ammonia	1	3	0	N	2.3	D002	>480	30	27		35	18
Ammonium Fluoride	0	3	0	N	6.1		>360	>240	>360	>360		
Ammonium Hydroxide	1	3	0	N	2.3	D002	240	30	180	90	107	
Amyl Acetate (Isoamyl Acetate)	3	1	0	N	3	D001	<5	>480	5.4	5.4	>480	
Amyl Alcohol	3	1	0	N	3	D001	24	>480	52	7.2		
Amyl Nitrile	2	2	0	Ox	3		175.8		46.8			
Aniline	2	3	0	N	6.1	U012	3	>1440	30	25	>480	>480
Antimony Tributrylate							>240		>240	>240		
Aqua Regia (Nitrohydrochloric Acid)					8	D002	>360		45	<5		
Benomyl						U271		>240				
Benzaldehyde	2	2	0	N	6		<5	>480	27	18		
Benzene	3	2	0	N	3	U019, D001, F005, D018	3	480	1.2	0.6	>480	10.2
Benzenesulfonic Acid								>240	>1200			
Benzethonium Chloride									>480	>480		
Benzonitrile (Phenyl Cyanide)	2	3	0	N	6.1					<0.6	>480	
Benzophenone Tetracarboxylic Dianhydride								>240				
Benzotrifluoride							>480	>480				
Benzotrifluoride							170	>480		50		
Benzoyl Chloride	2	3	2	WR	8				15		>480	
Benzyl Alcohol	1	2	0	N			>240	>480	>240	>240		
Benzyl Chloride (Chlorotoluene)	2	2	1	N	3	P028	15	>480			>480	26
Benzyl Cyanide	1	2	0	N				>240				
Benzyl Dimethylamine (Dimethylbenzylamine)	2	2	0	N	8			>240				
Biphenyl							>240		>240	>240		
Bisphenoldiglycidyl Ether								>480				
Bisphthalate							259.8		120	>360		
Boric Acid	0	0	0	N			>480		>480			
Bromine	0	3	0	Ox	8	D002					0	
Bromoacetic Acid								>240				
Bromoacetonitrile								>240		<0.6		
Bromoacetophenone							7	>240				
Bromobenzene	2	2	0	N	3	D001	13.3					
Bromoethanol										1.2		



Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Bromoethyl Acetate							35		33	33		
Bromoethylethyl Carbonate								>240				
Bromofluorobenzene											>480	
Bromofrom							11		11	16		
Bromopropanol									>480	1.2		
Bromopropionic Acid							120	>480	180	190		
Butadiene	4	2	2	N	2.1	D001	>240		46.8	<1.2	>480	
Butanediol Diglycidyl Ether								>240				
Butanol (Isobutanol)	3	1	0	N	3	D001, U031, F003	13	>480	10	1.2	>480	
Butoxyethanol (Butyl Cellosolve) (Butyl Glycol)							9	>240	90	45		>480
Butyl Glycol (Butoxyethanol) (Butyl Cellosolve)							9	>240	90	45		>480
Butoxypropanol							>240		>240	>240		
Butoxytriglycol							>240		>240	>240		
Butyl Acetate	3	1	0	N	3	D001	<5	>480	1.8	1.8		
Butyl Acrylate	2	2	2	N	3	D001	8	>480	20	20	51	
Butylamine	3	3	0	N	3	D001	19.8		12	1.2	>480	
Butyl Carbitol							>240		>240	>240		
Butyl Cellosolve (Butoxyethanol) (Butyl Glycol)	2	2	0	N		D001	9	>240	90	45		>480
Butyl Cellosolve Acetate							>240		>240	>240		
Butyl Chloride (Chlorobutane)	3	2	0	N	3	D001	12					
Butyl Dipropasol							>240		>240	>240		
Butylene Oxide (Epoxybutane)	3	2	1	N	3	D001			4.2			
Butyl Ether (Dibutyl Ether)	3	2	1	N	3	D001		>480			>480	
Butylfluazifop								>480				
Butyl Glycol								>240				
Butyl Hydroperoxide	4	1	4	Ox	N	D001, D003		>240				
Butyl Nitrite	3	1	3	N	3	D001, D003	97.8					
Butyl Phthalate (Dibutyl Phthalate)	1	0	0	N			30	>480	120	16.8	>480	
Butyl Toluene	2	1	0	N	6.1		11	>480	73.2	>240		
Butyraldehyde	3	2	2	N	3	D001		>480	25.2		>480	
Butyric Acid								120				
Butyrolactone	1	0	0	N				>480	18	60		
Carbitol Acetate							>240		>240	>240		
Carbon Disulfide	4	2	0	N	3	P022, D001, F005	1	1440	2	1	>480	
Carbon Tetrachloride	0	3	0	N	6.1	U211, D019	5	>480	4.8	3.6	>480	
Cellosolve (Ethoxyethanol)	2	2	0	N		D001, F005, U359	210	>480	45	25		
Cellosolve Acetate (Ethoxyethyl Acetate)	2	2	0	N		D001	<5	>480	25	10		
Chlorine	0	3	0	Ox	2.3		>240	>480	>480	>240	>480	>480
Chloroacetic Acid	1	3	0	N	6.1	D002					>480	60
Chloroacetone	2	3	2	N	6.1	D001		>240				
Chloroacetonitrile										<1.2		
Chloroaniline					6.1						325	
Chlorobenzene	3	2	0	N	3	U037, D021, D001, F002	<5	>480	7	<5	>480	
Chlorobenzotrichloride							>480			120		
Chlorobenzotrifluoride							320		50			
Chlorobenzyl Chloride							200			20		
Chlorobutadiene (Chlorophrene)	3	2	0	N		D001	3.6		3			
Chlorobutane (Butyl Chloride)	3	2	0	N	3	D001	12					

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Chloroethanol (Ethylene Chlorohydrin)	2	3	0	N	6.1	D001		>240	296.8		>480	
Chloroform	0	2	0	N	6.1	U044, D022	2.4	8	0.6	0.6	>480	<1
Chloromethyl Methyl Ether	3	4	3	WH		U046					300	
Chloronaphthalene	1	1	0	N		U047	174	>480		<3		
Chloronitropropane	2	0	3	N						1.3		
Chloroprene (Chlorobutadiene)	3	2	0	N		D001	3.6		3			
Chloropropanol												
Chloropropene	4	2	2	N	3	D001		>240				
Chlorosulfonic Acid	0	3	2	WH	8						180	>480
Chlorotoluene (Benzyl Chloride)	2	2	1	N	3	P028	15	>480			>480	26
Chromic Acid	0	3	1	Ox	8	D001, D002, D007	240	>240	75	70.2		
Citric Acid	1	2	0	N		N	>360		>360	>360		
Citrus Terpenes							>240		>240	>240		
Cleaning Agent	2	0	0	N				>480				
Copper	0	2	0	N					>300	>350		
Creosote	2	2	0	N		U051		>240	370			
Cresol	2	3	0	N	6.1	U052	<5	>240	>60	12.8	>480	<120
Crotonaldehyde	3	3	2	N	6.1	D001, U053			21			
Cumene							14		18	22		
Cyclohexane	3	1	0	N	3	U056, D001	10	>480	6	1.8	>480	
Cyclohexanol	2	1	0	N			80	>480	47	10		
Cyclohexanone	2	1	0	N	3	U051, D001, F003	<5	>480	30	33		
Cyclohexylamine	3	2	0	N	8	D001		>240	36	1.3		
Cyclo Octadiene							>480	>480				
Cyclopentanone	3	2	0	N	3	D001		>240				
Cypermethrin								>240				
Decanal (Decyl Aldehyde)									240			>480
Decane								>480				
Decyl Aldehyde (Decanal)									240			>480
Deep Woods Off®								>240				
Deoxidizer							>480			>480		
Diacetone Alcohol (Hydroxy Methyl Pentanone)	2	1	0	N	3	D001	240	>480	60	15		
Diaminodiphenylmethane (Methylenedianiline)	1	3	0	N	6.1			>1440			>480	
Diaminopropane (Propylenediamine)	3	2	0	N		D001			271.9	3		
Diamylamine	2	3	0	N		D001	>480		129			
Dibromoethane (Ethylene Dibromide)	0	3	0	N	6.1	U067	27	>480	4.8	<1.2	>480	7.8
Dibutylamine	2	3	0	N		D001	>480					
Dibutyl Ether (Butyl Ether)	3	2	1	N	3	D001		>480			300	
Dibutyl Phthalate (Butyl Phthalate)	1	0	0	N			30	>480	120	16.8	>480	
Dichloroaniline	1	3	0	N	6.1						300	
Dichlorobenzene	2	2	0	N	6.1	D027, U072, F002, U070, U071	<5	>480	6	14		
Dichlorobutene					8	D001	3.6	>240	16.3			>1440
Dichlorodiethyl Sulfide (Mustard Gas)								>240				
Dichlorodifluoromethane (Freon)					2.2	U075	10.2	>240	3	2.4	>480	

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Dichloroethane (Ethylene Dichloride)	3	2	0	N	3	D028, U076, D001, U077	2.4	144	1.8	0.6	>480	
Dichloroethylene	3	2	2	N	3	D001, D029, U078	7.2	>480				
Dichloromethane	1	2	0	N	6.1	U080, F002	6	>480	6	2	217	
Dichloropropene	3	3	0	N	3	D001					>480	
Diesel Fuel	2	0	0	N	3	D001	>240		>240	>240	195	
Diethanolamine	1	1	0	N			>480	>240	>480	>240		
Diethylacetamide								>480				
Diethylamine	3	3	0	N	3	D001	<5	6	12	4	>480	43.8
Diethylaminoethanol	2	3	0	N	3	D001	>480					
Diethylenedioxide (Dioxane)	3	2	1	N	3	D001, U108	<5	>480	6.4	2.4		49.6
Diethylene Glycol							>240		>240	>240		
Diethylene Glycol Butyl Ether							>323		148	44		
Diethylene Glycol Monomethyl Ether							>240		>240	>240		
Diethylene Glycol Monopropyl Ether							>240		>240	>240		
Diethylenetriamine	1	3	0	N	8			>240	>480			
Diethyl Ether (Ether) (Ethyl Ether)	4	2	1	N	3	U117, F003, D001	3	>480	10	10.2	>480	1
Diethylnitrosoamine								>240				
Diethylphthalate						U088		>240				
Diisobutylamine					3	D001	>480		52.2			
Diisobutyl Ketone	2	1	0	N	3	D001	120	>480	15	15		
Diisopropylamine	3	3	0	N	3	D001	125		40.2			
Dimercaptothiodiazole								>240				
Dimethylacetamide	2	2	0	N			<5	>480	30	15	>480	64
Dimethylamine	4	3	0	N	2.1	D001			>480	1.8		
Dimethylaminoethanol (Dimethylethanolamine)	2	2	0	N	8	D001	>480	350	235.2	4.8		
Dimethylaminopropylamine						D001			28.8	0.6		
Dimethylaniline	1	3	0	N	6.1			>240				
Dimethylbenzylamine (Benzyl dimethylamine)	2	2	0	N	8			>240				
Dimethylbutylamine					3		81					
Dimethylcyclohexylamine					8	D001		>480				
Dimethylethanolamine (Dimethylaminoethanol)	2	2	0	N	8	D001	>480	350	235.2	4.8		
Dimethylethylamine								2				
Dimethylformamide	2	1	0	N	3	D001	<5	1440	1.2	25	226	
Dimethylhydrazine	3	3	1	N	6.1	D001, U099, U098	6		37.8	3.6	>480	12
Dimethylmercury								60		0.25		
Dimethyl Sulfate	2	4	0	N		U103	30	>240	30	>240	>480	
Dimethyl Sulfoxide	1	1	0	N		U103	23	>480	60	79.8	374	
Dimethylvinylchloride							8					
Dinitrotoluene							21		>240	>240		
Dinol								>240				
Dinoseb						P020		>240				
Diocetyl Phthalate	1	0	0	N		U107	340	>480	120	<5		
Dioxane (Diethylenedioxide)	3	2	1	N	3	D001, U108	<5	>480	6.4	2.4		49.6
Dipentene					3	D001		36				
Diphenylcyclopropenone								>240				
Diphenylmethane Diisocyanate	1	2	0	N	6.1						>480	
Diphthalate								>240			>480	
Diquat Dibromide								>240				
Divinylbenzene	2	2	2	N			11	>480	72	33		
Dodecane	2	0	0	N				>480				

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Dynasylan							>480					
Epichlorohydrin	3	3	2	N	6.1	U041, D001	19.8	>480	10	<1.2	>480	57
Epoxy							>480					
Epoxybutane (Butylene Oxide)	3	2	1	N	3	D001			4.3			
Etch							>240		>480	<5		
Ethanol	3	0	0	N	3	D001	7	>480	37	12		
Ethanolamine	2	2	0	N	8		360	>480	360	210		
Ether (Ethyl Ether) (Diethyl Ether)	4	2	1	N	3	U117, F003, D001	3	>480	10	10.2	>480	1
Ethidium Bromide								>480				
Ethoxyethanol (Cellosolve)	2	2	0	N		D001, F005, U359	210	>480	45	25		
Ethoxyethanol (Ethyl Cellosolve)							91.8	>240	244.8	<0.6	>480	>480
Ethoxyethyl Acetate (Cellosolve Acetate)	2	2	0	N		D001	<5	>480	25	10		
Ethoxypropanol								>240				
EthoxyTriglycol							>240		>240	>240		
Ethyl Acetate	3	1	0	N	3	U112, D001, F003	<5	1440	10	4.8	72	36
Ethyl Acrylate	3	2	2	N	3	U113, D001		>240	48		14	79.8
Ethylamine					2.1	D001	66	28.2		66		
Ethyl Benzene	3	2	0	N	3	F003, D001	4	>480	13	5	>480	
Ethylbromide					6.1	D001			4.2			
Ethyl Butanol							>240		>240	>240		
Ethylbutylamine						D001			73.2			
Ethyl Cellosolve (Ethoxyethanol)							91.8	>240	244.8	<0.6	>480	>480
Ethyl Cellosolve Acetate											>480	
Ethyl Chloride								>480				
Ethyl Cyanide										<0.6		
Ethylene Chlorohydrin (Chloroethanol)	2	3	0	N	6.1	D001		>240	298.8		>480	
Ethylenediamine	3	3	0	N		D001	>240	47	399	4.8		>480
Ethylene Dibromide (Dibromoethane)	0	3	0	N	6.1	U067	27	>480	4.8	<1.2	>480	7.8
Ethylene Dichloride (Dichloroethane)	3	2	0	N	3	D028, U076, D001, U077	2.4	144	1.8	0.6	>480	
Ethylene Glycol							360	>480	360	360		
Ethylene Glycol Monoethyl Ether							>240		>240	>240		
Ethylene Glycol Mono-n-Butyl Ether							90	>480	48	45		
Ethyleneimine					6.1	P054, D001			<4.8			
Ethylene Oxide	4	2	3	N	2.3	U115, D001		234			>480	8
Ethyl Ether (Ether) (Diethyl Ether)	4	2	1	N	3	U117, F003, D001	3	>480	10	10.2	>480	1
Ethyl Glycol								>240				
Ethyl Glycol Acetate								>240				
Ethylglycol Ether									45	25		
Ethylhexanoic Acid							>240		>240			
Ethylhexanol									>480			
Ethyl Methacrylate						U118, D001	22.8					
Fluorobenzene					3	D001					>480	
Fluoroboric Acid	0	3	0	N	8	D002	>240	>240	>240	>240		

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Formaldehyde	4	3	0	N	8	U122	>1200	>300	32	6	>480	
Formic Acid	2	3	0	N	8	D002	5	60	>380	120	>480	>480
Freon ® (Dichlorodifluoromethane)					2.2	U075	10.2	>240	3	2.4	>480	
Furaldehyde (Furfural)	2	2	0	N	3	D001, U125	<5	>480	19.8	15	>480	
Furfural (Furaldehyde)	2	2	0	N	3	D001, U125	<5	>480	19.8	15	>480	
Furfuryl Alcohol					6.1	D001	28	>480		28		
Gasohol					3	D001					170	
Gasoline					3	D001	28	170	24	<5	>480	
Glutaraldehyde							>480	>240	>480	110		
Glycerin (Glycerol)								>240				
Glycerol (Glycerin)								>240				
Glycerolmonothiolglycolate								>240				
Glycerolpropoxytriacylate								>240				
Glycophase (Roundup ®)							>240	>240				
Glyphosatisopropylamine							>240	>240				
HCFC-141b							92	>480	33			
Heptane					3	D001	105	>480	45	1.5		
Hexachlorocyclopentadiene					6.1	U130	>480					
Hexamethyl Disilazane	3	2	1	N		D001	>380	>480	42	15		
Hexamethylene Diisocyanate					6.1						>480	>480
Hexamethylphosphoramide							90					
Hexane					3	D001	11	1440	5.8	4.3	>480	2
Hexene							>240		45	12		
Hexyl Carbitol							>240		>240	>240		
Hydraulic Fluid (Skydrol ®)						N	>240	>480	>240	<5		
Hydrazine	3	3	3	N	8	U133, D001	>480	126	386	150	>480	
Hydrobromic Acid							>360	>480	>480	>380		
Hydrochloric Acid (Muriatic Acid)					8	D002	360	>480	360	290	>480	300
Hydrocyanic Acid (Hydrogen Cyanide)	4	4	2	N	6.1	P063		>240			94	
Hydrofluoric Acid					8	U134, D002	50	15	8	90	67	190.2
Hydrogen Chloride	0	3	0	N	2.3	D002	>240		>240	>240	>480	
Hydrogen Cyanide (Hydrocyanic Acid)	4	4	2	N	6.1	P063		>240			94	
Hydrogen Fluoride							<15	>480	<15	<15	118	
Hydrogen Peroxide	0	2	3	Ox	5.1	D001	>380	>240	4.8	>480	>480	
Hydrogen Phosphide						P096			10.2	30		
Hydroquinone					6.1		>380	>240	108	>360		
Hydroxyethylacrylate								>240				
Hydroxyethyltrimethylammonium Hydroxide								>240				
Hydroxymethacrylate								>240				
Hydroxy Methyl Pentanone (Diacetone Alcohol)	2	1	0	N	3	D001	240	>480	60	15		
Hypophosphorus Acid							>480		>480	>480		
Iminobispropylamine									>480	6		
Isoamyl Acetate (Amyl Acetate)							<5	>480	5.4	5.4	>480	
Isoamyl Alcohol							6		126	126		
Isobutanol (Butanol)							38	>480	10	1.3	>480	
Isocane (Octane)					3	D001	120	>480	60	<5		
Isophorone (Isophorone Diisocyanate)	2	2	0	N				>480				
Isophorone Diisocyanate (Isophorone)	2	2	0	N				>480				
Isoprene	4	2	2	N	3		52.2		16.2			
Isopropanol (Propanol)					3	D001	30	>480	30	7.2		114
Isopropyl Acetate							18		22	22		
Isopropyl Ether (Propyl Ether)					3	D001	>60		42.6	3.6		
Jet Fuel					3	D001		>240			>480	
Kerosene					3	D001	>380	>480	185	<5		

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Lactic Acid						D002	>300	>480	>480	>360		
Lauric Acid							>360		>480	>360		
Limone						D001	>240		64.8	>240	>480	
Lubrication Oil						N		>240				
Malathion								>240				
Maleic Acid	1	3	1	N	8		>360		>480	>360		
MDI									460	480		
Memtetrahydrophthalic Anhydride (Methyl Norbornene Dicarboxylic Anhydride)					8			>240				
Mercaptoacetic Acid (Thioglycolic Acid)					8	D002		>240				
Mercaptoethanol						D001		>240				
Mercuric Chloride					6.1	D009					>480	
Mercury					8	U151, D009	>480	>480		>480	>480	
Methacrylic Acid	2	3	2	N	8		10.2	>480			>480	
Methacrylonitrile					3	U152, D001	7			<1.2		
Methanesulfonic Acid						D002			>240			
Methanol					3	D001, F003, U154	10.8	30	15	1.8	92	>480
Methoxyethanol							11	440	18	20		80
Methoxyethyl Acetate								>240				390
Methoxyethyl Ether								>480				
Methoxymethylpentanone					3				99			
Methoxypropanol					3	D001		>240				
Methoxypropylacetate								>240				
Methoxytriglycol							>240		>240	>240		
Methyl Acetate					3	D001	3	>480	14	<1.2		
Methyl Acrylate	3	2	2	N	3	D001			15	1.2	>480	
Methylamine	4	3	0	N	2.1	D001	>480	24	100	25.2	105	
Methylaminopropylamine									63	3		
Methyl Bromide	1	3	0	N	2.3	U029				<5		47
Methyl Butyl Ether					3	D001	5	>480	14	<5	>480	
Methyl Cellosolve						D001	40.2	>240	25	20		
Methyl Chloride	4	2	0	N	2.1	U045, D001	>240		>240	0.6	>480	
Methyl Chloroacetate					6.1							>480
Methyl Cyanide (Acetonitrile)							<5	1440	<10.8	<0.8	>480	>480
Methylenabls											>480	
Methylene Bromide								>480				
Methylenebis								>240			>480	
Methylenebis Diphenylmethane Diisocyanate								>480				
Methylene Chloride (Methylene Dichloride)	1	2	0	N		F002, U080	1.8	20	0.6	4		2
Methylenedianiline (Diaminodiphenylmethane)	1	3	0	N	6.1		>240	>1440	>240	>240	>480	
Methylene Dichloride (Methylene Chloride)	1	2	0	N		F002, U080	1.8	20	0.6	4		2
Methylethanolamine									>480			
Methyl Ethyl Ketone					3	D035, D001, F005, U159	3.6	9	2.4	1.2	>480	9
Methyl Ethyl Ketone Peroxide					N	U160, D001, D003			>240	45		
Methyl Ethyl Ketoxime							>240		>240	>240	>480	
Methyl Glycol Ether									25	20		
Methylhexanone (Methyl Isoamyl Ketone)					3	D001	<5	>480			120	
Methyl Iodide					6.1		9.8	5	6.6	1	>480	

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Methyl Isoamyl Ketone (Methylhexanone)					3	D001	<5	>480			120	
Methyl Isobutyl Ketone					3	U061, D001, F003	12	>480	15	6	120	
Methyl Isobutyl Ketoxime							>240		>240	>240		
Methyl Isocyanate					6.1	P064, D001			0.6	0.6	>480	2
Methyl Mercaptan					2.3	U153, D001					>480	
Methyl Methacrylate	3	2	2	N	3	D001, U062	<5	>480	19	<1.2	>480	
Methyl Norbornene Dicarboxylic Anhydride (Methyltetrahydrophthalic Anhydride)					8			>240				
Methyl Pentyl Ketone								>240				
Methyl Propanol							>240		>240	>240		
Methyl Propyl Ketone								>480	6	6		
Methyl Pyrrolidone							<5	>480	47	47		
Methyltrichlorosilane	3	3	2	WR	3	D001		>240				
Mineral Oil						N	>240					
Mineral Spirits						D001	3	>480	23	<5	>480	>10.2
Monoethanolamine	2	2	0	N	8		380	>480	57	50		
Monoethylamine	4	3	0	N	2.1		66	28.2				
Monoisopropanolamine (Propanolamine)									>480	30		
Morpholine	3	2	0	N	3	D002	<5	94	43	20		
Muriatic Acid (Hydrochloric Acid)					8	D002	360	>480	360	290	>480	300
Mustard Gas (Dichlorodiethyl Sulfide)								>240				
Naphthalene	2	2	0	N	4.1	U165		>240				
Naphtha					3	D001	>360	>480	15	<5		
Naphthylamine					6.1	U167, U168		>240				
Nickel							>360		>360	>360		
Nicotine					6.1	P075		>240			>480	
Ninhydrin								>240				
Nitric Acid	0	3	1	Ox	8	D002, D001	5	34.8	79.8	<5	>480	106.8
Nitrobenzene	2	3	1	N	6.1	F004, D036, U169	<5	1440	35	4.8	>480	
Nitrodiphenylamine								>240				
Nitroethane	3	1	3	N	3	D001		>480	49.2	1.8		
Nitrogen Dioxide (Nitrogen Tetroxide)					2.3	D002					24	>480
Nitrogen Tetroxide (Nitrogen Dioxide)					2.3	D002					24	>480
Nitroglycerin (Nitroglycerol)					1.1	P081, D003		>240				
Nitroglycerol (Nitroglycerin)					1.1	P081, D003		>240				
Nitroglycol								>240				
Nitrohydrochloric Acid (Aqua Regia)					8	D002	>360		45	<5		
Nitromethane	3	1	4	N	3	D001	1.5	>480	30	<1.2	>480	
Nitropropane	3	1	2	N	3	U171, D001	12	>480	5	1.8		
Nonylphenol									>1200			
Octane (Isocane)					3	D001	360	>480	60	<5	>480	
Octanol							360		53	30		
Oleic Acid							>360		1.5	30		
Oleum (Sulfuric Acid)	0	3	2	WR	8	D002	8	30	70.2	<5	>480	37
Ortho Toluidin								>480				
Osmium Tetroxide					6.1	P087						

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Oxalic Acid	1	2	0	N			360	>480	360	360	>480	
Oxybisbenzene							>240		>240	>240		
Palmitic Acid							30		193	4.8		
Parathion					6.1	P089		>240				120
PCB (Polychlorinated Biphenyl)	1	2	0	N	9	PCB, PCB1, PCB2	>480	>480	1440	4.8	>480	60
Pentachlorophenol	0	3	0	N	6.1	F027	>780	>480	6	<5		
Pentane					3	D001	1.2	>480	6.6	0.8		
Pentylalcohol								176				
Perchloric Acid	0	3	3	Ox	5.1	D001, D002	360	>240	360	360		
Perchloroethylene					6.1		8	>480	12	<3		
Petroleum Ether						D001	8	>480				
Phenol	2	3	0	N	6.1	U188	10	70	40.2	16.2	>480	
Phenolphthalein							>480		>480	>480		
Phenyl Cyanide (Benzonitrile)										<0.6	>480	
Phosphoric Acid	0	3	0	N	8	D002	360	>240	360	360	>480	>480
Phosphorus Oxychloride	0	3	2	WR	8	D002, D003		>240	<0.6		>480	50.4
Phosphorus Trichloride	0	3	2	WR	8	D002, D003					>480	
Phthalic Acid					8			>240				
Pickle Solution							>480		>480	>480		
Picolyl Chloride Hydrochloride								>240				
Picric Acid	4	3	4	N	1.1	D001	160		150	<3		
Polychlorinated Biphenyl (PCB)	1	2	0	N	9	PCB, PCB1, PCB2	>480	>480	1440	4.8	>480	60
Polyethylene Glycol								>480				
Polyol								>480				
Potassium Acetate											>480	
Potassium Chromate						D001, D007					>480	
Potassium Hydroxide	0	3	1	N	8	D002	360	>240	160	79.8		
Potassium Permanganate					5.1	D001		>240				
Promethazine Hydrochloride							>480		>480			
Propane							>480		>480			
Propanol (Isopropanol)					3	D001	7	>480	30	7.3		114
Propanolamine (Monoisopropanolamine)									>480	30		
Propiolactone										19.8		
Propionaldehyde	3	2	2	N	3	D001			12			
Propionic Acid								96				
Propiophenone								>240				
Propoxypropanol							>240		>240	>240		
Propyl Acetate					3	D001	15	>480	14	4.3		
Propylamine	3	3	0	N	3	U194, D001			13.8		>480	
Propyl Cellosolve							3540		>240	>240		
Propylenediamine (Diaminopropane)	3	2	0	N		D001			271.9	3		
Propylene Glycol							>240	>240	>240	>360		
Propylene Glycol Mono Ethyl Acetate							200	>480	18	13		
Propylene Oxide	2	4	2	N	3	D001	7	26	18	<0.6	>480	18
Propyl Ether (Isopropyl Ether)					3	D001	>60		42.6	3.6		
Propylmethacrylate							60					
Propyl Nitrate	3	2	3	Ox		D001, D003		>240				
Propyzamide								>240				
Psuedocumene							8		19	19		
Pyridine	3	2	0	N	3	U196, F005, D038	5.4	>480	1.8	2.4	>480	
Pyrolidine					3	D001					407	
Quinoline					6.1			>240				



Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Suits	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Roundup® (Glyphosate)							>240	>240				
Rubber Solvent					3		>360		30	<5		
Safrotin							>240		>240	>240		
Silver Cyanide					6.1	D003, D011, P104		>240				
Skydrol® (Hydraulic Fluid)							>240	>480	>240	<5		
Sodium Cyanide	0	3	0	N	6.1	D003, P106					>480	
Sodium Hydroxide	0	3	1	N	8	D002	360	>480	360	360	>480	>480
Sodium Hypochlorite					5.1	D001	360	>240	360	360		
Stoddard Solvent	2	0	0	N		D001	126	>480	10	<5	>480	
Stripper								132				
Styrene	3	2	2	N	3	D001	8	>1440	10	10	>480	43
Sulfur Dichloride							>480				70	
Sulfur Dioxide	0	3	0	N	2.3	D001					>480	
Sulfuric Acid (Oleum)	0	3	2	WR	8	D002	5	30	70.2	<5	>480	37
Sulfur Monochloride							>480					
Tannic Acid							>360		>300	>280		
Tetrachloroethane					6.1	U208, U209	13.2		5.4	1.8	0	
Tetrachloroethylene	0	2	0	N	6.1	U210, F002, D039	5	1440	6	<1.2	>480	1.8
Tetraethylenepentamine					8				>480	106		
Tetraethylorthosilicate					3			>480				
Tetrafluoroboric Acid								>240				
Tetrafluoroethylene	4	2	3	N	2.1	D001			>480			
Tetrahydrofuran	3	2	1	N	3	D001, U213	0.6	>480	1.2	1.2	>480	1.8
Tetramethylammonium Hydroxide					8			>240				
Tetramethylenediamine							108					
Thinner						D001		>240				
Thioglycolic Acid (Mercaptoacetic Acid)					8	D002		>240			>480	
Thiophene					3	D001		>360				
Thiourea						U219		>240				
Toluene	3	2	0	N	3	D001, F005, U220	<5	1440	1.2	0.6	>480	<4.8
Toluene Diisocyanate	1	3	2	N	6.1	U223	22	>480	65	7	>480	>480
Toluenesulfonic Acid					8			>480				
Toluidine	2	3	0	N	6.1	U328, U053	14		>240	>240	>480	>120
Transmission Oil						N		>240				
Triallylamine					3	D001	>480		63			
Tributylphosphate								>240				
Trichloroacetoneitrile									67.2			
Trichlorobenzene					8.1		<5		32	<5	>480	15
Trichloroethane	1	3	0	N	6.1	U227, F002, U226	1.8	>480	2.4	1.2	>480	
Trichloroethanol											>480	19
Trichloroethylene	2	2	0	N	6.1	U228, D040, F002	<5	>1440	1.8	0.6	>480	<1.2
Trichloropropane							21					
Tricresyl Phosphate					6.1		60		253	45		
Triethanolamine							>480	>240	170	60		
Triethylamine	3	2	0	N	3	U404, D001	>480		37.2			>480
Triethylene Diamine								220				
Triethylene Tetramine					8		>480	>240	>480			
Trifluoroacetic Acid					8	D002		>240				
Trifluoroethanol							7.2		>60	>60	>480	
Tripropylamine					3	D001	>480		>480			

Chemical	NFPA 704				DOT Class	Waste Codes	Gloves				Sufts	
	Fire	Health	Reactivity	Other			Nitrile	Film	Neoprene	Latex	Tychem (TM) 9400	Saranex
Explosive 1.1					1.1		<14.9 minutes					
Explosive 1.2					1.2		>15 but <179.9 minutes					
Explosive 1.3					1.3		>180 minutes					
Explosive 1.4					1.4							
Explosive 1.5					1.5							
Explosive 1.6					1.6							
Flammable Gas					2.1							
Nonflammable Gas					2.2							
Poison Gas/Toxic Gas					2.3							
Flammable Liquid					3							
Flammable Solid					4.1							
Spontaneously Combustible					4.2							
Dangerous when Wet					4.3							
Oxidizer					5.1							
Organic Peroxide					5.2							
Poison/Toxic					6.1							
Infectious Substance					6.2							
Radioactive Material					7							
Corrosive Material					8							
Misc Hazardous Materials					9							
None					N							

The permeation times are based on the lowest common denominator of the following sources. Specific manufacturers may have better permeation times. This is intended only as a guide. The suitability of each product must be determined by the user through their own testing. Neither this guide nor any statement made by Oklahoma State University should be construed as a warranty or that any product is fit for a particular purpose.

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