

# Cooley/Engineered Membranes

WHERE CHEMISTRY MAKES THE DIFFERENCE

February 20, 2003

Mr. Dale Cox  
Tarp Rite  
327 Lockhart Mill Road  
Jacksonville, NB E7M 3S5 Canada

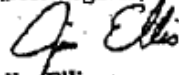
Dear Mr. Cox

This letter is to confirm that Cooley's reinforced polypropylene geomembrane material has a "A" rating, "fluid has little to minor effect" as per Cooley's polypropylene chemical resistance guideline, when exposed to the following chemicals.

- N-METHYLDIETHANOLAMINE (MDEA)
- Triethylene Glycol
- Methanol 33%
- Ethylene Glycol

If you have any further questions regarding our products, please feel free to contact me at (800) 333-3048, ext. 6210.

Best Regards,



Jim Ellis

Vice President / Business Manager - Cooley Engineered Membrane

## POLYPROPYLENE PP78™ CHEMICAL RESISTANCE GUIDELINE

Cooley Engineered Membranes offers a wide variety of geomembranes to fit your liner needs. Because each containment application is unique, this list is offered only as a guide in choosing the correct Cooley Geomembrane to fit your containment needs.

The following list of chemicals has been tested at ambient temperatures under static conditions. The effect of these chemicals on the geomembrane are subject to change based on variables such as but not limited to: exposure to additional chemicals, temperature, dilution of the chemical, stronger concentrations, time of exposure, etc.

It is always recommended that you contact Cooley Engineered Membranes prior to choosing your geomembrane and/or that you test a sample of the geomembrane under actual or simulated jobsite conditions.

**RATINGS:**

- A = FLUID HAS LITTLE TO MINOR EFFECT
- B = FLUID HAS MINOR TO MODERATE EFFECT
- C = FLUID HAS SEVERE EFFECT
- T = NO TEST DATA-LIKELY TO HAVE MINOR EFFECT
- X = NO TEST DATA-LIKELY TO HAVE SEVERE EFFECT

	Concentration			Concentration	
<b>A</b>					
Acetic Acid	5%	A	Amyl Acetate		C
Acetic Acid	50%	T	Amyl Alcohol		T
Acetic Acid	Glacial	A	Amyl Chloride		A
Acetic Anhydride		T	Aniline		A
Acetone		C	Animal Oil		T
Alkyl Alcohol		T	Antimony Chloride		A
Alkyl Chloride		X	Aqua Regia		X
Aluminum Chloride		T	ASTM Fuel A		C
Aluminum Fluoride		T	ASTM Fuel B		C
Aluminum Sulfate		T	ASTM Fuel C		C
Ammonia Carbonate		T	ASTM Oil #1		A
Ammonium Chloride		T	ASTM Oil #2		A
Ammonium Fluoride	20%	T	ASTM Oil #3		A
Ammonium Hydroxide	30%	A	Asphalt		A
Ammonium Nitrate		A			
Ammonium Phosphate		T	<b>B</b>		
Ammonium Sulfate		T	Barium Carbonate		T
Ammonium Sulfide		T	Barium Hydroxide		T

	Concentration			Concentration	
Barium Sulfate		T		Cyclohexanol	T
Benzene	<1%	T		Cyclohexanone	T
Benzene	25%	X			
Benzene	100%	C		D	
Benzoic Acid		T		Dextrine	T
Bismuth Carbonate		T		Dibutyl Phthalate	A
Borax Solutions		T		Diesel Fuel	B
Boric Acid	10%	T		Diethyl Ether	X
Bromic Acid		T		Diethyl Sebacate	A
Bromine Anhydrous		X		Dimethylamine	X
Butyl Acetate		T		Diethyl Keytone	X
Butyl Alcohol		A		Disodium Phosphate	T
Buryl Phenol		T			
Butyric Acid		T		E	
				Epichlorohydrine	B
C				Ethyl Acetate	C
Calcium Bisulfate		T		Ethyl Alcohol	T
Calcium Carbonate		A		Ethyl Bromide	X
Calcium Chloride		T		Ethyl Chloride	X
Calcium Hydroxide		T		Ethylene Dichloride	T
Calcium Hypochlorate		T		Ethylene Glycol	A
Calcium Nitrate	50%	T		Ethylene Oxide	T
Calcium Sulfate		T			
Calcium Disulfide		C		F	
Carbon Tetrachloride		C		Ferric Chloride	T
Carbonic Acid		C		Ferric Nitrate	T
Castor Oil		T		Ferrous Chloride	T
Chlorine Gas		X		Ferrous Sulfate	T
Chloracetic Acid		X		Fluosilic Acid	T
Chlorobenzene		X		Formaldehyde	A
Chloroform		X		Formic Acid	A
Chlorosulfonic Acid		X		Furfural	X
Chrome Aluminum		T			
Chromic Acid	30%	X			
Chromium Trioxide		X			
Citric Acid		T			
Copper Chloride		T			
Copper Nitrate		T			
Copper Sulfate		T			
Corn Oil		T			
Cottonseed Oil		T			
Crude Oil		A			
Cyclohexane		X			

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	Concentration	
<b>G</b>		
Gallic Acid		C
Gasoline	<25% BTX	C
Gasoline	>25% BTX	C
Glucose		T
Glycerine		A
<b>H</b>		
Hexane		C
Hydraulic Fluid		A
Hydrazine		A
Hydrobromic Acid		A
Hydrochloric Acid	20%	A
Hydrochloric Acid	37%	T
Hydrocyanic Acid		T
Hydrofluoric Acid	20%	A
Hydrofluoric Acid	75%	A
Hydrofluosilic Acid	30%	A
Hydrogen Peroxide	3%	T
Hydrogen Peroxide	10%	T
Hydrogen Sulfide		T
Hydroquinone		C
<b>I</b>		
Iso-Octane		A
Isopropyl Alcohol		T
<b>J</b>		
JP-4 Jet Fuel		C
Jet A		X
Jet B		X
<b>K</b>		
Kerosene		X

	Concentration	
<b>L</b>		
Lactic Acid		T
Lead Acetate		T
Linseed Oil		A
Lubricating Oils		A
<b>M</b>		
Magnesium Carbonate		T
Magnesium Chloride		T
Magnesium Hydroxide		A
Magnesium Nitrate		T
Magnesium Sulfate		T
Malic Acid		T
Mercuric Chloride		T
Methyl Ethyl Keytone		X
Mineral Oil		A
Mineral Spirits		A
<b>N</b>		
Naptha		C
Napthalene		X
Nitric Acid	10%	T
Nitric Acid	50%	A
Nitric Acid	70%	X
Nitrobenzene		X
<b>O</b>		
Oleic Acid		T
Oleum	25%	C
Oxalic Acid		T
<b>P</b>		
Palmitic Acid		T
Perchloroethylene	<1%	X
Perchloroethylene	100%	X
Phenol		T
Phenol Formaldehyde		T
Phosphoric Acid	50%	T
Phosphoric Acid	75%	T
Phosphorous Yellow		T
Phosphorous Pentoxide		T
Photographic Solutions		A

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Concentration			Concentration	
Phthalate Plasticizer		A	T	
Pickling Solutions		A	T	
Potassium Bicarbonate		T	X	
Potassium Carbonate		T	C	<1%
Potassium Chromate	40%	T	X	25%
Potassium Cyanide		T	X	100%
Potassium Dichromate		T	C	
Potassium Hydroxide		A	A	
Potassium Nitrate		T	T	
Potassium Perchlorate	10%	T	T	
Potassium Permanganate		T	C	
Potassium Sulfate		T		
Pyridine		X		
<b>S</b>			<b>U</b>	
Salt Water		A	Urea	T
Silicon Grease		T	<b>V</b>	
Silver Nitrate		T	Vegetable Oil	A
Skydrol Hydraulic Fluid		A	<b>W</b>	
Soap Solutions		A	Water	A
Sodium Acetate		T	<b>X</b>	
Sodium Bicarbonate		T	Xylene	<1% T
Sodium Bisulfate		T	Xylene	25% X
Sodium Borate		T	Xylene	100% X
Sodium Carbonate		T	<b>Z</b>	
Sodium Chlorate		T	Zinc Chloride	T
Sodium Chloride		T	Zinc Oxide	T
Sodium Dichromate	20%	T		
Sodium Dichromate	100%	T		
Sodium Ferrocyanide		T		
Sodium Fluoride		T		
Sodium Hydroxide	25%	T		
Sodium Hydroxide	60%	T		
Sodium Hypochlorite		T		
Sodium Nitrate		T		
Sodium Sulfate		A		
Soybean Oil		A		
Stannous Chloride		T		
Stearic Acid		T		
Styrene		X		
Sulfuric Acid	10%	T		
Sulfuric Acid	40%	A		
Sulfuric Acid	98%	X		

The data shown are the result of laboratory tests and are intended only as a guide. No performance warranty is intended or implied. Ratings were determined by visual experimentation of coated fabric samples after contact with test fluid for 23 days at room temperature.

When considering Cooley Engineered Membranes for a specific application, it is important to study other requirements such as permeability, service temperature, concentration, size to be contained, etc. A sample of material should be tested in actual service before specification. When impractical, tests should be devised which simulate actual service conditions as closely as possible. The Cooley Engineered Membranes Technical Department should be consulted for further recommendation. This table is presented and accepted at user's risk.

## Polypropylene PP78™

Cooley's reinforced polypropylene liner developed in conjunction with Montell Polymers offers the most versatile flexible geomembrane liner available today. The unique combination of custom fabric reinforcement encapsulated by extruded high performance polypropylene proves a strong, highly chemical resistant liner. A chemically inert polymer is modified by a Catalloy® process technology. With this process, the molecular structure of the polymer is modified to provide many specialized properties. These properties include excellent flexibility, low thermal coefficient of expansion and contraction, outstanding dimensional stability, wide temperature range for excellent seaming, good chemical resistance. All this performance without Environmental Stress Cracking (ESC). Used for the containment of the most aggressive chemicals to potable water and aquaculture services highlights the broad uses of the product. Thermally seamed and highly flexible, the liner can be supplied in large panels for minimum field seaming and simple installation.

PROPERTY	TEST METHOD	VALUE				
Gauge, nominal (mils)		60	45	36	30	20
Fibers, reinforcing 9 x 9 1000d polyester scrim		1	1	1	1	1
Breaking Strength - Fabric, minimum (lbs.)	ASTM D751 Method A	275 x 225	275 x 225	275 x 225	275 x 225	200 x 200
Low Temperature Flexibility 1/8 in Mandrel (°F)	ASTM D2136, 4 hrs.	-65				
Puncture Resistance, minimum (lbs.)	FTMS 101C	275	250	250	250	250
Tear Strength, minimum (lbs.)	ASTM D751 Tongue Tear	100	100	100	100	75
Dimensional Stability (% change, maximum)	ASTM D1204 180°F/1 hour	1.0				
Hydrostatic Resistance minimum (psf)	ASTM D751 Method A, Procedure 1	350	350	350	350	300
Ply Adhesion, minimum (lbs./in.)	ASTM D413	20	20	20	20	20
Water Absorption (% wt. chge, max)	ASTM D471	<1%				
UV Resistance	ASTM G26 Xenon Arc	>12,000 hrs.				
Resistance to Soil Bursal (% Tensile Retention)	ASTM D3083 (Part 9.5)	90% min.				

### TYPICAL FACTORY SEAM PROPERTIES:

PROPERTY	TEST METHOD	VALUE
Bonded Seam Strength (lbs./width)	ASTM D751	160 min
Peel Adhesion, minimum (lbs./Inch)	ASTM D413	20 or FTB