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**November 4, 2003**

**Perma-Liner Industries, Inc.  
6196 126<sup>th</sup> Avenue North  
Largo, Florida 33773**

**Attn: Mr. Eric Baum  
Vice President**

**Re: Chemical Resistance Testing of  
6 Inch Diameter PVC Pipe Containing Perma-Liner  
Industries Lateral Rehabilitation Sample  
8 Inch Diameter PVC Pipe Containing Perma-Liner  
Industries Point Repair System Sample  
12 Inch X 44 Inch Perma -Liner Industries Resin Sample**

**Dear Mr. Baum:**

**Please find attached chemical resistance test results for three (3) sets of coupons (9 each) samples of the referenced material samples. The samples were cut and test specimens were prepared by HTS laboratory personnel. The testing program was conducted in general accordance with the following:**

- **ASTM F1216, "Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin -Impregnated Tube".**
- **ASTM D543, "Test Method for Resistance of Plastics to Chemical Reagents".**
- **ASTM D2122, "Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings".**
- **ASTM D790, "Test Method for Flexural Properties of Unreinforced and Reinforced Plastics".**

**One sample from each set was utilized as a control sample for comparison purposes. The initial weight and thickness of each specimen were recorded prior to immersion.**

Eight (8) samples from each set were immersed in 8 different chemical reagents in accordance with ASTM F1216, section X2, Table X2.1. The samples were exposed to the reagents for a period of 30 days. At the end of 30 days the specimens from each sample were removed from the reagent containers, rinsed, dried, weighed and dimensions recorded.

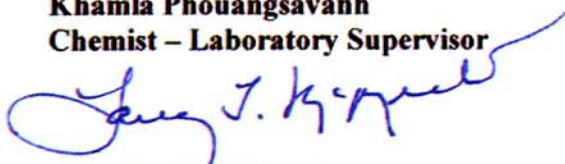
The samples were then tested for flexural stress and modulus of elasticity. A summary of all test data and percent change in each property is included in the attached summary of test data. ASTM F1216, Section X2.2.1 states that the test specimens should lose no more than 20% of their initial flexural strength and flexural modulus during the exposure time. As indicated by these test results, these samples comply with that specification requirement.

Should you have any questions or comments regarding these tests or this report, please do not hesitate to call us. Thank you very much.

Sincerely,



**Khamla Phouangsavanh**  
Chemist – Laboratory Supervisor



**Larry L. McMichael**  
Principal

F/letters/2003/Perma-Liner/HTS-2807



**SUMMARY OF TEST DATA**  
**RESISTANCE OF CIPP TO CHEMICAL REAGENTS**

Sample ID: 6" diameter pvc pipe containing Perma-Liner Industries Lateral Rehabilitation sample

Chemical Reagent (Concentration)	Mechanical Property	Test Method ASTM D	Unit	Control Sample	30 Days	
					Value	% Change
Tap water - pH 6-9 (100%)	Observation	543		N/A	No Change	
	Weight	543	g	73.15	73.53	0.52
	Thickness	2122	in.	0.197	0.197	0.00
			mm.	5.0	5.0	0.00
	Max. Flexural Modulus	790 790	psi	9657.9	9739.0	0.84
psi			359523	364460	1.37	
Nitric Acid (5%)	Observation	543		N/A	Plastic coating changed yellow	
	Weight	543	g	68.2	68.77	0.84
	Thickness	2122	in.	0.187	0.187	0.00
			mm.	4.7	4.7	0.00
	Max. Flexural Modulus	790 790	psi	9657.9	9849.0	1.98
psi			359523	360723	0.33	
Phosphoric Acid (10%)	Observation	543		N/A	No Change	
	Weight	543	g	62.07	62.61	0.87
	Thickness	2122	in.	0.162	0.162	0.00
			mm.	4.1	4.1	0.00
	Max. Flexural Modulus	790 790	psi	9657.9	8709.2	-9.82
psi			359523	299127	-16.80	
Sulfuric Acid (10%)	Observation	543		N/A	No Change	
	Weight	543	g	66.32	66.98	1.00
	Thickness	2122	in.	0.180	0.180	0.00
			mm.	4.6	4.6	0.00
	Max. Flexural Modulus	790 790	psi	9657.9	9540.9	-1.21
psi			359523	336277	-6.47	



**SUMMARY OF TEST DATA  
RESISTANCE OF CIPP TO CHEMICAL REAGENTS**

Sample ID: 6" diameter pvc pipe containing Perma-Liner Industries Lateral Rehabilitation sample

Chemical Reagent (Concentration)	Mechanical Property	Test Method ASTM D	Unit	Control Sample	30 Days	
					Value	% Change
Gasoline (100%)	Observation	543		N/A	Plastic coating bubbled & changed yellow	
	Weight	543	g	60.7	61.7	1.65
	Thickness	2122	in.	0.170	0.170	0.00
			mm.	4.3	4.3	0.00
	Max. Flexural Modulus	790	psi	9657.9	10402.5	7.71
psi			359523	353321	-1.73	
Vegetable Oil (100%)	Observation	543		N/A	No Change	
	Weight	543	g	66.27	66.39	0.18
	Thickness	2122	in.	0.179	0.179	0.00
			mm.	4.6	4.6	0.00
	Max. Flexural Modulus	790	psi	9657.9	10213.7	5.75
psi			359523	360899	0.38	
Detergent (0.1%)	Observation	543		N/A	No Change	
	Weight	543	g	63.16	63.57	0.65
	Thickness	2122	in.	0.174	0.174	0.00
			mm.	4.4	4.4	0.00
	Max. Flexural Modulus	790	psi	9657.9	9219.0	-4.54
psi			359523	338517	-5.84	
Soap (0.1%)	Observation	543		N/A	No Change	
	Weight	543	g	53.64	54.15	0.95
	Thickness	2122	in.	0.150	0.150	0.00
			mm.	3.8	3.8	0.00
	Max. Flexural Modulus	790	psi	9657.9	7984.7	-17.32
psi			359523	311111	-13.47	