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KTA-TATOR, INC.
115 Technology Drive, Pittsburgh, PA 15275

October 23, 2009
Via email: *mburatto@lifelast.com*

Mr. Mark Buratto
Lifelast, Inc.
1301 NE 144th Street
Suite 125
Vancouver, WA 98685

SUBJECT: Results of Physical Testing; KTA-Tator, Inc. Project No. 290675 – Interim Report

Dear Mr. Buratto:

In accordance with KTA-Tator, Inc. (KTA) Proposal No. PN090822 and subsequent signed Authorization to Proceed dated September 21, 2009, KTA has performed various physical tests on a coating membrane provided by Lifelast, Inc. The results of the testing are contained in this report.

SAMPLES

The samples listed in Table 1, "Samples" were received from Lifelast, Inc. on September 14, 2009. It should be noted that at no time did KTA personnel witness the preparation of the samples.

Table 1 – Samples

Sample ID	Sample Description
Sample A	Six (6) free film sheets measuring 12″ x 12″. Designated for water absorption, permeance and tensile strength.
Samples B, C, D, E, F, G	Six (6) steel panels measuring 16″ x 1 ½″ coated on one side. Designated for flexibility.
Samples H, I, J, K, L, M	Six (6) steel panels measuring 4″ x 4″coated on both sides. Designated for wet adhesion to steel.
Samples N, O, P	Three (3) steel panels measuring 4″ x 4″ coated on one side. Designated for dry adhesion to steel.
Samples Q, R, S	Three (3) steel panels measuring 4″ x 4″ coated on one side. Designated for cathodic disbondment.

Sample ID	Sample Description
Samples T, U, V, W	Four (4) steel pipe sections measuring 16″ long with a 2″ diameter, coated on the outside. Designated for impact resistance.
Samples X, Y, Z	Three (3) steel panels measuring 4″ x 4″ coated on one side with a ¼″ diameter hole through the middle. Designated for Taber abrasion.
Samples I, II, III	Three (3) steel panels measuring 4″ x 4″ coated on one side. Designated for hardness.

LABORATORY INVESTIGATION

The laboratory investigation consisted of performing various physical tests on a coating membrane in accordance with the specification received from Lifelast, Inc. The specification outlined testing parameters for the following tests: water absorption, permeance, cathodic disbondment (attached cell method), adhesion to steel (dry), wet adhesion to steel, impact resistance, abrasion resistance, tensile strength and flexibility. In addition to the specified testing, Lifelast, Inc. also requested that Shore D hardness values be obtained on the coating membrane. The test descriptions and the results of the testing are provided below.

Water Absorption

The water absorption of Sample A was measured according to ASTM D 570, "Standard Test Method for Water Absorption of Plastics." Three (3) bars measuring 3″ x 1″ were cut from the free film (Sample A) and the thickness of each bar was measured using Mitutoyo Digimatic Calipers. The samples were conditioned in an oven maintained at 50°F for twenty-four (24) hours. After conditioning, the samples were immediately weighed. The samples were then submerged in individual containers of deionized water maintained at laboratory conditions of 23.0°C ± 3°C. The samples were removed from the water following twenty-four (24) hours, one week and every two (2) weeks thereafter. The samples were wiped dry of any excess water, weighed and immediately replaced in the water. The testing is ongoing. As of October 23, 2009, the samples have been immersed for thirty (30) days. The percent increase in weight was determined using the following equation:

*Increase in weight (%) = (wet weight – conditioned weight)/ conditioned weight*100*

The percent increase in weight is reported in Table 2, "Water Absorption Data."

Table 2 – Water Absorption Data

Replicate	Avg. Thickness (mm)	Increase in Weight (%) 24 hours	Increase in Weight (%) Week 1	Increase in Weight (%) Week 3
1	0.86	0.401	0.632	0.931
2	0.84	0.388	0.660	0.891
3	0.84	0.381	0.645	0.962

Water Vapor Permeability

Four (4) discs of the coating (one designated as the control disc) were cut from the Sample A free film and tested for water vapor permeability using the inverted water method (Method BW) of ASTM E 96, "Standard Test Methods for Water Vapor Transmission of Materials." The thickness of each disk was measured in five (5) spots using Mitutoyo Digimatic Calipers. Each disc was sealed to a 4″ diameter glass dish filled ¾ of the way with deionized water. The discs were sealed to the dishes using wax. The dishes were then weighed, inverted and placed into a temperature/humidity chamber maintained at approximately 23.0°C and 50% relative humidity for a period of seventeen (17) days. The dishes were weighed separately at various recorded intervals, and the results plotted on the graph, as well as thickness and area of the discs. The permeance in English (inch-pounds) units is reported in perms in Table 3, "Permeability Results." A table containing daily weights of the samples and other pertinent data is appended.

Table 3 – Permeability Results

Replicate	Avg. Coating Thickness (mils)	Permeance (English Perms)	Avg. Permeance (English Perms)
2	34.8	0.00637	0.00849
3	45.7	0.00425	
4	34.6	0.01486	

Cathodic Disbondment

Resistance to cathodic disbondment was tested in accordance with ASTM G 95, "Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method)" at ambient laboratory conditions (25°C). The panels were inspected for holidays using a high voltage holiday detector. Coating thickness measurements were obtained on five (5) spots on each sample using a PosiTector 6000-F3 non-destructive electronic coating thickness gage. A ⅛″ diameter holiday was drilled into the center of panels Q, R and S. A 3″ diameter plastic pipe section was attached to each panel with silicone adhesive, and the "cell" was filled with approximately 1000 mL of an electrolyte solution consisting of 3% by mass sodium chloride and deionized water. A -3.0 V potential was impressed upon each of the samples for twenty-eight (28) days.

The samples were removed and evaluated for disbondment after twenty-eight (28) days. Adhesion was assessed at the immersed holiday site and at one (1) non-immersed site by cutting 45° radial cuts in the shape of an "X" through the coating to the substrate at the sites and manually peeling back the coating with a utility knife blade to determine the extent of coating adhesion loss. A holiday was also drilled in a non-immersed area of each panel and two (2) additional radial cuts were made at the sites. Coating adhesion was assessed in the same manner at the non-immersed site. The non-immersed site exhibited coating disbondment, and the amount of coating disbondment at the immersed site was greater than the undercut area on the steel because the cohesive integrity of the coating was greater than the adhesive strength of the coating to the steel. If the peeling was continued, total disbondment would result. For these purposes, the undercut area on the steel was used as a measure of the disbondment. Coating

thickness measurements and disbondment data are provided in Table 4, "Results of Cathodic Disbondment Testing." Individual applied voltage readings measured twice a week across the resistor for each cell are reported in Table 5, "Individual Voltage Measurements."

Table 4 – Results of Cathodic Disbondment Testing

Sample	Avg. Coating Thickness (mils)	Avg. Radial Undercutting (mm)
Q	36.7	5.46
R	34.5	5.72
S	39.3	5.83

Table 5 – Individual Voltage Measurements

Date of Reading	Q Voltage (VDC)	R Voltage (VDC)	S Voltage (VDC)
9/17/09	-3.018	-2.982	-2.947
9/21/09	-2.968	-2.996	-3.119
9/25/09	-3.048	-2.912	-2.973
9/29/09	-2.960	-2.928	-2.917
10/2/09	-2.920	-2.812	-2.998
10/6/09	-2.715	-2.935	-3.090
10/9/09	-3.030	-3.040	-2.895
10/13/09	-2.996	-2.760	-3.88
10/15/09	-3.054	-2.941	-2.930

Adhesion to Steel (Dry)

Tensile adhesion (pull-off strength) was measured in accordance with ASTM D 4541, "Pull-Off Strength of Coatings Using Portable Adhesion Testers," Annex A5, "Self-Aligning Adhesion Tester Type V." Coating thickness measurements were obtained on five (5) spots on each sample using a PosiTector 6000-F3 non-destructive electronic coating thickness gage. The testing surfaces of panels N, O and P were wiped clean and abraded gently using fine sandpaper. The coating was scored to the metal and pull stubs with an abraded test surface of 20 mm diameter were attached to the coating using a two-component epoxy adhesive (Araldite 2011), which was allowed to cure for twenty-four (24) hours at ambient laboratory conditions. The pull stubs were then detached using a DeFelsko PosiTest Automatic Adhesion Tester. The force (in psi) required to remove each pull stub was recorded along with the location of break and approximate percentage of each. The location of break is defined as adhesive (a split between layers), cohesive (within a layer) or glue failure (coating strength exceeds glue strength). The results of the testing can be found in Table 6, "Results of Dry Tensile Adhesion Testing."

Table 6 – Results of Dry Tensile Adhesion Testing

Sample	Average Measured Coating Thickness (mils)	Pull Stub ID	Pull-Off Strength (psi)	Location of Break	Avg. Pull-Off Strength (psi)
N	34.8	1	2676	50% adhesive – coating to steel; 50% glue failure	3724
		2	4889	100% adhesive – coating to steel	
		3	3608	75% adhesive – coating to steel; 25% glue failure	
O	34.8	4	4073	100% adhesive – coating to steel	4658
		5	5167	100% adhesive – coating to steel	
		6	4733	85% adhesive – coating to steel; 15% glue failure	
P	34.1	7	4585	100% adhesive – coating to steel	5163
		8	5288	100% adhesive – coating to steel	
		9	5617	100% adhesive – coating to steel	

Wet Adhesion to Steel

Wet adhesion to steel will be conducted in accordance with ASTM D 870, "Testing Water Resistance of Coatings Using Water Immersion" in congruence with ASTM D 4541, "Pull-Off Strength of Coatings Using Portable Adhesion Testers," Annex A5, "Self-Aligning Adhesion Tester Type V." Panels H, I, J, K, L and M were immersed up to ¾ length of the panel in water maintained at 38°C ± 2°C. Panels H, I and J will be removed on Friday, October 23, 2009, for a total of thirty (30) days immersion and panels K, L and M will be removed on Monday, November 23, 2009, for a total of sixty (60) day immersion. Upon removal from the water, the panels will be scored to the metal, a 20 mm diameter pull stub attached, and removed twenty-four (24) hours later. Coating thickness measurements were obtained on five spots on each sample using a PosiTector 6000-F3 non-destructive electronic coating thickness gage prior to immersion. The thickness will be re-measured when the panels are removed from the water. The pre-immersion thickness measurements obtained can be found in Table 7, "Thickness Measurements of Pre-Exposed Panels."

Table 7 – Thickness Measurements of Pre-Exposed Panels

Sample	Avg. Thickness (mils)
H	41.3
I	37.3
J	35.9
K	38.1
L	36.4
M	37.3

Impact Resistance

The impact resistance of the coating material was determined in accordance with ASTM G 14, "Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)." Four (4) 16″ long pipe sections labeled, T, U, V and W were used for this testing. Coating thickness measurements were obtained on five (5) spots on each sample using a PosiTector 6000-F3 non-destructive electronic coating thickness gage. The pipe was secured in the apparatus outlined in the method. The 3.2 pound weight was dropped from various heights and the locations and the impacted areas inspected for crack or holidays in the coating film using a high-voltage holiday detector. Sample T was used to determine an appropriate range of impact height. Twenty (20) impact locations were observed on samples T, U and V and the impact strength calculated by employing height, weight, and frequency of coating failure data. The results of the testing can be found in Table 8, "Results of Impact Resistance Testing." The impact strength was determined to be 107 inch-pounds. The calculation employed to determine the impact strength is outlined below.

$$m = [h_o + d(A/N \pm ½)] \times W$$

Where:
m = impact strength (inch-pounds)
h_o = minimum height at which the less frequent event occurs (inches)
d = increment in height of drop (inches)
A = sum of the frequency of occurrence at each height increment times the number of increments above the h_o value for each observation in the N total
N = total number of the less frequent event (coating failures or non-failures)
W = tup weight (pounds)

Note: The (-) sign is used when the mean is based on coating failures; the (+) sign is used when it is based on non-failures

Table 8 – Results of Impact Resistance Testing

Sample	Avg. Thickness (mils)	Replicate No.	Height of Drop (inches)	Observations
T	36.8	1	33.0	Non-failure
		2	33.0	Non-failure
		3	34.5	Failure
		4	34.0	Failure
		5	33.5	Failure
U	36.0	6	33.0	Non-failure
		7	33.5	Non-failure
		8	34.0	Failure
		9	33.5	Non-failure
		10	33.5	Non-failure
		11	34.0	Failure
		12	34.0	Non-failure
		13	34.0	Failure
		14	34.0	Failure

Sample	Avg. Thickness (mils)	Replicate No.	Height of Drop (inches)	Observations
V	36.1	15	33.5	Failure
		16	33.5	Non-failure
		17	33.0	Failure
		18	33.0	Failure
		19	33.0	Non-failure
		20	33.0	Failure

Abrasion Resistance

Taber abrasion resistance was determined in accordance with ASTM D 4060, "Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser." Coating thickness measurements were obtained on five (5) spots on each sample using a PosiTector 6000-F3 non-destructive electronic coating thickness gage. Triplicate 4″ x 4″ panels were weighed then subjected to 1000 cycles using a 1000g load and CS-17 abrasion wheels. Post weights were acquired for the samples, and the weight loss (in mg) reported. The results of the testing are contained in Table 9, "Taber Abrasion Resistance Results."

Table 9 – Taber Abrasion Resistance Results

Sample	Avg. Thickness Initial (mils)	Avg. Thickness Final (mils)	Weight Loss (mg)	Avg. Weight Loss (mg)
X	27.0	25.8	24.3	18.5
Y	32.7	31.9	21.0	
Z	30.0	29.4	10.1	

Tensile Strength

The tensile strength of the coating material was determined in accordance with ASTM D 412, "Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension," Method A. Nine (9) specimens were cut into a dumbbell shape using Die C. The specimens were pulled with a Tinius Olsen Universal Testing Machine at a rate of 2.0 inches per minute. The tensile strength was calculated using the force required to break the specimens along with the width and thickness of each. The dimensions of the sample were measured using Mitutoyo Digimatic Calipers. The individual results of three replicates are reported along with the average in Table 10, "Results of Tensile Strength Testing."

Table 10 – Results of Tensile Strength Testing

Sample	Cross-Sectional Area (in^2)	Force to Rupture (lbf)	Tensile Strength (psi)	Avg. Tensile Strength (psi)
1	0.00789	32	4056	4062
5	0.00860	35	4070	
6	0.0101	41	4059	

Flexibility

Flexibility testing was performed on Samples B, C, D, E, F and G in accordance with ASTM D 522, "Mandrel Bend Test of Attached Organic Coatings," Method B. Each panel was bent 180° over a 3″ mandrel then examined visually with a 5X illuminated lens for cracking along the axis of curvature. No cracking was observed on the samples.

Hardness (Shore D)

The hardness of the coating was evaluated in accordance with ASTM D 2240, "Standard Test Method for Rubber Property – Durometer Hardness." Using a Shore D durometer, five (5) readings were obtained from the panels labeled I, II and III by KTA. The results were then averaged. The results of the test can be found in Table 11, "Results of Durometer Hardness Testing."

Table 11 – Results of Durometer Hardness Testing

Sample	Avg. Durometer Hardness Value
I	77.8
II	77.0
III	77.7

If you have any questions or comments regarding this report, please contact me by telephone at 412-788-1300, extension 239, or by email cstewart@kta.com.

Very truly yours,

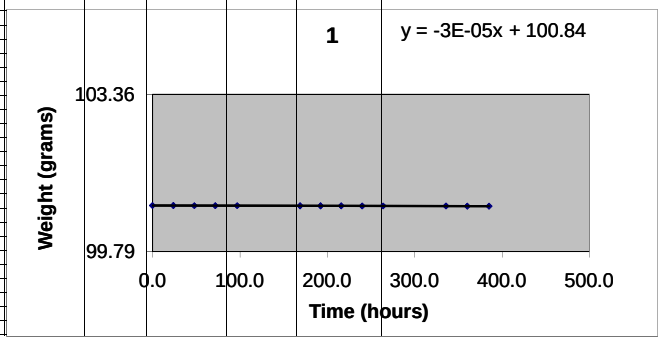
KTA-TATOR, INC.

Chrissy M. Stewart
Chemist

CMS/CMP/WDC:kdw
Attachment – Wet Cup Permeability Form
JN290675
(290675 Lifelast.doc)

Lifelast 290675 Inverted Wet Cup

Date	Hours	Cup #1 (g)	Cup #1(grain)	Cup #2 (g)	Cup #2(grain)	Cup #3(g)	Cup #3(grain)	Cup #4(g)	Cup #4(grain)
09/28/09	0.0	100.84	1555.96	334.02	5153.85	358.40	5530.08	338.98	5230.51
09/29/09	24.0	100.84	1555.95	334.01	5153.73	358.38	5529.85	338.96	5230.14
09/30/09	48.0	100.84	1555.90	334.00	5153.54	358.36	5529.56	338.93	5229.66
10/01/09	72.0	100.84	1555.90	333.99	5153.42	358.35	5529.39	338.90	5229.26
10/02/09	97.0	100.84	1555.90	333.99	5153.42	358.35	5529.28	338.88	5228.87
10/05/09	169.0	100.83	1555.85	333.92	5152.42	358.31	5528.74	338.77	5227.28
10/06/09	192.5	100.83	1555.84	333.92	5152.35	358.30	5528.63	338.74	5226.70
10/07/09	216.0	100.83	1555.84	333.91	5152.15	358.29	5528.46	338.70	5226.19
10/08/09	240.0	100.83	1555.81	333.88	5151.74	358.28	5528.31	338.67	5225.65
10/09/09	264.0	100.83	1555.82	333.87	5151.55	358.28	5528.24	338.64	5225.22
10/12/09	336	100.83	1555.81	333.81	5150.72	358.25	5527.83	338.54	5223.66
10/13/09	360.333	100.83	1555.73	333.79	5150.35	358.24	5527.63	338.49	5222.96
10/14/09	385.25	100.83	1555.73	333.77	5150.06	358.23	5527.47	338.46	5222.44



	1	2	3	4
Thickness(in)	0.03070	0.03480	0.04570	0.03460
Radius (in)	2.23000	2.15000	2.15000	2.15000
Radius (m)	0.05664	0.05461	0.05461	0.05461
Area (sq.m)	0.01008	0.00937	0.00937	0.00937
Slope (grams/hr)	0.00003	0.00060	0.00040	0.00140
Area (sq.ft.)	0.10849	0.10085	0.10085	0.10085
WVT(grams/hr/sq.m)	0.00298	0.06404	0.04269	0.14943
Permeance(WVP metric perms)	0.00001	0.00017	0.00012	0.00041
Permeability (perm cm)	0.00000	0.00002	0.00001	0.00004
Slope (grains/hr)	0.00046	0.00926	0.00617	0.02160
WVT(grains/hr/sq.ft.)	0.00427	0.09180	0.06120	0.21420
Permeance (WVP English)	0.00030	0.00637	0.00425	0.01486
Permeability (perm in.)	0.00001	0.00022	0.00019	0.00051

Temperature	70.00000	
Vapor Pressure	732.00000	mm Hg
	28.82000	in Hg
Humidity change (as a decimal)	0.50000	(100% to 50%)

METRIC AVERAGES:

WVT (grams/hr/sq.m)	0.08539
Permeance (metric perms)	0.00023
Permeability (perm cm)	0.00002

ENGLISH AVERAGES:

WVT(grains/hr/sq.ft)	0.12240
Permeance (English perms)	0.00849
Permeability (perm in.)	0.00031