

Appendix K

Geomembrane Third Party Conformance Results

Appendix K.1 - 80-mil LLDPE DSMS Geomembrane Conformance Results Appendix K.2 - 40-mil LLDPE Smooth Geomembrane Conformance Results Appendix K.3 - 80-mil LLDPE DSMS Exposed Geomembrane Conformance Results



Appendix K.1

80-mil LLDPE DSMS Geomembrane Conformance Results

TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/4/2014 Date Reported: 6/11/2014 Client Sample ID: R#F14A231002 L#CEE810230 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cycitia</u> TRI Job No.: **G140484** TRI Control No.: **98083** GAI-LAI

						SPECIMEN	S								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils	;)													
	Apparatus: De	ad-weight dia	al micrometer	with gauge poi	ints tapered a	at an angle of 60	0° +/- 2° to th	e horizontal w	ith the tip						
	rounded to a ra	adius of 0.8+,	/-0.1 mm(0.03	1+/-0.004 in),	with a specifi	ied force of 0.56	S+/-0.05 N (2+/	(-0.2 oz)							
	Loading Time:	5 sec Spec	cimen Size: 4'	' x 4"											72 min.
	84	84	83	84	84	84	84	83	83	83	84	0	83	84	80 MAR\
ASTM D1505	Density (grams/	/ cm. ³)													
	0.9311	0.9314	0.9312								0.9312	0.0002	0.9311	0.9314	0.939 ma
STM D6693	Tensile Properties	<u>s:</u>													
Type IV	•					narrow section.			_						
	Length Overal	l: 4.5in Cond	ditioning: Con	ducted test in s	standard labo	oratory atmosph	ere of 23+/-2 ⁰	C (73.4+/-3.6	⁰ F), and						
	50+/-5% relativ														
	Tensile Strength														
	MD 258	275	288	269	266						271	11	258	288	169 min
	TD 245	272	258	239	237		_				250	15	237	272	
	Elongation at Bre MD 449	eak (perc 549	ent, %) 588		543	ength = 2.0 ii	1.				534	51	440	600	200 min
	TD 566	549 598	588 594	541 550	543 538						534 569	26	449 538	588 598	300 min
STM D1603	Carbon Black Co			J JU	550						509	20	530	290	
01000	2.24	2.22	///////////////////////////////////////								2.23	0.01	2.22	2.24	2 - 3

(End of Table 1)

(Sheet 1 of 1)

By accepting the data and results presented on this report, the Client agrees to limit the liability of TRI Environmental, Inc. from Client and all other parties for claims on issues, due to the use of this data, to the cost for the respective tests presented in this report; and the Client agrees to indemnify and hold harmless TRI Environmental, Inc. from and against all liabilities in excess of the aforementioned limit.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/5/2014 Date Reported: 6/11/2014 Client Sample ID: R#F14A232018 L#CEE810230 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G140489 TRI Control No.: 98091

					SPECIMEN	S								Proj.
	1 2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													1
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-weigh	nt dial micromete	er with gauge po	oints tapered a	at an angle of 6	0° +/- 2° to th	e horizontal wi	ith the tip						4
	rounded to a radius of	0.8+/-0.1 mm(0.	031+/-0.004 in)	, with a specifi	ied force of 0.5	6+/-0.05 N (2+/	(-0.2 oz)							1
	Loading Time: 5 sec	Specimen Size:	4" x 4"											72 min.
	82 82	83	82	82	81	82	81	82	82	82	0	81	83	80 MARV
ASTM D1505	Density (grams/ cm. ³)													ł
	0.9319 0.931	2 0.9308	3							0.9313	0.0005	0.9308	0.9319	0.939 max.
ASTM D6693	Tensile Properties:													
Гуре IV	Test Specimens: Type							n		-				4
	Length Overall: 4.5in	-			oratory atmospl	ere of 23+/-2°	C (73.4+/-3.6	^r F), and						
	50+/-5% relative humio													
	Tensile Strength at Brea MD 242 266		256	253						257	10	242	267	169 min.
	TD 251 259		230 229	253 262						252	13	242	262	109 11111.
	Elongation at Break (p				ength = 2.0 i	n.								1
	MD 485 538		509	510						516	22	485	538	300 min.
	TD 566 569		549	626						580	30	549	626	
ASTM D1603	Carbon Black Content	(percent, %))											4
	2.12 2.17									2.15	0.03	2.12	2.17	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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GAI-LAI

 TABLE 1.

 MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/6/2014 Date Reported: 6/17/2014 Client Sample ID: R#F14A233035 L#CEE810230 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: TRI Job No.: **G140495** TRI Control No.: **98106**

SPECIMENS Proj. 2 3 4 5 6 10 Ava. Std. Dev. Specs. 8 9 Min Max METHOD DESCRIPTION **ASTM D5994** Thickness (mils) Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) 72 min. Loading Time: 5 sec Specimen Size: 4" x 4" 83 84 83 83 83 84 84 83 84 83 83 1 **80 MARV** 83 84 Density (grams/ cm.³) **ASTM D1505** 0.9342 0.9332 0.9340 0.9338 0.0005 0.9332 0.9342 0.939 max. **ASTM D6693 Tensile Properties:** Type IV Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min Tensile Strength at Break (lbs/ in.- width) MD 284 279 256 279 270 308 19 169 min. 256 308 ΤD 254 275 276 269 256 266 10 254 276 Gauge Length = 2.0 in. Elongation at Break (percent, %) MD 561 563 515 28 548 591 556 515 591 300 min. 570 606 621 581 21 ΤD 611 598 570 621 Carbon Black Content (percent, %) **ASTM D1603** 2.33 2.33 2.32 0.01 2.32 2.33 2 - 3

(End of Table 1)

(Sheet 1 of 1)

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GAI-LA

TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/10/2014 Date Reported: 6/19/2014 Client Sample ID: R#F14A234052 L#CEE810100 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G140508 TRI Control No.: 98138

					:	SPECIMENS								ſ	Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	N													
ASTM D5994	Thickness (mils	6)													
	Apparatus: De	ad-weight dia	l micrometer	with gauge p	oints tapered a	at an angle of 60	° +/- 2° to the	e horizontal w	ith the tip						
	rounded to a r	adius of 0.8+/	-0.1 mm(0.03	31+/-0.004 in)	, with a specifi	ed force of 0.56	+/-0.05 N (2+/·	0.2 oz)							
	Loading Time	:5 sec Spec	cimen Size: 4	!" x 4"											72 min.
	82	81	82	82	81	84	82	82	83	81	82	1	81	84	80 MARV
ASTM D1505	Density (grams	/ cm. ³)													
	0.9362	0.9333	0.9345								0.9347	0.0015	0.9333	0.9362	0.939 max.
ASTM D6693	Tensile Propertie	<u>s:</u>													
Type IV						narrow section:								-	
	Length Overa	ll: 4.5in Cond	litioning: Con	nducted test in	n standard labo	oratory atmosphe	ere of 23+/-2°	C (73.4+/-3.6	^o F), and						
	50+/-5% relati														
	Tensile Strength				0=0										
	MD 242 TD 212	269	266	262	259						260	11	242	269	169 min.
	•	246	233	223	226	nath 20in					228	13	212	246	
	Elongation at Bro MD 491	555	533	531	539	ngth = 2.0 in	•				530	24	491	555	300 min.
	TD 519	583	556	536	539						530 547	24 24	491 519	583	300 11111.
ASTM D1603	Carbon Black Co				JJJ						J 71		513	305	
	2.05	2.36									2.21	0.22	2.05	2.36	2 - 3
												1	1		

(End of Table 1)

(Sheet 1 of 1)

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GAI-LAI

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/11/2014 Date Reported: 6/19/2014 Client Sample ID: R#F14A235070 L#CEE810100 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cycitia TRI Job No.: G140516 TRI Control No.: 98156 GAI-LAI

						SPECIMEN	S								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													1
ASTM D5994	Thickness (mils	;)													
	Apparatus: De	ad-weight dia	al micrometer w	vith gauge poi	nts tapered a	t an angle of 60	0° +/- 2° to the	e horizontal w	ith the tip						
	rounded to a r	adius of 0.8+,	/-0.1 mm(0.031	1+/-0.004 in), v	with a specifi	ed force of 0.56	6+/-0.05 N (2+/	0.2 oz)							
	Loading Time:														72 min.
	82	80	81	82	82	82	81	83	82	81	82	1	80	83	80 MARV
ASTM D1505	Density (grams														
	0.9327	0.9324	0.9334								0.9328	0.0005	0.9324	0.9334	0.939 max.
ASTM D6693	Tensile Propertie														l
Type IV	Test Specimer								0 (T) and		-				1
	Length Overal				standard labo	ratory atmosph	ere of 23+/-2*	6 (73.4+/-3.6	F), and						[
	50+/-5% relati Tensile Strength		•												
	MD 248	236	(103/111 With 242	239	228						239	7	228	248	169 min.
	TD 239	230	215	243	228						231	11	215	243	
	Elongation at Bre					ength = 2.0 i	n.								
	MD 511	489	508	510	476	•					499	16	476	511	300 min.
	TD 573	559	548	585	560						565	14	548	585	
ASTM D1603	Carbon Black Co	ontent (pe	rcent, %)												
	2.31	2.31									2.31	0.00	2.31	2.31	2 - 3
	(End of Tab	ole 1)							(Sheet 1 of	1)					

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TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/11/2014 Date Reported: 6/19/2014 Client Sample ID: R#F14A236087 L#CEE810100 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cycitia TRI Job No.: G140516 TRI Control No.: 98157 GAI-LAP

				ę	SPECIMENS	5								Proj.
	1	2	3 4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-we	eight dial micro	ometer with gauge po	ints tapered a	t an angle of 60	° +/- 2° to th	e horizontal w	ith the tip						
	rounded to a radius	of 0.8+/-0.1 m	m(0.031+/-0.004 in),	with a specifie	ed force of 0.56	+/-0.05 N (2+/	(-0.2 oz)							
	Loading Time: 5 sec	c Specimen S	Size: 4" x 4"											72 min.
	81 8	32 8	31 82	83	82	82	84	81	80	82	1	80	84	80 MARV
ASTM D1505	Density (grams/ cm.	.3)												
	0.9325 0.9	333 0.9	336							0.9331	0.0006	0.9325	0.9336	0.939 max.
ASTM D6693	Tensile Properties:													
Type IV			f narrow section:0.25							-				
	Length Overall: 4.5ir	n Conditioning	g: Conducted test in a	standard labo	ratory atmosphe	ere of 23+/-2 ⁰	C (73.4+/-3.6	^o F), and						
	50+/-5% relative hur		•											
	Tensile Strength at B													
			58 262	241						258	10	241	266	169 min.
		1. T. T	61 236	197	.,,					233	24	197	261	
	Elongation at Break				ngth = 2.0 ir).				-00	4.0			
			34 531	495						522	18	495	536	300 min.
			09 550	433						537	66	433	609	
ASTM D1603	Carbon Black Conten		, %)							0.16	0.00	0.00	0.00	A A
	2.09 2.	.22								2.16	0.09	2.09	2.22	2 - 3
	<i>·</i> · · · · · · · ·													

(End of Table 2)

(Sheet 1 of 1)

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TABLE 3.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/11/2014 Date Reported: 6/19/2014 Client Sample ID: R#F14A241003 L#CEE810120 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: TRI Job No.: **G140516** TRI Control No.: **98158** GAI-LAI

					:	SPECIMENS	;							[Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994		ad-weight dia		00,		t an angle of 60 ed force of 0.56+			vith the tip						
	Loading Time:				nin a specine		/-0.03 N (2+/-	0.2 02)							72 min.
	82	81	81	82	81	81	82	82	80	81	81	1	80	82	80 MARV
ASTM D1505	Density (grams/	cm. ³)													
	0.9350	0.9360	0.9336								0.9348	0.0012	0.9336	0.9360	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV						narrow section:1 ratory atmosphe					-			-	
	50+/-5% relativ	-													
	Tensile Strength		*												
	MD 266 TD 209	269 239	230 239	243 220	206 212						243 224	26 14	206 209	269 239	169 min.
	Elongation at Bre	ak (perce	ent, %)		Gauge Le	ngth = 2.0 in									
	MD 506	511	444	473	393						465	49	393	511	300 min.
	TD 426	523	534	479	469						486	43	426	534	
ASTM D1603	Carbon Black Co		rcent, %)												
	2.31	2.26									2.28	0.04	2.26	2.31	2 - 3
	(End of Tab	le 3)							(Sheet 1 of	1)					

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TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/13/2014 Date Reported: 6/27/2014 Client Sample ID: R#F14A242020 L#CEE810120 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Eyeitia TRI Job No.: G140528 TRI Control No.: 98198 GAI-LAP

						SPECIMEN	S								Proj.
	1 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION														l
ASTM D5994	Thickness (mils)														
	Apparatus: Dead-we	eight dial micr	rometer w	ith gauge poil	nts tapered a	t an angle of 6	0° +/- 2° to the	horizontal w	rith the tip						
	rounded to a radius	of 0.8+/-0.1 r	mm(0.031-	+/-0.004 in), v	with a specifi	ed force of 0.56	S+/-0.05 N (2+/-0	0.2 oz)							[
	Loading Time: 5 sec	Specimen	Size: 4" x	<i>(</i> 4"											72 min.
	82 8	32	81	80	84	83	84	82	83	82	82	1	80	84	80 MARV
ASTM D1505	Density (grams/ cm.	3)													l
	0.9309 0.9	313 0.	9308								0.9310	0.0003	0.9308	0.9313	0.939 max.
STM D6693	Tensile Properties:														
ype IV	Test Specimens: Typ	pe IV, Width	of narrow	section:0.25i	in, Length of	narrow section.	1.3in, Width Ov	verall:0.75in,							
	Length Overall: 4.5ir	n Conditionii	ing: Condu	ucted test in s	standard labo	ratory atmosph	ere of 23+/-2 ⁰ (C (73.4+/-3.6	^o F), and						
	50+/-5% relative hur	nidity. Rate o	of Separat	ion: 2"/min											[
	Tensile Strength at Br	reak (lbs/	/ in wid	lth)											[
	MD 272 2	59	242	262	281						263	15	242	281	169 min.
			239	259	231						245	11	231	259	Ĺ
	Elongation at Break	(percent, 9	%)		Gauge Le	ength = 2.0 i	n.								
			499	506	538						517	19	499	538	300 min.
			553	584	546						561	15	546	584	
STM D1603	Carbon Black Conten		nt, %)												l
	2.38 2.	.30									2.34	0.06	2.30	2.38	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/17/2014 Date Reported: 6/27/2014 Client Sample ID: R#F14A243037 L#CEE810120 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G140552 TRI Control No.: 98300

				9	SPECIMEN	S								Proj.
	1 2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-weight dial	l micrometer with	n gauge poir	nts tapered a	t an angle of 60	0° +/- 2° to the theorem 2 to the second	he horizontal w	ith the tip						
	rounded to a radius of 0.8+/-	-0.1 mm(0.031+/·	-0.004 in), v	with a specifie	ed force of 0.56	S+/-0.05 N (2+	/-0.2 oz)							
	Loading Time: 5 sec Speci		! "											72 min.
	81 81	81	82	82	81	81	82	83	81	81	1	81	83	80 MARV
ASTM D1505	Density (grams/ cm.3)													
	0.9321 0.9316	0.9317								0.9318	0.0003	0.9316	0.9321	0.939 max.
ASTM D6693	Tensile Properties:													
Type IV	Test Specimens: Type IV, W							0						
	Length Overall: 4.5in Cond	-		tandard labo	ratory atmosph	ere of 23+/-2	°C (73.4+/-3.6	°F), and						
	50+/-5% relative humidity. R	•												
	Tensile Strength at Break (MD 248 243	(IDS/ In Widtr 233		241						242	5	000	040	160 min
	TD 227 226	233 215	243 190	241 212						242	5 15	233 190	248 227	169 min.
	Elongation at Break (perce				ength = 2.0 il	n				217	1.7	190	221	
	MD 485 474	461	475	481						475	9	461	485	300 min.
	TD 548 543	503	451							511	39	451	548	
ASTM D1603	Carbon Black Content (per													
	2.14 2.21									2.18	0.05	2.14	2.21	2 - 3
	(End of Table 1)							(Sheet 1 of	1)					

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GAI-LA

TABLE 2.

MATERIAL PROPERTIES

_ _ . . . _ . . _

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/17/2014 Date Reported: 6/27/2014 Client Sample ID: R#F14A244054 L#CEE810120 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cycitia TRI Job No.: G140552 TRI Control No.: 98301 GAI-LAP

				:	SPECIMENS	5								Proj.
	1 2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-weight dia	l micrometer v	vith gauge poi	ints tapered a	t an angle of 60	$^{\circ}$ +/- 2° to th	e horizontal wi	th the tip						
	rounded to a radius of 0.8+/-			with a specifie	ed force of 0.56	+/-0.05 N (2+/	/-0.2 oz)							
	Loading Time: 5 sec Spec					<u></u>		·····						72 min.
	82 84	82	81	81	83	82	81	83	83	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ cm.3)													
	0.9314 0.9319	0.9316								0.9316	0.0002	0.9314	0.9319	0.939 max.
ASTM D6693	Tensile Properties:													
Type IV	Test Specimens: Type IV, W Length Overall: 4.5in Cond							F) and		-				
	50+/-5% relative humidity. R				ratory atmosph		0 (70.447 0.0	<i>i), and</i>						
	Tensile Strength at Break	,												
	MD 224 230	246	233	247						236	10	224	247	169 min.
	TD 221 256	239	243	244						241	13	221	256	
	Elongation at Break (perce	ent, %)		Gauge Le	ength = 2.0 ir	1.								
	MD 476 479	506	486	524						494	20	476	524	300 min.
	TD 511 574	558	570	580						559	28	511	580	
ASTM D1603	Carbon Black Content (per	rcent, %)												
	2.31 2.24									2.28	0.05	2.24	2.31	2 - 3
	(End of Table 2)							(Sheet 1 of	1)					

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TABLE 1.MATERIAL PROPERTIES

_ _ . . . _ . . _

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/18/2014 Date Reported: 6/27/2014 Client Sample ID: R#F14A245071 L#CEE810120 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cycitia</u> TRI Job No.: **G140554** TRI Control No.: **98303** GAI-LAI

				SP	ECIMENS	i								Proj.
	1 2	3 4	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-weight di	ial micrometer with gau	ige points ta	apered at an	angle of 60	° +/- 2° to the	e horizontal witl	n the tip						
	rounded to a radius of 0.8+	+/-0.1 mm(0.031+/-0.00	04 in), with a	a specified fo	orce of 0.56+	-/-0.05 N (2+/-	0.2 oz)							
	Loading Time: 5 sec Spe					· · · · · · <u></u> · · · · · · ·								72 min.
	84 85	84 8	4	84	84	83	84	85	83	84	1	83	85	80 MARV
ASTM D1505	Density (grams/ cm. ³)													
	0.9324 0.9319	0.9316								0.9319	0.0004	0.9316	0.9324	0.939 max.
ASTM D6693	Tensile Properties:	147 101 1	0.05' /			o: 14% # 0	"							
Type IV	Test Specimens: Type IV, Length Overall: 4.5in Con			0				E) and		-				
	50+/-5% relative humidity.	-		aru laborato	ry atmosphe	16 01 20+/-2	<i>J</i> (7 <i>J</i> .47/-J.0 1), and						
	Tensile Strength at Break	•												
	MD 269 256	276 25	56	256						263	9	256	276	169 min.
	TD 263 298	255 22	26	269						262	26	226	298	
	Elongation at Break (perc	cent, %)	Gai	uge Leng	th = 2.0 in									
	MD 538 505	564 52		531						533	21	505	564	300 min.
	TD 585 626	565 48	39	570						567	50	489	626	
ASTM D1603	Carbon Black Content (pe	ercent, %)												
	2.42 2.40									2.41	0.01	2.40	2.42	2 - 3
	(End of Table 1)						(Sheet 1 of	1)					

By accepting the data and results presented on this report, the Client agrees to limit the liability of TRI Environmental, Inc. from Client and all other parties for claims on issues, due to the use of this data, to the cost for the respective tests presented in this report; and the Client agrees to indemnify and hold harmless TRI Environmental, Inc. from and against all liabilities in excess of the aforementioned limit.

TABLE 2.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/18/2014 Date Reported: 6/27/2014 Client Sample ID: R#F14A247088 L#CEE810110 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cycitia</u> TRI Job No.: **G140554** TRI Control No.: **98304** GAI-LAI

					SPECIMENS	5								Proj.
	1 2	2 3	4	5	6	7	8	9	10	Avg.	Std. De	V. Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)										· · ·			
	Apparatus: Dead-we	ight dial microme	ter with gauge po	ints tapered a	at an angle of 60	° +/- 2° to the	horizontal w	ith the tip						
	rounded to a radius of	of 0.8+/-0.1 mm(0	0.031+/-0.004 in),	with a specifi	ed force of 0.56-	+/-0.05 N (2+/-	0.2 oz)							1
	Loading Time: 5 sec	Specimen Size	: 4" x 4"											72 min.
	82 8	1 81	83	83	83	82	83	83	83	82	1	81	83	80 MARV
ASTM D1505	Density (grams/ cm.	3)												[
	0.9314 0.9	327 0.932	4							0.9322	0.0007	0.9314	0.9327	0.939 max.
STM D6693	Tensile Properties:													
Гуре IV	Test Specimens: Typ							_		-				
	Length Overall: 4.5in	Conditioning: C	Conducted test in	standard labo	oratory atmosphe	ere of $23 + / -2^{\circ}$ (C (73.4+/-3.6	°F), and						[
	50+/-5% relative hun													
	Tensile Strength at Br													
		85 264		287						276	10	264	287	169 min.
	TD 236 2		275	234						254	18	234	275	
	Elongation at Break				ength = 2.0 ir).								l
		46 529		518						533	15	518	551	300 min.
		68 583		500						554	36	500	583	[
STM D1603	Carbon Black Conten		»)							0.60	0.04	0.00	0.05	
	2.65 2.	60								2.63	0.04	2.60	2.65	2 - 3
	(End of Table 2)							(Chaot 1 of	4)					

(End of Table 2)

(Sheet 1 of 1)

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TABLE 3.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/18/2014 Date Reported: 6/27/2014 Client Sample ID: R#F14A251004 L#CEE810110 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cycitia TRI Job No.: G140554 TRI Control No.: 98305 GAI-LAI

					9	SPECIMENS	6								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils Apparatus: De rounded to a ra	ad-weight dial	micrometer with 0.1 mm(0.031+/						th the tip						
	Loading Time:	5 sec Speci	men Size: 4" x 4	4"											72 min.
		82	81	81	82	81	82	84	82	81	82	1	81	84	80 MARV
ASTM D1505	Density (grams/	′ cm.³)													
	0.9322		0.9321								0.9320	0.0002	0.9317	0.9322	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV			lidth of narrow s tioning: Conduc						⁹ F), and		-	-		-	
			ate of Separatio												
	Tensile Strength														
	MD 278 TD 254	246 282	252 279	301 256	269 259						269 266	22 13	246 254	301 282	169 min.
	Elongation at Bre	eak (perce	nt, %)	1	Gauge Le	ngth = 2.0 ir	1.								
	MD 558	485	508	586	546						537	40	485	586	300 min.
	TD 578	625	623	563	588						595	28	563	625	
ASTM D1603	Carbon Black Co	ontent (per	cent, %)												
	2.25	2.74									2.49	0.34	2.25	2.74	2 - 3
	(End of Tab	ole 3)							(Sheet 1 of	1)					

By accepting the data and results presented on this report, the Client agrees to limit the liability of TRI Environmental, Inc. from Client and all other parties for claims on issues, due to the use of this data, to the cost for the respective tests presented in this report; and the Client agrees to indemnify and hold harmless TRI Environmental, Inc. from and against all liabilities in excess of the aforementioned limit.

TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/20/2014 Date Reported: 6/28/2014 Client Sample ID: R#F14A252023 L#CEE810110 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cypitia</u> TRI Job No.: **G140568** TRI Control No.: **98336**

SPECIMENS Proj. 2 3 4 5 6 9 10 Avg. Std. Dev. Specs. 8 Min Max METHOD DESCRIPTION **ASTM D5994** Thickness (mils) Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) 72 min. Loading Time: 5 sec Specimen Size: 4" x 4" 85 86 85 85 84 84 85 84 84 85 85 1 **80 MARV** 84 86 Density (grams/ cm.3) **ASTM D1505** 0.9327 0.9330 0.9325 0.9328 0.0002 0.9325 0.9330 0.939 max. **ASTM D6693 Tensile Properties:** Type IV Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2°C (73.4+/-3.6°F), and 50+/-5% relative humidity. Rate of Separation: 2"/min Tensile Strength at Break (lbs/ in.- width) MD 287 269 269 270 10 261 265 169 min. 261 287 ΤD 251 236 246 272 262 253 14 236 272 Elongation at Break (percent, %) Gauge Length = 2.0 in. MD 556 526 505 515 522 21 508 505 556 300 min. 563 516 594 TD 541 604 564 36 516 604 **ASTM D1603** Carbon Black Content (percent, %) 2.34 2.37 0.04 2.31 2.31 2.37 2 - 3

(End of Table 1)

(Sheet 1 of 1)

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GAI-LA

TABLE 1.MATERIAL PROPERTIES

_ _ . . . _ . . _

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/23/2014 Date Reported: 6/28/2014 Client Sample ID: R#F14A253040 L#CEE810110 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Eyeitia</u> TRI Job No.: **G140572** TRI Control No.: **98347** GAI-LAI

					SPECIMEN	S								Proj.
	1 2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-weight	dial micrometer	with gauge poi	ints tapered a	t an angle of 60	0° +/- 2° to th	e horizontal wi	th the tip						
	rounded to a radius of 0.	8+/-0.1 mm(0.03	31+/-0.004 in),	with a specifi	ed force of 0.56	S+/-0.05 N (2+/	-0.2 oz)							
	Loading Time: 5 sec S		" x 4"											72 min.
	84 83	83	84	84	83	83	83	83	84	83	0	83	84	80 MARV
ASTM D1505	Density (grams/ cm.3)													
	0.9324 0.9329	0.9327								0.9326	0.0002	0.9324	0.9329	0.939 max.
ASTM D6693	Tensile Properties:													
Type IV	Test Specimens: Type I									-				
	Length Overall: 4.5in C	-		standard labo	ratory atmosph	ere of 23+/-2°	C (73.4+/-3.6°	F), and						
	50+/-5% relative humidit													
	Tensile Strength at Brea MD 239 312	k (ids/ in w 300	(10th) 279	275						281	28	000	010	169 min.
	TD 260 253	300 285	279	275 259						261	20 12	239 253	312 285	169 11111.
	Elongation at Break (pe		209		ength = 2.0 i	n				205	12	255	205	
	MD 454 575	576	533	535	,	•••				535	50	454	576	300 min.
	TD 570 578	639	586	585						592	27	570	639	
ASTM D1603	Carbon Black Content (percent, %)												
	2.08 2.29	. ,								2.19	0.14	2.08	2.29	2 - 3
	(End of Table 1)							(Sheet 1 of	1)					

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TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 6/24/2014 Date Reported: 6/28/2014 Client Sample ID: R#F14A254054 L#CEE810110 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: TRI Job No.: **G140583**

TRI Control No.: 98376

					;	SPECIMENS	5								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	N													
ASTM D5994	Thickness (mils	s)													
	Apparatus: De	ad-weight dia	l micrometer v	with gauge po	ints tapered a	t an angle of 60	0° +/- 2° to the	e horizontal w	ith the tip						
	rounded to a r	adius of 0.8+/	-0.1 mm(0.03	1+/-0.004 in),	with a specifie	ed force of 0.56	+/-0.05 N (2+/-	0.2 oz)							
	Loading Time.														72 min.
	85	86	85	83	84	84	83	85	84	85	84	1	83	86	80 MARV
ASTM D1505	Density (grams														
	0.9340		0.9341								0.9338	0.0003	0.9335	0.9341	0.939 max.
ASTM D6693	Tensile Propertie														
Type IV						narrow section:			⁰ (C) and		-				
					standard labol	ratory atmosph	ere of 23+/-2	6 (73.4+/-3.6	F), and						
	50+/-5% relati Tensile Strength		•												
	MD 248	236	242	243	259						246	9	236	259	169 min.
	TD 263	223	264	282	247						256	22	223	282	
	Elongation at Bre	eak (perce	ent, %)		Gauge Le	ngth = 2.0 ii	٦.								
	MD 518	483	499	480	520	U					500	19	480	520	300 min.
	TD 569	496	581	613	551						562	43	496	613	
ASTM D1603	Carbon Black Co	ontent (pe	rcent, %)												
	2.31	2.27									2.29	0.03	2.27	2.31	2 - 3
	(End of Tat	ole 1)							(Sheet 1 of	1)					

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GAI-LAI



MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/11/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B063029 L# CEK810150 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cycitia</u> TRI Job No.: **G150096** TRI Control No.: **102545** GAI-LA

						SPECIMEN	S								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils	5)													
	Apparatus: De	ad-weight dia	l micrometer v	with gauge po	oints tapered a	t an angle of 6	0° +/- 2° to t	he horizontal w	ith the tip						
	rounded to a r	adius of 0.8+/	-0.1 mm(0.03	1+/-0.004 in),	with a specifie	ed force of 0.56	S+/-0.05 N (2-	+/-0.2 oz)							
	Loading Time:	5 sec Spec	imen Size: 4"	' x 4"											72 min.
	83	83	80	81	80	84	82	82	81	81	82	1	80	84	80 MARV
ASTM D1505	Density (grams	/ cm. ³)													
	0.9339	0.9346	0.9342								0.9342	0.0004	0.9339	0.9346	0.939 max.
ASTM D6693	Tensile Propertie	<u>s:</u>													
Type IV	Test Specimer														
	Length Overal	l: 4.5in Cond	litioning: Conc	ducted test in	standard labo	ratory atmosph	ere of 23+/-2	⁰ C (73.4+/-3.6	⁰ F), and						
	50+/-5% relati		•												
	Tensile Strength			idth)											
	MD 266	302	282	243	275						274	22	243	302	169 min.
	TD 284	279	273	288	297						284	9	273	297	
	Elongation at Bre				· · · · · · · · · · · . · · · · · · · · ·	ngth = 2.0 ii	n.								
	MD 570	635	625	513	604						589	50	513	635	300 min.
	TD 616	598	606	616	643						616	17	598	643	
ASTM D1603	Carbon Black Co		rcent, %)												
	2.53	2.47									2.50	0.04	2.47	2.53	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/11/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B065047 L# CEK810150 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150096 GAI-LAI

TRI Control No.: 102546

						SPECIMEN	S								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils))													
	Apparatus: Dea	ad-weight dia	l micrometer v	with gauge p	oints tapered a	t an angle of 60	0° +/- 2° to the	e horizontal w	vith the tip						
	rounded to a ra	adius of 0.8+/	-0.1 mm(0.03	1+/-0.004 in)	, with a specifi	ed force of 0.56	6+/-0.05 N (2+/	-0.2 oz)							
	Loading Time:	5 sec Spec	imen Size: 4"	x 4"											72 min.
	84	81	82	81	81	82	81	82	80	82	82	1	80	84	80 MARV
ASTM D1505	Density (grams/	cm. ³)													
	0.9354	0.9347	0.9338								0.9346	0.0008	0.9338	0.9354	0.939 max.
ASTM D6693	Tensile Properties	<u>):</u>													
Type IV	Test Specimen	• •			-				_		_				
	Length Overall	:4.5in Cona	litioning: Cond	ducted test in	n standard labo	ratory atmosph	ere of 23+/-2°	C (73.4+/-3.6	⁰ F), and						
	50+/-5% relativ														
	Tensile Strength														
	MD 290	285	273	298	272						284	11	272	298	169 min.
	TD 266	289	270	305	241						274	24	241	305	
	Elongation at Bre					ength = 2.0 ii	า.								
	MD 548	528	543	569	520						541	19	520	569	300 min.
	TD 585	649	625	650	541						610	47	541	650	
ASTM D1603	Carbon Black Co		rcent, %)												
	2.03	2.20									2.12	0.12	2.03	2.20	2 - 3

(End of Table 2)

(Sheet 1 of 1)

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TABLE 3.

MATERIAL PROPERTIES

ODECIMENC

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/11/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B066064 L# CEK810150 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150096 TRI Control No.: 102547 GAI-LA

Droi

					SPECIMENS)								Proj.
	1	2 3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils) Apparatus: Dead-w rounded to a radius	0	0 0 1	•	0			ith the tip						
	Loading Time: 5 se		. ,	, ,		,	,							72 min.
	83	82 83	2 81	82	83	83	82	81	84	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ cm	. ³)												
		9336 0.93	847							0.9340	0.0007	0.9335	0.9347	0.939 max.
ASTM D6693	Tensile Properties:													
Type IV	Test Specimens: T Length Overall: 4.5							[°] F), and		-			-	
	50+/-5% relative ht	imidity. Rate of S	Separation: 2"/min											
	Tensile Strength at E	Break (lbs/ ir	n width)											
	MD 251	256 26	7 272	262						262	8	251	272	169 min.
		305 25		275						283	21	258	305	
	Elongation at Break	(percent, %))	Gauge Le	ength = 2.0 in									
	· · · · · · · · · · · · · · · · · · ·	518 52		525						520	10	503	528	300 min.
		561 49		505						528	34	491	566	
ASTM D1603	Carbon Black Conte	nt (percent,	%)											
	2.40 2	2.16								2.28	0.17	2.16	2.40	2 - 3

(End of Table 3)

(Sheet 1 of 1)

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TABLE 4.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/11/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B067081 L# CEK810150 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Expitia TRI Job No.: G150096 GAI-LAI

TRI Control No.: 102548

					:	SPECIMENS									Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils)													
	Apparatus: De	ad-weight dia	l micrometer w	vith gauge po	ints tapered a	t an angle of 60	° +/- 2° to the	horizontal w	ith the tip						
	rounded to a ra	adius of 0.8+/	/-0.1 mm(0.031	+/-0.004 in),	with a specifie	ed force of 0.56+	/-0.05 N (2+/-0	.2 oz)							
	Loading Time:	5 sec Spec	cimen Size: 4"	x 4"											72 min.
	83	84	83	83	83	82	81	83	82	81	82	1	81	84	80 MARV
ASTM D1505	Density (grams/	' cm. ³)													
	0.9348	0.9346	0.9339								0.9344	0.0005	0.9339	0.9348	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV						narrow section:1		-	_		-				
	Length Overall	:4.5in Cond	ditioning: Cond	ucted test in a	standard laboi	ratory atmosphe	re of 23+/-2 [°] C	(73.4+/-3.6	^o F), and						
	50+/-5% relativ		•												
	Tensile Strength														
	MD 268	285	264	269	266						270	8	264	285	169 min.
	TD 230	285	236	282	256						258	25	230	285	
	Elongation at Bre	eak (perce	ent, %)			ength = 2.0 in	•								
	MD 519	560	521	515	529						529	18	515	560	300 min.
	TD 520	614	553	603	591						576	39	520	614	
ASTM D1603	Carbon Black Co		rcent, %)												
	2.45	2.41									2.43	0.03	2.41	2.45	2 - 3

(End of Table 4)

(Sheet 1 of 1)

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MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/12/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B071007 L# CEK810140 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150100 GAI-LAI

TRI Control No.: 102555

						SPECIMENS	5								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	N													
ASTM D5994	Thickness (mils	S)													
	Apparatus: De	ead-weight dia	l micrometer v	with gauge p	oints tapered a	at an angle of 60	° +/- 2° to the	horizontal wi	th the tip						
	rounded to a l	radius of 0.8+/	-0.1 mm(0.03	1+/-0.004 in)	, with a specifi	ied force of 0.56	+/-0.05 N (2+/-	0.2 oz)							
	Loading Time	:5 sec Spec	cimen Size: 4"	x 4"											72 min.
	80	81	81	80	81	80	82	80	81	80	80	1	80	82	80 MARV
ASTM D1505	Density (grams	/ cm. ³)													
	0.9338	0.9346	0.9345								0.9343	0.0004	0.9338	0.9346	0.939 max.
ASTM D6693	Tensile Propertie	<u>s:</u>													
Type IV						narrow section:	-								
	Length Overa	ll: 4.5in Cond	litioning: Cond	lucted test in	n standard labo	oratory atmosphe	ere of $23 + / -2^{\circ}$ (C (73.4+/-3.6°	F), and						
	50+/-5% relati		•												
	Tensile Strength	at Break	(lbs/ in wi	dth)											
	MD 227	239	249	239	256						242	11	227	256	169 min.
	TD 257	282	258	282	200						256	34	200	282	
	Elongation at Br	eak (perce				ength = 2.0 in	1.								
	MD 485	505	534	508	534						513	21	485	534	300 min.
	TD 583	640	608	624	486						588	61	486	640	
ASTM D1603	Carbon Black Co	ontent (pe	rcent, %)												
	2.31	2.23									2.27	0.06	2.23	2.31	2 - 3

(End of Table 1)

(Sheet 1 of 1)

By accepting the data and results presented on this report, the Client agrees to limit the liability of TRI Environmental, Inc. from Client and all other parties for claims on issues, due to the use of this data, to the cost for the respective tests presented in this report; and the Client agrees to indemnify and hold harmless TRI Environmental, Inc. from and against all liabilities in excess of the aforementioned limit.



MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/13/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B072024 L# CEK810140 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150101 GAI-LAI

TRI Control No.: 102556

					ę	SPECIMEN	5								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils)													
	Apparatus: De	ad-weight dial	micrometer w	vith gauge po	oints tapered at	an angle of 60	0° +/- 2° to the	horizontal wi	ith the tip						
	rounded to a ra	adius of 0.8+/-	0.1 mm(0.031	1+/-0.004 in),	, with a specifie	d force of 0.56	+/-0.05 N (2+/-	0.2 oz)							
	Loading Time:	5 sec Speci	imen Size: 4"	x 4"											72 min.
	81	82	80	81	84	81	81	81	81	81	81	1	80	84	80 MARV
ASTM D1505	Density (grams/	′ cm. ³)													
	0.9339	0.9332	0.9327								0.9333	0.0006	0.9327	0.9339	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV	Test Specimen								-						
	Length Overall	: 4.5in Condi	itioning: Cond	lucted test in	standard labor	atory atmosph	ere of 23+/-2 ⁰	C (73.4+/-3.6°	°F), and						
	50+/-5% relativ														
	Tensile Strength														
	MD 260	233	233	236	231						239	12	231	260	169 min.
	TD 239	243	270	249	259						252	13	239	270	
	Elongation at Bre				· · · · · · · · · · · · · · · · · · ·	ngth = 2.0 ii	7.								
	MD 533	500	511	493	491						506	17	491	533	300 min.
	TD 569	564	614	588	615						590	24	564	615	{
ASTM D1603	Carbon Black Co		cent, %)												
	2.22	2.83									2.52	0.43	2.22	2.83	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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MATERIAL PROPERTIES CLIENT: AMEC Foster Wheeler Environment & Infrastructure PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/16/2015 Date Reported: 2/18/2015 Client Sample ID: R# F15B073041 L# CEK810140 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Expitia TRI Job No.: G150108

TRI Control No.: **102576**

				ę	SPECIMENS	6								Proj.
	1 2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION													
ASTM D5994	Thickness (mils)													
	Apparatus: Dead-weig	ht dial micrometer	with gauge poil	nts tapered at	an angle of 60	° +/- 2° to th	e horizontal w	rith the tip						
	rounded to a radius of	0.8+/-0.1 mm(0.03	31+/-0.004 in), v	with a specifie	d force of 0.56	+/-0.05 N (2+/	′-0.2 oz)							
	Loading Time: 5 sec	Specimen Size: 4	" x 4"											72 min.
	82 81	81	82	81	81	81	82	82	81	81	1	81	82	80 MARV
ASTM D1505	Density (grams/ cm.3)													
	0.9367 0.93									0.9367	0.0000	0.9367	0.9367	0.939 max
ASTM D6693	Tensile Properties:													
Type IV	Test Specimens: Type	IV, Width of narro	w section:0.25i	in, Length of r	narrow section:	1.3in, Width C	verall:0.75in,			-				
	Length Overall: 4.5in	Conditioning: Con	ducted test in s	tandard labor	atory atmosphe	ere of 23+/-2 ⁰	C (73.4+/-3.6	⁰ F), and						
	50+/-5% relative humi	dity. Rate of Separ	ation: 2"/min											
	Tensile Strength at Bre	ak (lbs/inw	vidth)											
	MD 275 272	2 255	275	244						264	14	244	275	169 min.
	TD 236 259	F	265	247						251	11	236	265	
	Elongation at Break (p	percent, %)		Gauge Le	ngth = 2.0 ir	1.								
	MD 516 51	5 475	516	464						497	26	464	516	300 min.
	TD 554 576	6 565	610	579						577	21	554	610	
ASTM D1603	Carbon Black Content	(percent, %)												
	2.34 2.2	9								2.32	0.03	2.29	2.34	2 - 3



MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/18/2015 Date Reported: 2/24/2015 Client Sample ID: R#F15B074058 L#CEK810140 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150120 GAI-LAI

TRI Control No.: 102739

					5	SPECIMENS	3							ſ	Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIC)N													
ASTM D5994	Thickness (mile	s)													
	Apparatus: D	ead-weight dia	l micrometer w	vith gauge poi	nts tapered at	an angle of 60	° +/- 2° to th	e horizontal wi	ith the tip						
	rounded to a	radius of 0.8+/	-0.1 mm(0.031	1+/-0.004 in), v	with a specifie	d force of 0.56-	+/-0.05 N (2+/	-0.2 oz)							
	Loading Time	: 5 sec Spec	imen Size: 4" .	x 4"											72 min.
	81	81	81	81	81	81	81	81	82	81	81	0	81	82	80 MARV
ASTM D1505	Density (grams	s/ cm. ³)													
	0.9367	0.9367	0.9367								0.9367	0.0000	0.9367	0.9367	0.939 max.
ASTM D6693	Tensile Propertie	<u>es:</u>													
Type IV						arrow section:					_				
	Length Overa	ll: 4.5in Cona	litioning: Cond	lucted test in s	standard labor	atory atmosphe	ere of 23+/-2 ⁰	C (73.4+/-3.6 [°]	⁰ F), and						
		ive humidity. F	•												
	Tensile Strength														
	MD 292	269	288	288	281						284	9	269	292	169 min.
	TD 266	295	194	256	275						257	38	194	295	
	Elongation at Br					ngth = 2.0 ir	7.				= 1 0	40		· · · · · <u>· · · · · ·</u> · · · · ·	
	MD 554	508	554	544	541						540	19 75	508	554	300 min.
	TD 613	659	464	593	630						592	75	464	659	
ASTM D1603	Carbon Black C		icenii, %)								2 20	0.04	0.07	0.00	^ ^
	2.33	2.27									2.30	0.04	2.27	2.33	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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TABLE 2.

MATERIAL PROPERTIES

CDECIMENC

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/18/2015 Date Reported: 2/24/2015 Client Sample ID: R#F15B075075 L#CEK810140 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cypitia</u> TRI Job No.: **G150120** TRI Control No.: **102740** GAI-LA

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					5	PECIMENS									Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION	1													
ASTM D5994	Thickness (mils) Apparatus: Dea		l micrometer i	with aguae poir	nte tanarad at :	an angle of 60°	2° $1/2^{\circ}$ to the	horizontal w	ith the tin						
	rounded to a rad	dius of 0.8+/-	-0.1 mm(0.03	81+/-0.004 in), w					un une up						
	Loading Time: 5	5 sec Spec													72 min.
	82	81	81	83	81	81	81	81	82	81	81	1	81	83	80 MARV
ASTM D1505	Density (grams/	cm. ³)													
	0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693	Tensile Properties	<u>.</u>													
Type IV	Test Specimens	: Туре IV, И	Vidth of narrow	w section:0.25ir	n, Length of na	arrow section:1	.3in, Width O	verall:0.75in,							
	Length Overall:	4.5in Cond	litioning: Conc	ducted test in st	tandard labora	tory atmosphe	re of 23+/-2 ⁰	C (73.4+/-3.6	⁰ F), and		-				
	50+/-5% relative	e humidity. R	late of Separa	ation: 2"/min											
	Tensile Strength a	at Break	(lbs/ in wi	idth)											
	MD 245	279	267	272	291						271	17	245	291	169 min.
	TD 275	269	236	272	272						265	16	236	275	
	Elongation at Brea	ak (perce	ent, %)		Gauge Len	ngth = 2.0 in								•••••	
	MD 549	535	524	529	546	-					537	11	524	549	300 min.
	TD 638	611	558	516	623						589	51	516	638	
ASTM D1603	Carbon Black Cor	ntent (pei	rcent, %)												
	2.31	2.32									2.32	0.01	2.31	2.32	2 - 3

(End of Table 2)

(Sheet 1 of 1)

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TABLE 3.

_ _ . . . _ . . _

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/18/2015 Date Reported: 2/24/2015 Client Sample ID: R#F15B076092 L#CEM810770 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cypitia</u> TRI Job No.: **G150120** GAI-LAI

TRI Control No.: 102741

					:	SPECIMENS	6								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils)													
	Apparatus: De	ad-weight dial	l micrometer w	ith gauge poi	ints tapered at	t an angle of 60	° +/- 2° to the	horizontal wi	ith the tip						
	rounded to a ra	adius of 0.8+/-	-0.1 mm(0.031	+/-0.004 in),	with a specifie	ed force of 0.56	+/-0.05 N (2+/-0).2 oz)							
	Loading Time:	5 sec Spec	imen Size: 4" .	x 4"											72 min.
	81	81	81	80	81	81	81	81	81	81	81	0	80	81	80 MARV
ASTM D1505	Density (grams/	′ cm. ³)													
	0.9355	0.9355	0.9355								0.9355	0.0000	0.9355	0.9355	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV	Test Specimer								_						
	Length Overall	1:4.5in Cond	litioning: Cond	ucted test in s	standard labor	atory atmosphe	ere of 23+/-2° C	; (73.4+/-3.6	°F), and						
	50+/-5% relativ		•												
	Tensile Strength		(lbs/ in wid	dth)											
	MD 260	262	285	236	228						254	23	228	285	169 min.
	TD 281	272	261	252	241						261	16	241	281	
	Elongation at Bre		ent, %)		· · · · · · · · · · · · · · · · · · ·	ngth = 2.0 ir	1.								
	MD 503	524	560	530	521						528	21	503	560	300 min.
	TD 614	599	578	574	545						582	26	545	614	
ASTM D1603	Carbon Black Co		rcent, %)												
	2.36	2.31									2.33	0.04	2.31	2.36	2 - 3

(End of Table 3)

(Sheet 1 of 1)

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TABLE 4.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/18/2015 Date Reported: 2/24/2015 Client Sample ID: R#F15B077110 L#CEM810770 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Cypitia</u> TRI Job No.: **G150120** TRI Control No.: **102742** GAI-LA

SPECIMENS Proj. 2 3 5 6 8 10 Ava. Std. Dev. Specs. 4 9 Min Max METHOD DESCRIPTION **ASTM D5994** Thickness (mils) Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) 72 min. Loading Time: 5 sec Specimen Size: 4" x 4" 81 82 81 81 81 82 81 81 81 81 81 0 **80 MARV** 81 82 Density (grams/ cm.3) **ASTM D1505** 0.9361 0.9361 0.9361 0.9361 0.0000 0.9361 0.9361 0.939 max. **ASTM D6693 Tensile Properties:** Type IV Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2°C (73.4+/-3.6°F), and 50+/-5% relative humidity. Rate of Separation: 2"/min Tensile Strength at Break (lbs/in.-width) MD 278 279 267 267 269 241 15 169 min. 241 279 ΤD 242 262 236 275 259 255 16 236 275 Elongation at Break (percent, %) Gauge Length = 2.0 in. MD 523 533 525 520 524 525 5 520 533 300 min. 31 TD 551 580 543 611 605 578 543 611 **ASTM D1603** Carbon Black Content (percent, %) 2.26 2.29 0.04 2.31 2.26 2.31 2 - 3

(End of Table 4)

(Sheet 1 of 1)

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MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/19/2015 Date Reported: 2/24/2015 Client Sample ID: R#F15B081017 L#CEM810770 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150122 GAI-LA

TRI Control No.: 102746

	SPECIMENS					Proj.
	1 2 3 4 5 6 7 8 9 1	D Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION					
ASTM D5994	Thickness (mils)					
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60 $^{\circ}$ +/- 2 $^{\circ}$ to the horizontal with the tip					1
	rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)					
	Loading Time: 5 sec Specimen Size: 4" x 4"					72 min.
	82 82 82 81 81 81 82 82 82 8	2 81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm. ³)					
	0.9361 0.9361 0.9361	0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693	Tensile Properties:					1
Type IV	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in,	_				1
	Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of $23+/-2^{0}$ C (73.4+/-3.6 ⁰ F), and					
	50+/-5% relative humidity. Rate of Separation: 2"/min					
	Tensile Strength at Break (lbs/ in width)					
	MD 251 259 261 243 256	254	7	243	261	169 min.
	TD 269 262 258 265 241	259	11	241	269	
	Elongation at Break (percent, %) Gauge Length = 2.0 in.					
	MD 515 541 543 506 529	527	16	506	543	300 min.
	TD 599 591 603 593 541	585	25	541	603	
ASTM D1603	Carbon Black Content (percent, %)					
	2.27 2.32	2.29	0.04	2.27	2.32	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/20/2015 Date Reported: 2/27/2015 Client Sample ID: R#F15B083034 L#CEM810770 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: <u>Maria Expitia</u> TRI Job No.: **G150126** GAI-LA

TRI Control No.: 102761

						SPECIMENS	5								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils	;)													
	Apparatus: De	ad-weight dia	l micrometer v	vith gauge po	oints tapered a	at an angle of 60	° +/- 2° to the	horizontal wit	h the tip						
	rounded to a r	adius of 0.8+/	-0.1 mm(0.031	+/-0.004 in),	, with a specifi	ed force of 0.56-	-/-0.05 N (2+/-0).2 oz)							
	Loading Time:	5 sec Spec	cimen Size: 4"	x 4"											72 min.
	81	82	81	81	81	81	81	81	82	81	81	0	81	82	80 MARV
ASTM D1505	Density (grams	/ cm. ³)													
	0.9339	0.9348	0.9353								0.9347	0.0007	0.9339	0.9353	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV						narrow section:1					_				
	Length Overal	l: 4.5in Conc	litioning: Cond	ucted test in	standard labo	oratory atmosphe	re of 23+/-2° C	; (73.4+/-3.6°	F), and						
	50+/-5% relati														
	Tensile Strength	at Break	(lbs/ in wie	dth)											
	MD 248	259	249	239	228						245	12	228	259	169 min.
	TD 275	262	264	259	275						267	8	259	275	
	Elongation at Bre				.	ength = 2.0 in	.								
	MD 523	521	526	506	478						511	20	478	526	300 min.
	TD 625	613	629	608	639						623	13	608	639	
ASTM D1603	Carbon Black Co	ontent (pe	rcent, %)												
	2.14	2.25									2.19	0.08	2.14	2.25	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/23/2015 Date Reported: 2/27/2015 Client Sample ID: R#F15B084051 L#CEM810770 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150138 TRI Control No.: 102800 GAI-LA

					S	SPECIMENS	;								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION														
ASTM D5994*	Thickness (mils)														
	Apparatus: Dead	l-weight dial	micrometer wi	ith gauge poir	nts tapered at a	an angle of 60 $^{\circ}$	+/- 2° to the	e horizontal wit	th the tip						
	rounded to a rad	ius of 0.8+/-	0.1 mm(0.031+	+/-0.004 in), v	with a specified	force of 0.56+,	/-0.05 N (2+/-	0.2 oz)							
	Loading Time: 5	sec Speci	imen Size: 4" x	4"											72 min.
	87	85	90	86	83	82	88	89	89	85	86	3	82	90	80 MARV
ASTM D1505*	Density (grams/ o	.m. ³)													
	0.9340	0.9340	0.9340								0.9340	0.0000	0.9340	0.9340	0.939 max.
ASTM D6693*	Tensile Properties:														
Type IV	Test Specimens.										_				
	Length Overall:	4.5in Condi	itioning: Condu	icted test in s	tandard labora	tory atmospher	e of 23+/-2°	C (73.4+/-3.6 ⁰	F), and						
	50+/-5% relative		•												
	Tensile Strength a														
	MD 259	282	287	259	286						275	14	259	287	169 min.
	TD 267	274	279	283	270						275	7	267	283	
	Elongation at Brea					ngth = 2.0 in	.								
	MD 497	544	548 COF	515	541						529	22	497	548	300 min.
	TD 634	628	625	628	602						623	12	602	634	
ASTM D1603*	Carbon Black Con		cent, %)								2 1 0	0.01	0.17	0.10	• •
	2.17	2.18									2.18	0.01	2.17	2.18	2 - 3

*Tested at TRI, TX

(End of Table 1)

(Sheet 1 of 1)

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MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/24/2015 Date Reported: 2/27/2015 Client Sample ID: R#F15B085068 L#CEM810770 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: G150139 GAI-LAI

TRI Control No.: 102801

					5	SPECIMENS	5							ľ	Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIO	Ν													
ASTM D5994	Thickness (mils)													
	Apparatus: De	ad-weight dial	micrometer v	vith gauge point	s tapered at	an angle of 60	$^{\circ}$ +/- 2 $^{\circ}$ to the	e horizontal wi	th the tip						
	rounded to a ra	adius of 0.8+/-	0.1 mm(0.03	1+/-0.004 in), wi	th a specifie	d force of 0.56-	-/-0.05 N (2+/-	-0.2 oz)							
	Loading Time:	5 sec Speci	men Size: 4"	x 4"											72 min.
	81	81	82	81	82	81	82	82	81	82	81	0	81	82	80 MARV
ASTM D1505	Density (grams/	' cm. ³)													
	0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693	Tensile Properties	<u>s:</u>													
Type IV				v section:0.25in,					_		_			-	
	Length Overall	: 4.5in Condi	tioning: Cona	lucted test in sta	ndard labora	atory atmosphe	re of 23+/-2°	C (73.4+/-3.6 ^c	°F), and						
	50+/-5% relativ														
	Tensile Strength														
	MD 260	236	267	229	266						252	18	229	267	169 min.
	TD 263	256	242	272	259						258	11	242	272	
	Elongation at Bre					ngth = 2.0 ir).								
	MD 531	505	546	486	546						523	27	486	546	300 min.
	TD 591	608	588	590	575						590	12	575	608	
ASTM D1603	Carbon Black Co		cent, %)								0.00				• •
	2.26	2.31									2.28	0.03	2.26	2.31	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/26/2015 Date Reported: 3/5/2015 Client Sample ID: R#F15B086085 L#CEM810870 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Cypitia TRI Job No.: **G150158** GAI-LA

TRI Control No.: 102869

					5	SPECIMEN	5								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION														
ASTM D5994	Thickness (mils)														
	Apparatus: Dead	l-weight dia	l micrometer	with gauge poi	ints tapered at	t an angle of 60	0° +/- 2° to th	e horizontal w	vith the tip						
	rounded to a rad	lius of 0.8+/-	-0.1 mm(0.03	81+/-0.004 in),	with a specifie	ed force of 0.56	+/-0.05 N (2+/	-0.2 oz)							
	Loading Time: 5	sec Spec	imen Size: 4'	" x 4"											72 min.
	83	81	81	82	81	81	81	81	82	81	81	1	81	83	80 MARV
ASTM D1505	Density (grams/ c	cm. ³)													
	0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693	Tensile Properties:														
Type IV	Test Specimens.														
	Length Overall:		-		standard labor	ratory atmosph	ere of 23+/-2°	C (73.4+/-3.6	°F), and						
	50+/-5% relative		•												
	Tensile Strength a		•••••••		070						070	10			
	MD 259 TD 278	267	305	265 265	270 206						273 252	18 27	259	305	169 min.
	· · · · · · · · · · · · · · · · · · ·	257	254			nath 20i	~				232	21	206	278	
	Elongation at Brea MD 517	528	574	525	555	ngth = 2.0 ii	1.				540	24	517	574	300 min.
	TD 633	528 593	581	525 624	483						583	60	483	574 633	
ASTM D1603	Carbon Black Con			V 4 7										000	
	2.39	2.20									2.29	0.13	2.20	2.39	2 - 3

(End of Table 1)

(Sheet 1 of 1)

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TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: 2/26/2015 Date Reported: 3/5/2015 Client Sample ID: R#F15B087103 L#CEM810870 Material Description: 80mil LLDPE Microspike Geomembrane QC'd By: Maria Expetia

GAI-LA

TRI Job No.: **G150158** TRI Control No.: **102870**

					5	SPECIMENS	S								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTIC	DN													
ASTM D5994	Thickness (mil Apparatus: D	S) Dead-weight dia	l micrometer v	with gauge poi	nts tapered at	t an angle of 60	0° +/- 2° to ti	ne horizontal w	vith the tip						
	rounded to a	radius of 0.8+/	-0.1 mm(0.03	1+/-0.004 in), I	with a specifie	ed force of 0.56	+/-0.05 N (2+	/-0.2 oz)							
	Loading Time	e: 5 sec Spec	cimen Size: 4"	x 4"											72 min.
	82	81	81	81	81	81	81	81	81	81	81	0	81	82	80 MARV
ASTM D1505	Density (gram	s/ cm.³)													
	0.9367	0.9367	0.9367								0.9367	0.0000	0.9367	0.9367	0.939 max.
ASTM D6693	Tensile Propertie	<u>es:</u>													
Type IV		ens: Type IV, V all: 4.5in Cond							⁰ F), and		-				
	50+/-5% rela	tive humidity. F	Rate of Separa	tion: 2"/min											
	Tensile Strengtl	h at Break	(lbs/ in wi	dth)											
	MD 272	273	295	262	254						271	15	254	295	169 min.
	TD 258	239	266	254	272						258	13	239	272	
	Elongation at B	reak (perce	ent, %)		Gauge Le	ngth = 2.0 ii	า.								
	MD 539	513	554	524	512						528	18	512	554	300 min.
	TD 603	547	611	578	619						591	29	547	619	
ASTM D1603	Carbon Black C		rcent, %)											I	
	2.27	2.16									2.22	0.08	2.16	2.27	2 - 3

(End of Table 2)

(Sheet 1 of 1)

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Appendix K.2

40-mil LLDPE Smooth Geomembrane Conformance Results

TABLE 1.MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: 10/9/2014 Date Reported: 10/13/2014 Client Sample ID: R#F14D402025 L#CEH810040 Material Description: 40mil LLDPE Smooth Geomembrane QC'd By: <u>Maria Cypitia</u> TRI Job No.: **G141050** TRI Control No.: **100853**

GAI-LA

					:	SPECIMEN	IS								Proj.
	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Specs.
METHOD	DESCRIPTION														•
ASTM D5199	Thickness (mils)														
Procedure B	Apparatus:Dead	weight dial N	Aicrometer with 6	.35 mm (0.	250 in) dia pre	esser foot and	a pressure of 4	3.10 kPA (6.3	8 psi)						
	provided by a 142	gm dead we	eight. Loading ti	ime: 5 sec	Specimen Si	ze: 10pcs3in	. Diameter.								38 min.
	42	42	43	41	43	42	42	42	43	42	42	1	41	43	40 min. av
ASTM D1505	Density (grams/ cr	n.°)													
	0.9346	0.9346	0.9346								0.9346	0.0000	0.9346	0.9346	0.939 max
ASTM D6693	Tensile Properties:														
Type IV	Test Specimens:														
	Length Overall: 4.				ndard laborat	ory atmospher	re of 23+/-2° C	(73.4+/-3.6° F), and		_				_
	50+/-5% relative h														
	Tensile Strength at				000						007				
	MD 226 TD 212	228	238	215	230						227	8	215	238	140 min.
	TD 212 Elongation at Break	229	216	219	212	nath 05	in. (NSF M	odified)			218	<i>.1</i>	212	229	
	MD 748	760	831	717	795	ngin = 2.5 i	111. (INSF IVI	ouilleu)			770	44	717	831	650 min.
	TD 729	831	766	747	735						760	43	726	831	050 11111.
ASTM D1603	Carbon Black Conte			• • •	, 20						,	70	720	031	
	2.30	2.31	, /0/								2.30	0.00	2.30	2.31	2 - 3
												■	■		

(End of Table 1)

(Sheet 1 of 1)

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Appendix K.3

80-mil LLDPE DSMS Exposed Geomembrane Conformance Technical Memorandum & Test Results



Technical Memorandum

To:	Ron Roberts (CC&V)	Date:	June 11, 2015
From:	Andrea Meduna, PE (Amec Foster Wheeler)	Project No.:	74201125N0.****.****
CC:	Ron DiDonato (CC&V) Scott Redabaugh, (CC&V) Jeff Gaul, (CC&V) Robert Redd, (Amec Foster Wheeler)		
Re:	Test Results of Exposed LLDPE Geomembrane	Liner in Phase	1 of SGVLF

BACKGROUND

This memorandum presents the results of laboratory testing conducted on two samples of 80-mil double-sided textured Linear Low Density Polyethylene (LLDPE) geomembrane deployed on the east side ("Victor Side") of the Phase 1 Squaw Gulch Valley Leach Facility (SGVLF) (refer to AMEC drawing A200) from October 8, 2014 through November 6, 2014 that has been left exposed to ultraviolet radiation to the present date (approximately 217 to 246 days). According to the project technical specification outlined below, the geomembrane cannot be exposed for longer than 180 days.

Section 02776.0 Geomembrane

3.06 Fill Placement,

H. Drain Cover Fill,

7. Contractor shall place drain cover fill at a rate such that the geomembrane liner is not exposed to ultraviolet light for more than 180 days.

After deployment of the geomembrane, it was recommended by Amec Foster Wheeler to cover the geomembrane liner prior to winter to protect from clay and rocks rolling onto the deployed geomembrane, ultraviolet light, and the overall exposure to the elements. As of May 6, 2015, a majority of the geomembrane liner in the area stated above had not been covered with drain cover fill material as required.

It was recommended by Amec Foster Wheeler to either remove all geomembrane liner exposed for more than 180 days or perform testing on geomembrane from each resin lot (two) that had been deployed. Amec Foster Wheeler sampled areas of the deployed geomembrane liner from the two resin lots that had been deployed to perform testing. After the samples were taken the holes in the geomembrane liner were repaired.

Amec Foster Wheeler Environment & Infrastructure, Inc. 2000 S. Colorado Blvd., Suite 2-1000 Denver, CO 80222 Tel: +1 (303) 935-6505 Fax: +1 (303) 935-6575 amecfw.com Continued.

The laboratory testing consisted of the following:

- ASTM D5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
- ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique
- ASTM D1603 Standard Method for Carbon Black Content in Olefin Plastics
- ASTM D638/GRI GM 17, Type IV Standard Test Method for Tensile Properties of Plastics

The purpose of the testing is to evaluate the integrity of the geomembrane liner after being exposed to ultraviolet light/sunlight, rain, snow, and wind. Testing was performed by TRI Environmental, Inc. to remain consistent with the initial conformance testing.

GEOMEMBRANE PROPERTY TESTING

The above testing procedures were performed on the two samples taken from the exposed geomembrane. The exposed geomembrane liner test results were compared to the same resin lot and nearest roll number that was tested after manufacturing as part of the third party conformance testing program. The test results are presented in Table 1 and attached to this memorandum. The test results suggest the exposed LLDPE geomembrane liner still meet the minimum requirements of the technical specifications.

Roll Number	Lot Number	Average Thickness (mils)	Average Density g/cm³)	Carbon Black (%)	Avg. Break Strength Machine Direction (ppi)	Avg. Break Strength Transverse Direction (ppi)	Avg. Break Elongation Machine Direction (%)	Avg. Break Elongation Transverse Direction (%)
F14A251011	CEE810110	84.6	0.938	2.43	253	267	536	527
F14A251004	CEE810110	82	0.932	2.49	269	266	537	595
F14A242028	CEE810120	85.7	0.938	2.35	268	259	517	565
F14A242020	CEE810120	82	0.931	2.34	263	245	517	561
Specifi	cation	80	0.939	2 to 3	169	169	300	300

Table 1. Geomembrane Testing Results

Exposed geomembrane sample test results Testing results from nearest roll produced during conformance testing

CONCLUSIONS

The following conclusions are based on the attached laboratory test results:

• There is no evidence indicating a significant reduction in material properties of the exposed geomembrane.

Continued.

- The difference of tested material properties of the third party conformance samples and the exposed geomembrane liner is relatively small.
- Exposed geomembrane liner properties still exceed the minimum requirements of the project technical specifications.

RECOMMENDATIONS

The following recommendations are offered based on the attached laboratory test results:

- Allow the deployed geomembrane liner to remain in-place.
- Amec Foster Wheeler Representatives will visually inspect the area prior and during drain cover fill placement for any anomalies that could be due to being left exposed.
 - Should any area be suspect, Amec Foster Wheeler will sample the area and wait for laboratory testing. All costs associated with removal of material over failed liner should be the responsibility of the contractor based on their decision to leave it exposed for longer than the allowable 180 days.
- The geomembrane liner exposed for greater than 180 days within the Phase 1 SGVLF should be covered with drain cover fill as soon as possible for protection against ultraviolet radiation.

GEOMEMBRANE TEST RESULTS TRI Client: Amec Foster Wheeler Project: Cripple Creek / Squaw Gulch / CALIPROJECT7755

Material: 80 mll Microspike LLDPE Geomembrane Sample Identification: P - 103 Roll: 251011 Lot: 810110 TRI Log #: E2400-74-01

Thickness (ASTM D 5994) Thickness (mils) Density (ASTM D 1505)	1 88.3	2 81.9	3 82.8	4	5	6	7	8	9	10		
Thickness (mils)	88.3	81.9	82.8								1	
	88.3	81.9	82.8								Spec: Ave	erage:80
Density (ASTM D 1505)				81.5	82.2	81.6	83.2	87.4	88.5 Initial Aver	89.0 rage: 82	84.6 81.5	3 << min
											Spec: 0.93	39 (max)
Density (g/cm3)	0.938	0.938	0.938					Initial /	Average 0	.9320	0.938	0.000
Carbon Black Content (ASTM D	0 1603,	mod.)									Spec: Rar	nge 2-3
% Carbon Black	2.42	2.43							Initial Te	st: 2.49	2.43	0.01
ensile Properties (ASTM D 638	8/GRI (GM 17, 2	ipm stra	in rate, T	ype IV s	pecimen	· LLDPE)					
MD Yield Strength (ppi)	177	180	178	171	164						174	7
D Yield Strength (ppi)	178	177	177	175	169						175	4
/ID Break Strength (ppi)	256	207	243	278	283				Initial Av	/g: 269	253	31Spec: 169
TD Break Strength (ppi)	277	266	261	260	270				Initial Av	/g: 266	267	7
MD Yield Elongation (%)	20	22	21	22	21						21	1
TD Yield Elongation (%)	23	24	21	23	24						23	1
MD Break Elongation (%)	542	428	507	597	606				Initial Av	-	536	73 Spec: 30
TD Break Elongation (%)	546	523	514	516	538				Initial Av	ʻg: 595	527	14

MD Machine Direction

TD Transverse Direction

Page 3 of 3

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

TRI ENVIRONMENTAL, INC.

GEOMEMBRANE TEST RESULTS TRI Client: Amec Foster Wheeler Project: Cripple Creek / Squaw Gulch / CALIPROJECT7755

Material: 80 mil Microspike LLDPE GeomembraneSample Identification: P - 65Roll: 242028Lot: 810120TRI Log #: E2400-74-01

ARAMETER	тести		ATE NUM	DED							MEAN	STD. DEV.
	1	2	3	4	5	6	7	8	9	10		DEV.
hickness (ASTM D 5994)		2	5	-	5	U	,	U	,	10		
											Spec: Ave	rage:80
hickness (mils)	84.9	86.6	81.2	88.2	86.1	86.2	87.1	81.6	86.9	88.2	85.7	2
									Initial	Avg: 82	81.2	<< min
ensity (ASTM D 1505)											0	20 ()
											Spec: 0.9	39 (max)
ensity (g/cm3)	0.938	0.938	0.938					I	nitial Tes	t 0.9310	0.938	0.000
arbon Black Content (ASTI	M D 1603,	mod.)									Spec: Rar	nge 2-3
Carbon Black	2.34	2.36							Initial Te	est: 2.34	2.35	0.01
Carbon Diack	2.54	2.50							initial its	501. 2.04	2.33	0.01
ensile Properties (ASTM D	638/GRI (GM 17, 2	2 ipm stra	in rate, T	ype IV s	pecimen	- LLDPE)					
ID Yield Strength (ppi)	156	157	160	159	158						158	2
D Yield Strength (ppi)	166	169	176	175	172						172	4
ID Break Strength (ppi)	273	259	268	281	260				Initial A	vg: 263	268	9 Spec
D Break Strength (ppi)	264	239	263	271	259				Initial A	vg: 245	259	12
ID Yield Elongation (%)	30	29	26	26	26						27	2
D Yield Elongation (%)	21	20	18	20	19						20	1
ID Break Elongation (%)	529	496	507	546	508				Initial A	vg: 517	517	20 Spec
D Break Elongation (%)	573	522	571	592	569				Initial A	va: 561	565	26

MD Machine Direction

TD Transverse Direction

Page 2 of 3

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