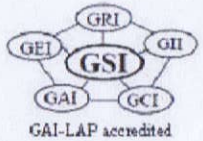
APPENDIX G

GCL MANUFACTURER QUALITY CONTROL DOCUMENTATION

CETCO®



GAI-LAP accredited

Date: 3/5/2014
Purchase Order: 30314008
ORDER NUMBER: 000302530

American Evironmental Group
Suite 100
Richfield, OH 44286
jedens@aeg.net

To Whom it May Concern:

Please find enclosed the MQA/MQC test data package for Geosynthetic Clay Liner shipments to American Evironmental Group.

The enclosed data package includes results of all the MQC tests required by ASTM D5889, with the exception of index flux/hydraulic conductivity. This test, which is run according to ASTM D5887, is normally performed once per production lot (once per week), unless a higher frequency is required by the project specifications. Because of the GCL's low permeability, this test can take several weeks to complete. The index flux/hydraulic conductivity results associated with this lot of material will be provided under separate cover as soon as they are available.

Although the index flux/hydraulic conductivity test results are not yet available, CETCO accepts responsibility for our GCL should the index flux/hydraulic conductivity tests produce unacceptable results. If, upon delivery and prior to installation, individual rolls of GCL are found to be nonconforming to accepted project specifications, CETCO will replace the nonconforming material at no charge.

Questions regarding this information should be directed to Chris Athanassopoulos, Technical Support Engineer, at (847) 851-1831.

Sincerely,

Roger B. Wilkerson
Quality Assurance Coordinator
CETCO Lovell Plant

GEOSYNTHETIC CLAY LINER
MANUFACTURING QUALITY ASSURANCE DATA PACKAGE

PROJECT NAME: ASARCO SMELTER
CUSTOMER P.O.: 30314008
ORDER NUMBER: 000302530
PREPARED FOR: American Evironmental Group

CONTENTS:

- Product Certifications
- GCL Order packing list and MQA tracking form
- GCL manufacturing quality control test data
- Bentonite clay certification
- Raw material test results

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PRODUCT CERTIFICATIONS

PROJECT NAME: ASARCO SMELTER
CUSTOMER P.O.: 30314008
ORDER NUMBERS: 000302530
PREPARED FOR: American Evironmental Group

The GCL manufactured for the above-referenced order number(s) is certified to meet the values listed in the tables below:

GCL PROPERTY SPECIFICATIONS FOR BENTOMAT DN

Test Method	Test Method Property	Test Frequency	Certified Value
ASTM D 5891	Bentonite Fluid Loss	1 per 50 Tons	18 ml Max
ASTM D 5993	Bentonite Mass/Area	40,000 sq ft (4000 sq m)	0.75 lb /sq ft Min
ASTM D 5890	Bentonite Swell Index	1 per 50 Tons	24 ml/2g Min
ASTM D 6768	GCL Grab Strength	200,000 sq ft (20,000 sq m)	50 lbs/in MARV
ASTM D 6243	GCL Hydrated Internal Shear Strength	Periodic	500 psf typ @ 200 psf normal load
ASTM D 5887	GCL Hydraulic Conductivity	Weekly	5.0E-9 cm/s Max
ASTM D 5887	GCL Index Flux	Weekly	1.0E-8 m3/m2/s Max
ASTM D 6496	GCL Peel Strength	40,000 sq ft (4000 sq m)	3.5 lbs/in Min

See next sheet

SPECIALLY REQUESTED CERTIFIED PROPERTIES FOR THIS ORDER OF BENTOMAT DN

Test Method	Test Method Property	Requested Frequency	Requested Value	Requested Conditions
ASTM D 5887	GCL Hydraulic Conductivity	250,000 sqft	5.0E-9 cm/s	Standard

Bentonite property tests are performed at a bentonite processing facility before shipment to CETCO's production facility. All tensile testing is in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

NEEDLE DETECTION AND REMOVAL PROCEDURE

CETCO hereby affirms that all Bentomat® geosynthetic clay liner material manufactured for this project is continually passed under a magnet for needle removal and then screened with a metal detection device. CETCO certifies Bentomat® to be essentially free of broken needles and fragments of needles that would negatively effect the performance of the final product.

Roger B. Wilkerson
Quality Assurance Coordinator

CETCO

GCL PACKING LIST AND MQA TRACKING FORM

Listing of finished and raw materials used to produce certification package number 000302530

GCL								Geotextiles				Clay
LO-BENTOMAT DN								N/W-WHITE			LO-N/W-BLACK-DN-6 OZ	LO-CG 50
Order	GCL Lot #	GCL Roll #	Length	Width	weight	sq ft	Roll # Tested	Cap Lot #	Cap Roll #	Roll # Tested	Base Roll #	Clay Lot #
000302530	201342LO	10302	150	14.5	2785	2175	10299	2023091778			2022966376	101013A
000302530	201342LO	10308	150	14.5	2815	2175	10299	2023091771			2022951476	101013B
000302530	201342LO	10319	150	14.5	2840	2175	10317	2023091788			2022966367	101013B
000302530	201342LO	10323	150	14.5	2735	2175	10317	2023091769			2022966367	101013B
000302530	201342LO	10324	150	14.5	2830	2175	10317	2023091769			2022966367	101013B
000302530	201342LO	10335	150	14.5	2755	2175	10335	2023091760			2022909902	101013B
000302530	201342LO	10350	150	14.5	2775	2175	10335	2023091781			2022962030	101013C
000302530	201342LO	10352	150	14.5	2790	2175	10335	2023069572			2022962030	101013C
000302530	201342LO	10363	150	14.5	2735	2175	10353	2023071364			2022962040	101013C
000302530	201342LO	10364	150	14.5	2775	2175	10353	2023071364			2022962040	101013C
000302530	201342LO	10366	150	14.5	2795	2175	10353	2023071364			2022962040	101013C
000302530	201342LO	10371	150	14.5	2810	2175	10371	2023071338			2022966397	101013C
000302530	201342LO	10380	150	14.5	2840	2175	10371	2023071335			2022966397	101013C
000302530	201342LO	10391	150	14.5	2870	2175	10389	2023071423			2022962026	101013C
000302530	201342LO	10414	150	14.5	2650	2175	10409	2023071334			2022962031	101013D
000302530	201342LO	10431	150	14.5	2975	2175	10415	2023071417			2023083722	101013E
000302530	201342LO	10437	150	14.5	2875	2175	10433	2023071418			2023083720	101013E
000302530	201342LO	10438	150	14.5	2885	2175	10433	2023071418			2023083720	101013E
000302530	201342LO	10439	150	14.5	2900	2175	10433	2023071418			2023083720	101013E
000302530	201342LO	10441	150	14.5	2870	2175	10433	2023071418			2023083720	101013E
000302530	201342LO	10445	150	14.5	2815	2175	10433	2023091934			2023083720	101013E
000302530	201342LO	10447	150	14.5	2850	2175	10433	2023091934			2023083729	101013E
000302530	201342LO	10448	150	14.5	2820	2175	10433	2023091934			2023083729	101013E
000302530	201342LO	10449	150	14.5	2870	2175	10433	2023091934			2023083729	101013E
000302530	201342LO	10451	150	14.5	2830	2175	10451	2023091940			2023083729	101013E
000302530	201342LO	10455	150	14.5	2835	2175	10451	2023091940			2023083729	101013E
000302530	201342LO	10456	150	14.5	2835	2175	10451	2023091940			2023083729	101013E
000302530	201342LO	10457	150	14.5	2855	2175	10451	2023091940			2023083729	101013E
000302530	201342LO	10458	150	14.5	2875	2175	10451	2023091927			2023083729	101013E
000302530	201342LO	10459	150	14.5	2870	2175	10451	2023091927			2023083731	101013F

Order	GCL Lot #	GCL Roll #	Length	Width	weight	sq ft	Roll # Tested	Cap Lot #	Cap Roll #	Roll # Tested	Base Roll #	Clay Lot #
000302530	201342LO	10461 ✓	150	14.5	2850	2175	10451	2023091927			2023083731	101013F
000302530	201342LO	10466 ✓	150	14.5	2810	2175	10451	2023091936			2023083731	101013F
000302530	201342LO	10468 ✓	150	14.5	2820	2175	10451	2023091936			2023083731	101013F
000302530	201342LO	10470 ✓	150	14.5	2835	2175	10469	2023091936			2023083731	101013F
000302530	201342LO	10473 ✓	150	14.5	2950	2175	10469	2023091941			2022951492	101013F
000302530	201403LO	8 ✓	150	14.5	3040	2175	1	2023118625			J20071376	010914E
000302530	201403LO	9 ✓	150	14.5	3105	2175	1	2023118625			J20071376	010914E
000302530	201403LO	10 ✓	150	14.5	3055	2175	1	2023118625			J20071376	010914E
000302530	201403LO	11 ✓	150	14.5	3095	2175	1	2023118625			J20071376	010914E
000302530	201403LO	12 ✓	150	14.5	3080	2175	1	2023118625			J20071376	010914E
000302530	201403LO	13 ✓	150	14.5	3085	2175	1	2023143124			J20071376	010914E
000302530	201403LO	14 ✓	150	14.5	3065	2175	1	2023143124			J20071374	010914E
000302530	201403LO	15 ✓	150	14.5	3055	2175	1	2023143124			J20071374	010914E
					Total sq ft:	**93525**					Total Number of Rolls Certified: **43**	

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GCL MANUFACTURING QUALITY CONTROL TEST DATA

The following rolls in GCL certification package number 000302530 have been tested in our production facility lab.

	Product	Lot # Tested	Roll # Tested	Mass Area	Grab Strength	Peel Strength 6496
			ASTM Test Method:	D 5993	D 6768	D 6496
			Required Value:	0.75 lb /sq ft Min	50 lbs/in MARV	3.5 lbs/in Min
	LO-BENTOMAT DN	201342LO	10299	0.95	95.2	11.8
	LO-BENTOMAT DN	201342LO	10317	0.85	95.2	15.2
✱	LO-BENTOMAT DN	201342LO	10335	0.87	95.2	14.0
	LO-BENTOMAT DN	201342LO	10353	0.89	95.2	10.9
✱	LO-BENTOMAT DN	201342LO	10371	0.87	71.3	13.2
	LO-BENTOMAT DN	201342LO	10389	0.91	71.3	9.1
	LO-BENTOMAT DN	201342LO	10409	0.81	71.3	11.5
	LO-BENTOMAT DN	201342LO	10415	0.97	71.2	11.2
	LO-BENTOMAT DN	201342LO	10433	0.95	71.2	7.7
✱	LO-BENTOMAT DN	201342LO	10451	0.93	71.2	8.5
	LO-BENTOMAT DN	201342LO	10469	0.89	71.2	10.2
	LO-BENTOMAT DN	201403LO	1	0.90	93.1	6.0

1/50,000 1/250,000

BENTONITE CLAY CERTIFICATION

The Bentonite Clay used to produce package 000302530
has been tested by American Colloid Company and yielded the following test results.

Clay Lot #	Moist	Swell	Fluid Loss
ASTM Test Method:	D 2216	D 5890	D 5891
Required Value:	12% Max	24 ml/2g Min	18 ml Max
101013A	10.20	24.00	16.80
101013B	10.80	26.00	16.40
101013C	11.10	30.00	13.60
101013D	12.00	29.00	13.60
101013E	10.90	30.00	14.00
101013F	11.30	28.00	14.00
010914E	8.20	25.00	15.00

1/50 ton 1/50 ton

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GEOTEXTILE TEST RESULTS FROM MATERIAL SUPPLIERS

The GCL in certification package number 000302530 was manufactured with geotextiles which were tested with the following results.

BASE GEOTEXTILE

Material	Roll Number	Mass Area oz/yd2	Grab Strength lbs
PPX HH65L	2022909902	7.0	206.1
PPX HH65L	2022951476	6.7	188.2
PPX HH65L	2022951492	6.5	177.1
PPX HH65L	2022962026	6.9	190.0
PPX HH65L	2022962030	6.6	156.4
PPX HH65L	2022962031	6.3	155.3
PPX HH65L	2022962040	6.9	184.6
PPX HH65L	2022966367	6.5	203.5
PPX HH65L	2022966376	6.8	206.5
PPX HH65L	2022966397	7.0	206.9
PPX HH65L	2023083720	6.5	208.8
PPX HH65L	2023083722	8.2	251.6
PPX HH65L	2023083729	6.6	211.5
PPX HH65L	2023083731	6.3	198.0
PT-TENCATE	J20071374	6.2	200.9
PT-TENCATE	J20071376	6.2	195.2

COVER GEOTEXTILE

Material	Roll Number	Mass Area oz/yd2	Grab Strength lbs
PPX 650	2023069572	6.8	135.5
PPX 650	2023071334	7.0	138.3
PPX 650	2023071335	7.0	138.3
PPX 650	2023071338	7.1	142.9
PPX 650	2023071364	7.0	133.2
PPX 650	2023071417	6.8	140.2
PPX 650	2023071418	7.3	154.3
PPX 650	2023071423	6.7	223.5
PPX 650	2023091760	7.0	116.1
PPX 650	2023091769	6.8	114.9
PPX 650	2023091771	6.9	112.1
PPX 650	2023091778	7.1	246.4
PPX 650	2023091781	6.6	119.4
PPX 650	2023091788	6.8	134.5
PPX 650	2023091927	6.6	123.6
PPX 650	2023091934	6.5	114.7
PPX 650	2023091936	6.8	137.0
PPX 650	2023091940	6.8	124.1
PPX 650	2023091941	6.8	124.1
PPX 650	2023118625	6.8	159.4
PPX 650	2023143124	7.2	145.2

Certifications from our suppliers are on file at our production facility.

An '*' or 'PT' indicates supplier certifications were unavailable prior to shipping so testing was performed at a CETCO lab.

CETCO - 92 HWY 37, Lovell, WY. 82431 Computation Sheet : GRI Accredited ASTM D-5887, Index Flux

Sample: Bentomat DN
Lot Number: 201403LO
Roll Number: 1
Project Name: Weekly Perm

Permeability equation : ((0.879*Thickness)/(2*Pi*r^2*Time))*ln(Change in Head)

Flux equation : ((Inflow+Outflow)/200)/Pi*r^2/Time

Initial Thickness : 0.892 cm. **Hydration :** 48hrs **Permeant :** De-aired DI Water **Date:** 3/13/2014

Test Position : CET-L-306 **Initial Head :** 2psi 140.6 cm. **Analyst :** SW **Date Started:** 1/15/2014

Cell Size : 4 in. **Max. Effective Stress :** 5psi 34.5kPa **Requested by :**

Final Thickness : 0.843 cm.

*** indicates value meets Flux Ratio ASTM termination criteria**

Conversions : 2 psi

Flux (English) = Flux * 9.2366E+10

Date	Time (min)	Reading In	X	Reading Out	Y	X-Y	Head (cm)	H (cm)	Initial K (cm/sec)	Initial Flux ($m^3/m^2/sec$)		Avg Flux ($m^3/m^2/sec$)	Final K (cm/sec)	Final Flux (Gal/Acre /Day)	Inflow to Outflow Ratio
1/20/2014	0	0.0	24.0	24.0	0.0	24.0	140.63	164.63							
	117	0.4	23.6	23.7	0.3	23.3	140.63	163.93	2.94E-09	6.15E-09			2.77E-9		1.33
	233	0.8	23.2	23.4	0.6	22.6	140.63	163.23	2.97E-09	6.20E-09	*		2.81E-9		1.33
	360	1.2	22.8	22.9	1.1	21.7	140.63	162.33	3.51E-09	7.28E-09	*		3.32E-9		0.80
1/21/2014	1225	3.9	20.1	20.4	3.6	16.5	140.63	157.13	3.03E-09	6.18E-09	*		2.87E-9		1.08
	1328	4.2	19.8	20.1	3.9	15.9	140.63	156.53	2.99E-09	5.99E-09	*		2.83E-9		1.00
	1428	4.5	19.5	19.8	4.2	15.3	140.63	155.93	3.10E-09	6.17E-09	*	**6.11E-09**	2.93E-9	564	1.00
							Final Flux	**6.1E-9**	$m^3/m^2/sec$						-0.23
							Final Hydraulic Conductivity	**2.9E-9**	cm/s						

Roger B.Wilkerson

y Assurance Coordinator
PO Box 428
vell, Wyoming 82431

CETCO - 92 HWY 37, Lovell, WY. 82431 Computation Sheet : GRI Accredited ASTM D-5887, Index Flux

Sample: Bentomat DN
Lot Number: 201342LO
Roll Number: 10409
Project Name: Weekly Perm

Permeability equation : ((0.879*Thickness)/(2*Pi*r^2*Time))*ln(Change in Head)

Flux equation : ((Inflow+Outflow)/200)/Pi*r^2/Time

Initial Thickness : 0.801 cm. **Hydration :** 48hrs **Permeant :** De-aired DI Water **Date:** 11/12/2013

Test Position : CET-L-302 **Initial Head :** 2psi 140.6 cm. **Analyst :** SW **Date Started:** 11/7/2013

Cell Size : 4 in. **Max. Effective Stress :** 5psi 34.5kPa **Requested by :**

Final Thickness : 0.757 cm.

*** indicates value meets Flux Ratio ASTM termination criteria**

Conversions : 2 psi

Flux (English) = Flux * 9.2366E+10

Date	Time (min)	Reading In	X	Reading Out	Y	X-Y	Head (cm)	H (cm)	Initial K (cm/sec)	Initial Flux ($m^3/m^2/sec$)		Avg Flux ($m^3/m^2/sec$)	Final K (cm/sec)	Final Flux (Gal/Acre /Day)	Inflow to Outflow Ratio
11/11/2013	0	0.0	24.0	24.0	0.0	24.0	140.63	164.63							
	156	0.8	23.2	23.3	0.7	22.5	140.63	163.13	4.25E-09	9.88E-09			4.01E-9		1.14
	261	1.3	22.7	22.8	1.2	21.5	140.63	162.13	4.24E-09	9.79E-09	*		4.01E-9		1.00
11/12/2013	1389	6.7	17.3	17.6	6.4	10.9	140.63	151.53	4.34E-09	9.66E-09	*		4.10E-9		1.04
	1583	7.6	16.4	16.7	7.3	9.1	140.63	149.73	4.46E-09	9.54E-09	*		4.21E-9		1.00
	1683	8.1	15.9	16.2	7.8	8.1	140.63	148.73	4.85E-09	1.03E-08	*		4.58E-9		1.00
	1799	8.7	15.3	15.7	8.3	7.0	140.63	147.63	4.63E-09	9.75E-09	*		4.38E-9		1.20
	1901	9.2	14.8	15.3	8.7	6.1	140.63	146.73	4.34E-09	9.07E-09	*	**9.70E-09**	4.10E-9	896	1.25
							Final Flux	**9.7E-9**	$m^3/m^2/sec$						-0.60
							Final Hydraulic Conductivity	**4.4E-9**	cm/s						

Roger B. Wilkerson

Quality Assurance Coordinator
PO Box 428
Lovell, Wyoming 82431