AIR MONITORING, INC.

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STATIONARY SOURCE SAMPLING REPORT

FOR

KNAUF INSULATION, LLC

ALBION, MICHIGAN

Line Nos. 1, 2 & 4 Melter Baghouse Stack (SV-MELT 6, 7&9)
Resinated Line No. 1 Collection Stack (SV-SCRUBBER)
Resinated Line No. 1 Curing & Cooling Table Stack (SV-HEAF)
Line No. 3 Melter Baghouse Stack (SV-EP0022)
Resinated Line 3 Collection & Curing Stack (SV-EP0023)
Line Nos. 2 & 4 Non-Resinated Collection Stack (SV-WETSCRUBBER)

Test Dates: September 29 – October 3, 2014

Integrity Project No. 14-061

Certified By:

Date 11/11/14	Date 11/11/14
James A. Lewis, QSTI Vice President/QA Manager Integrity Air Monitoring, Inc.	J.A. Tony Blanton, QSTI President/Technical Director Integrity Air Monitoring, Inc.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: B7205 County: Calhoun

Source Address: 1000 East North Street City: Albion

AQD Source ID (SRN): B7205 ROP No.: MI-ROP-B7205-2009 ROP Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From ____ To ____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From ____ To ____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From 9/29/2014 To 10/3/2014

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

2014 Performance Test Repport for Sep 29 - Oct 3 2014.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Kevin Keen	Plant Manager	517-630-2038
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official: [signature] Plant Manager Date: 11/12/14

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

1.0 INTRODUCTION

This section of the report describes the test purpose and provides a brief outline of the test activities and the personnel involved in the test program performed at the Knauf Insulation, LLC (Knauf Insulation) facility in Albion, Michigan.

1.1 Purpose

The purpose of the test program was to determine compliance with emission limits established in Michigan Department of Environmental Quality ROP Permit No. MI-ROP-B7205-2009. The tests were also subject to the requirements of 40 CFR Part 60, Subpart PPP and 40 CFR Part 63, Subpart NNN. Sampling was performed at the Line Nos. 1, 2 & 4 Melter Baghouse Stack (SV-MELT 6, 7 & 9), Resinated Line 1 Collection Stack (SV-SCRUBBER), Resinated Line 1 Curing & Cooling Table Stack (SV-HEAF), Resinated Line 3 Collection, Curing & Cooling Table Stack (SV-EP0023), Resinated Line 3 Melter Baghouse Stack (SV-EP0022) and Non-Resinated Line Nos. 2 & 4 Collection Stack (SV-WETSCRUBBER). The Resinated Line 1 Collection Stack and Resinated Line 1 Curing & Cooling Table Stack were tested under two operating conditions to establish operating ranges for each venturi scrubber. The Resinated Line 3 Collection, Curing and Cooling Table Stack was also tested at two venturi scrubber operational conditions. The two operational conditions are required in 40 CFR Part 63, Subpart NNN. A set of three test runs was conducted at each condition. One condition was set at minimum water flow and differential pressure and the second condition was set at maximum water flow and differential pressure in order to establish minimum and maximum values that will be used to determine compliance after the performance tests. The testing was conducted with all process lines at an operational rate above 8,100 lbs/hr (90% of maximum design).

1.2 Outline of Test Program

Integrity Air Monitoring, Inc. (Integrity Air) performed stationary source sampling on September 29 – October 3, 2014. Table 1 details the sources tested, the pollutants of interest, the United States Environmental Protection Agency (US EPA) Reference Methods used to quantify the pollutants and the run time for each reference method. The sampling included three sampling runs for each target pollutant. The sampling at Resinated Line 1 Collection Stack and Resinated Line 1 Curing & Cooling Table (HEAF) Stack was performed simultaneously during both operational conditions.

Table 1 – Target Pollutants and Reference Methods		
Pollutant	**Run Length**	**Reference Method**
Line 1 Collection /Curing (HEAF)& Cooling Table Scrubbers (Condition 1) – 09/29/14		
Particulate Matter (PM) & Total Organic Carbon (TOC)	2-hours	5E
Filterable & Condensible PM	2-hours	5/202
Ammonia, Formaldehyde, Phenol, Methanol, Formic Acid	1-hour	318/320
Line 1 Collection /Curing (HEAF) & Cooling Table Scrubbers (Condition 2) – 09/30/14		
PM & TOC	2-hours	5E
Filterable & Condensible PM	2-hours	5/202
Ammonia, Formaldehyde, Phenol, Methanol, Formic Acid	1-hour	318/320
Lines 1, 2 & 4 Melter – 10/01/14		
Filterable & Condensible PM	2-hours	5/202
Total Chromium	2-hours	306
Line 3 Collection/Curing & Cooling Table Scrubbers (Condition 1) – 10/01/14		
PM & TOC	2-hours	5E
Filterable & Condensible PM	2-hours	5/202
Ammonia, Formaldehyde, Phenol, Methanol, Formic Acid	1-hour	318/320
Line 3 Collection/Curing & Cooling Table Scrubbers (Condition 2) – 10/02/14		
PM & TOC	2-hours	5E
Filterable & Condensible PM	2-hours	5/202
Ammonia, Formaldehyde, Phenol, Methanol, Formic Acid	1-hour	318/320
Line 3 Melter -10/02/14		
Filterable & Condensible PM	2-hours	5/202
Total Chromium	2-hours	306
Lines 2 & 4 Non-Resinated Collection Scrubber – 10/03/14		
PM & TOC	2-hours	5E
Filterable & Condensible PM	2-hours	5/202

In addition to the sampling performed for the target pollutants, Integrity Air also performed US EPA Reference Methods 1, 2, and 4 to determine the location of the sampling points, the volumetric flow rate and the molecular weight and the moisture content, respectively. Integrity Air followed standard operating procedures (SOP) IAM-001, 002 and 017 as described in Version 1.7 of Integrity Air's Quality Manual.

A Site-Specific Test Plan was submitted to the State of Michigan Department of Environmental Quality (MDEQ) prior to sampling. There were no deviations from the reference methods, SOP's or Integrity Air's Quality Manual during this test project. There were no external environmental conditions such as rain, wind, cold or heat that impacted the integrity of the test results.

1.3 Test Participants

Representatives from the MDEQ were invited to witness the test program. Table 2 is provided to detail the Integrity Air Monitoring test personnel and contact information. The Integrity Air Monitoring, Inc. project manager for this project was J.A."Tony" Blanton. Mr. Blanton's contact information is provided should any testing related questions arise. Table 2 also provides the MDEQ personnel present and the main Knauf Insulation personnel involved in the test proceedings and production issues and their contact information.

Table 2 – Test Participants

Name	Title	Affiliation	Contact Info
J.A. "Tony" Blanton, QSTI	President	Integrity Air Monitoring, Inc.	Telephone: (704) 948-2359 Facsimile: (704) 948-2361 tony@integrityair.net
James A. Lewis, QSTI	Vice President	Integrity Air Monitoring, Inc.	Telephone: (704) 948-2359 Facsimile: (704) 948-2361 jim@integrityair.net
Robert F. Callahan, QSTI	Senior Consultant	Integrity Air Monitoring, Inc.	Telephone: (704) 948-2359 Facsimile: (704) 948-2361 rob@integrityair.net
Andrew J. Dickson, QSTI	Sampling Technician	Integrity Air Monitoring, Inc.	Telephone: (704) 948-2359 Facsimile: (704) 948-2361 andrew@integrityair.net
E.W. "Rusty" Caton, QSTI	Sampling Technician	Integrity Air Monitoring, Inc.	Telephone: (704) 948-2359 Facsimile: (704) 948-2361 rusty@integrityair.net
Eric M. Wendt	Sampling Technician	Integrity Air Monitoring, Inc.	Telephone: (704) 948-2359 Facsimile: (704) 948-2361 eric@integrityair.net
Grant Plummer	FTIR Analyst	Enthalpy Analytical, Inc.	Telephone: (919) 850-4392 Facsimile: (919) 850-9012 grant.plummer@enthalpy.com
Grover Thomas	Manager HSE Special Projects	Knauf Insulation, LLC	Telephone: (517) 630 -2700 Facsimile: (517) 630-2009 grover.thomas@knaufinsulation.co m
Don Adams	Technical Specialist HSE	Knauf Insulation, LLC	Telephone: (517) 630-2072 Facsimile: (517) 630-2009 don.adams@knaufinsulation.com
Rachael Underwood	HSE Specialist	Knauf Insulation, LLC	Telephone: (517) 630-2008 Facsimile: (517) 630-2009 rachael.underwood@knaufinsulati on.com
Rex I. Lane	Sr. Environmental Quality Analyst	Michigan DEQ Kalamazoo District Office	Telephone: (269) 567-3547 Facsimile: (269) 567-3555 laner@michigan.gov
Nathaniel N. Hude.	Field Operations Section	Michigan DEQ	Telephone: (517) 284-6779 Facsimile: (517) 335-3122 huden@michigan.gov

2.0 RESULTS

This section presents the sampling results in tabular form. Detailed sampling results and example calculations for the test program can be found in Appendix 1.

2.1 Summary of Results

Tables 3 through 11 present the results from the sampling performed at each source and for each operating condition.

2.2 Discussion

These results are primarily intended to demonstrate compliance with federal and state air quality standards. Additional sampling was performed for compounds outside of the permit requirements and will be used by Knauf Insulation for future emissions inventories and permit modifications.

2.2.1 Production During Tests

Tables 3 through 11 include process operational parameters and production rates. Additional information regarding operational parameters and the hand recorded data sheets can be found in Appendix 5. Information on the free formaldehyde content of the resin is provided in Appendix 6.

Table 3 - Emission test results for PM Line 1 Collection Stack Exhaust (SV-SCRUBBER) September 29, 2014 Knauf Insulation LLC, Albion, Michigan - Condition 1

Test Data		Run 1	Run 2	Run 3	Average	Limit
Date		9/29/2014	9/29/2014	9/29/2014		
Start Time		8:37 AM	11:03 AM	1:33 PM		
End Time		10:40 AM	1:13 PM	3:39 PM		
Flow Rate	(ACFM)	102.232	99.953	96.018	99.401	
Flow Rate	(DSCFM)	86.539	84.850	81.319	84.236	
Sample Volume	(DSCF)	88.208	103.863	103.950	98.673	
Water Vapor	(volume %)	4.4	3.8	3.8	4.0	
Stack Temperature	(°F)	115.5	117.6	118.5	117.2	
Percent of Isokinetic Sampling	(%)	97.4	95.6	95.7	96.2	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line Speed	(ft/min)	79	79	79	79	
Trimmed Blanket Width	(feet)	6	6	6	6	
LOI	(%)	7.9	8.5	8.1	8.1	
Mat Area Weight	(lb/ft²)	0.301	0.277	0.315	0.298	
Manufacturing Density	(lb/ft³)	0.402	0.370	0.421	0.398	
Binder Flow Rate	(gal/min)	7.7	8.0	7.7	7.8	
Water Flow Rate	(gal/min)	3.5	3.5	3.5	3.5	
East Suction Fan	(amps)	269.6	266.0	267.0	267.5	
Middle Suction Fan	(amps)	392.0	386.0	393.0	390.4	
West Suction Fan	(amps)	362.0	360.0	361.0	360.9	
North Scrubber Water Flow	(gal/min)	143	142	141	142	
South West Scrubber Water Flow	(gal/min)	149	143	142	145	
South East Scrubber Water Flow	(gal/min)	147	148	150	148	
North Scrubber Water Pressure	(psig)	12	12	12	12	
South West Scrubber Water Pressure	(psig)	9	9	9	9	
South East Scrubber Water Pressure	(psig)	19	19	19	19	
Diff. Pressure North Scrubber	(in H2O)	4.5	4.4	4.4	4.4	
Diff. Pressure South West Scrubber	(in H2O)	4.8	4.5	4.4	4.6	
Diff. Pressure South East Scrubber	(in H2O)	4.6	4.5	4.5	4.5	
Total (Resinated) Glass Pull Rate	(lb/hr)	8.805	8.810	8.788	8.801	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.40	4.41	4.39	4.40	
NSPS Glass Pull Rate	(tons/hr)	3.95	3.61	4.12	3.89	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	29.6	29.7	30.7	30.0	
Mass Collected (Condensable)	(mg)	3.6	5.1	2.3	3.7	
Emission Rate	(lb/hr)	4.4	4.8	4.4	4.5	**12.8**
Emission Rate	(lb/TGP)	1.00	1.08	1.01	1.03	
Emission Rate	(lb/1000 lb exhaust)	0.012	0.013	0.011	0.012	**0.04**
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	40.2	48.9	61.9	50.3	
Mass Collected (TOC)	(mg)	14.2	19.0	18.3	17.2	
Emission Rate	(lb/hr)	7.04	7.32	8.28	7.54	**12.8**
Emission Rate	(lb/TGP)	1.60	1.66	1.88	1.71	
Emission Rate	(lb/TGP-nsps)	1.78	2.03	2.01	1.94	**11.0**
Emission Rate	(lb/1000 lb exhaust)	0.018	0.018	0.022	0.019	**0.04**
Formaldehyde						
Emission Concentration	(ppmvw)	1.29	1.36	1.48	1.38	
Emission Concentration	(ppmvd)	1.35	1.41	1.54	1.43	
Emission Concentration	(mg/m³)	1.69	1.77	1.92	1.79	**7.0**
Emission Rate	(lb/hr)	0.546	0.561	0.585	0.564	
Emission Rate	(lb/TGP)	0.124	0.127	0.133	0.128	**1.2**

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 3 Line #1 Collection Stack (continued)

		Run 1	Run 2	Run 3	Average	Limit
Phenol						
Emission Concentration	(ppmvw)	2.2	2.45	2.64	2.43	
Emission Concentration	(ppmvd)	2.3	2.55	2.74	2.53	
Emission Concentration	(mg/m³)	9.01	9.97	10.74	9.90	25.0
Emission Rate	(lb/hr)	2.92	3.17	3.27	3.13	
Emission Rate	(lb/TGP)	0.660	0.72	0.74	0.71	
Ammonia						
Emission Concentration	(ppmvw)	42.6	51.3	51.6	48.50	
Emission Concentration	(ppmvd)	44.58	53.34	53.64	50.52	
Emission Concentration	(mg/m³)	31.6	37.8	38	35.80	57.0
Emission Rate	(lb/hr)	10.23	12	11.6	11.29	
Emission Rate	(lb/TGP)	2.32	2.73	2.63	2.57	
Methanol						
Emission Concentration	(ppmvw)	4.58	5.00	5.05	4.88	
Emission Concentration	(ppmvd)	4.79	5.20	5.25	5.08	
Emission Concentration	(mg/m³)	6.38	6.92	6.99	6.77	
Emission Rate	(lb/hr)	2.07	2.20	2.13	2.14	
Emission Rate	(lb/TGP)	0.47	0.50	0.48	0.49	
Formic Acid						
Emission Concentration	(ppmvw)	<0.879	<0.879	<0..879	<0.879	
Emission Concentration	(ppmvd)	<0.920	<0.914	<0.914	<0.916	
Emission Concentration	(mg/m³)	<1.76	<1.75	<1.75	<1.75	
Emission Rate	(lb/hr)	<0.57	<0.56	<0.12	<0.13	
Emission Rate	(lb/TGP)	<0.13	<0.13	<0.12	<0.13	

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 4 - Emission test results for PM Line 1 Collection Stack Exhaust (SV-SCRUBBER) September 30, 2014
Knauf Insulation LLC, Albion, Michigan - Condition 2

Test Data		Run 1	Run 2	Run 3	Average	Limit
Date		9/30/2014	9/30/2014	9/30/2014		
Start Time		7:59 AM	10:26 AM	1:15 PM		
End Time		10:07 AM	12:33 PM	3:20 PM		
Flow Rate	(ACFM)	88,009	87,558	88,130	87,899	
Flow Rate	(DSCFM)	73,302	72,919	73,043	73,088	
Sample Volume	(DSCF)	109.03	110.20	109.57	109.60	
Water Vapor	(volume %)	5.1	5.2	5.4	5.2	
Stack Temperature	(°F)	119.5	119.7	121.3	120.1	
Percent of Isokinetic Sampling	(%)	96.7	97.0	97.5	97.1	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line Speed	(ft/min)	74	74	77	75	
Trimmed Blanket Width	(feet)	6	6	6	6	
LOI	(%)	8.4	8.6	8.4	8.5	
Mat Area Weight	(lb/ft^2)	0.318	0.299	0.308	0.308	
Manufacturing Density	(lb/ft^3)	0.424	0.398	0.410	0.411	
Binder Flow Rate	(gal/min)	7.9	7.9	7.9	7.9	
Water Flow Rate	(gal/min)	3.8	3.8	4.0	3.9	
East Suction Fan	(amps)	368	369	369	369	
Middle Suction Fan	(amps)	362	369	371	367	
West Suction Fan	(amps)	366	368	367	367	
North Scrubber Water Flow	(gal/min)	248	248	248	248	
South West Scrubber Water Flow	(gal/min)	229	229	231	229	
South East Scrubber Water Flow	(gal/min)	227	226	226	227	
North Scrubber Water Pressure	(psig)	37	37	37	37	
South West Scrubber Water Pressure	(psig)	23	23	23	23	
South East Scrubber Water Pressure	(psig)	39	39	39	39	
Diff. Pressure North Scrubber	(in H2O)	10.5	10.6	10.5	10.6	
Diff. Pressure South West Scrubber	(in H2O)	10.0	10.0	10.0	10.0	
Diff. Pressure South East Scrubber	(in H2O)	10.2	10.3	10.3	10.3	
Total (Resinated) Glass Pull Rate	(lb/hr)	8,798	8,806	8,805	8,803	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.40	4.40	4.40	4.40	
NSPS Glass Pull Rate	(tons/hr)	3.91	3.66	3.89	3.82	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	39.5	10.8	48.7	33.0	
Mass Collected (Condensable)	(mg)	5.5	10.3	2.9	6.2	
Emission Rate	(lb/hr)	4.7	2.3	5.1	4.0	12.8
Emission Rate	(lb/TGP)	1.07	0.52	1.15	0.91	
Emission Rate	(lb/1000 lb exhaust)	0.015	0.007	0.015	0.012	0.04
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	49.8	51.6	55.5	52.3	
Mass Collected (TOC)	(mg)	15.6	15.8	18.8	16.7	
Emission Rate	(lb/hr)	5.80	5.88	6.54	6.07	12.8
Emission Rate	(lb/TGP)	1.32	1.34	1.48	1.38	
Emission Rate	(lb/TGP-NSPS)	1.48	1.61	1.68	1.59	11.0
Emission Rate	(lb/1000 lb exhaust)	0.018	0.018	0.020	0.019	0.04
Formaldehyde						
Emission Concentration	(ppmvw)	0.93	1.10	1.65	1.23	
Emission Concentration	(ppmvd)	0.98	1.16	1.74	1.30	
Emission Concentration	(mg/m^3)	1.23	1.45	2.18	1.62	7.0
Emission Rate	(lb/hr)	0.337	0.396	0.596	0.443	
Emission Rate	(lb/TGP)	0.077	0.090	0.135	0.101	1.2

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 4 Line #1 Collection Stack (continued)

		Run 1	Run 2	Run 3	Average	Limit
Phenol						
Emission Concentration	(ppmvw)	2.22	2.26	2.39	2.29	
Emission Concentration	(ppmvd)	2.34	2.38	2.53	2.42	
Emission Concentration	(mg/m^3)	9.16	9.33	9.88	9.46	25.0
Emission Rate	(lb/hr)	2.51	2.55	2.70	2.59	
Emission Rate	(lb/TGP)	0.57	0.58	0.61	0.59	
Ammonia						
Emission Concentration	(ppmvw)	48.80	50.50	55.60	51.63	
Emission Concentration	(ppmvd)	51.44	53.27	58.77	54.49	
Emission Concentration	(mg/m^3)	36.4	37.7	41.6	38.6	57.0
Emission Rate	(lb/hr)	10.00	10.30	11.39	10.56	"
Emission Rate	(lb/TGP)	2.27	2.34	2.59	2.40	
Methanol						
Emission Concentration	(ppmvw)	5.05	5.24	5.70	5.33	
Emission Concentration	(ppmvd)	5.32	5.53	6.03	5.63	
Emission Concentration	(mg/m^3)	7.09	7.36	8.03	7.49	
Emission Rate	(lb/hr)	1.95	2.01	2.20	2.05	
Emission Rate	(lb/TGP)	0.44	0.46	0.50	0.47	
Formic Acid						
Emission Concentration	(ppmvw)	<0.879	<0.879	<0.879	<0.879	
Emission Concentration	(ppmvd)	<0.927	<0.927	<0.929	<0.928	
Emission Concentration	(mg/m^3)	<1.77	<1.77	<1.78	<1.77	
Emission Rate	(lb/hr)	<0.49	<0.48	<0.49	<0.49	
Emission Rate	(lb/TGP)	<0.11	<0.11	<0.11	<0.11	

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 5 - Emission test results for PM Line 1 HEAF Stack Exhaust (SV-HEAF) September 29, 2014
Knauf Insulation LLC, Albion, Michigan - Condition 1

Test Data		Run 1	Run 2	Run 3	Average	
Date		9/29/2014	9/29/2014	9/29/2014		
Start Time		8:33 AM	11:03 AM	1:33 PM		
End Time		10:37 AM	1:06 PM	3:35 PM		
Flow Rate	(ACFM)	72.614	73.904	74.755	73.758	
Flow Rate	(DSCFM)	60.962	61.529	61.985	61.492	
Sample Volume	(DSCF)	108.85	103.73	104.70	105.76	
Water Vapor	(volume %)	3.7	3.9	3.8	3.8	
Stack Temperature	(°F)	124.6	128.4	130.6	127.9	
Percent of Isokinetic Sampling	(%)	96.7	98.0	98.2	97.6	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line Speed	(ft/min)	79	79	79	79	
Trimmed Blanket Width	(feet)	6	6	6	6	
LOI	(%)	7.9	8.5	8.1	8.1	
Mat Area Weight	(lb/ft^2)	0.301	0.277	0.315	0.298	
Manufacturing Density	(lb/ft^3)	0.402	0.370	0.421	0.398	
Binder Flow Rate	(gal/min)	7.7	8.0	7.7	7.8	
Water Flow Rate	(gal/min)	3.5	3.5	3.5	3.5	
Oven Zone #1	(°F)	500	500	500	500	
Oven Zone #2	(°F)	500	500	500	500	
Oven Zone #3	(°F)	486	485	485	485	
Cooling Scrubber Fan	(amps)	117	116	117	117	
Cooling Scrubber Water Flow	(gal/min)	143	142	142	142	
Cooling Scrubber Inlet Pressure	(psig)	29	29	29	29	
Cooling Scrubber Diff. Pressure	(H2O)	6.3	6.3	6.4	6.3	
West HEAF Fan	(amps)	301	300	302	301	
East HEAF Fan	(amps)	276	274	272	274	
East HEAF Temperature	(°F)	135	138	140	138	
West HEAF Temperature	(°F)	119	116	118	118	
East HEAF Differential Pressure	(H2O)	12.0	12.0	12.0	12.0	
West HEAF Differential Pressure	(H2O)	14.0	14.0	14.0	14.0	
Total (Resinated) Glass Pull Rate	(lb/hr)	8.805	8.810	8.788	8.801	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.40	4.41	4.39	4.40	
NSPS Glass Pull Rate	(tons/hr)	3.95	3.61	4.12	3.89	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	3.2	2.8	10.6	5.5	
Mass Collected (Condensable)	(mg)	10.99	10.8	13.4	11.7	
Emission Rate	(lb/hr)	1.1	1.1	1.9	1.4	**7.91**
Emission Rate	(lb/TGP)	0.26	0.25	0.44	0.32	
Emission Rate	(lb/1000 lb exhaust)	0.004	0.004	0.006	0.005	**0.03**
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	27.7	14.5	12.1	18.1	
Mass Collected (TOC)	(mg)	18.4	23.7	21.1	21.1	
Emission Rate	(lb/hr)	3.41	2.99	2.59	3.00	**7.91**
Emission Rate	(lb/TGP)	0.77	0.68	0.59	0.68	
Emission Rate [1]	(lb/TGP$_{nsps}$)	0.86	0.83	0.63	0.77	**11.0**
Emission Rate	(lb/1000 lb exhaust)	0.012	0.010	0.009	0.010	**0.03**

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 5 Line #1 HEAF Stack (Continued)

		Run 1	Run 2	Run 3	Average	Limit
Formaldehyde						
Emission Concentration	(ppmvw)	5.12	4.86	5.03	5.00	
Emission Concentration	(ppmvd)	5.32	5.06	5.23	5.20	
Emission Concentration	(mg/m³)	6.64	6.31	6.53	6.49	12.3
Emission Rate	(lb/hr)	1.520	1.460	1.520	1.500	
Emission Rate	(lb/TGP)	0.344	0.330	0.345	0.340	1.2
Phenol						
Emission Concentration	(ppmvw)	<2.19	<2.19	<2.19	<2.19	
Emission Concentration	(ppmvd)	<2.27	<2.28	<2.28	<2.28	
Emission Concentration	(mg/m³)	<8.90	<8.92	<8.91	<8.91	15.0
Emission Rate	(lb/hr)	<2.03	<2.06	<2.07	<2.05	
Emission Rate	(lb/TGP)	<0.46	<0.47	<0.47	<0.47	
Ammonia						
Emission Concentration	(ppmvw)	17.6	19.5	20.7	19.27	
Emission Concentration	(ppmvd)	18.28	20.29	21.53	20.03	
Emission Concentration	(mg/m³)	12.9	14.4	15.2	14.2	65.8
Emission Rate	(lb/hr)	2.96	3.31	3.54	3.27	
Emission Rate	(lb/TGP)	0.67	0.75	0.81	0.74	
Methanol						
Emission Concentration	(ppmvw)	<1.24	<1.24	<1.24	<1.24	
Emission Concentration	(ppmvd)	<1.29	<1.29	<1.29	<1.29	
Emission Concentration	(mg/m³)	<1.72	<1.72	<1.72	<1.72	
Emission Rate	(lb/hr)	<0.39	<0.40	<0.40	<0.40	
Emission Rate	(lb/TGP)	<0.09	<0.09	<0.09	<0.09	
Formic Acid						
Emission Concentration	(ppmvw)	<0.879	<0.879	<0.879	<0.879	
Emission Concentration	(ppmvd)	<0.913	<0.915	<0.914	<0.914	
Emission Concentration	(mg/m³)	<1.75	<1.75	<1.75	<1.75	
Emission Rate	(lb/hr)	<0.40	<0.40	<0.41	<0.40	
Emission Rate	(lb/TGP)	<0.09	<0.09	<0.09	<0.09	

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 6 - Emission test results for PM Line 1 HEAF Stack Exhaust (SV-HEAF) September 30, 2014
Knauf Insulation LLC, Albion, Michigan - Condition 2

Test Data		Run 1	Run 2	Run 3	Average	
Date		9/30/2014	9/30/2014	9/30/2014		
Start Time		7:59 AM	10:26 AM	1:13 PM		
End Time		10:02 AM	12:47 PM	12:29 PM	15:17	
Flow Rate	(ACFM)	71,156	70,404	70,241	70,601	
Flow Rate	(DSCFM)	59,612	59,033	59,072	59,239	
Sample Volume	(DSCF)	99.369	99.620	99.583	99.521	
Water Vapor	(volume %)	3.5	3.7	3.2	3.5	
Stack Temperature	(°F)	126.3	125.2	126.1	125.9	
Percent of Isokinetic Sampling	(%)	96.9	98.1	98.0	97.6	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line Speed	(ft/min)	74	74	77	75	
Trimmed Blanket Width	(feet)	6	6	6	6	
LOI	(%)	8.4	8.6	8.4	8.5	
Mat Area Weight	(lb/ft²)	0.318	0.299	0.308	0.308	
Manufacturing Density	(lb/ft³)	0.424	0.398	0.410	0.411	
Binder Flow Rate	(gal/min)	7.9	7.9	7.9	7.9	
Water Flow Rate	(gal/min)	3.8	3.8	4.0	3.9	
Oven Zone #1	(°F)	500	500	500	500	
Oven Zone #2	(°F)	500	500	500	500	
Oven Zone #3	(°F)	487	485	485	486	
Cooling Scrubber Fan	(amps)	130	129	130	130	
Cooling Scrubber Water Flow	(gal/min)	188	187	187	187	
Cooling Scrubber Inlet Pressure	(psig)	48	48	48	48	
Cooling Scrubber Diff. Pressure	(H2O)	9.9	9.9	9.8	9.8	
West HEAF Fan	(amps)	277	278	282	279	
East HEAF Fan	(amps)	255	257	255	256	
East HEAF Temperature	(°F)	146	140	143	143	
West HEAF Temperature	(°F)	123	124	125	124	
East HEAF Differential Pressure	(H2O)	16.5	16.4	16.5	16.5	
West HEAF Differential Pressure	(H2O)	17.1	17.1	17.0	17.1	
Total (Resinated) Glass Pull Rate	(lb/hr)	8,798	8,806	8,805	8,803	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.40	4.40	4.40	4.40	
NSPS Glass Pull Rate	(tons/hr)	3.91	3.66	3.89	3.82	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	8.3	13.1	6.2	9.2	
Mass Collected (Condensable)	(mg)	19.1	12.1	16.1	15.7	
Emission Rate	(lb/hr)	2.3	2.0	1.8	2.0	7.91
Emission Rate	(lb/TGP)	0.52	0.46	0.42	0.46	
Emission Rate	(lb/1000 lb exhaust)	0.008	0.007	0.007	0.007	0.03
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	18.0	14.4	11.5	14.6	
Mass Collected (TOC)	(mg)	22.8	21.4	22.9	22.4	
Emission Rate	(lb/hr)	3.23	2.80	2.69	2.91	7.91
Emission Rate	(lb/TGP)	0.73	0.64	0.61	0.66	
Emission Rate	(lb/TGP_{-NSPS})	0.83	0.76	0.69	0.76	11.0
Emission Rate	(lb/1000 lb exhaust)	0.012	0.010	0.010	0.011	0.03

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 6 Line #1 HEAF Stack (continued)

		Run 1	Run 2	Run 3	Average	Limit
Formaldehyde						
Emission Concentration	(ppmvw)	6.27	7.10	7.16	6.84	
Emission Concentration	(ppmvd)	6.50	7.37	7.40	7.09	
Emission Concentration	(mg/m^3)	8.11	9.20	9.24	8.85	12.3
Emission Rate	(lb/hr)	1.81	2.04	2.05	1.96	
Emission Rate	(lb/TGP)	0.412	0.462	0.464	0.446	1.2
Phenol						
Emission Concentration	(ppmvw)	<2.19	<2.19	<2.19	<2.19	
Emission Concentration	(ppmvd)	<2.27	<2.27	<2.26	<2.27	
Emission Concentration	(mg/m^3)	<8.88	<8.90	<8.86	<8.88	15.0
Emission Rate	(lb/hr)	<1.98	<1.97	<1.96	<1.97	
Emission Rate	(lb/TGP)	<0.45	<0.45	<0.45	<0.45	
Ammonia						
Emission Concentration	(ppmvw)	24.10	22.30	23.30	23.23	
Emission Concentration	(ppmvd)	24.97	23.15	24.08	24.07	
Emission Concentration	(mg/m^3)	17.7	16.4	17.0	17.0	65.8
Emission Rate	(lb/hr)	3.95	3.63	3.77	3.78	
Emission Rate	(lb/TGP)	0.90	0.82	0.86	0.86	
Methanol						
Emission Concentration	(ppmvw)	<1.24	<1.24	<1.24	<1.24	
Emission Concentration	(ppmvd)	<1.28	<1.29	<1.28	<1.28	
Emission Concentration	(mg/m^3)	<1.71	<1.71	<1.71	<1.71	
Emission Rate	(lb/hr)	<0.38	<0.38	<0.38	<0.38	
Emission Rate	(lb/TGP)	<0.09	<0.09	<0.09	<0.09	
Formic Acid						
Emission Concentration	(ppmvw)	<0.879	<0.879	<0.879	<0.879	
Emission Concentration	(ppmvd)	<0.911	<0.913	<0.908	<0.911	
Emission Concentration	(mg/m^3)	<1.74	<1.75	<1.74	<1.74	
Emission Rate	(lb/hr)	<0.39	<0.39	<0.38	<0.39	
Emission Rate	(lb/TGP)	<0.09	<0.09	<0.09	<0.09	

Note 1: Allowable lb/ton is the sum of Collection and HEAF.

Table 7 - Emission test results for PM Line 3 Collection/Curing Stack Exhaust (SV-EP0023) October 1, 2014 Knauf Insulation LLC, Albion, Michigan - Condition 1

Test Data		Run 1	Run 2	Run 3	Average	
Date		10/1/2014	10/1/2014	10/1/2014		
Start Time		8:00 AM	10:21 AM	1:05 PM		
End Time		10:07 AM	12:29 PM	3:13 PM		
Flow Rate	(ACFM)	121.555	124.734	121.721	122.670	
Flow Rate	(DSCFM)	104.609	106.717	104.064	105.130	
Sample Volume	(DSCF)	103.576	99.696	96.970	100.081	
Water Vapor	(volume %)	5.0	5.5	5.3	5.3	
Stack Temperature	(°F)	103.5	104.8	105.7	104.7	
Percent of Isokinetic Sampling	(%)	97.5	98.7	98.5	98.2	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line Speed	(ft/min)	68	68	68	68	
Trimmed Blanket Width	(feet)	7.6	7.6	7.6	7.6	
LOI	(%)	6.7	6.5	6.1	6.4	
Mat Area Weight	(lb/ft^2)	0.250	0.247	0.247	0.248	
Manufacturing Density	(lb/ft^3)	0.387	0.383	0.383	0.384	
Binder Flow Rate	(gal/min)	7.7	7.6	7.1	7.5	
Water Flow Rate	(gal/min)	6.1	6.0	6.2	6.1	
Oven Zone #1	(°F)	510	510	510	510	
Oven Zone #2	(°F)	520	520	520	520	
Oven Zone #3	(°F)	529	529	530	529	
North Scrubber Water Pressure	(psig)	22	19	12	18	
South Scrubber Water Pressure	(psig)	11	11	10	11	
North Scrubber Water Flow	(gal/min)	155	144	148	149	
South Scrubber Water Flow	(gal/min)	150	147	147	148	
North Scrubber Diff. Pressure	(in H2O)	5.0	4.2	4.1	4.4	
South Scrubber Diff. Pressure	(in H2O)	4.3	4.3	4.3	4.3	
North Fan	(amps)	385	375	377	379	
South Fan	(amps)	407	407	407	407	
Oven Entrance Water Pressure	(psig)	21	20	20	20	
Oven Entrance Water Flow	(gal/min)	136	135	138	136	
Oven Entrance Diff. Pressure	(in H2O)	5.0	5.0	5.0	5.0	
Oven Entrance Fan	(amps)	88	88	88	88	
Oven Exit Water Pressure	(psig)	20	20	20	20	
Oven Exit Water Flow	(gal/min)	134	131	134	133	
Oven Exit Differential Pressure	(in H2O)	5.3	4.8	4.8	5.0	
Oven Exit Fan	(amps)	82	83	81	82	
Cooling Scrubber Water Pressure	(psig)	37	36	41	38	
Cooling Scrubber Water Flow	(gal/min)	130	129	132	130	
Cooling Scrubber Diff. Pressure	(in H2O)	4.9	4.9	4.8	4.8	
Cooling Scrubber Fan	(amps)	72	72	72	72	
Total (Resinated) Glass Pull Rate	(lb/hr)	8.201	8.205	8.197	8.201	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.10	4.10	4.10	4.10	
NSPS Glass Pull Rate	(tons/hr)	3.63	3.59	3.61	3.61	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	30.0	25.6	24.0	26.5	
Mass Collected (Condensable)	(mg)	5.7	4.5	8.6	6.3	
Emission Rate	(lb/hr)	5.2	4.5	5.0	4.9	19.2
Emission Rate	(lb/TGP)	1.26	1.09	1.21	1.19	
Emission Rate	(lb/1000 lb exhaust)	0.011	0.009	0.010	0.010	0.036
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	35.7	49.7	47.9	44.4	
Mass Collected (TOC)	(mg)	18.0	18.2	18.4	18.2	
Emission Rate	(lb/hr)	7.16	9.59	9.39	8.71	19.2
Emission Rate	(lb/TGP)	1.75	2.34	2.29	2.12	
Emission Rate	(lb/TGP$_{NSPS}$)	1.97	2.67	2.60	2.41	**11.0**
Emission Rate	(lb/1000 lb exhaust)	0.015	0.020	0.020	0.018	0.036

Table 7 Line #3 Collection/Curing Stack (continued)

		Run 1	Run 2	Run 3	Average	Limit
Formaldehyde						
Emission Concentration	(ppmvw)	4.52	4.66	4.77	4.65	
Emission Concentration	(ppmvd)	4.76	4.93	5.04	4.91	
Emission Concentration	(mg/m^3)	5.94	6.15	6.29	6.13	7.25
Emission Rate	(lb/hr)	2.33	2.46	2.45	2.41	
Emission Rate	(lb/TGP)	0.568	0.600	0.598	0.589	0.8
Phenol						
Emission Concentration	(ppmvw)	2.19	2.21 J	<2.19	<2.20	
Emission Concentration	(ppmvd)	2.31	2.34	<2.31	<2.32	
Emission Concentration	(mg/m^3)	9.02	9.15	<9.05	<9.07	20.0
Emission Rate	(lb/hr)	3.54	3.66	<3.53	<3.57	
Emission Rate	(lb/TGP)	0.86	0.89	<0.86	<0.87	
Ammonia						
Emission Concentration	(ppmvw)	38.30	40.80	39.50	39.53	
Emission Concentration	(ppmvd)	40.33	43.16	41.71	41.74	
Emission Concentration	(mg/m^3)	28.6	30.6	29.5	29.5	59.7
Emission Rate	(lb/hr)	11.19	12.22	11.51	11.64	
Emission Rate	(lb/TGP)	2.73	2.98	2.81	2.84	
Methanol						
Emission Concentration	(ppmvw)	2.92	2.91	2.68	2.84	
Emission Concentration	(ppmvd)	2.92	2.91	2.68	2.84	
Emission Concentration	(mg/m^3)	4.10	4.10	3.77	3.99	
Emission Rate	(lb/hr)	1.61	1.64	1.47	1.57	
Emission Rate	(lb/TGP)	0.39	0.40	0.36	0.38	
Formic Acid						
Emission Concentration	(ppmvw)	<0.879	<0.879	<0.879	<0.879	
Emission Concentration	(ppmvd)	<0.926	<0.930	<0.928	<0.928	
Emission Concentration	(mg/m^3)	<1.77	<1.78	<1.78	<1.78	
Emission Rate	(lb/hr)	<0.69	<0.71	<0.69	<0.70	
Emission Rate	(lb/TGP)	<0.17	<0.17	<0.17	<0.17	

Table 8 - Emission test results for PM Line 3 Collection/Curing Stack Exhaust (SV-EP0023) October 2, 2014
Knauf Insulation LLC, Albion, Michigan - Condition 2

Test Data		Run 1	Run 2	Run 3	Average	
Date		10/2/2014	10/2/2014	10/2/2014		
Start Time		8:00 AM	10:33 AM	1:56 PM		
End Time		10:07 AM	12:43 PM	4:02 PM		
Flow Rate	(ACFM)	105,574	99,969	98,246	101,263	
Flow Rate	(DSCFM)	89,019	83,457	81,829	84,768	
Sample Volume	(DSCF)	105.285	100.930	95.998	100.738	
Water Vapor	(volume %)	6.0	6.3	6.0	6.1	
Stack Temperature	(°F)	107.7	111.0	113.6	110.8	
Percent of Isokinetic Sampling	(%)	98.2	99.7	98.8	98.9	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line Speed	(ft/min)	65	66	66	66	
Trimmed Blanket Width	(feet)	7.6	7.6	7.6	7.6	
LOI	(%)	5.8	5.4	6.8	6.0	
Mat Area Weight	(lb/ft²)	0.254	0.245	0.249	0.249	
Manufacturing Density	(lb/ft³)	0.393	0.380	0.386	0.386	
Binder Flow Rate	(gal/min)	7.6	7.2	8.2	7.7	
Water Flow Rate	(gal/min)	5.9	5.7	5.7	5.8	
Oven Zone #1	(°F)	510	507	490	502	
Oven Zone #2	(°F)	520	516	495	511	
Oven Zone #3	(°F)	530	526	505	521	
North Scrubber Water Pressure	(psig)	28	27	30	28	
South Scrubber Water Pressure	(psig)	21	21	21	21	
North Scrubber Water Flow	(gal/min)	209	213	208	210	
South Scrubber Water Flow	(gal/min)	206	207	210	207	
North Scrubber Duffel Pressure	(in H2O)	9.8	9.7	10.3	9.9	
South Scrubber Diff. Pressure	(in H2O)	8.6	8.4	8.4	8.5	
North Fan	(amps)	392	390	427	402	
South Fan	(amps)	415	417	421	418	
Oven Entrance Water Pressure	(psig)	29	29	29	29	
Oven Entrance Water Flow	(gal/min)	164	165	165	165	
Oven Entrance Diff. Pressure	(in H2O)	9.6	9.5	8.3	9.2	
Oven Entrance Fan	(Hz)	77	77	58	71	
Oven Exit Water Pressure	(psig)	33	32	32	32	
Oven Exit Water Flow	(gal/min)	168	168	165	167	
Oven Exit Differential Pressure	(in H2O)	9.4	9.3	8.4	9.0	
Oven Exit Fan	(amps)	70	69	53	64	
Cooling Scrubber Water Pressure	(psig)	43	42	42	42	
Cooling Scrubber Water Flow	(gal/min)	159	158	162	160	
Cooling Scrubber Diff. Pressure	(in H2O)	10	9.9	10.1	10.0	
Cooling Scrubber Fan	(amps)	59	59	58	59	
Total (Resinated) Glass Pull Rate	(lb/hr)	8,193	8,195	8,188	8,192	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.10	4.10	4.09	4.10	
NSPS Glass Pull Rate	(tons/hr)	3.58	3.51	3.52	3.53	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	42.6	40.2	39.5	40.8	
Mass Collected (Condensable)	(mg)	3.72	5.48	4.32	4.51	
Emission Rate	(lb/hr)	5.9	5.7	5.4	5.7	**19.2**
Emission Rate	(lb/TGP)	1.44	1.40	1.33	1.39	
Emission Rate	(lb/1000 lb exhaust)	0.015	0.014	0.014	0.014	**0.036**
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	57.8	55.7	45.9	53.2	
Mass Collected (TOC)	(mg)	17.4	17.6	17.2	17.4	
Emission Rate	(lb/hr)	8.39	8.00	7.10	7.83	**19.2**
Emission Rate	(lb/TGP)	2.05	1.95	1.74	1.91	
Emission Rate	(lb/TGP$_{NSPS}$)	2.34	2.28	2.26	2.21	**11.0**
Emission Rate	(lb/1000 lb exhaust)	0.021	0.021	0.019	0.020	**0.036**

Table 8 Line #3 Collection/Curing Stack (continued)

		Run 1	Run 2	Run 3	Average	Limit
Formaldehyde						
Emission Concentration	(ppmvw)	4.73	5.16	4.22	4.70	
Emission Concentration	(ppmvd)	5.03	5.51	4.49	5.01	
Emission Concentration	(mg/m^3)	6.28	6.88	5.61	6.26	7.25
Emission Rate	(lb/hr)	2.10	2.15	1.72	1.99	
Emission Rate	(lb/TGP)	0.512	0.525	0.420	0.485	0.8
Phenol						
Emission Concentration	(ppmvw)	<2.19	<2.19	<2.19	<2.19	
Emission Concentration	(ppmvd)	<2.33	<2.34	<2.33	<2.33	
Emission Concentration	(mg/m^3)	<9.12	<9.15	<9.12	<9.13	20.0
Emission Rate	(lb/hr)	<3.04	<2.86	<2.80	<2.90	
Emission Rate	(lb/TGP)	<0.74	<0.70	<0.68	<0.71	
Ammonia						
Emission Concentration	(ppmvw)	39.3	42.4	48.6	43.4	
Emission Concentration	(ppmvd)	41.8	45.3	51.7	46.3	
Emission Concentration	(mg/m^3)	29.6	32	36.6	32.8	59.7
Emission Rate	(lb/hr)	9.88	10.02	11.23	10.38	
Emission Rate	(lb/TGP)	2.41	2.45	2.74	2.54	
Methanol						
Emission Concentration	(ppmvw)	3.33	3.82	4.24	3.80	
Emission Concentration	(ppmvd)	3.54	4.08	4.51	4.04	
Emission Concentration	(mg/m^3)	4.72	5.43	6.01	5.39	
Emission Rate	(lb/hr)	1.57	1.70	1.84	1.71	
Emission Rate	(lb/TGP)	0.38	0.41	0.45	0.42	
Formic Acid						
Emission Concentration	(ppmvw)	<0.879	<0.879	<0.879	<0.879	
Emission Concentration	(ppmvd)	<0.936	<0.938	<0.935	<0.936	
Emission Concentration	(mg/m^3)	<1.79	<1.80	<1.79	<1.79	
Emission Rate	(lb/hr)	<0.60	<0.56	<0.55	<0.57	
Emission Rate	(lb/TGP)	<0.15	<0.14	<0.13	<0.14	

Table 9 - Emission test results for PM Line 2 & 4 Non-Resinated Collection Stack Exhaust (SV-WETSCRUBBER) October 3, 2014 Knauf Insulation LLC, Albion, Michigan

Test Data		Run 1	Run 2	Run 3	Average	
Date		10/3/2014	10/3/2014	10/3/2014		
Start Time		8:45 AM	11:13 AM	1:28 PM		
End Time		10:56 AM	1:16 PM	3:30 PM		
Flow Rate	(ACFM)	67,573	63,626	64,879	65,359	
Flow Rate	(DSCFM)	53,030	49,712	51,153	51,298	
Sample Volume	(DSCF)	111.709	100.715	105.769	106.064	
Water Vapor	(volume %)	7.2	7.6	7.2	7.3	
Stack Temperature	(°F)	131.1	131.5	130.5	131.0	
Percent of Isokinetic Sampling	(%)	98.5	99.2	96.6	98.1	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Line 2 Scrubber Water Pressure	(psig)	11	11	11	11	
Line 4 Scrubber Water Pressure	(psig)	20	18	18	19	
Line 2 Scrubber Water Flow	(gal/min)	219	220	220	220	
Line 4 Scrubber Water Flow	(gal/min)	216	218	218	218	
Line 2 Scrubber Diff.l Pressure	(in H2O)	6.8	7	7.0	6.9	
Line 4 Scrubber Diff. Pressure	(in H2O)	6.9	6.9	7.0	6.9	
Line 2 Fan	(amps)	235	235	236	235	
Line 4 Fan	(amps)	315	315	313	314	
Line 2 Silicone Application Rate	(rpm)	50.0	50.0	50.0	50.0	
Line 4 Silicone Application Rate	(rpm)	50.0	50.0	50.0	50.0	
Total (Non-Resinated) Glass Pull Rate	(lb/hr)	8,365	8,364	8,364	8,364	
Total (Non-Resinated) Glass Pull Rate	(tons/hr)	4.18	4.18	4.18	4.18	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	78.1	85.6	80.4	81.4	
Mass Collected (Condensable)	(mg)	6.91	5.36	2.66	4.98	
Emission Rate	(lb/hr)	6.0	6.8	6.1	6.3	8.92
Emission Rate	(lb/TGP)	1.44	1.62	1.45	1.51	
Emission Rate	(lb/1000 lb exhaust)	0.024	0.027	0.025	0.025	0.03
Particulate Matter (Method 5E)						
Mass Collected (Filterable)	(mg)	96.9	89.2	101.2	95.7	
Mass Collected (TOC)	(mg)	6.12	5.77	5.21	5.70	
Emission Rate	(lb/hr)	6.45	6.19	6.79	6.48	8.92
Emission Rate	(lb/TGP)	1.54	1.48	1.62	1.55	11.00
Emission Rate	(lb/1000 lb exhaust)	0.026	0.027	0.028	0.027	0.03

Table 10 - Emission test results for Line 1, 2, & 4 PM Baghouse Stack Exhausts (SV-MELT6,7&9) October 1, 2014 Knauf Insulation LLC, Albion, Michigan

Test Data		Run 1	Run 2	Run 3	Average	
Date		10/1/2014	10/1/2014	10/1/2014		
Start Time		8:09 AM	10:30 AM	12:55 PM		
End Time		10:14 AM	12:35 PM	3:01 PM		
Flow Rate	(ACFM)	30,020	29,539	30,533	30,031	
Flow Rate	(DSCFM)	25,830	25,435	26,220	25,828	
Sample Volume	(DSCF)	104.530	100.609	107.028	104.056	
Water Vapor	(volume %)	2.4	2.3	2.1	2.3	
Stack Temperature	(°F)	119.2	119.4	121.9	120.2	
Percent of Isokinetic Sampling	(%)	97.8	98.4	98.7	98.3	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
North RayJet						
Differential Pressure	(in H2O)	6.5	6.5	6.5	6.5	
Operational Temperature	(°F)	122	122	122	122	
Baghouse Leak Detector Reading	pico-amps	44.4	40.9	45.3	43.5	
South RayJet						
Differential Pressure	(in H2O)	3.5	3.5	3.5	3.5	
Operational Temperature	(°F)	118	118	118	118	
Baghouse Leak Detector Reading	pico-amps	37.0	34.2	33.5	34.9	
Line 1 (Resinated) Glass Pull Rate	(lb/hr)	8,781	8,799	8,801	8,794	
Line 1 (Resinated) Glass Pull Rate	(tons/hr)	4.39	4.40	4.40	4.40	
Line 2 (Non-Resinated) Glass Pull Rate	(lb/hr)	4,201	4,251	4,217	4,223	
Line 2 (Non-Resinated) Glass Pull Rate	(tons/hr)	2.10	2.13	2.11	2.11	
Line 4 (Non-Resinated) Glass Pull Rate	(lb/hr)	4,042	4,040	4,036	4,039	
Line 4 (Non-Resinated) Glass Pull Rate	(tons/hr)	2.02	2.02	2.02	2.02	
Total Glass Pull Rate	(lb/hr)	17,023	17,090	17,054	17,056	
Total Glass Pull Rate	(tons/hr)	8.51	8.55	8.53	8.53	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	3.0	2.7	2.2	2.6	
Mass Collected (Condensable)	(mg)	3.00	4.32	3.58	3.63	
Emission Rate	(lb/hr)	0.20	0.23	0.19	0.21	2.08
Emission Rate	(lb/TGP)	0.023	0.027	0.022	0.024	0.50
Emission Rate	(lb/1000 lb exhaust)	0.0017	0.0020	0.0015	0.0017	0.01
Total Chromium Emissions		**Run 1**	**Run 2**	**Run 3**	**Average**	
Emission Concentration	(gr/dscf)	0.0065	0.0011	0.0025	0.0034	
Emission Rate	(lb/hr)	1.51	0.25	0.55	0.77	
Emission Rate	(lb/TGP)	0.18	0.03	0.06	0.09	
Emission Rate	(lb/1000 lb exhaust)	0.012	0.002	0.005	0.006	

Table 11 - Emission test results for Line #3 PM Baghouse Stack Exhaust (SV-EP0022) October 2, 2014
Knauf Insulation LLC, Albion, Michigan

Test Data		Run 1	Run 2	Run 3	Average	
Date		10/2/2014	10/2/2014	10/2/2014		
Start Time		8:29 AM	11:02 AM	1:25 PM		
End Time		10:32 AM	1:07 PM	3:28 PM		
Flow Rate	(ACFM)	14,765	14,939	14,948	14,884	
Flow Rate	(DSCFM)	12,762	12,845	12,757	12,788	
Sample Volume	(DSCF)	85.652	87.785	86.835	86.757	
Water Vapor	(volume %)	2.7	2.6	2.9	2.7	
Stack Temperature	(°F)	113.4	116.3	118.1	115.9	
Percent of Isokinetic Sampling	(%)	97.3	98.4	98.6	98.1	
Process Parameters		**Run 1**	**Run 2**	**Run 3**	**Average**	
Differential Pressure	(in H2O)	5.8	5.9	6.0	5.9	
Operational Temperature	(°F)	115	117	120	117	
Baghouse Leak Detector Reading	(mg/m3)	0.85	0.67	0.68	0.73	
Total (Resinated) Glass Pull Rate	(lb/hr)	8,185	8,188	8,194	8,189	
Total (Resinated) Glass Pull Rate	(tons/hr)	4.09	4.09	4.10	4.09	
Test Results		**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
Particulate Matter (Method 5/202)						
Mass Collected (Filterable)	(mg)	3.6	5.8	6.1	5.1	
Mass Collected (Condensable)	(mg)	3.66	3.45	4.66	3.92	
Emission Rate	(lb/hr)	0.14	0.18	0.21	0.18	0.92
Emission Rate	(lb/TGP)	0.035	0.044	0.051	0.043	0.50
Emission Rate	(lb/1000 lb exhaust)	0.0024	0.0030	0.0035	0.0029	0.017
Chromium Emissions		**Run 1**	**Run 2**	**Run 3**	**Average**	
Emission Concentration	(gr/dscf)	0.0010	0.0050	0.0007	0.0022	
Emission Rate	(lb/hr)	0.11	0.54	0.08	0.24	
Emission Rate	(lb/TGP)	0.03	0.13	0.02	0.06	
Emission Rate	(lb/1000 lb exhaust)	0.0019	0.0093	0.0013	0.0042	

3.0 PROCESS DESCRIPTION

This section contains a brief description of the processes and related control equipment.

Knauf Insulation, LLC (Knauf) operates a fiberglass insulation manufacturing plant in Albion, Michigan. Knauf has four fiberglass manufacturing lines, identified as Line 1, Line 2, Line 3 and Line 4. Line 1 and Line 3 are capable of producing resinated wool fiberglass insulation. Line 2 and Line 4 are capable of producing non-resinated wool fiberglass insulation. The wool fiberglass production lines are a continuous process consisting of the following processes:

- Raw materials handling
- Melting and Refining
- Forming and Collection
- Curing and Cooling
- Facing, Sizing, and Packaging

Each process step and its associated controls and emission configuration is described in the following subsections.

3.1 Raw Materials Handling

The glass batching (or raw material handling) operation consists of unloading trucks and rail cars, storing the contents, and blending the various raw materials used to produce glass. Raw materials include silica sand, cullet (broken glass), syenite sand, soda ash, borax and lime. These raw materials are conveyed to storage silos from which they are later weighed and blended in the proper proportions for the particular type of glass to be manufactured. Knauf also recycles cullet and baghouse dust from the process, which is blended into the mixed glass "batch". After blending, the mixed glass "batch" is conveyed to the melting area where it is fed into the melters.

The primary control measure for potential particulate matter emissions for the batch mixing operation is bin vents and the facility building, which acts as a process enclosure to limit airborne particulate matter from being released to the outside ambient air. Storage bins for raw materials and mixed batch are equipped with bin vents (or fabric filters) for control and recovery of materials, which are vented to the in-plant environment.

3.2 Melting and Refining

The next step in the wool fiberglass manufacturing process consists of melting the batch and delivering the molten glass to the fiberization units ("fiberizers") by means of a melter and a forehearth. The batch is electrically melted and formed into glass in a "steel shell" melter. From the melter, the glass flows to a gas fired brick forehearth from which the glass can be divided into several small streams, one for each fiberization unit.

An electrically fired, water cooled, brick lined melting unit is used to melt the batch for each production line. Particulate matter emissions occur from the loading of batch mix into the melters. Potential particulate matter emissions are collected from above the melters by two Rayjet dust collectors on Lines 1, 2 and 4 and is vertically discharged from the combined melter baghouse stack, SV-MELT 6,7,9, to the outside ambient air. On Line 3, a Mactiflo cartridge baghouse is used and vertically discharges from the baghouse stack, SV-EP0022, to the outside ambient air.

Molten glass flows from the melters to dedicated natural gas fired forehearths. The purpose of the forehearth is to split the molten glass flow into several streams, and present a consistent glass flow (or pull rate) to each fiber-forming unit. Potential regulated air pollutant emissions from the Lines 1, 2 and 4 forehearths are vented internally to the ambient air. Potential regulated air pollutant emissions from the Line 3 forehearth are combined with the exhaust system serving the forming, conditioning and collection processes.

3.3 Forming and Collection

Fiber forming units, or fiberizers, are positioned below orifices in the Forehearth to receive the molten glass stream, and "spin" it into glass fibers. The fiberizers use centrifugal force, natural gas heat, and compressed air blast to form the fibers.

A mixture of binder, dedusting agent and overspray (pit) water are applied to the fibers just below the fiberizers for the resinated line. For non-resinated product production, a silicone copolymer is sprayed onto the fibers.

Conditioned fiber from the fiberizers is pulled down onto the collection chain in the vacuum chamber, by fans located downstream of the collection plenum called suction fans. The collection plenum on the resinated lines is a box where the vacuum chamber exhaust is impinged with a water spray to control buildup of fiber on the plenums. The exiting exhaust is then accelerated through a transition duct to venturi scrubbers where it is subjected to additional water sprays to control particulates. The suction fans discharge the scrubbed gas stream vertically through the collection exhaust stack SV-SCRUBBER for Line 1 and SV-EP0023 for Line 3 to the outside air.

On the non-resinated Lines 2 and 4, the collection exhaust air passes through venturi scrubbers and is then discharged vertically through the collection exhaust stack SV-WETSCRUBBER to the outside air.

3.4 Curing and Cooling

For resinated production, the collected fibers, coated with binder and dedusting agent, are conveyed to a natural gas-fired, recirculation air oven, where the fiberglass blanket is sized to thickness and the binder is cured by means of the recirculating heated air. A cooling section is provided downstream of the curing oven, where ambient plant air is drawn through the cured fiberglass blanket.

Potential regulated air pollutant emissions from the Line 1 curing section of the wool fiberglass manufacturing line are collected and controlled with a High Efficiency Air Filter (HEAF). Potential regulated air pollutant emissions from the Line 1 cooling section of the wool fiberglass manufacturing line are collected and controlled with a venturi scrubber. Both of the scrubbed gas streams vertically discharge through the combined curing and cooling table exhaust stack SV-HEAF to the outside air.

Potential regulated air pollutant emissions from the Line 3 curing and cooling sections of the wool fiberglass manufacturing line are collected and controlled with venturi scrubbers, and the scrubbed gas stream vertically discharged through the collection, curing and cooling table exhaust stack SV-EP0023 to the outside air.

No curing is required for non-resinated fiberglass.

3.5 Facing, Sizing and Packaging

The resinated product is next conveyed to the slitting operation where batts and rolls are sized for length and width according to customer demand. If applicable to the product being manufactured, a vapor barrier facing paper is applied.

Wool fiberglass insulation may either be produced with or without the application of the facing paper. When facing is applied, a hot roll facing applicator is used to electrically heat the facing paper or hot melt glue is used to adhere the facing to insulation. In the sizing operation, wool fiberglass insulation is slit with slitter saws to width, and then chopped to length with choppers. The sized insulation is then folded and packed into batts, or rolled and over wrapped. Trim and scrap are fed into the dicers, and the blowing wool bagger or scrap materials may be fed back into the wool fiberglass blanket. The finished product is packaged, stored and shipped.

Non-resinated fiberglass is conveyed from the forming chamber to the dicers where dedusting oil is applied. The diced product is then placed into bags, stored in the warehouse and shipped.

Potential particulate matter emissions from sizing and packaging area equipment are collected and controlled with wet impingement air tumbler, tube sock filters and/or screen room filters. The exhaust from these devices exhausts to the inside plant air.

3.6 Demonstration of Operating Rate

Copies of the glass pull rate and process information recorded during sampling periods are included in Appendix 5.

4.0 SAMPLING METHODS

This section describes the sampling strategy, sampling and analytical methods, and quality assurance/quality control procedures implemented during this project.

4.1 Sampling Strategy

The sampling and analytical procedures used during this test program were those established by the US EPA and MDEQ. A Sampling Protocol was submitted to MDEQ prior to the sampling and was adhered to through out the test program. Tests were conducted during specific operating conditions. There were no unusual operating conditions noted during the sampling.

4.2 Sampling and Analytical Procedures

The following table provides the US EPA methods used in this sampling program.

Table 12 – Sampling and Analytical Procedures

Reference Method	Parameter
1	Location of Sampling Points
2	Volumetric Flow and Molecular Weight
4	Moisture Content
5	Particulate Matter
5E	Particulate Matter & TOC
202	Condensable Particulate Matter
318/320	Formaldehyde, Phenol, Methanol, Formic Acid & Ammonia
306	Total Chromium

A sampling and analysis synopsis for each of these methods is discussed briefly in the following subsections. These test methods are available in the Code of Federal Regulations Volume 40, Part 60 or by request from Integrity.

4.2.1 Sampling Ports, Traverse Points and Cyclonic Flow

The sampling locations were prepared according to the criteria in Method 1. The duct diameters upstream and downstream from the sampling ports were measured and documented prior to sampling. The number of traverse points was chosen with respect to sampling port location. The amount of cyclonic flow was determined according to the criteria detailed in Method 1.

4.2.2 Stack Gas Velocity and Volumetric Flow Rate Determination

Method 2 is used to determine the average gas velocity in a stack using the average temperature and average velocity head. The temperature is measured with a calibrated thermocouple and the velocity determined with a Type S (Stausscheibe) pitot tube. This method is further used to calculate volumetric flow rate.

Measurements of velocity head and temperature at the inlet and exhaust test locations were performed at the traverse points specified by Method 1. A differential pressure gauge scaled for the range of Δp values encountered during the traverse was used. An inclined manometer (oil type) scaled 0.00 – 0.25 or 0 – 10 inches of water, was used at the outlet test locations.

Each apparatus was set-up according to manufacturer and reference method recommendations. Pre-test and post-test leak checks were conducted. The atmospheric and static pressure of each duct was also determined for each set of velocity head readings. The volumetric flow rate calculations used were those specified in Method 2.

4.2.3 Dry Molecular Weight Determination

Method 3 is applicable for determining carbon dioxide and oxygen concentrations and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. This method may also be applicable to other processes where it has been determined that compounds other than carbon dioxide, oxygen, carbon monoxide, and nitrogen are not present in concentrations sufficient to affect the results.

Since the sources were emitting essentially air, a dry molecular weight of 29.0 was used according to Method 2, Section 8.6.

4.2.4 Moisture Determination

Method 4 was used to determine the stack gas moisture content. The moisture content is used to correct the concentration or mass emission rate to a dry basis. The moisture content at each test location was determined in conjunction with Reference Method 5. This procedure is discussed in Section 4.2.5.

4.2.5 Particulate Matter Sampling and Analysis

Sampling and analysis for total particulate matter (condensable and non-condensable) was performed according to US EPA Methods 5 and 202. The principal components of the sampling system were sequentially:

- A stainless steel sample nozzle and borosilicate glass probe liner;
- A heated (248°F ±25°F) probe and filter assembly with tared glass fiber filter;
- A Method 23-type condenser kept below 85 degrees F using recirculating water;
- A dry impinger section consisting of a dropout impinger followed by a modified Greensburg-Smith impinger;
- A glass filter holder (with thermocouple) containing an untared Teflon membrane filter and Teflon frit;
- A cold section consisting of two sequential impingers. The first impingers contained 100 ml of deionized water followed by a final impinger containing 200 grams of silica gel; and
- A metering system capable of maintaining an isokinetic sampling rate and accurately determining the sample volume according to those specifications in APTD-0581.

Sample recovery began immediately following each run. The filter was removed from the glass filter support and sealed in a petri dish. The nozzle, probe liner, and front half of the filter assembly were brushed and rinsed with acetone into a glass storage container which was sealed and the liquid level was marked. The sample containers were transported to Integrity's Air Quality Laboratory in Huntersville, North Carolina.

The non-condensable particulate matter analyses began by transferring the acetone samples to tared beakers. These samples were taken to dryness, placed in an oven at 104°C for one hour and then placed in a desiccator along with the filters for an initial drying period of 24 hours. The non-condensable particulate mass was determined gravimetrically. The tare weights of the filters and beakers were subtracted from the final weights to determine the net non-condensable particulate weight. An aliquot of the reagent grade acetone was analyzed to determine the blank correction factor. The acetone rinse (corrected for the blank) was added to the filter catch to obtain the non-condensable particulate weight.

The condensable portion of the sampling system was purged with filtered ultra-high purity nitrogen for one hour and then measured to the nearest milliliter. This moisture collected in the first two impingers (prior to the Teflon membrane filter) was placed in a high-density polyethylene (HDPE) container (container 1) along with the water rinses of the condenser, impingers, connecting glassware and front-half of the filter holder. The same components were then rinsed with acetone and twice rinsed with hexane. The solvent rinses were combined in one glass container (container 2). The Teflon membrane filter was placed in a petri dish. All sample containers were sealed and the liquid level was marked. The moisture collected by the impinger following the filter holder and the silica gel was determined to the nearest 0.1 gram and discarded.

A field train blank and reagent blanks (water, acetone and hexane) were submitted along with the samples and chain of custody documentation. The samples were analyzed in-house by Integrity Air. Documentation of the laboratory analyses and chain of custody can be found in Appendix 3.

4.2.6 Particulate Matter and TOC Sampling and Analysis

Sampling and analysis for particulate matter and total organic carbon (TOC) was performed according to US EPA Method 5E. The principal components of the Method 5E sampling system were sequentially:

- A borosilicate glass sample nozzle and probe liner;
- A heated (248°F ±25°F) probe and filter assembly with tared glass fiber filter;
- An impinger train consisting of four sequential impingers. The impingers contained 100 ml each of 0.1N NaOH in the first two impingers followed by an empty impinger and a final impinger containing 200 grams of silica gel.
- A metering system capable of maintaining an isokinetic sampling rate and accurately determining the sample volume according to those specifications in APTD-0581.

Method 5E sample recovery began immediately following each run. The filter was removed from the glass filter support and sealed in a petri dish. The liquid in the first three impingers was measured to the nearest milliliter. The moisture collected by the silica gel in the fourth impinger was determined to the nearest 0.1 gram. The collected condensate measurements were recorded on the corresponding field data sheet and placed in a labeled sample jar. The impingers and connecting glassware were rinsed three times with 0.1N NaOH and placed into the same container as the condensate catch.

The nozzle, probe liner, and front half of the filter assembly were first rinsed with deionized water into a glass storage container which was sealed and the liquid level was marked. The nozzle, probe liner, and front half of the filter assembly were then brushed and rinsed with acetone. The rinses were collected into a separate glass storage container which was sealed and the liquid level was marked. The sample containers were transported to Integrity's Air Quality Laboratory in Huntersville, North Carolina.

The particulate matter analyses began by transferring the acetone and deionized water rinse samples to tared beakers. These samples were taken to dryness at 68 ° F +/- 10° and ambient pressure, and then placed in a desiccator along with the filters for an initial drying period of 24 hours. The non-condensable particulate mass was determined gravimetrically. The tare weights of the filters and beakers were subtracted from the final weights to determine the net non-condensable particulate weight. An aliquot of the reagent grade acetone and deionized water were analyzed to determine the blank correction factor. The acetone and deionized water rinses (corrected for the blanks) were added to the filter catch to obtain the non-condensable particulate weight. Integrity personnel performed the particulate matter and method blank analyses in-house. Analysis for total organic compound (TOC) was performed by Element One. A detailed analysis and analytical description, appropriate documentation of the laboratory analyses, and chain of custody can be found in Appendix 3.

4.2.7 Total Chromium Sampling and Analysis

Testing for total chromium was performed according to US EPA Method 306. Gaseous and particulate pollutants were withdrawn isokinetically from the emission source and collected in a multicomponent sampling train.

The principal components of the sampling system were sequentially:

- A borosilicate glass nozzle and probe liner;
- An impinger train consisting of four sequential impingers. The first two impingers contained 100 ml each of 0.1N sodium hydroxide followed by an empty impinger and a final impinger containing 200 grams of silica gel; and
- A metering system capable of maintaining an isokinetic sampling rate and accurately determining the sample volume according to those specifications in APTD-0581.

Sample recovery began by measuring the liquid in the first three impingers to the nearest milliliter. The ph of the absorbing solution was checked and verified to be greater than 8.5. The moisture collected by the silica gel in the fourth impinger was determined to the nearest 0.1 gram. All collected condensate measurements were recorded on corresponding field data sheets. The nozzle, probe impingers and connecting glassware was rinsed with approximately 200 ml of 0.1N NaOH. The impinger contents and rinses were transferred to a 500 ml high density polyethylene storage container. The container was then sealed and the liquid level was marked. The sample containers were shipped with chain of custody documentation to Element One in Wilmington, North Carolina for total chromium analysis. A 0.1N sodium hydroxide blank was included for analysis. The samples were analyzed using inductively coupled plasma emission spectrometry (ICP) for total chrome and Ion Chromatograph (IC) equipped with a post-column reactor. The laboratory report is included in Appendix 3.

4.2.8 Extractive Fourier Transform Infrared Spectroscopy

Infrared absorption spectroscopy was performed by directing an infrared beam to pass through a sample to a detector. The frequency-dependent infrared absorbance of the sample was measured by comparing this detector signal to a signal obtained without a sample in the beam path.

Most molecules absorb infrared radiation and the absorbance occurs in a specific and reproducible pattern. The infrared spectrum measures fundamental molecular properties such as bond stretching and a compound can then be identified from its infrared spectrum. Within constraints, there is a linear relationship between infrared absorption and compound concentration. When the frequency dependent absorptivity is known (measured), it can be used to quantify compound concentration in a sample mixture. Absorptivity is measured by preparing, in the laboratory, standard samples of compounds at known concentrations and measuring the FTIR "reference spectra" of these standard samples. These "reference spectra" are then used in sample analysis. Compounds are detected by matching sample absorbance bands with bands in reference spectra, and then concentrations are measured by comparing sample band intensities with reference band intensities.

The gas sample was extracted from the source through a heated probe and filter assembly containing a glass fiber filter. The sample was pulled through a heated Teflon sample line to the FTIR using a sample pump attached to the exit of the sample cell. The probe, filter, sample line and gas cell temperatures were maintained at approximately 265°F during testing.

The sample analysis was performed using a MIDAC I-2000 spectrometer equipped with a heated fixed path cell system. One cell was 10 meters and the other cell was 10.0 cm. The detectors were liquid cooled MCT, and the nominal spectral resolution was one half wave number (0.5 cm^{-1}). The path length was determined according to EPA Method 320 by using a certified ethylene cylinder (100 ppm). The path length was determined at the beginning and end of the test day as well as before and after each sampling run. Enthalpy personnel determined dilution factors and calculated target values with mass flow controllers and/or primary standard bubble meters. Detailed information regarding the FTIR analysis can be found electronically on compact disk (Provided in front cover) or by request from Integrity.

4.2.9 Sampling Ports and Points

The dimensions of the sampling locations and the location of the sampling ports are detailed in Figures 1 - 6. The drawings provided are not to scale.

Line 1 Collection Stack (SV-Scrubber)

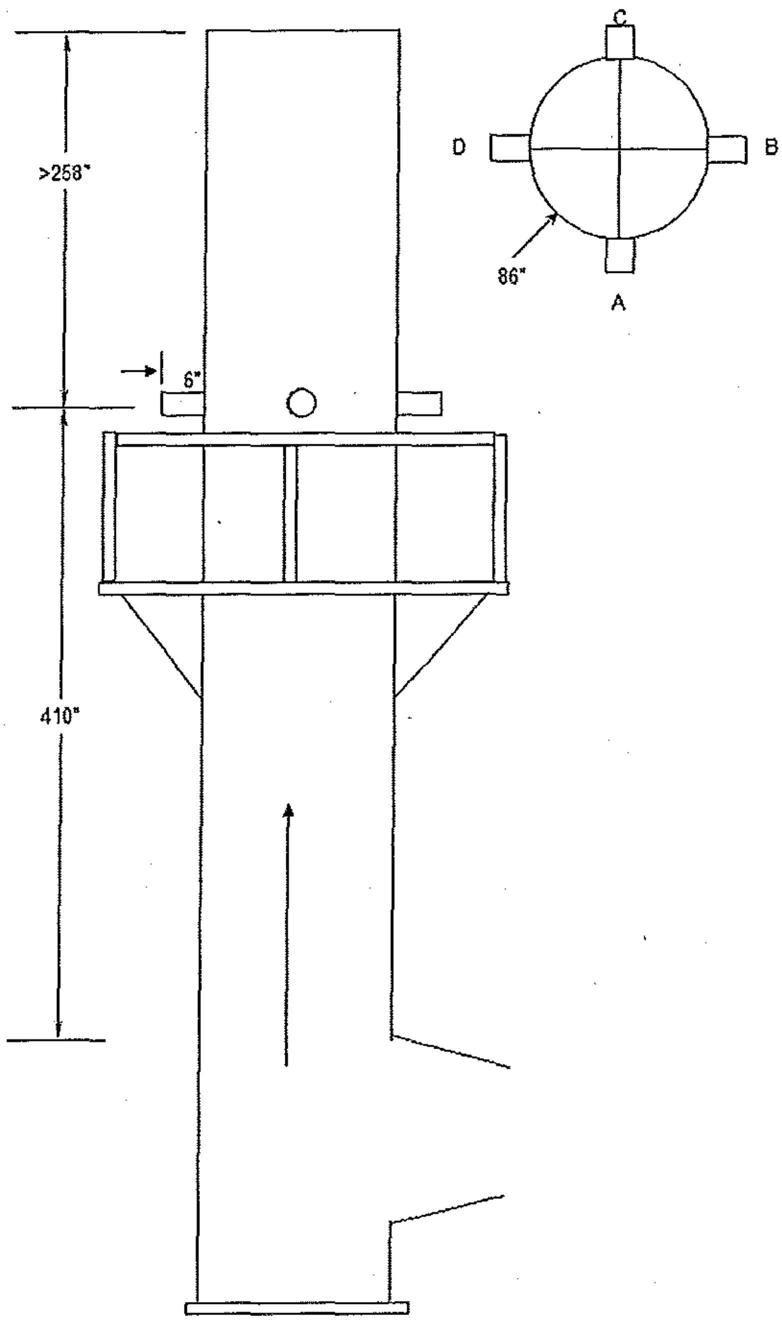

Figure 1

Location of Sampling Ports

Line 1 Curing & Cooling Stack (SV-HEAF)

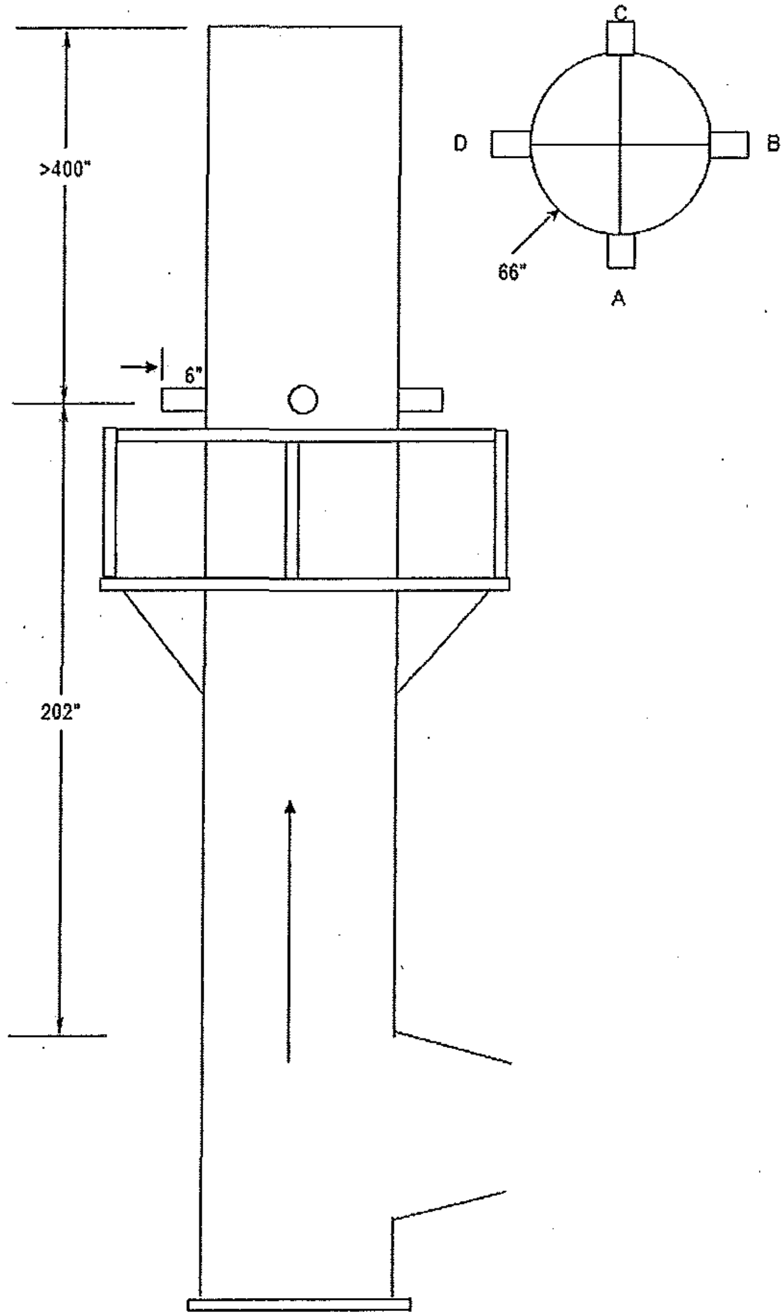

Figure 2

Location of Sampling Ports

Line 3 Collection and Curing Table Stack (SV-EP0023)

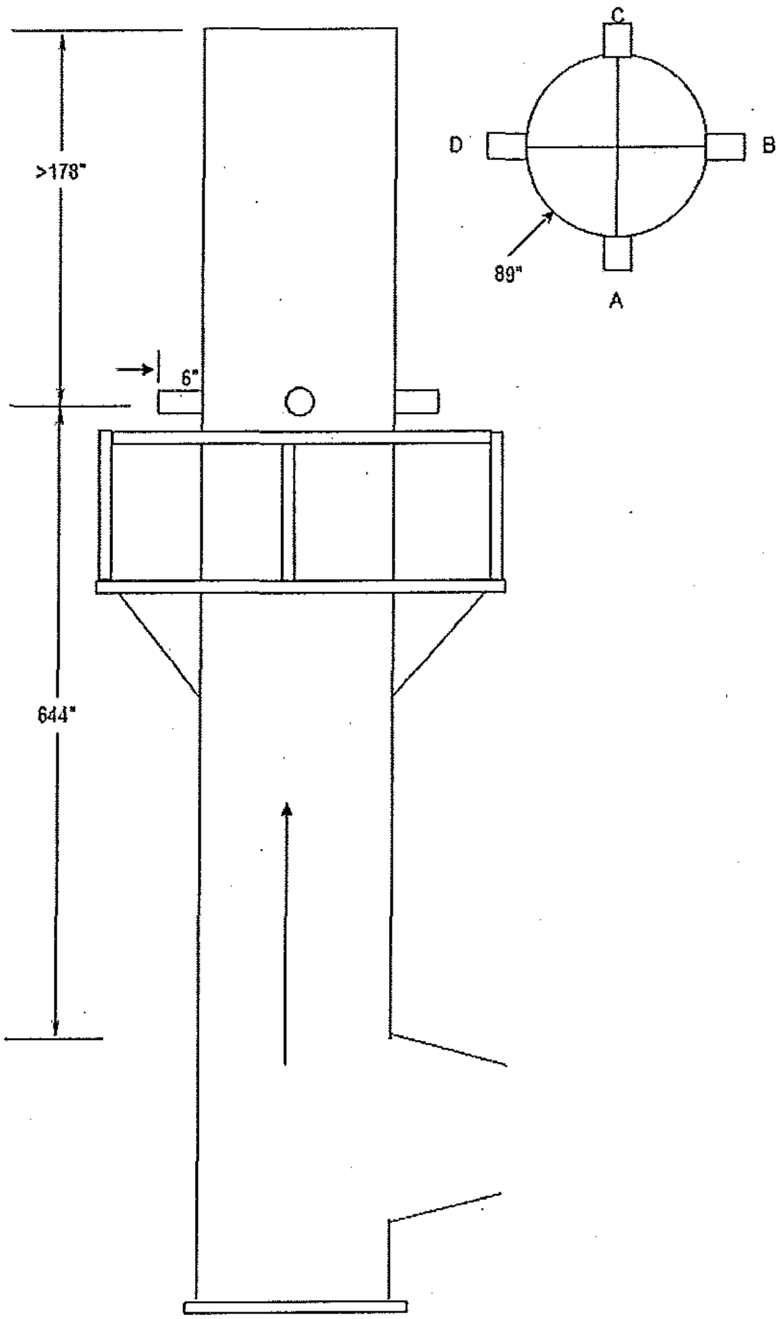

Figure 3

Location of Sampling Ports

Line 2 and 4 Non-Resinated Collection Stack (SV-WETSCRUBBER)

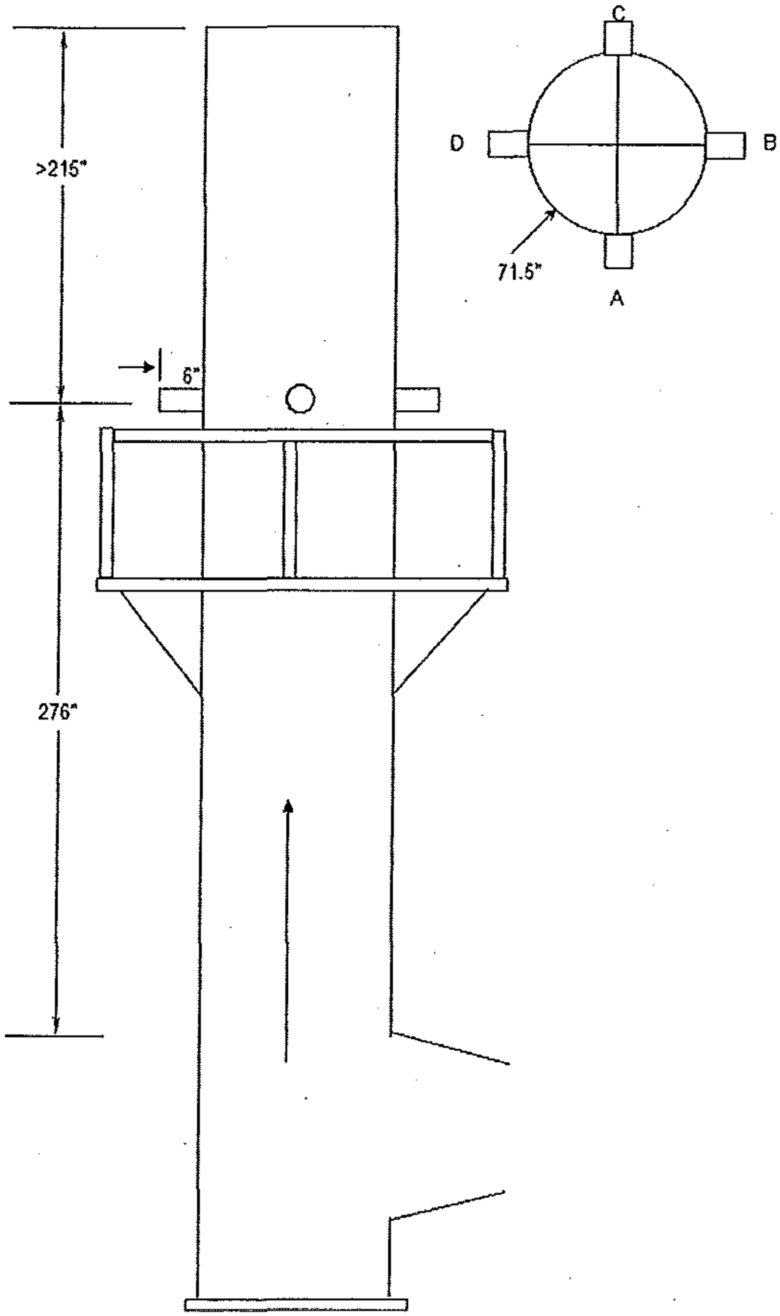

Figure 4

Location of Sampling Ports

Line 1, 2 and 4 Melter Baghouse Stack (SV-MELT 6, 7 & 9)

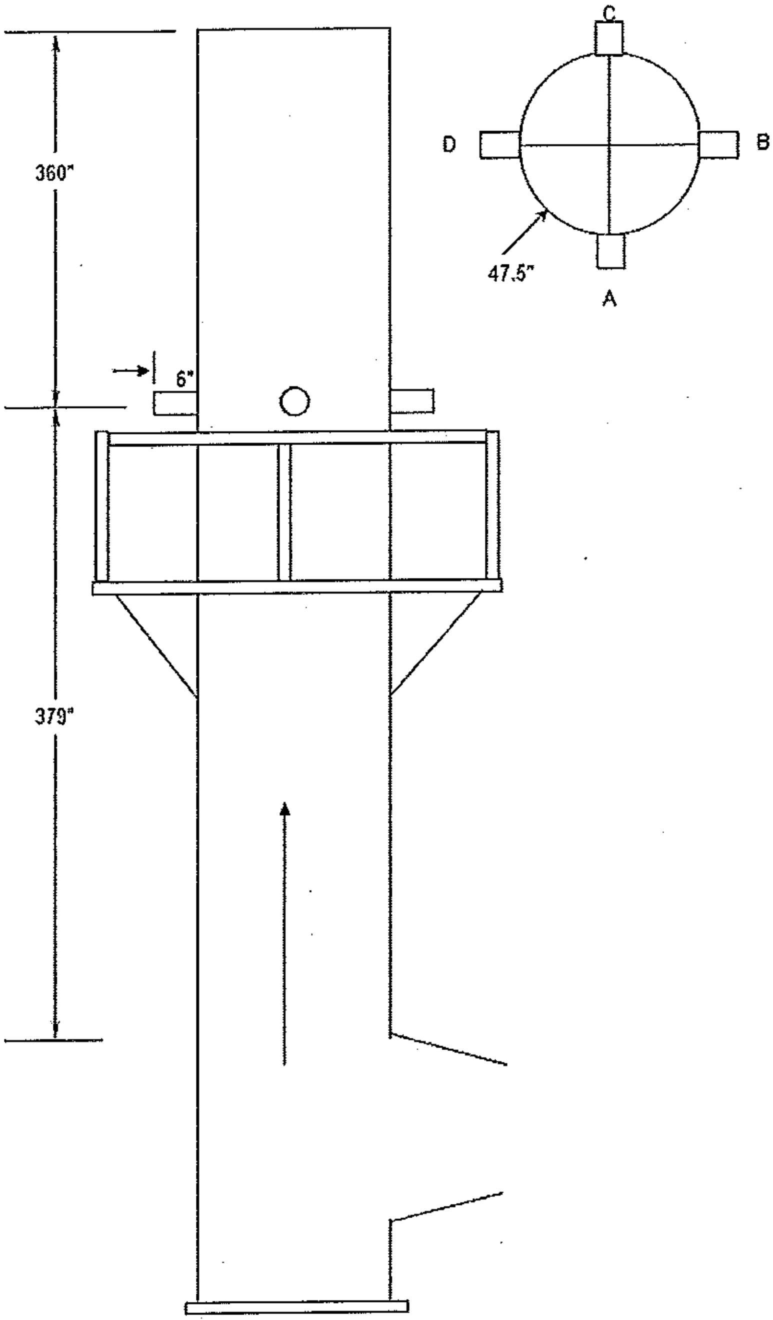

Figure 5

Location of Sampling Ports

Line 3 Melter Baghouse Stack (SV-EP0022)

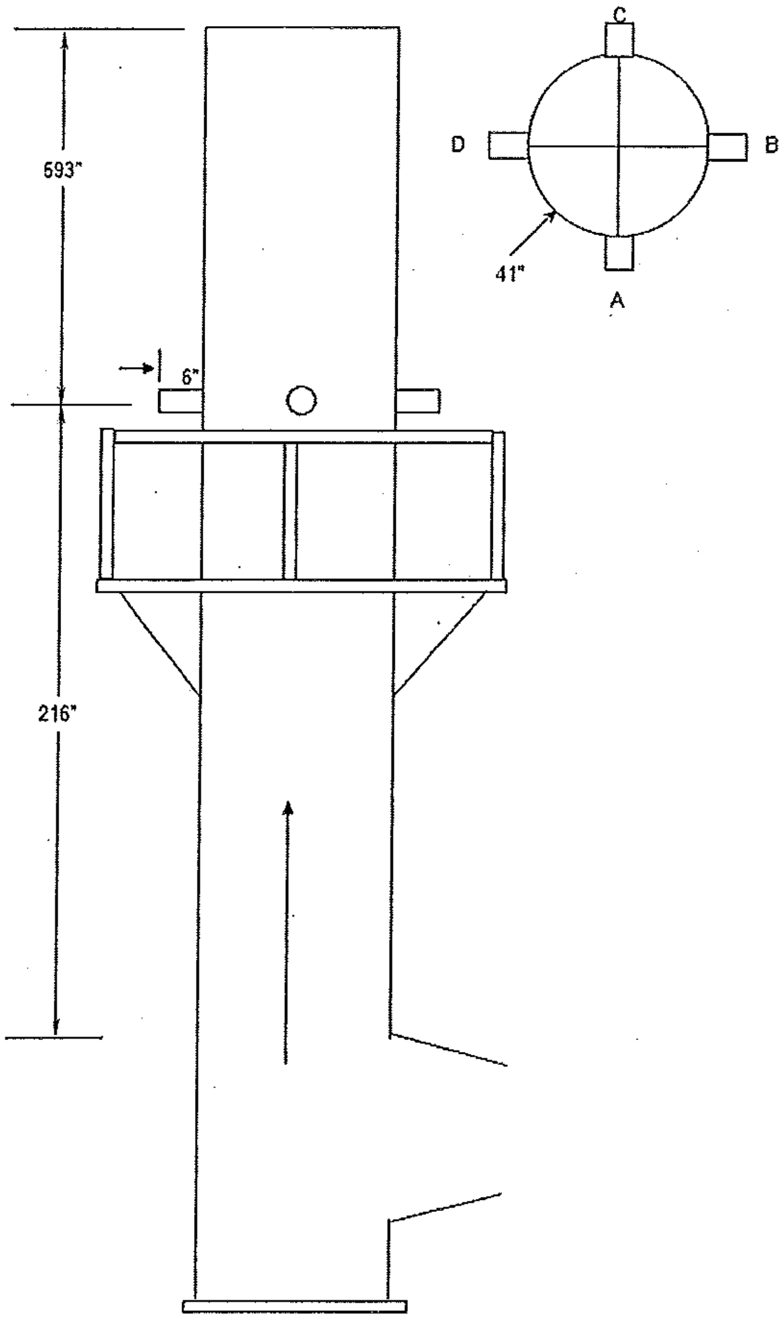

Figure 6

Location of Sampling Ports

4.3 Quality Assurance and Quality Control

Integrity Air Monitoring, Inc. has established quality assurance and quality control (QA/QC) guidelines to ensure the highest quality sampling and analytical data from source tests. As stated in our Quality Manual, Integrity Air carries out source testing activities to comply with the requirements of ASTM D7036-04 for local, state and federal laws and regulations.

Data quality objectives were maintained throughout this project. The following table provides the QA activities followed during this sampling project and the results.

Table 13 – Project QA Activities and Results

Parameter	Criteria	Within Limits?
Moisture Train Leak Check	< 0.02 cfm	yes
Pitot Tube Leak Check	< 0.1 in. H_2O in 15 sec.	yes
Console Calibration	γ +/- 0.02	yes
Thermocouples	+/- 2% of ref. temp.	yes
Acetone Blank	Conc. < 0.001	yes

Quality control procedures for the isokinetic pollutant sampling methods have included the analysis of reagent and field blanks. Method 320 Quality Assurance procedures can be found in the sampling and analysis discussion of the laboratory report and can be found in Appendix 3.

Field data and final laboratory results were independently audited and reviewed for verification of data. The Emission Test Report is audited for completeness and reasonableness of data. The report requires the signature of the project manager and Vice President or President before release to the client. Data and final reports are archived in a secured area for a minimum period of three years.

Integrity's field and laboratory test equipment has been maintained and calibrated in accordance with quality assurance procedures established by the US EPA in the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III. Equipment calibrations including pre-test and post-test calibration data are presented in Appendix 4.

5.0 APPENDICES

The appendices contain detailed support documentation that encompasses the relevant aspects of the emission test program. This data serves as the foundation for the test report. The emission test report presents a summary of the information gathered during the sampling activities. The following appendices have been provided to facilitate the review of the test report:

Appendix 1 – Detailed Summary of Results and Example Calculations

Appendix 2 – Field Data Sheets

Appendix 3 – Laboratory Data and FTIR Data

Appendix 4 – Calibration Data and Protocol Gas Certificates of Analysis

Appendix 5 – Facility Production Documentation

Appendix 6 - Free-Formaldehyde Content Determination of the Resin