CleanAir

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REPORT FOR FORMALDEHYDE, METHANOL, AND NICKEL EMISSIONS TESTING

Airlane North Plant

SVN-1A & SVN-1B Exhaust Stacks & Scrubber Outlet (SVN-4)

Lacks Enterprises, Inc.
525 West Allegan Street
Lansing, Michigan 48933
Client Reference No. 15-AS-1163950

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COMMITMENT TO QUALITY

To the best of our knowledge, the data presented in this report are accurate, complete, error free and representative of the actual emissions during the test program. Clean Air Engineering operates in conformance with the requirements of ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies.

Report Submittal:

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I hereby certify that the information contained within the final test report has been reviewed and, to the best of my ability, verified as accurate.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS & ABBREVIATIONS

AAS (atomic absorption spectrometry)
acfm (actual cubic feet per minute)
ACI (activated carbon injection)
ADL (above detection limit)
AIG (ammonia injection grid)
APC (air pollution control)
AQCS (air quality control system(s))
ASME (American Society of Mechanical Engineers)
ASTM (American Society for Testing and Materials)
BDL (below detection limit)
Btu (British thermal units)
CAM (compliance assurance monitoring)
CARB (California Air Resources Board)
CCM (Controlled Condensation Method)
CE (capture efficiency)
°C (degrees Celsius)
CEMS (continuous emissions monitoring system(s))
CFB (circulating fluidized bed)
CFR (Code of Federal Regulations)
cm (centimeter(s))
COMS (continuous opacity monitoring system(s))
CT (combustion turbine)
CTI (Cooling Technology Institute)
CTM (Conditional Test Method)
CVAAS (cold vapor atomic absorption spectroscopy)
CVAFS (cold vapor atomic fluorescence spectrometry)
DI H_2O (de-ionized water)
%dv (percent, dry volume)
DLL (detection level limited)
DE (destruction efficiency)
DCI (dry carbon injection)
DGM (dry gas meter)
dscf (dry standard cubic feet)
dscfm (dry standard cubic feet per minute)
dscm (dry standard cubic meter)
ESP (electrostatic precipitator)
FAMS (flue gas adsorbent mercury speciation)
°F (degrees Fahrenheit)
FB (field blank)
FCC (fluidized catalytic cracking)
FCCU (fluidized catalytic cracking unit)
FEGT (furnace exit gas temperatures)
FF (fabric filter)
FGD (flue gas desulfurization)
FIA (flame ionization analyzer)
FID (flame ionization detector)
FPD (flame photometric detection)
FRB (field reagent blank)
FSTM (flue gas sorbent total mercury)
ft (feet or foot)
ft^2 (square feet)
ft^3 (cubic feet)
ft/sec (feet per second)
FTIR (Fourier Transform Infrared Spectroscopy)
FTRB (field train reagent blank)
g (gram(s))
GC (gas chromatography)
GFAAS (graphite furnace atomic absorption spectroscopy)
GFC (gas filter correlation)
gr/dscf (grains per dry standard cubic feet)
> (greater than)/ ≥ (greater than or equal to)
g/s (grams per second)
H_2O (water)
HAP(s) (hazardous air pollutant(s))
HI (heat input)
hr (hour(s))
HR GC/MS (high-resolution gas chromatography and mass spectrometry)
HRVOC (highly reactive volatile organic compounds)
HSRG(s) (heat recovery steam generator(s))
HVT (high velocity thermocouple)
IC (ion chromatography)
IC/PCR (ion chromatography with post column reactor)
ICP/MS (inductively coupled argon plasma mass spectroscopy)
ID (induced draft)
in. (inch(es))
in. H_2O (inches water)
in. Hg (inches mercury)
IPA (isopropyl alcohol)
ISE (ion-specific electrode)
kg (kilogram(s))
kg/hr (kilogram(s) per hour)
< (less than)/ ≤ (less than or equal to)
L (liter(s))
lb (pound(s))
lb/hr (pound per hour)
lb/MMBtu (pound per million British thermal units)
lb/TBtu (pound per trillion British thermal units)
lb/lb-mole (pound per pound mole)
LR GC/MS (low-resolution gas chromatography and mass spectrometry)
m (meter)
m^3 (cubic meter)
MACT (maximum achievable control technology)
MASS® (Multi-Point Automated Sampling System)
MATS (Mercury and Air Toxics Standards)
MDL (method detection limit)
µg (microgram(s))
min. (minute(s))
mg (milligram(s))
ml (milliliter(s))
MMBtu (million British thermal units)
MW (megawatt(s))
NCASI (National Council for Air and Stream Improvement)
ND (non-detect)
NDIR (non-dispersive infrared)
NDO (natural draft opening)
NESHAP (National Emission Standards for Hazardous Air Pollutants)
ng (nanogram(s))
Nm^3 (Normal cubic meter)
% (percent)
PEMS (predictive emissions monitoring systems)
PFGC (pneumatic focusing gas chromatography)
pg (picogram(s))
PJFF (pulse jet fabric filter)
ppb (parts per billion)
PPE (personal protective equipment)
ppm (parts per million)
ppmdv (parts per million, dry volume)
ppmwv (parts per million, wet volume)
PSD (particle size distribution)
psi (pound(s) per square inch)
PTE (permanent total enclosure)
PTFE (polytetrafluoroethylene)
QA/QC (quality assurance/quality control)
QI (qualified individual)
QSTI (qualified source testing individual)
QSTO (qualified source testing observer)
RA (relative accuracy)
RATA (relative accuracy test audit)
RB (reagent blank)
RE (removal or reduction efficiency)
RM (reference method)
scf (standard cubic feet)
scfm (standard cubic feet per minute)
SCR (selective catalytic reduction)
SDA (spray dryer absorber)
SNCR (selective non-catalytic reduction)
STD (standard)
STMS (sorbent trap monitoring system)
TBtu (trillion British thermal units)
TEOM (Tapered Element Oscillating Microbalance)
TEQ (toxic equivalency quotient)
ton/hr (ton per hour)
ton/yr (ton per year)
TSS (third stage separator)
USEPA or EPA (United States Environmental Protection Agency)
UVA (ultraviolet absorption)
WFGD (wet flue gas desulfurization)
%wv (percent, wet volume)

1. PROJECT OVERVIEW

TEST PROGRAM SUMMARY

Lacks Enterprises, Inc. contracted CleanAir Engineering (CleanAir) to testing on the Scrubber Outlet (SVN-4) and Exhaust Stacks (SVN-1A and SVN-1B) at the Airlane North (ALN) Plant located in Kentwood, Michigan.

The objective of the test program is to perform testing to demonstrate compliance with applicable limits outlined in the Michigan Renewable Operating Permit MI-ROP-N0895-2018a.

A summary of the test program results is presented below. Section 2 Results provides a more detailed account of the test conditions and data analysis.

Table 1-1:
Summary of Results / Permit Limits

Source Constituent	Sampling Method	Average Emission	Permit Limit[1]
SVN-1A Exhaust Stack[2]			
Ni (lb/hr)	EPA 29	0.0027	0.0598
SVN-1B Exhaust Stack[2]			
Ni (lb/hr)	EPA 29	0.0006	0.0598
Scrubber Outlet (SVN-4)			
CH_3OH (lb/hr)	EPA 308	4.04	8.25
CH_2O (lb/hr)	EPA 316	0.07	2.72

[1] Permit limits obtained from Michigan Renewable Operating Permit MI-ROP-N0895-2018a.

[2] SVN-1A and SVN-1B is a combined emission limit.

TEST PROGRAM DETAILS

PARAMETERS

The test program included the following measurements:

- formaldehyde (CH_2O)
- methanol (CH_3OH)
- nickel (Ni)
- flue gas composition (e.g., O_2, CO_2, H_2O)
- flue gas temperature
- flue gas flow rate

SCHEDULE

Testing was performed on October 22 and 25, 2021. Table 1-2 outlines the on-site schedule followed during the test program.

Table 1-2:
Test Schedule

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	SVN-1A Exhaust Stack	USEPA Method 29	Nickel	10/22/21	09:39	10:44
2	SVN-1A Exhaust Stack	USEPA Method 29	Nickel	10/22/21	11:54	12:58
3	SVN-1A Exhaust Stack	USEPA Method 29	Nickel	10/22/21	13:32	14:37
1	SVN-1B Exhaust Stack	USEPA Method 29	Nickel	10/22/21	09:39	10:44
2	SVN-1B Exhaust Stack	USEPA Method 29	Nickel	10/22/21	11:54	12:58
3	SVN-1B Exhaust Stack	USEPA Method 29	Nickel	10/22/21	13:32	14:37
1	Scrubber Outlet (SVN-4)	USEPA Method 308	Methanol	10/22/21	09:05	11:35
2	Scrubber Outlet (SVN-4)	USEPA Method 308	Methanol	10/22/21	12:38	15:08
3	Scrubber Outlet (SVN-4)	USEPA Method 308	Methanol	10/22/21	15:57	19:58
1	Scrubber Outlet (SVN-4)	USEPA Method 316	Formaldehyde	10/22/21	16:08	17:15
2	Scrubber Outlet (SVN-4)	USEPA Method 316	Formaldehyde	10/22/21	17:40	20:13
3A	Scrubber Outlet (SVN-4)	USEPA Method 316	Formaldehyde	10/25/21	16:52	17:58
3B	Scrubber Outlet (SVN-4)	USEPA Method 316	Formaldehyde	10/25/21	16:52	17:58

DISCUSSION

Volumetric Flow Determination – USEPA Methods 1-4

EPA Methods 1 through 4 of 40 CFR 60, Appendix A, were used to measure the flue gas volumetric flow. These methods determined several characteristics of the flue gas stream: velocity, moisture, and flow rate. The sources are ambient, therefore 20.9% dv for oxygen (O_2) and 0.0% dv for carbon dioxide (CO_2) were used.

Nickel – USEPA Method 29

EPA Method 29 was used for the nickel determinations at the SVN-1A and SVN-1B Exhaust Stacks. The method involves isokinetic sampling of the flue gas and subsequent collection of particulate matter onto a quartz fiber filter. Gaseous metals were absorbed into an acidic hydrogen peroxide solution. The filter and the absorbing solution were digested and analyzed for nickel using inductively coupled argon plasma (ICP-MS) mass spectroscopy.

Three test runs for each source plus one reagent blank for the project of water and 0.1 N HNO_3 (train rinses) quartz filters (3), and 10%H_2O_2/5%HNO_3 (impinger absorbing solution) were collected. Element One, Inc., located in Wilmington, North Carolina, performed the analysis. The laboratory report is in Appendix G.

Methanol – USEPA Method 308

EPA Method 308 was used to measure the methanol concentration at the Scrubber Outlet (SVN-4). A gas sample was extracted from the stack and the methanol was collected in deionized distilled water and adsorbed on silica gel.

The collected samples were shipped to Enthalpy Analytical, LLC, located in Durham, North Carolina. The laboratory separated the methanol in the water fraction from other organic compounds by gas chromatography (GC) and then measured the sample by flame ionization detector (FID). The fraction adsorbed on the silica gel was extracted with an aqueous solution of n-propanol and then separated and measured by GC/FID. The laboratory report is in Appendix G.

A required methanol spike recovery check was also performed as part of Method 308, Section 13. Two collocated identical sampling trains (Side A and Side B) sampled the same relative point in the stack with the probe tips within 1 inch of each other. Both trains sampled stack gas simultaneously at a single point for 150 minutes in duration. Side A sample runs were not spiked. Side B sample runs were spiked with a known amount of CH_3OH. The trains were recovered and analyzed. The average spike recovery was 83.8% with the results reported in Appendix C.

Formaldehyde – USEPA Method 316

EPA Method 316 was utilized for the formaldehyde determinations. Gaseous and particulate pollutants were withdrawn isokinetically from the emission source and collected in high purity water containing formaldehyde. The high purity water was analyzed using the modified pararosaniline method. Formaldehyde in the sample reacted with acidic pararosaniline and sodium sulfite, forming a purple chromophore. The intensity of the purple color, measured spectrophotometrically, provided the formaldehyde concentration in the sample.

Three test runs plus a water reagent blank were collected and analyzed Enthalpy Analytical, LLC. The laboratory report is in Appendix G.

The field spike recovery was 94.6% with the results reported in Appendix C.

Method 1 Measurements

During the October field testing, the upstream and downstream disturbances distances were measured on-site by CleanAir. Based on the field measurements of the SVN1A and SVN-1B outlet locations, the location of the sample test ports did not meet the EPA Method 1 requirement of being at least two diameters downstream from the nearest upstream disturbance. All historical testing has been performed at these same test ports, utilizing the maximum required number of points for a round stack which meets Method 1 minimum requirements. This number is 24. For future testing, the sample ports on the outlet locations should be moved to meet the EPA Method 1 requirement.

Verification of the Absence of Cyclonic Flow

A cyclonic flow check was performed in accordance with EPA Method 1, Section 11.4. This procedure is referred to as the "nulling" technique. An S-type pitot tube connected to an inclined manometer was used in this method. This is the same apparatus as referenced in EPA Method 2.

The pitot tube was positioned at each of the EPA Method 1 traverse point locations so that the face openings of the pitot tube are orientated perpendicular to the stack or duct cross-sectional plane. This position was referenced as the "0° reference." The velocity pressure (ΔP) measurement at this position was recorded. If the ΔP reading was zero, a cyclonic angle of 0° is recorded. If the ΔP reading was not zero, the pitot tube was rotated clockwise (positive) or counterclockwise (negative) as required to obtain a zero ΔP reading. The angle required to obtain the zero reading was measured using a digital protractor (±0.1°) attached to the pitot tube.

After all the traverse points had been checked, the average of the absolute values of each angle was calculated. If this resultant angle is ≤ 20°, the flow condition at the location is considered acceptable. The measured resultant angles for the SVN-1A and SVN-1B Exhaust Stacks were both 0.6°. The measured resultant angle for the Scrubber Outlet (SVN-4) was 0.7°. The field data is in Appendix E.

End of Section

2. RESULTS

This section summarizes the test program results. Additional results are available in the report appendices.

Table 2-1:
SVN-1A Exhaust Stack – Nickel Results, Method 29

Run No.		1	2	3	Average
Date (2021)		Oct 22	Oct 22	Oct 22	
Start Time (approx.)		09:39	11:54	13:32	
Stop Time (approx.)		10:44	12:58	14:37	
Gas Conditions					
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
T_s	Stack temperature (°F)	77	78	77	**78**
B_w	Actual water vapor in gas (% by volume)	1.66	1.98	1.70	**1.78**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	36,800	35,500	36,500	**36,300**
Q_s	Volumetric flow rate, standard (scfm)	35,300	34,000	35,000	**34,800**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	34,700	33,300	34,400	**34,200**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	33.46	32.12	33.02	**32.86**
%I	Isokinetic sampling (%)	100.4	100.4	100.0	**100.3**
Laboratory Data					
m_n	Total matter corrected for allowable blanks (µg)	22.3400	23.8400	13.4400	
Nickel Results - Total					
C_{sd}	Concentration (lb/dscf)	1.472E-09	1.637E-09	8.976E-10	**1.336E-09**
C_{sd}	Concentration (mg/dscm)	0.0236	0.0262	0.0144	**0.0214**
$E_{lb/hr}$	Rate (lb/hr)	0.00307	0.00327	0.00185	**0.00273**

Table 2-2:
SVN-1B Exhaust Stack – Nickel Results, Method 29

Run No.		1	2	3	Average
Date (2021)		Oct 22	Oct 22	Oct 22	
Start Time (approx.)		09:39	11:54	13:32	
Stop Time (approx.)		10:44	12:58	14:37	
Gas Conditions					
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
T_s	Stack temperature (°F)	79	80	80	**80**
B_w	Actual water vapor in gas (% by volume)	1.55	1.55	1.64	**1.58**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	19,900	20,100	19,900	**20,000**
Q_s	Volumetric flow rate, standard (scfm)	19,000	19,100	19,000	**19,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	18,700	18,800	18,700	**18,700**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	31.75	31.99	31.70	**31.81**
%I	Isokinetic sampling (%)	94.5	94.4	94.3	**94.4**
Laboratory Data					
m_n	Total matter corrected for allowable blanks (µg)	6.8000	6.7200	9.3400	
Nickel Results - Total					
C_{sd}	Concentration (lb/dscf)	4.723E-10	4.632E-10	6.496E-10	**5.283E-10**
C_{sd}	Concentration (mg/dscm)	0.00756	0.00742	0.01040	**0.00846**
$E_{lb/hr}$	Rate (lb/hr)	0.000529	0.000523	0.000729	**0.000594**

Table 2-3:
Scrubber Outlet SVN-4 – Methanol Results, Method 308

Run No.		**1**	**2**	**3**	**Average**
Date (2021)		Oct 22	Oct 22	Oct 22	
Start Time (approx.)		09:05	12:38	15:57	
Stop Time (approx.)		11:35	15:08	19:58	
Gas Conditions					
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
T_s	Stack temperature (°F)*	61	61	61	**61**
B_w	Actual water vapor in gas (% by volume)*	1.72	1.72	1.72	**1.72**
Gas Flow Rate*					
Q_a	Volumetric flow rate, actual (acfm)*	12,550	12,550	12,550	**12,550**
Q_s	Volumetric flow rate, standard (scfm)*	12,414	12,414	12,414	**12,414**
Q_{std}	Volumetric flow rate, dry standard (dscfm)*	12,201	12,201	12,201	**12,201**
Sampling Data					
$V_{mstd\text{-}A\ Side}$	Volume metered, standard (dscf)	1.01	1.03	1.00	**1.01**
$V_{mstd\text{-}B\ Side}$	Volume metered, standard (dscf)	1.00	1.09	0.98	**1.02**
Laboratory Data					
m_n	Total CH3OH collected (ug)	2,484	2,613	2,513	**2,537**
Methanol (CH3OH) Results					
C_{sd}	CH3OH Concentration (ppmdv)	65.2	67.4	66.6	**66.4**
C_w	CH3OH Concentration (ppmwv)	64.0	66.3	65.4	**65.2**
$E_{lb/hr}$	CH3OH Rate (lb/hr)	3.96	4.10	4.05	**4.04**

* Obtained by averaging data from Runs 1 and 2 Method 316 testing.

Table 2-4:
Scrubber Outlet SVN-4 – Formaldehyde Results, Method 316

Run No.		1	2	3A	Average
Date (2021)		Oct 22	Oct 22	Oct 25	
Start Time (approx.)		16:08	17:40	16:52	
Stop Time (approx.)		17:15	20:13	17:58	
Gas Conditions					
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
T_s	Stack temperature (°F)	61	61	60	**61**
B_w	Actual water vapor in gas (% by volume)	1.63	1.81	1.79	**1.74**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	12,700	12,400	11,800	**12,300**
Q_s	Volumetric flow rate, standard (scfm)	12,500	12,300	11,600	**12,133**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	12,300	12,100	11,400	**11,933**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	35.9836	35.6403	33.7599	
%I	Isokinetic sampling (%)	94.6506	95.9740	96.9367	**95.8537**
Laboratory Data					
m_n	Total CH2O collected (mg)	1.46200	1.41000	1.47600	
Formaldehyde (CH2O) Results					
C_{sd}	CH2O Concentration (lb/dscf)	8.96E-08	8.72E-08	9.64E-08	**9.11E-08**
C_{sd}	CH2O Concentration (ppmdv)	1.15	1.12	1.24	**1.17**
$E_{lb/hr}$	CH2O Rate (lb/hr)	0.0664	0.0631	0.0660	**0.0652**

End of Section

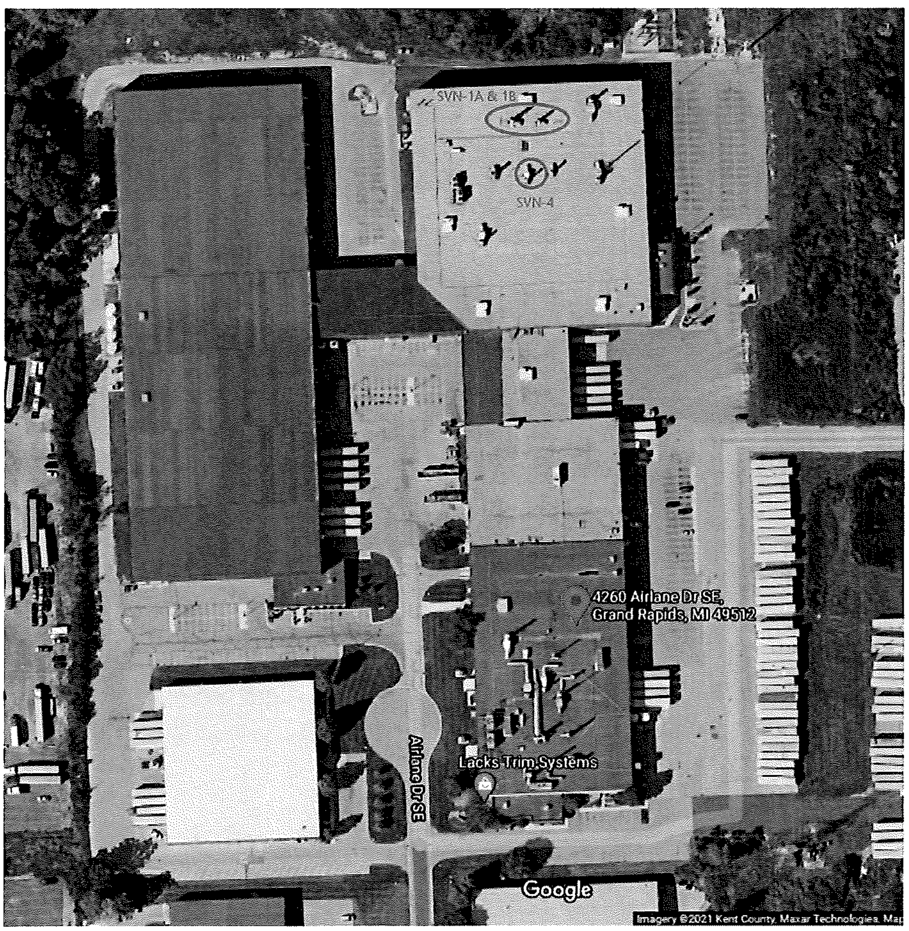
3. DESCRIPTION OF INSTALLATION

PROCESS DESCRIPTION

Lacks Enterprise Inc. is a privately owned company based in Grand Rapids, Michigan, which produces molded, painted, or plated plastic products. The Scrubber Outlet SVN-4 emission group consists of one electroless copper/electroless nickel tank controlled by a packed bed scrubber with mist eliminator. The SVN-1A emission group consists of four semi-bright nickel tanks and three bright nickel tanks. The SVN-1B emission group consists of one microporous nickel and one chrome pre-dip tank.

The testing reported in this document was performed at the SVN-1A Exhaust Stack, SVN-1B Exhaust Stack, and Scrubber Outlet SVN-4 located on the roof. Figure 3-1 presents a photograph of the locations.

Figure 3-1:
Location Photograph



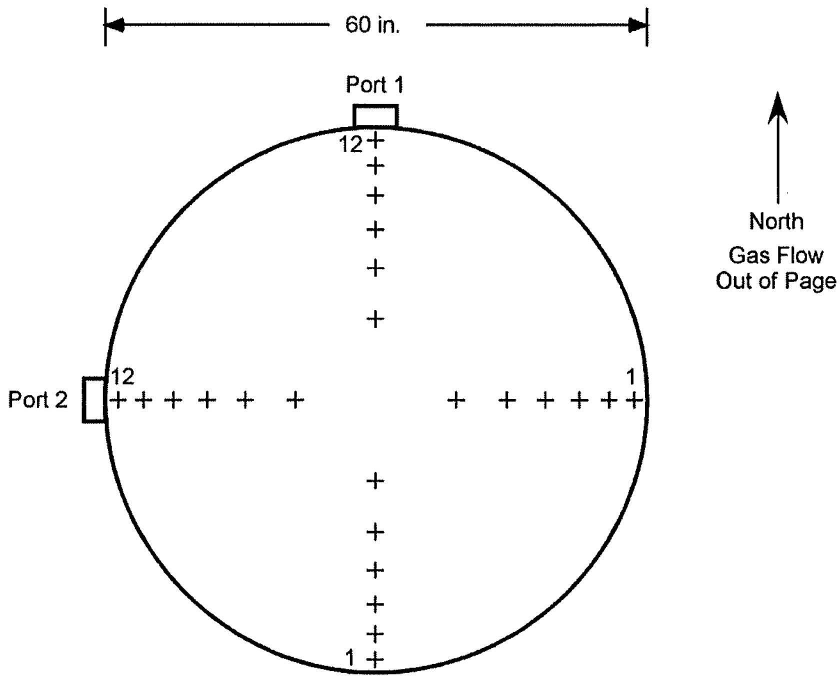
Test Locations

The sample point placement was determined by EPA Method 1 specifications. Table 3-1 presents the sampling information for the test locations. The figures represent the layout of the test location.

Table 3-1:
Sampling Information

Source Constituent	Method	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
SVN-1A Exhaust Stack							
Ni	EPA 29	1-3	2	12	2.5	60	3-2
SVN-1B Exhaust Stack							
Ni	EPA 29	1-3	2	12	2.5	60	3-3
Scrubber Outlet (SVN-4)							
CH_3OH	EPA 308	1-3	1	1	150	150	NA
CH_2O	EPA 316	1-3	2	12	2.5	60	3-4

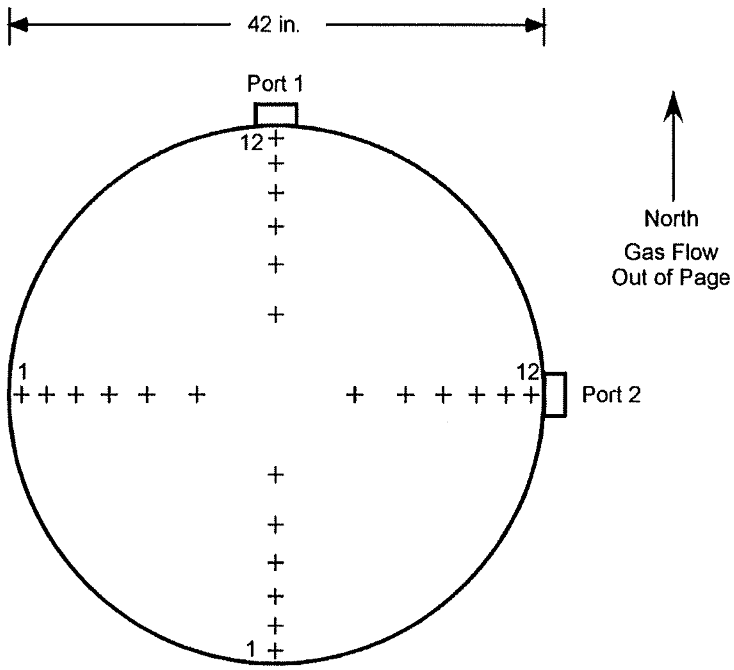
Figure 3-2:
SVN-1A Exhaust Stack Sample Point Layout (EPA Method 1)



Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	97.9	58.7
2	93.3	56.0
3	88.2	52.9
4	82.3	49.4
5	75.0	45.0
6	64.4	38.6
7	35.6	21.4
8	25.0	15.0
9	17.7	10.6
10	11.8	7.1
11	6.7	4.0
12	2.1	1.3

Duct diameters upstream from flow disturbance (A): 1.5 Limit: 0.5
Duct diameters downstream from flow disturbance (B): 1.7 Limit: 2.0

Figure 3-3:
SVN-1B Exhaust Stack Sample Point Layout (EPA Method 1)

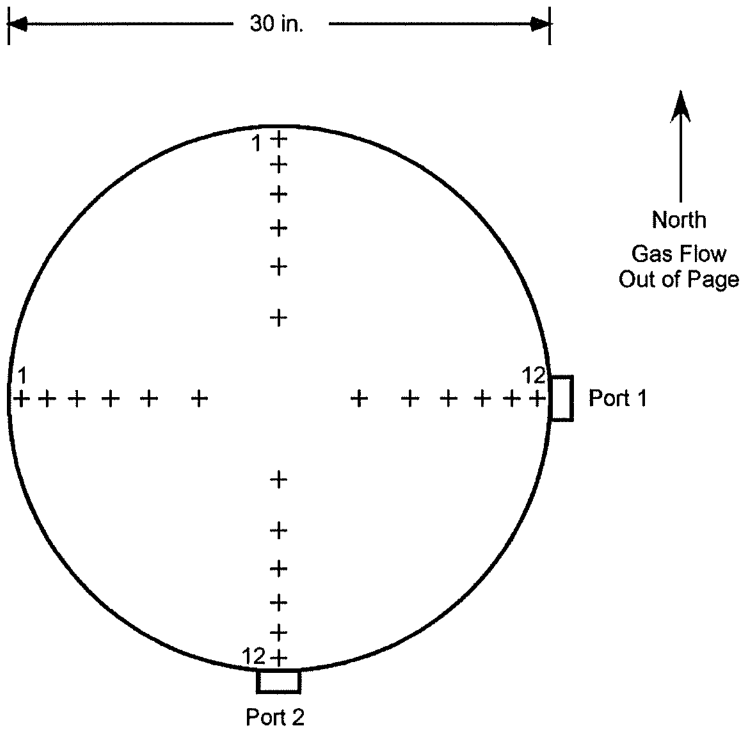


Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	97.9	41.0*
2	93.3	39.2
3	88.2	37.0
4	82.3	34.6
5	75.0	31.5
6	64.4	27.0
7	35.6	15.0
8	25.0	10.5
9	17.7	7.4
10	11.8	5.0
11	6.7	2.8
12	2.1	1.0*

* Points 1 and 12 were too close to the stack wall and were corrected to 1 inch.

Duct diameters upstream from flow disturbance (A): 0.7 Limit: 0.5
Duct diameters downstream from flow disturbance (B): 1.3 Limit: 2.0

Figure 3-4:
Scrubber Outlet (SVN-4) Exhaust Stack Sample Point Layout (EPA Method 1)



Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	97.9	29.0
2	93.3	28.0
3	88.2	26.5
4	82.3	24.7
5	75.0	22.5
6	64.4	19.3
7	35.6	10.7
8	25.0	7.5
9	17.7	5.3
10	11.8	3.5
11	6.7	2.0
12	2.1	1.0

End of Section

4. METHODOLOGY

PROCEDURES AND REGULATIONS

The test program sampling measurements followed procedures and regulations outlined by the USEPA and Michigan Department of Environment, Great Lakes, and Energy (EGLE). These methods appear in detail in Title 40 of the CFR and at https://www.epa.gov/emc.

Appendix A includes diagrams of the sampling apparatus, as well as specifications for sampling, recovery, and analytical procedures. Any modifications to standard test methods are explicitly indicated in this appendix. In accordance with ASTM D7036 requirements, CleanAir included a description of any such modifications along with the full context of the objectives and requirements of the test program in the test protocol submitted prior to the measurement portion of this project. Modifications to standard methods are not covered by the ISO 17025 and TNI portions of CleanAir's A2LA accreditation.

CleanAir follows specific QA/QC procedures outlined in the individual methods and in USEPA "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III Stationary Source-Specific Methods," EPA/600/R-94/038C. Appendix D contains additional QA/QC measures, as outlined in CleanAir's internal Quality Manual.

TITLE 40 CFR PART 60, APPENDIX A

Method 1 "Sample and Velocity Traverses for Stationary Sources"

Method 2 "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"

Method 3 "Gas Analysis for the Determination of Dry Molecular Weight"

Method 4 "Determination of Moisture Content in Stack Gases"

Method 29 "Determination of Metals Emissions from Stationary Sources"

TITLE 40 CFR PART 63, APPENDIX A

Method 308 "Procedure for Determination of Methanol Emission from Stationary Sources"

Method 316 "Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries"

ASTM D6831-02 "Standard Test Method for Sampling and Determining Particulate Matter in Stack Gases

End of Section

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5. APPENDIX

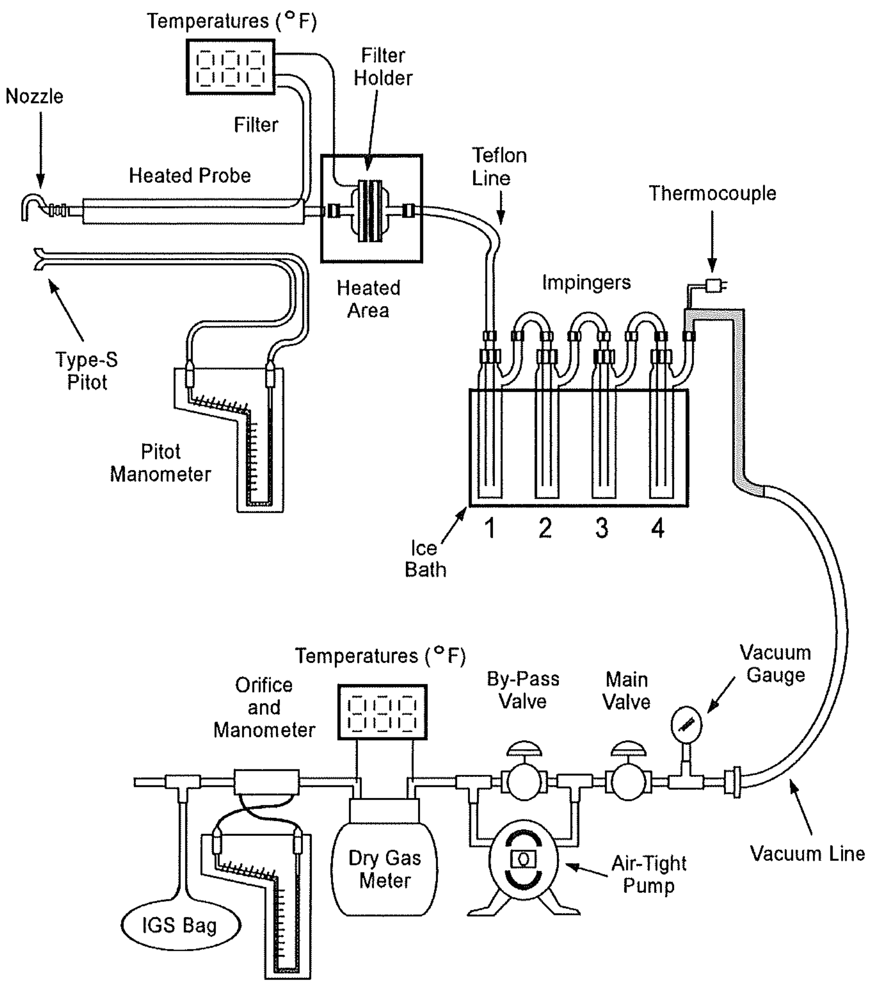
APPENDIX A: TEST METHOD SPECIFICATIONS

Specification Sheet for EPA Method 29

Source Location Name(s)	SVN-1A and 1B Exhaust Stacks
Pollutant(s) to be Determined	Nickel
Other Parameters to be Determined from Train	Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	24
Sample Time per Point	N/A	2.5 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	6 feet
Probe Temperature Set-Point	248˚F±25˚F	248˚F±25˚F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.84
Pitot Tube Calibration by	Geometric or Wind Tunnel	Geometric
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4˚F	1.0˚F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass	Borosilicate Glass
Filter Support Material	Teflon (or other non-metallic material)	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248˚F±25˚F	248˚F±25˚F
Filter Material	Quartz or Glass Fiber	Quartz Fiber
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

EPA Method 29
Sampling Train Configuration



<u>Impinger Contents</u>

Impinger 1	5% HNO_3 / 10% H_2O_2
Impinger 2	5% HNO_3 / 10% H_2O_2
Impinger 3	Empty
Impinger 4	Silica Gel

EPA Method 29
Sample Recovery Flowchart
(Trace Metals only)

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Collect one complete blank set per field test.

Container 1
Quartz Filter
250 ml HDPE

1. Remove with acid washed polypropylene or Teflon tweezers to plastic container.
2. Remove any particulate or filter fiber into sample container using a non-metallic nylon bristle brush
3. If necessary, fold the filter and transfer to the container

Container 3
Probe Rinse
250 ml HDPE

1. **Probe liner, nozzle, cyclone bypass and front half (FH) filter housing**
2. Brush/rinse 3X with a total of 100 ml 0.1N HNO3
3. Visual Inspection
4. Label container and measure volume by weight

Container 4
1000 ml HDPE

1. **Back Half (BH) filter housing, Z-piece, impingers 1, 2, 3 and U-bends**
2. Measure impinger volume by weight
3. Transfer to sample container
4. Rinse 3X with a total of 100 ml of 0.1N HNO3
5. Visual Inspection
6. Label container and measure volume by weight

Container 6
Silica Gel

1. Measure volume by weight, note any color change
2. Recycle silica gel

Container 8A
0.1 N HNO3
1000 ml HDPE

1. 200 ml of 0.1N HNO3 from rinse bottle

Container 8B
D.I. Water Blank
250 ml HDPE

1. 100 ml of water from rinse bottle

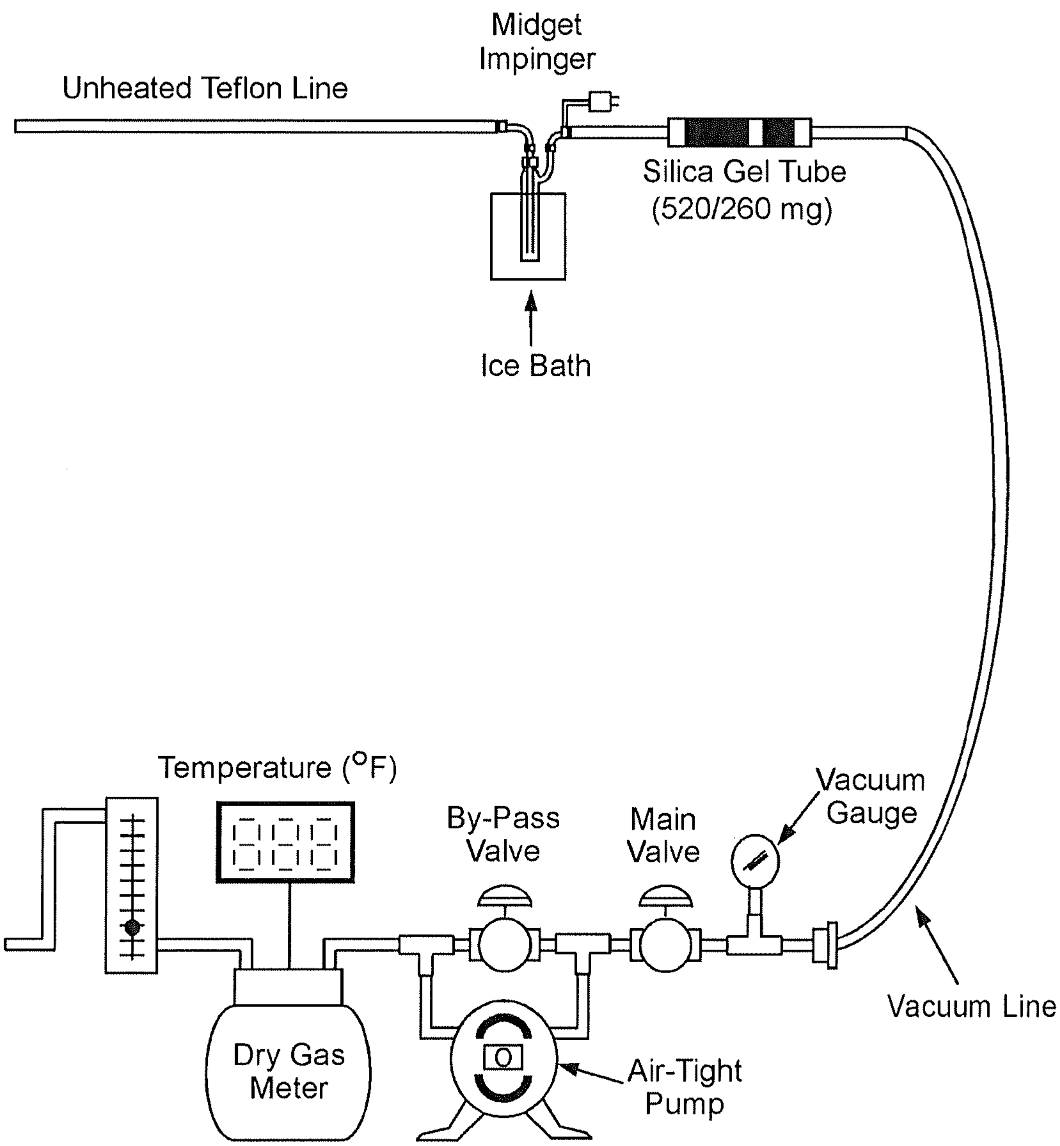
Container 9
5% HNO3 / 10% H2O2
250 ml HDPE

1. 200 ml of nitric acid absorbing solution from rinse bottle

Container 12
Filter Blanks
250 ml HDPE

1. 3 clean, unused filters

EPA Method 308
Sampling Train Configuration



Impinger Content	
Impinger 1	DI H_2O

EPA Method 316
Glassware Preparation Procedures

1. Wash with soap and hot tap water
2. Rinse 3X with hot tap water
3. Rinse 3X with D.I. water
4. Rinse 3X with Methanol
5. Rinse 3X with MeCl2
6. Allow to air dry
7. Cover all openings with aluminum foil
8. Write "F" on foil with Sharpie to differentiate from dioxin

EPA Method 316
Analytical Flowchart

Container 1
Field Sample

↓

Using the pipet set to 2.50 ml, pipet 2.50 ml of solution into a polystyrene cuvette

↓

Using the pipet set to 250 µl, pipet 250 µl of pararosaniline reagent solution into the cuvette

↓

Seal the top of the cuvette with Parafilm and shake at least 30 seconds to ensure solution is well-mixed

↓

Peel back a corner of the Parafilm and using the 250 µl pipet, pipet 250 µl of the sodium sulfite reagent solution into the cuvette

↓

Reseal the top of the cuvette with Parafilm and shake at least 30 seconds to ensure solution is well-mixed

↓

Record the time addition of the sodium sulfite and let the color develop at room temperature for 1 hour

↓

Analyze samples by spectrophotometry

Container 2
HPLC Water Blank

↓

Analyze using same procedure as Container 1

Container 4
Field Blank

↓

Analyze using same procedure as Container 1