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RESULTS OF EMISSIONS TESTING  
CONDUCTED AT  
GERDAU SPECIALTY STEEL  
IN  
JACKSON, MICHIGAN

Test Date(s): May 6-9, 2014

Report Date: July 15, 2014

Derenzo and Associates, Inc. Project No.: 1304006

**Derenzo and Associates, Inc.**

*Environmental Consultants*

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RESULTS OF EMISSIONS TESTING  
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**1.0 INTRODUCTION**

Gerdau Specialty Steel (Gerdau) retained Derenzo and Associates, Inc., (Derenzo and Associates) to perform compliance emission testing for the determination of emissions of particulate matter (PM), particulate matter less than 10 microns (PM-10), mercury (Hg), manganese (Mn), lead (Pb), nitrogen oxides (NOx), volatile organic compounds (VOC), and visible emissions (VE) from the exhaust of the #3 Baghouse controlling emissions from the FG-EAF/LMF/VAD at the Gerdau facility located in Jackson, Michigan. Since July 2004, Baghouse #3 has controlled emissions from all steel making processes at the Gerdau Facility.

Testing was conducted following the provisions specified in State of Michigan Renewable Operating Permit (ROP) No. MI-ROP-B4306-2009.

Derenzo and Associates personnel Michael Brack, Daniel Wilson, Jason Logan, and Charles Scamp conducted the emissions testing May 6-9, 2014. Mr. Nathan Hude of the Michigan Department of Environmental Quality, Air Quality Division (MDEQ-AQD) witnessed portions of the testing project. Ms. Sersena White with the MDEQ-AQD was onsite to witness the melt shop operations for portions of the emissions testing project.

Questions regarding results of this emission test report should be directed to:

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This test report was prepared by Derenzo, Associates, Inc. based on field sampling data collected by Derenzo and Associates, Inc. and analyses performed by a third-party laboratory. Facility process data were collected and provided by Gerdau employees or representatives. This test report has been reviewed by Gerdau representatives and approved for submittal to the MDEQ-AQD.

The on-site sampling and analysis was supervised by an individual that has obtained certification as a Qualified Stack Testing Individual (QSTI).

I certify that the testing was conducted in accordance with the approved test notification unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.



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Jason Logan  
Environmental Consultant



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Michael J. Brack, QSTI  
Senior Project Manager

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## 2.0 SUMMARY OF RESULTS

Emissions compliance testing was conducted from May 6-9, 2014 for the listed analytes. Testing was performed for 24 hours (six 240-minute runs). A minimum of two separate heats were processed during each 240-minute sampling period.

Testing was performed using United States Environmental Protection Agency (USEPA) Reference Methods 1, 2, 3A, 4, 7E, 10, 17, 29, 202, and 205. Sampling for Particulate Matter (PM), mercury (Hg), manganese (Mn), and lead (Pb) was accomplished using a combined USEPA Method 17 and 29 sampling train. Sampling for PM-10 was accomplished using a combined USEPA Method 17 and 202 sampling train. Isokinetic sampling rates were determined in accordance with USEPA 5D, which addresses particulate (and metals) sampling in the exhaust of the relatively low flow characteristics of a positive pressure baghouse.

Gerdau has demonstrated compliance with respect to the limits presented in ROP No. MI-ROP-B4306-2009.

Summary Tables 1-5, following the text portion of this report, provides individual test results.

## 3.0 PROCESS DESCRIPTION

Gerdau produces steel bars using two (2) electric arc furnaces (EAFs) to melt scrap, along with a ladle metallurgy furnace (LMF), and a vacuum arc degasser (VAD) for refining molten steel at the Jackson, Michigan facility. Exhaust gases from the processes (identified as FG-EAF/LMF/VAD) are directed to a positive pressure, reverse air-cleaned baghouse that contains polyester filter tubes (#3 Baghouse) for particulate matter control. Typical production (through the caster) at the facility is 50-55 tons per hour. Production through the molten steel refiners (VAD and LMF) is the same as that through the caster (50-55 tons per hour). The fume collection system has a maximum rated capacity of 618,000 ACFM @ 275 °F (not including reverse air).

Draft hoods and canopy hoods associated with the EAFs are connected by ducts to a spark-arrestor that subsequently connects to three separate fans, which are connected to the #3 baghouse. The LMF is equipped with a hood that is fitted over a hot metal ladle. It is connected through ductwork to the #3 baghouse. The VAD has a hood outside the vacuum chamber that collects fugitive emissions released when the vacuum chamber is opened after a ladle is degassed. This hood is connected by ductwork to the #3 baghouse. The baghouse was designed and supplied by Brandt Filtration Group of Norcross, Georgia.

The primary raw material for the plant is steel scrap. After melting in the EAFs, approximately one percent by weight of carbon, manganese, silicon, and a fraction of a percent of aluminum are added as alloys. The nominal quantity of steel melted in the EAFs is 54 tons per hour (measured through the caster). The EAF furnace vessels are lined with a consumable material, earthen in nature.

The constituents of the scrap charges are weighed prior to charging into the EAF to assure charge quality. The melt rate (scrap to molten metal) is controlled by regulation of amperage and voltage inputs to the electric arc furnace. Final tap temperature is fixed based on product quality and is measured directly with a molten metal thermometer (thermocouple). Casting time is controlled by regulation of molten metal flow rates through the casting station.

A typical 120-minute "batch cycle" consists of:

1. Initial charge of steel scrap into furnace;
2. Partial meltdown of first charge;
3. Addition of second charge to furnace;
4. Complete meltdown of scrap charges;
5. Addition of alloys;
6. Heating of bath to final tap temperature; and,
7. Tapping of the molten steel from the furnace.

Metal bars are produced, processed, and shipped per customer specification.

#### 4.0 TESTING AND ANALYSIS

The emissions testing program was conducted using United States Environmental Protection Agency (USEPA), sampling methodologies outlined in the approved test plan dated February 21, 2014 and in accordance with the test plan additions required by the letter of approval issued by the MDEQ-AQD dated March 25, 2014.

Testing was performed on May 6-9, 2014 while the facility operated at an average production rate of 55.0 tons per hour through the caster.

##### 4.1 Exhaust Gas Sampling Location, Velocity, Molecular Weight, and Moisture Content

Pollutant mass emission rate calculations require the determination of exhaust gas flowrate (USEPA Methods 1 and 2). Exhaust gas flowrate measurements require (1) measurement of the velocity pressure and temperature at various, required traverse point locations within the gas stream (USEPA Method 2), (2) measurement of the molecular weight of the exhaust gas (USEPA Method 3A), and (3) measurement of the moisture content of the exhaust gas (USEPA Method 4).

###### 4.1.1 Sample and velocity traverse

USEPA Method 1 was used to determine the number of traverse points required, and the adequacy of the sample port locations for testing of the source. Based on flow disturbance data, the sampling port positions meet the minimum criteria for a "representative measurement" of the gas

velocity. Figure 1 (following the text portion of this report) provides a schematic of the traverse and sampling locations.

#### 4.1.2 Stack gas velocity and volumetric flow rate

USEPA Method 2 was used to determine the average gas velocity at each of the three inlet ducts. Velocity pressure measurements of the exhaust gas were made using an S-type pitot tube connected to an oil manometer capable of reading pressures from 0.0" to 10" water column. Concurrent temperature measurements of the exhaust gas were made with a type-K thermocouple attached to the Pitot tube. Flowrate values are presented in the tables that describe the emission results for each analyte. Cyclonic flow measurements were conducted on each of the three inlet ducts to verify the absence of cyclonic flow. The measurements were determined to be less than 20° on average.

Velocity traverses were performed prior to and at the end of each 240-minute sampling event. The pretest traverse was used to determine the isokinetic sampling rate (delta H) per USEPA Method 5D and associated guidance documentation. The isokinetic sampling rate was established for each test based on the pretest traverse data. Emissions data for the isokinetic sampling (PM and Metals) were calculated based on the average pre-test and post-test flowrate data.

#### 4.1.3 Determination of molecular weight

Carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>) concentrations were measured concurrently with the air pollutant sampling test runs in accordance with USEPA Method 3A using the Fuji Model ZRF Infrared Gas Analyzer, a multi-component instrumental analyzer, which is capable of measuring concentrations of CO<sub>2</sub> and O<sub>2</sub>. The analyzer incorporates NDIR technology for the measurement of CO<sub>2</sub> concentrations, and a Zirconia O<sub>2</sub> sensor, Model ZFK3, for the measurement of O<sub>2</sub> concentrations.

The available instrument CO<sub>2</sub> concentration ranges are 5% and 15% by volume. For O<sub>2</sub> measurement, the available instrument ranges are 10% and 25% by volume.

Based on previous EAF testing, the O<sub>2</sub> and CO<sub>2</sub> concentrations were expected to be approximately 21% and 0.3% respectively. Therefore, the instrument ranges were set to 25% by volume for O<sub>2</sub> and 5% by volume for CO<sub>2</sub> concentration measurements. The average O<sub>2</sub> and CO<sub>2</sub> concentrations for the testing were 20.61% and 0.17% respectively.

#### 4.1.4 Determination of moisture content

USEPA Method 4 (as part of the USEPA Methods 17/29 and 17/202 sampling trains) was used to determine the moisture content of the baghouse exhaust for each test. Moisture determinations were obtained as part of the metals and PM sampling and determined gravimetrically. Moisture content was applied to each applicable flowrate measurement to correct to dry conditions. The average moisture content for the compliance demonstration testing was 1.5 % by weight.

#### 4.1.5 NO<sub>x</sub> and CO Concentration and Measurements

NO<sub>x</sub> and CO pollutant concentrations in the exhaust of the IC engine were determined using a chemiluminescence NO<sub>x</sub> analyzer and NDIR CO analyzer. Engine exhaust gas was delivered to the instruments using the Teflon® heated sample line and gas conditioning system described in section 4.2 of this document. Instrument calibration was verified prior to, and at the conclusion of each one-hour test period.

CO and NO<sub>x</sub> calculation sheets and recorded instrument response data are included in Appendix A and Appendix B, respectively.

#### 4.1.6 Visible Emission Determinations

Opacity was determined at the #3 Baghouse Exhaust and Melt Shop Roof Monitors using USEPA Method 9. Opacity readings were performed every 15 seconds over the duration of one heat per source and reduced to six-minute averages. The opacity determinations were performed by a certified observer of visible emissions in accordance USEPA Method 9.

Opacity field data sheets and the certified observer certificate are provided in Appendix A and Appendix B, respectively.

### 4.2 **Extractive gas sampling procedure**

The extractive gas sampling system that served the instrumental analyzers used for USEPA Methods 3A, 7E, and 25A was configured as described below.

Sample probe - Stainless steel single opening probe that was attached to a pre-existing rake probe, installed by Gerdau, to sample the cross section of the stack.

Three-way valve - A stainless steel three-way valve is installed between the sample probe and a stainless steel particulate filter to allow the introduction of calibration gases into the sampling system. The three-way valve is turned toward the desired gas flow direction during this sampling. During system bias checks, excess calibration gas exits the sampling probe tip to avoid the introduction of process gas or ambient air during calibration.

Heated sample line – A heated Teflon® line is used to transport the sample gas from the stack to the instrument rack. The heated Teflon® line is equipped with a temperature controller which maintains the temperature of the sample line at approximately 250°F to prevent moisture condensation.

Sample pump and flow control valve – A single head 100% oil-free vacuum pump fitted with a stainless steel flow control valve is used to transfer sampled gases from the heated sample line to the instrumental analyzer. The vacuum pump is leak-free and non-reactive to the gases being sampled. Subsequent sample transport lines and fittings are either stainless steel or Teflon®.

Gas Conditioner - A thermoelectric condenser utilizing the "Peltier Effect" equipped with a peristaltic pump is used to remove moisture from the sampled gas stream that is directed to the instrumental analyzers (except the total hydrocarbon analyzer), which require a conditioned (or dry) gas samples. From the moisture removal system, a sample gas manifold constructed of Teflon® transport lines and stainless steel Tee fittings is used to continuously deliver the sampled gas to the instrumental analyzers. Since the instrumental analyzers are equipped with internal sampling pumps, the end of the sample gas manifold is equipped with an atmospheric dump (or bypass discharge vent) to avoid over pressurization of the instrumental analyzers.

Data Logger – A data logging system is used to record 1-minute average data from the analog output of the instrumental analyzers.

#### 4.3 Metals and PM Testing

Particulate matter and metals emissions testing was conducted on May 6-7, 2014 and consisted of triplicate 240-minute test runs. The average production rate during the testing was 57.6 T<sub>p</sub>H through the castor.

The combined USEPA Method 17/29 sampling train consisted of a "goose-neck" nozzle constructed of stainless steel, a quartz filter, a Teflon probe liner, and a series of specially cleaned, standard, and modified Greenberg-Smith impingers.

The impingers were charged as follows:

- 1st impinger: 100 ml of 5% $\text{HNO}_3$ /10% $\text{H}_2\text{O}_2$
- 2nd impinger: 100 ml of 5% $\text{HNO}_3$ /10% $\text{H}_2\text{O}_2$
- 3rd impinger: empty (knock-out)
- 4th impinger: 100 ml acidic  $\text{KMnO}_4$
- 5th impinger: 100 ml acidic  $\text{KMnO}_4$
- 6th impinger: approximately 300 grams of pre-dried silica gel and glass fiber.

The sampling train was followed in series by an umbilical line, dry gas meter and calibrated orifice connected to an inclined manometer. Type K thermocouples, connected to a digital potentiometer, were used to measure the probe heater, filter heater, impinger outlet, and dry test meter inlet and outlet temperatures. A carbon vane pump was used to provide the necessary vacuum for the sampling train.

Prior to sampling, a preliminary traverse of the baghouse inlet ducts were performed to determine the average gas velocity and flowrate of the collected process gases flowing into the baghouse. Use of prior stack testing data at this site, duct moisture, and fixed gas content were estimated. Based on this information, a sample nozzle of appropriate inside diameter was selected, and the impinger train charged as previously described. Additionally, the inlet flowrate information was used to calculate the critical orifice flowrate within the metering console and maintain isokinetic

sampling throughout each test event. Sample time per traverse point was calculated based on the total anticipated sampling time (240 minutes for this source).

The sample train was assembled as completely as possible in the staging area and transported to the sampling site. Sealing all openings with parafilm prevented potential contamination of the sample train. Once in the sampling area, the probe and filter heaters were brought to temperatures of  $250 \pm 25$  °F, and the apparatus was leak checked. Upon successful completion of the leak check, the initial dry test meter reading was recorded, and the probe placed at the first sampling point (atop the fabric filter bags).

The isokinetic-sampling rate in terms of pressure drop across the calibrated orifice was calculated using the guidance in USEPA Technology Transfer Network Emission Measurement Center Document titled "TID-02 Isokinetic Equation for Method 5D" and recorded on the data sheet. The pump and timer were turned on, and the sample rate was adjusted to correspond to the calculated isokinetic rate.

Once the sample rate was set, the following data were recorded:

- Dry test meter inlet and outlet temperatures
- Sample vacuum
- Filter heater temperature
- Probe temperature
- Impinger outlet temperature
- Orifice differential
- Sample volume (dry gas meter readings)

At the end of the sample time for the first point, the probe was moved to the next point, and the measurements, calculations and recording of data were repeated. Upon completion of sampling from a cell, the pump was turned off and the dry test meter reading recorded. The probe assembly was then placed into the next cell and the previously described sampling procedure was repeated for the second, third and fourth cells.

When the sample run was completed, the final, dry gas meter reading was recorded and the probe was removed from the final cell. A post-test leak check was performed on the sampling train at a vacuum at least as great as that of the highest sample vacuum measured during the sample run. The final leak rate was recorded on the data sheet. The sample train was sealed from contamination and transported to the staging area for recovery. Recovery consisted of triplicate rinses (and brushing) of the nozzle, nozzle fitting, probe liner and front half of the filter holder (front half assembly) with exactly 100 mL of acetone followed by triplicate rinses of 0.1 normality nitric acid (0.1 N HNO<sub>3</sub>). The front half train assembly was then rinsed with water and acetone and these rinses were discarded. The filter was recovered into a plastic Petri dish. The first two impingers were quantitatively recovered subsequent to the performance of moisture net weight gain determinations. The filter support, back half of the filter holder, first two impingers and connecting glassware were then rinsed with 100 mL of 0.1 N HNO<sub>3</sub>. The third impinger was weighed for subsequent moisture determinations, rinsed with 100 mL of 0.1 N HNO<sub>3</sub>, and

recovered. The fourth and fifth impingers were quantitatively recovered subsequent to the performance of moisture net weight gain determinations. The permanganate impingers and connecting glassware was then rinsed with 100 mL of the acidified permanganate solution and then 100mL of water. Rinses were added to the original permanganate impinger sample containers. All samples were placed into uniquely labeled containers and shipped to Element One, Inc. located in Wilmington, North Carolina by an authorized shipping courier and following the requirements of the International Air Transport Association for hazardous material shipments.

#### 4.4 Particulate Matter/PM-10 Testing

PM-10 emissions testing was conducted on May 8-9, 2014 and consisted of triplicate 240-minute test runs. The typical average production rate during the testing was 52.4 tons per hour.

The combined USEPA Method 17/202 sampling train consisted of a "goose-neck" nozzle constructed of stainless steel, a quartz filter, a Teflon probe liner, and a series of specially cleaned, standard, and modified Greenberg-Smith impingers and a CPM filter.

The impinger train consisted of an inline condenser, a knock-out impinger, a standard Greenberg-Smith (G-S) impinger (dry), a non-heated CPM filter (with exhaust thermocouple), a modified G-S impinger containing 100 milliliters of deionized water, and a modified G-S impinger containing a known amount of indicating silica gel. Cold water was placed around the CPM portion of the Method 202 sampling train, whereas crushed ice was placed around the back two impingers. A recirculation pump was used to circulate cold water through the condenser. Upon completion of the required post-test leak check of the isokinetic sampling train, the impingers were transported to the on-site laboratory where a nitrogen purge was conducted. The nitrogen purge consisted of bubbling reagent grade nitrogen through the impinger train at a rate of at least 14 liters per minute for 60 minutes, which was conducted on all PM-10 sampling trains. Upon completion of the nitrogen purge, the samples were recovered using acetone and a pre-cleaned brush, where particulates from the nozzle and front half of the Method 17 filter holder were recovered into a labeled sample container. Within a controlled environment, the filter was recovered from the filter holder assembly using pre-cleaned tweezers and stored in a petri dish. Then the front half of the filter holder was rinsed with acetone into the container used to store the nozzle rinse.

Each sample container was clearly marked with a unique identification number and liquid levels were marked on each container for the determination of any leakage during shipment. Sample containers were placed in a cooler and kept secured until shipment to the laboratory.

Sample recovery of the Method 202 sampling train includes quantitatively recovery of the liquid contained in the dropout and next impinger into a clean glass sample bottle subsequent to posttest weighing. Two water rinses were performed on the filter holder back half, probe extension, condenser, the first two impingers, and connecting glassware, and the front half of the CPM filter holder. These rinses were added to the first two-impinger sample bottle.

The water rinses were followed by an acetone rinse and then a two hexane rinses. These solvent rinses were added to separate glass sample containers. The CPM filter was recovered and placed into a uniquely labeled petri dish.

The cold impinger-water weight gain was determined gravimetrically and discarded. The silica gel impinger weight gain was determined gravimetrically.

Gravimetric analyses on the sample filters and the solvent rinses were analyzed by Bureau Veritas, Novi, Michigan.

The sampling train was followed in series by an umbilical line, dry gas meter and calibrated orifice connected to an inclined manometer. Type K thermocouples, connected to a digital potentiometer, were used to measure the exhaust, CPM filter holder outlet, impinger outlet, and dry test meter inlet and outlet temperatures. A carbon vane pump was used to provide the necessary vacuum for the sampling train. See Figure 4.

Prior to sampling, a preliminary traverse of the baghouse inlet ducts were performed to determine the average gas velocity and flowrate of the collected process gases flowing into the baghouse. Use of prior stack testing data at this site, duct moisture, and fixed gas content were estimated. Based on this information, a sample nozzle of appropriate inside diameter was selected, and the impinger train charged as previously described. Additionally, the inlet flowrate information was used to calculate the critical orifice flowrate within the metering console and maintain isokinetic sampling throughout each test event. Sample time per traverse point was calculated based on the total anticipated sampling time (240 minutes for this source).

The sample train was assembled as completely as possible in the staging area and transported to the sampling site. Sealing all openings with parafilm prevented potential contamination of the sample train. Once in the sampling area, the apparatus was leak checked. Upon successful completion of the leak check, the initial dry test meter reading was recorded, and the probe placed at the first sampling point (atop the fabric filter bags in the baghouse cell).

The isokinetic-sampling rate in terms of pressure drop across the calibrated orifice was calculated using the guidance in USEPA Technology Transfer Network Emission Measurement Center Document titled "TID-02 Isokinetic Equation for Method 5D" and recorded on the data sheet. The pump and timer were turned on, and the sample rate was adjusted to correspond to the calculated isokinetic rate.

Once the sample rate was set, the following data were recorded:

- Dry test meter inlet and outlet temperatures
- Sample vacuum
- CPM Filter temperature
- Exhaust temperature
- Impinger outlet temperature
- Orifice differential pressure
- Sample volume (dry gas meter readings)

At the end of the sample time for the first point in the upper baghouse cell, the probe was moved to the next point, and the measurements, calculations, and recording of data were repeated. Upon completion of sampling from a port (two cells per port), the pump was turned off and the dry test meter reading recorded. The probe assembly was then placed at the first point in the next cell in the next port, and the previously described sampling procedure was repeated.

When the sample run was completed, the final, dry gas meter reading was recorded and the probe was removed from the final port. A post-test leak check was performed on the sampling train at a vacuum at least as great as that of the highest sample vacuum measured during the sample run. The final leak rate was recorded on the data sheet. The sample train was sealed from contamination and transported to the staging area for recovery.

At the conclusion of each test period, the impingers were transported to the recovery area where they were weighed. Any liquid recovered in the knockout impinger was transferred to the GS impinger, an appropriate amount of degassed high-purity water was added to cover the impinger tip, the impinger train was reassembled and purged with nitrogen at a rate of at least 14 liters per minute for 60 minutes. Upon completion of the nitrogen purge, the samples were recovered and the glassware rinsed with DI water, acetone, and hexane in accordance with the Method 202 sample recovery procedures. The samples and recovered rinses were clearly and uniquely labeled and transferred to Bureau Veritas North America, Inc. (Novi, Michigan) for analysis.

#### 4.5 Quality Assurance/Quality Control

USEPA Quality Assurance/Quality Control (QA/QC) procedures were followed during the emissions testing program. The following information is a general overview of the QA/QC requirements of the test program. Please refer to the individual USEPA test methods for detailed information regarding these procedures.

##### 4.5.1 Exhaust gas properties and flowrate

In accordance with the USEPA Methods 1-4, the following QA/QC activities were performed:

Prior to arriving onsite, the instruments used during the source testing to measure the duct gas properties, such as the barometer, pyrometer, and pitot tube are calibrated to specifications outlined in the sampling methods.

##### 4.5.2 Instrumental Analyzer Testing

Upon site arrival, the instrumental analyzers were set-up in accordance with the manufacturer's written recommended procedures. Upon setting the appropriate ranges for each instrument, zero and appropriate certified USEPA Protocol 1 and NIST span gases were introduced in sequence to set the instrument zero and span pots. Prior to testing, a sampling system bias check was performed to ensure that the system bias error was less than 5%. Instrumental analyzer zero and calibration drift checks were performed prior to and following each test run to ensure that the zero

and calibration drift error were less than 3%. Additionally, USEPA Method 205 field verification activities were performed as outlined in the reference method.

Calibration data for the instrumental analyzer sampling are presented within the appendices of this report.

#### 4.5.3 Isokinetic Testing

The QA/QC guidelines practiced during the particulate and metals testing include:

- All sampling media were pre-cleaned in accordance with the applicable test method prior to use in the field.
- The isokinetic sampling meter was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5.
- Blank filter, acetone, hexane, HNO<sub>3</sub>, 5/10, KMnO<sub>4</sub>, and water samples were taken during the testing program and analyzed with the test samples.
- Sampling nozzles are calibrated in the field using the three-point averaging technique.

Calibration data for the isokinetic sampling equipment are presented within the appendices of this report.

## 5.0 MEASUREMENT RESULTS

The summary tables, presented immediately following the text portion of this report, include averages from triplicate test events for each target analyte.

### 5.1 Gaseous Pollutant Measurement Results

Table 1 presents PM concentrations and emission rates. Inlet duct flowrates, sample volumes, laboratory weights, and exhaust gas moisture content are also included in the summary table.

Table 2 presents Hg, Mn, and Pb concentrations and emission rates. Process production rates, inlet duct flowrates, sample volumes, laboratory weights, and exhaust gas moisture content are also included in the summary table.

Table 3 presents NO<sub>x</sub> and VOC emission factors.

Table 4 presents PM-10 concentrations and emission rates.

Table 5 presents Visible Emission determinations.

The facility operated at a production rate of 55.0 Tph, through the caster, during the emissions compliance tests. A minimum of two heats were processed during each 240-minute test event.

#### 5.1.1 Particulate Matter/PM-10

The three-test average PM concentration was 0.0005 gr/dscf. The allowable PM concentration is 0.0052 gr/dscf. The three-test average PM emission rate was 2.95 lb/hr. The allowable PM emission rate is 24.7 lb/hr.

The three-test average PM-10 concentration was 0.0004 gr/dscf. The allowable PM concentration is 0.0052 gr/dscf. The three-test average PM-10 emission rate was 1.78 lb/hr. The allowable PM-10 emission rate is 24.7 lb/hr.

Particulate matter emission rates are calculated based on the pre-test flowrate measurements.

#### 5.1.2 Metals (Hg, Pb, Mn)

The measured three-test average Hg emission rate was 0.004 lb/hr, resulting in annual emission of 0.018 TpY based on 8,760 production hours. The allowable Hg emission rates are 0.026 lb/hr and 0.069 TpY.

The measured three-test average Mn concentration was 0.018 mg/m<sup>3</sup>, which is less than the allowable concentration of 0.39 mg/m<sup>3</sup>. The three-test average Mn emission rate was 0.044 lb/hr, resulting in annual emission of 0.19 TpY based on 8,760 production hours. The allowable Mn emission rates are 0.817 lb/hr and 2.8 TpY.

The measured three-test average Pb emission rate was 0.006 lb/hr. The allowable Pb emission rate is 0.28 lb/hr.

Metals emission rates are calculated based on the pre-test flowrate measurements.

#### 5.1.3 NOx and CO Emission Factors

The measured six-test average NOx emission factor was 0.27 pounds per ton of scrap charged (ppt). The average tons per hour production rate during this period was 57.6. The allowable NOx emission factor is 0.53 ppt.

The measured six-test average VOC emission factor was 0.11 ppt. The average tons per hour production rate during this period as 57.6. The allowable VOC emission factor is 0.30.

#### 5.1.4 Visible Emissions

The maximum opacity observed during a 6-minute period in a single heat at the melt shop roof monitors was 0%. The permit limit is 15%.

The maximum opacity observed during a 6-minute period in a single heat at the #3 Baghouse Exhaust was 0%. The permit limit is 5%.

## 6.0 INLET DUST ANALYSIS

An integrated sample of the process dust entering the baghouse was obtained simultaneously with the isokinetic sampling. An analysis of the inlet dust for the three target metal analytes was performed by Consumers Energy Laboratory Services located in Jackson, Michigan. Manganese and Lead analysis was performed using USEPA Method 3050/6020 using inductive coupled plasma mass spectrometry (ICP/MS). Mercury analysis was performed using SWA Method 846/7471, a cold vapor extraction technique. Based on the analysis of the inlet samples the following table was developed:

Analyte	Unit	GPM-1	GPM-2	GPM-3	GPM-4	GPM-5	GPM-6	Average
Hg	(mg/Kg)	3.61	3.77	2.73	2.79	2.72	3.00	3.10
Mn	(mg/Kg)	31,100	27,700	33,600	36,100	40,500	35,700	34,117
Pb	(mg/Kg)	5,070	5,820	4,740	4,300	4,470	4,710	4,852

## 7.0 ADDITIONAL SUPPORTING INFORMATION

Routine maintenance activities performed on the baghouse included periodic cleanout of collected dust handling equipment as needed.

Please find under the following listed appendices, the supporting information and data gathered for this emissions test program.

- Appendix A provides copies of the computer calculated and field-sampling data sheets.
- Appendix B provides testing equipment calibration data and certification(s).
- Appendix C provides laboratory data.
- Appendix D provides process operational data.
- Appendix E provides raw CEM Data

**Table 1**  
**Particulate Matter**  
**Concentrations and Emission Rates**  
**from the**  
**FG-EAF/LMF/VAD #3 Baghouse Exhaust**  
**at the**  
**Gerdau Specialty Steel North America Facility**  
**Jackson, Michigan**

**Test Date(s): May 6-7, 2014**  
**Project Number: 1304006**

Test ID	Test Date	Flowrate (dscfm)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	Moisture (%)
GPM-1	5/6/2014	660,542	20.63	0.10	1.53
GPM-2	5/7/2014	651,182	20.61	0.20	1.81
GPM-3	5/7/2014	608,831	20.61	0.16	1.96
Average		640,185	20.62	0.15	1.77

**PM (Filterable)**

Test ID	Test Times (EDT)	Sample Volume (dscf)	Lab Weight (gr)	PM (gr/dscf)	PM (lb/hr)
GPM-1	11:35-19:16	178.11	0.177	0.0010	5.65
GPM-2	9:54-14:04	178.16	0.049	0.0003	1.55
GPM-3	16:52-21:02	164.43	0.052	0.0003	1.67
Average		173.57	0.093	<b>0.0005</b>	<b>2.95</b>
Allowable Limits:				<b>0.0052</b>	<b>24.7</b>

Definitions:

- (EDT) = Eastern Daylight Time
- (dscfm) = dry standard cubic feet per minute
- (dscf) = dry standard cubic feet
- (gr) = grains
- (gr/dscf) = grains per dry standard cubic foot
- (%) = percent
- (lb/hr) = pounds per hour

Equations:

- (gr/dscf) = gr / dscf
- (lb/hr) = gr/dscf \* 0.00858 \* dscfm

Table 2  
Lead, Manganese, and Mercury  
Concentrations and Emission Rates  
from the  
FG-EAF/LMF/VAD #3 Baghouse Exhaust  
at the  
Gerdau Specialty Steel North America Facility  
Jackson, Michigan

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Test Date(s): May 6-7, 2014

Project Number: 1304006

Test ID	Test Date	Flowrate (dscfm)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	Moisture (%)
GPM-1	5/6/2014	660,542	20.63	0.10	1.53
GPM-2	5/7/2014	651,182	20.61	0.20	1.81
GPM-3	5/7/2014	608,831	20.61	0.16	1.96
Average		640,185	20.62	0.15	1.77

### Lead (Pb)

Test ID	Test Times (EDT)	Sample Volume (dscm)	Lab Weight (mg)	Pb (mg/dscm)	Pb (lb/hr)
GPM-1	11:35-19:16	5.04	0.033	0.0064	0.016
GPM-2	9:54-14:04	5.04	0.049	0.0038	0.002
GPM-3	16:52-21:02	4.66	0.052	0.0003	0.001
Average		4.91	0.045	0.0035	0.006
Allowable Limit:					0.280

### Manganese (Mn)

Test ID	Test Times (EST)	Sample Volume (dscm)	Lab Weight (mg)	Mn (mg/dscm)	Mn (lb/hr)
GPM-1	11:35-19:16	5.04	0.240	0.0476	0.118
GPM-2	9:54-14:04	5.04	0.019	0.0038	0.009
GPM-3	16:52-21:02	4.66	0.013	0.0028	0.006
Average		4.91	0.091	0.018	0.044
Allowable Limits:					0.39

### Mercury (Hg)

Test ID	Test Times (EST)	Sample Volume (dscm)	Lab Weight (mg)	Hg (mg/dscm)	Hg (lb/hr)
GPM-1	11:35-19:16	5.04	0.010	0.0020	0.005
GPM-2	9:54-14:04	5.04	0.011	0.0021	0.005
GPM-3	16:52-21:02	4.66	0.005	0.0011	0.003
Average		4.91	0.009	0.0017	0.004
Allowable Limit:					0.026

#### Definitions:

- (EDT) = Eastern Daylight Time
- (dscfm) = dry standard cubic feet per minute
- (dscm) = dry standard cubic meters
- (mg) = milligrams
- (mg/dscm) = milligrams per dry standard cubic meter
- (%) = percent
- (lb/hr) = pounds per hour

#### Equations:

- (mg/dscm) = mg / dscm
- (lb/hr) = mg/(dscm\*35.315)\*.01543\*dscfm\*(60/7000)

**Table 3**  
**Nitrogen Oxides and Volatile Organic Compounds**  
**Concentrations and Emission Rates**  
**from the**  
**FG-EAF/LMF/VAD #3 Baghouse Exhaust**  
**at the**  
**Gerdau Specialty Steel North America Facility**  
**Jackson, Michigan**

Test Date(s): May 6 -7, 2014  
 Project Number: 1304006

Test ID	Test Date	Test Times (EDT)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	Moisture (%)
GNOxVOC-1	5/6/2014	15:12-16:12	20.60	0.19	1.53
GNOxVOC-2	5/6/2014	16:56-17:56	20.63	0.07	1.53
GNOxVOC-3	5/6/2014	18:33-19:33	20.63	0.04	1.53
GNOxVOC-4	5/7/2014	9:55-10:55	20.61	0.16	1.81
GNOxVOC-5	5/7/2014	11:32-12:32	20.61	0.16	1.81
GNOxVOC-6	5/7/2014	13:02-14:02	20.61	0.16	1.81
Average			20.61	0.13	1.67

**NO<sub>x</sub>**

Test ID	Flowrate (dscfm)	Concentration (ppmv)	Emission Rate (pph)	Production Rate (tph)	Emission Factor (ppt)
GNOxVOC-1	660,542	4.49	21.3	57.2	0.37
GNOxVOC-2	660,542	2.82	13.4	57.2	0.23
GNOxVOC-3	660,542	2.61	12.4	57.2	0.22
GNOxVOC-4	630,007	3.69	16.7	58.1	0.29
GNOxVOC-5	630,007	3.25	14.7	58.1	0.29
GNOxVOC-6	630,007	1.53	6.9	58.1	0.25
Average		3.07	14.2	57.6	0.27

Allowable Limit: **0.53**

**VOC**

Test ID	Flowrate (scfm)	Concentration (ppmv)	Emission Rate (pph)	Production Rate (tph)	Emission Factor (ppt)
GNOxVOC-1	670,803	1.53	7.05	57.2	0.12
GNOxVOC-2	670,803	2.19	10.12	57.2	0.18
GNOxVOC-3	670,803	1.13	5.20	57.2	0.09
GNOxVOC-4	663,168	1.64	7.22	58.1	0.12
GNOxVOC-5	663,168	1.32	5.84	58.1	0.10
GNOxVOC-6	663,168	0.34	1.49	58.1	0.03
666,986		1.36	6.15	57.6	0.11

Allowable Limit: **0.30**

**Definitions:**

- (EDT) = Eastern Daylight Time
- (scfm) = standard cubic feet per minute
- (dscfm) = dry standard cubic feet per minute
- (dscm) = dry standard cubic meters
- (ppmv) = parts per million by volume
- (pph) = pounds per hour
- (ppt) = pounds per ton
- (tph) = tons per hour
- (%) = percent

**Equations:**

$$(\text{pph}) = (\text{ppmv}) (\text{dscfm}) (60 \text{ min/hr}) (\text{MW}) / (385)$$

$$(\text{ppt}) = \text{pph}/(\text{tons per hour production rate})$$

$$\text{MW NO}_x = 46.0055$$

$$\text{MW VOC} = 44.09$$

**Table 4**  
**Particulate Matter less than 10 Microns (PM10)**  
**Concentrations and Emission Rates**  
**from the**  
**FG-EAF/LMF/VAD #3 Baghouse Exhaust**  
**at the**  
**Gerdau Specialty Steel North America Facility**  
**Jackson, Michigan**

Test Date(s): May 8 - 9, 2014  
 Project Number: 1304006

Test ID	Test Date	Flowrate (dscfm)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	Moisture (%)
GPC-1 (PM10)	5/8/2014	640,607	20.67	0.14	2.28
GPC-2 (PM10)	5/8/2014	516,309	20.55	0.17	2.47
GPC-3 (PM10)	5/9/2014	661,934	20.62	0.19	1.94
Average		606,283	20.61	0.17	2.23

**PM10 (Filterable & Condensable)**

Test ID	Test Times (EDT)	Sample Volume (dscf)	Lab Weight (gr)	PM (gr/dscf)	PM (lb/hr)
GPC-1 (PM10)	9:43-14:14	178.20	0.062	0.0003	1.90
GPC-2 (PM10)	15:35-20:44	175.29	0.083	0.0005	2.11
GPC-3 (PM10)	10:20-14:36	178.79	0.042	0.0002	1.32
Average		177.43	0.062	<b>0.0004</b>	<b>1.78</b>
Allowable Limits:				<b>0.0052</b>	<b>24.7</b>

**Definitions:**

- (EDT) = Eastern Daylight Time
- (dscfm) = dry standard cubic feet per minute
- (dscf) = dry standard cubic feet
- (gr) = grains
- (gr/dscf) = grains per dry standard cubic foot
- (%) = percent
- (lb/hr) = pounds per hour

**Equations:**

- (gr/dscf) = gr / dscf
- (lb/hr) = gr/dscf \* 0.00858 \* dscfm

**Table 5  
Opacity Observations  
from the  
FG-EAF/LMF/VAD #3 Baghouse and Melt Shop Roof Monitors  
at the  
Gerdau Specialty Steel North America Facility  
Jackson, Michigan**

Test Date(s): May 6 & 8, 2014  
Project Number: 1304006

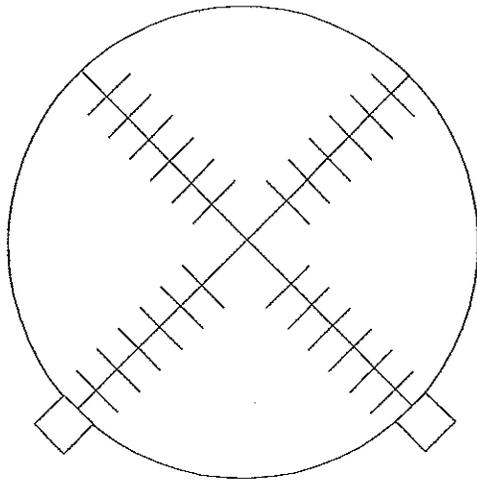
Test Date	Test Number	Start Time (EDT)	Stop Time (EDT)	6-Minute Max (%)	Permit Limit (%)
<b>#3 Baghouse Exhaust</b>					
05/06/14	1	15:13	17:27	0.0	5 (10% excersion)
<b>Melt Shop Roof Monitor</b>					
05/08/14	1	15:46	17:43	0.0	15 (20% excersion)

Note: Opacity limits allow a one time per hour, 6-minute average of 10% from the #3 Baghouse and 20% from the Melt Shop Roof Monitors

Definitions:

(EDT) = Eastern Daylight Time

(%) = Percent



Duct Diameter = 108.625"

Inlet Traverse Point	Distance from stack wall (in.)
1	3.48
2	11.41
3	21.07
4	35.09
5	73.54
6	87.55
7	97.22
8	105.15

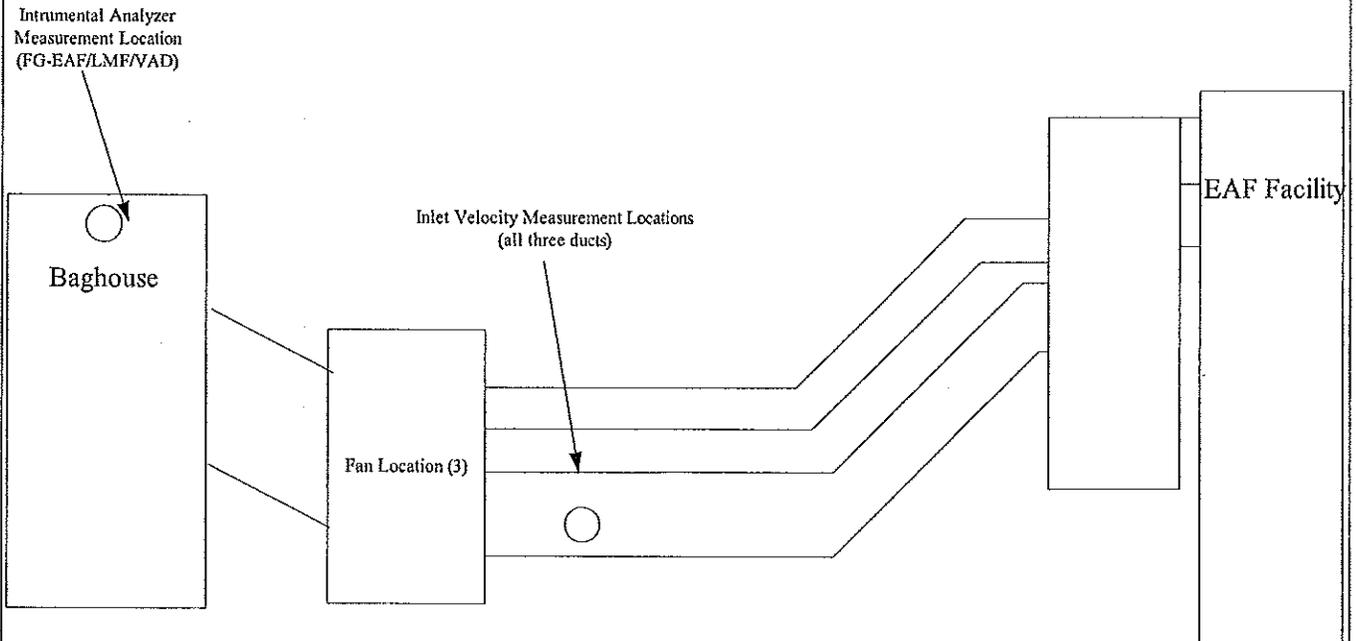


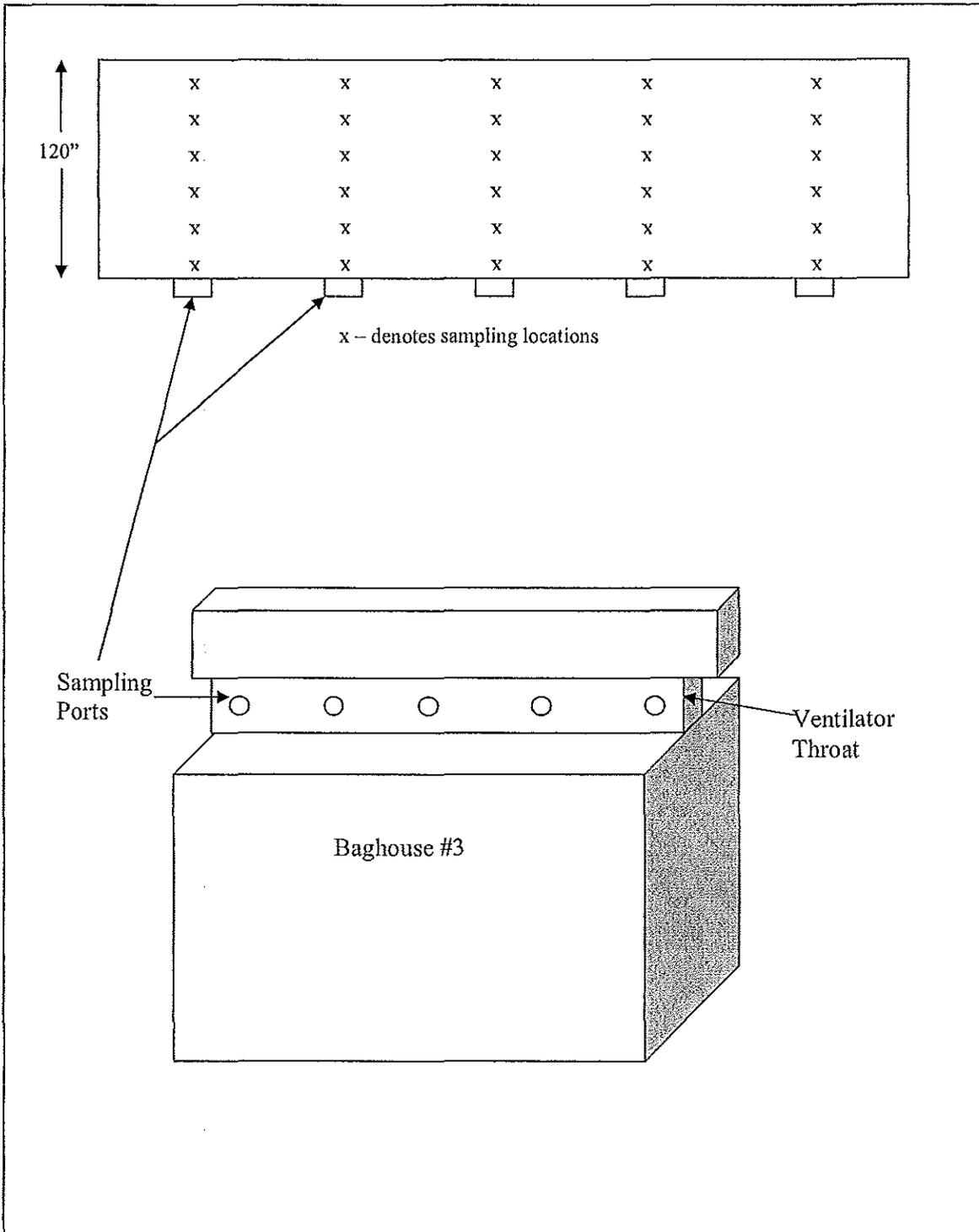
Figure 1

Sampling and measurement locations for the compliance testing conducted at the Gerdau facility in Jackson, Michigan.

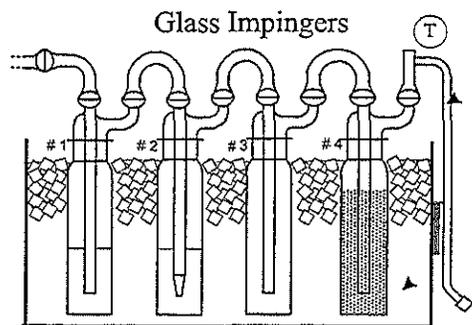
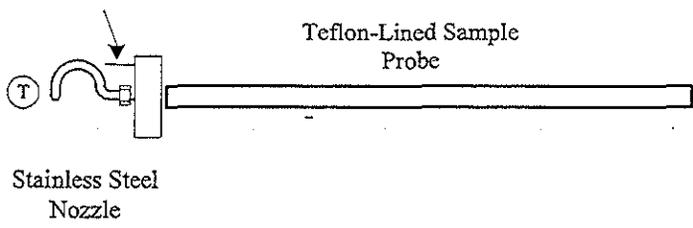
**DERENZO AND ASSOCIATES INC.**

Sampling Dates: May 6-9, 2014

Project No. 1304006

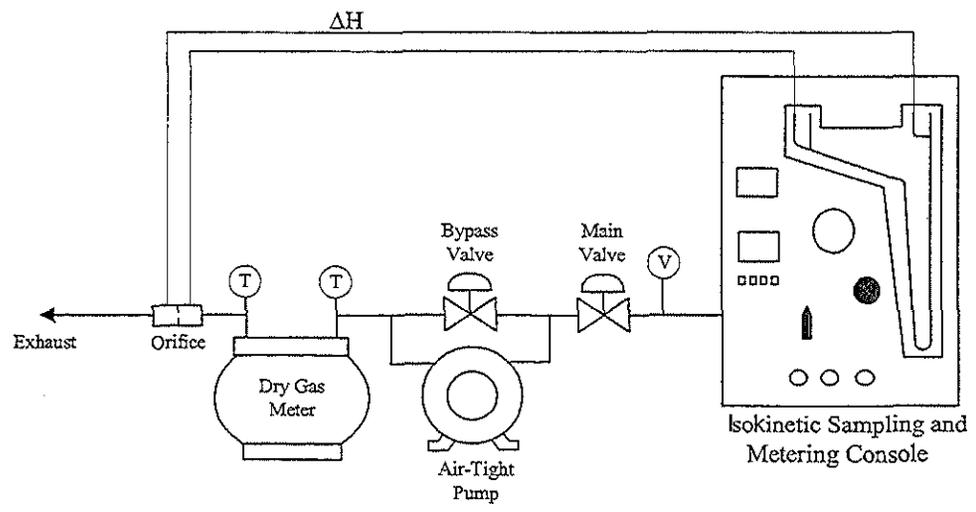


<p><b>Figure 2</b></p> <p>Sampling locations for the determination of Particulate Matter, Metals, and PM10 from the #3 Baghouse at the Gerdau facility in Jackson, Michigan.</p>	<p><b>Derenzo and Associates, Inc.</b></p> <p>Sampling Date(s): June 6-9, 2014</p>
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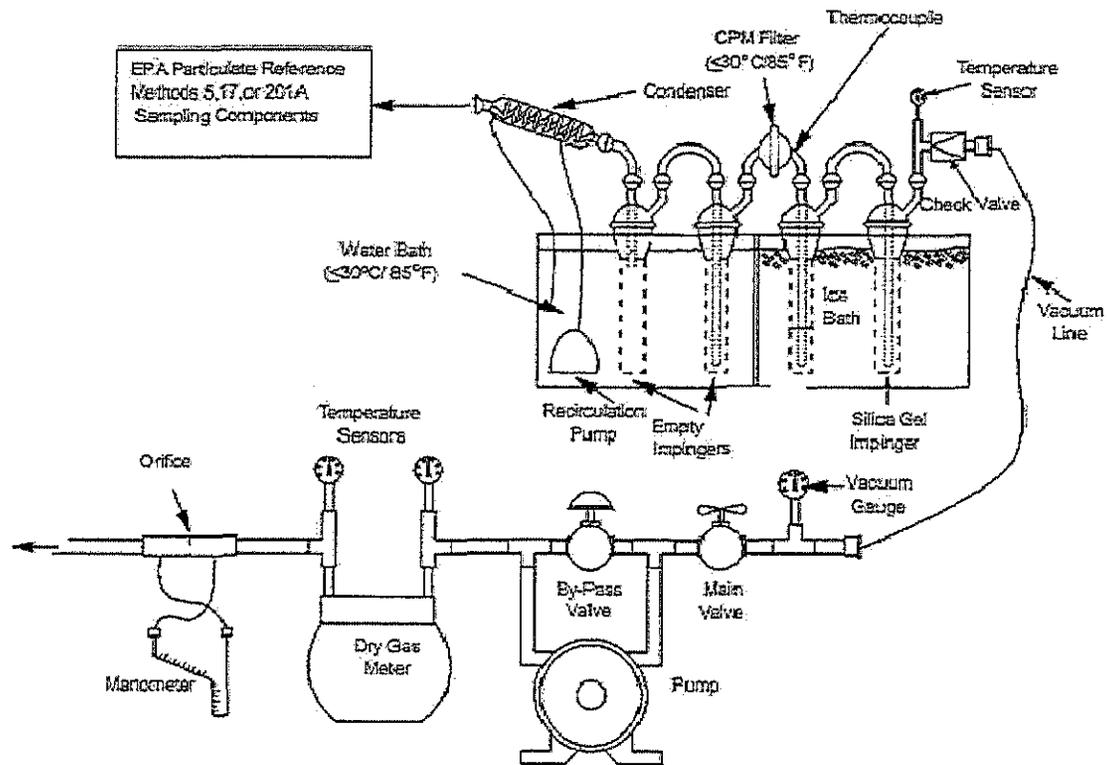


(V) = Vacuum Gauge  
 (T) = Temperature Measurement

Vacuum Line



USEPA Method 17 Sample Train		
Scale None	Sheet 1 of 1	Derenzo and Associates Project No.

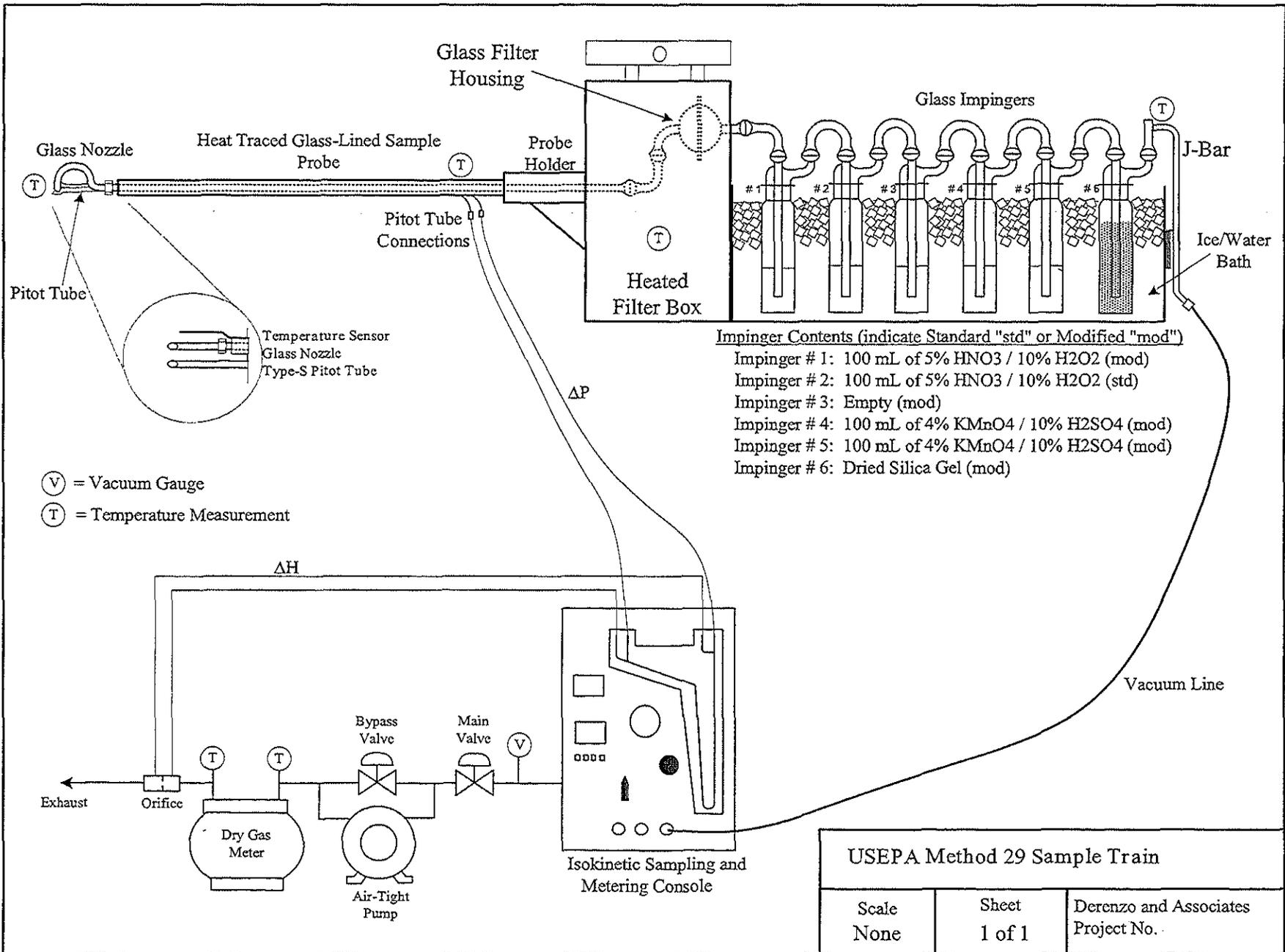


### USEPA Method 202 Sample Train

Scale  
None

Sheet  
1 of 1

Derenzo and Associates  
Project No.



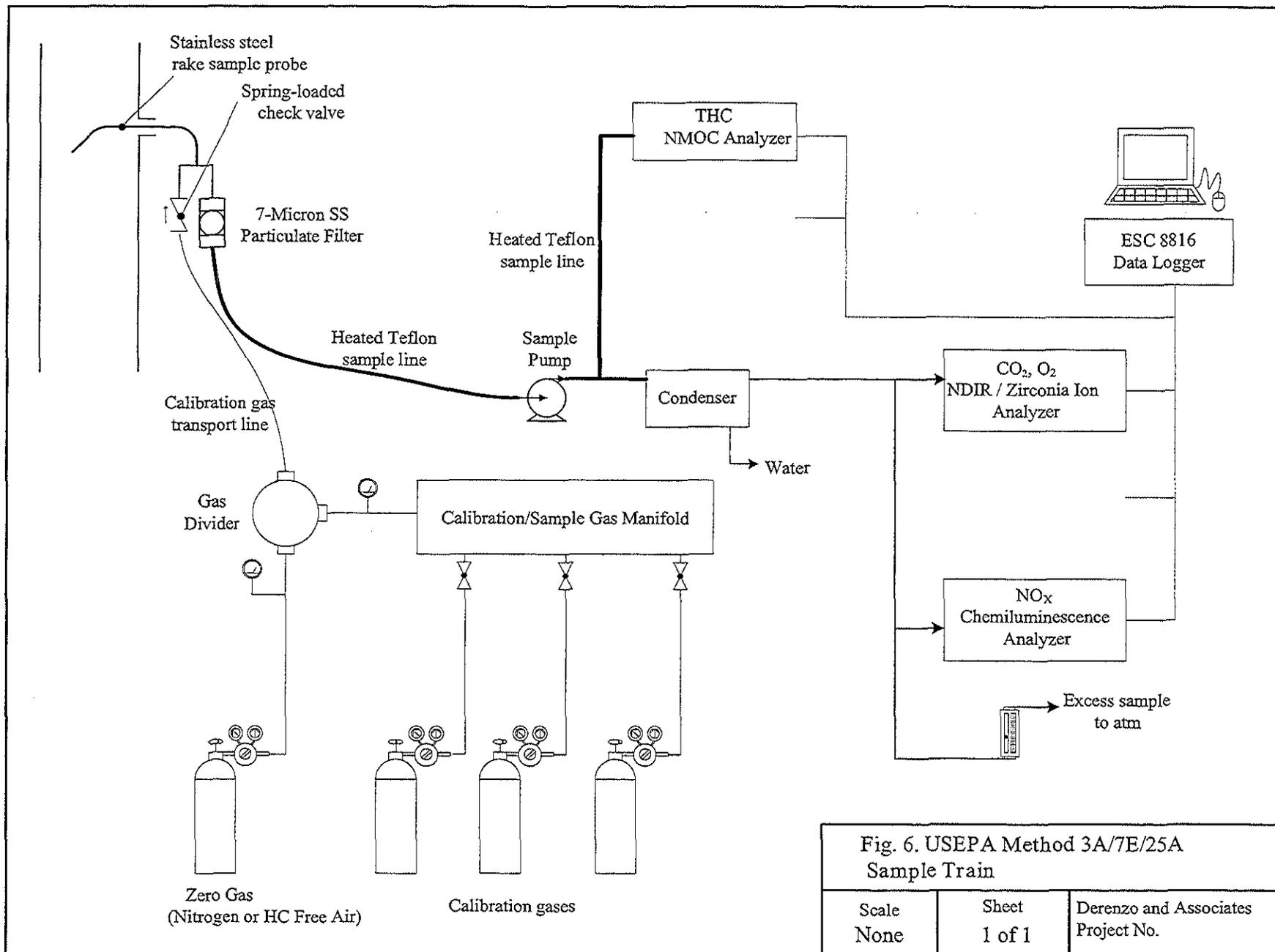


Fig. 6. USEPA Method 3A/7E/25A Sample Train

Scale  
None

Sheet  
1 of 1

Derenzo and Associates  
Project No.