09/10/2026

Michelle Hall
Charter Manufacturing Company, Inc.
4300 E. 49th Street
Cuyahoga Heights, OH 44125

Yes	TOXIC REVIEW
Yes	PSD
No	SYNTHETIC MINOR TO AVOID MAJOR NSR
No	CEMS
Yes	MACT/GACT
Yes	NSPS
No	NESHAPS
No	NETTING
Yes	MAJOR NON-ATTAINMENT
Yes	MODELING SUBMITTED
No	MAJOR GHG
No	SYNTHETIC MINOR TO AVOID MAJOR GHG

RE: DRAFT AIR POLLUTION PERMIT-TO-INSTALL

Facility ID: 1318171623
Permit Number: P0141210
Permit Type: Administrative Modification
County: Cuyahoga

Dear Permit Holder:

A draft of the Ohio Administrative Code (OAC) Chapter 3745-31 Air Pollution Permit-to-Install for the referenced facility has been issued for the emissions unit(s) listed in the Authorization section of the enclosed draft permit. This draft action is not an authorization to begin construction or modification of your emissions unit(s). The purpose of this draft is to solicit public comments on the permit. A public notice will appear in the Ohio Environmental Protection Agency (Ohio EPA) ***Weekly Review and Public Notices*** website. A copy of the public notice and the draft permit are enclosed. This permit can be accessed electronically on the Ohio EPA document search webpage: ***eDocument Search***. Comments will be accepted as a marked-up copy of the draft permit or in narrative format. Any comments must be sent to the following:

Andrea Moore
Permitting Section
Ohio EPA, DAPC
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, Ohio 43216-1049

and

Cleveland Division of Air Quality
2nd Floor
75 Erieview Plaza
Cleveland, OH 44114

Comments and/or a request for a public hearing will be accepted within 30 days of the date the notice is published on the Ohio EPA ***Weekly Review and Public Notices*** website. You will be notified in writing if a public hearing is scheduled. A decision on issuing a final permit-to-install will be made after consideration of comments received and oral testimony if a public hearing is conducted. Any permit fee that will be due upon issuance of a final Permit-to-Install is indicated in the Authorization section. Please do not submit any payment now. If you have any questions, please contact Cleveland Division of Air Quality at (216)664-2297.

Sincerely,

Robert Hodanbosi
Chief, Division of Air Pollution Control

cc: U.S. EPA Region 5 - *Via E-Mail Notification*
CDAQ; Pennsylvania; Canada

PUBLIC NOTICE

The following matters are the subject of this public notice by the Ohio Environmental Protection Agency. The complete public notice, including any additional instructions for submitting comments, requesting information, a public hearing, or filing an appeal may be obtained at: ***Weekly Review and Public Notices | Ohio Environmental Protection Agency*** or Hearing Clerk, Ohio EPA, 50 W. Town St., Columbus, Ohio 43215. Ph: 614-644-3037 email: ***HClerk@epa.ohio.gov***

Draft Air Pollution Permit-to-Install Administrative Modification

Charter Manufacturing Company, Inc.
4300 East 49th Street
Cuyahoga Heights, OH 44125-1004

ID#:	P0141210
Date of Action:	09/10/2026
Permit Desc:	Agency-initiated administrative modification to incorporate RACT standards. Pursuant to Part D of Title I of the Clean Air Act (CAA), Ohio EPA is required to establish a State Implementation Plan (SIP) for the attainment and maintenance of the NAAQS. The above-mentioned permit is a part of Ohio's SIP for attainment and maintenance of the 2015 ozone NAAQS and will be submitted to United States Environmental Protection Agency (U.S. EPA) as a modification of the SIP.

The permit can be accessed electronically and comments may be submitted at: https://ohioepa.commentinput.com - Search by entering the permit P0141210 in the "Search Projects" search box.

The public comment period will run until 10/12/2026 at 11:59 PM.

Permit Strategy Write-Up

1. Check all that apply:

   ☐ Synthetic Minor Determination **N/A**

   ☐ Netting Determination **N/A**

2. Source Description:

   Charter Manufacturing Company is a steel making facility using an Electric Arc Furnace (P900) for the melting of scrap steel and using a Direct Evacuation Control (system) with adjustable gap for capture and control of CO and VOC emissions, and a baghouse for control of particulate emissions.

   As required by the reclassification to serious nonattainment for ozone under the 2015 ozone National Ambient Air Quality Standards (NAAQS) promulgated by U.S. EPA, this facility has submitted a VOC Reasonably Available Control Technology (RACT) study on March 31, 2026 (subsequently revised on 4/30/2026, 6/11/2026, 7/17/2026, and 8/6/2026) to address the feasibility of controlling VOC emissions from the electric arc furnace. This facility has no prior existing source-specific VOC RACT requirements under OAC rule 3745-21-11(B).

   This PTI administrative modification includes the implementation of the proposed VOC RACT requirements for emissions unit P900 identified in the August 2026 revision of the RACT study. The facility-wide Section B. of this permit identifies the VOC RACT limit for P900 established under OAC rule 3745- 21-11(B), and the applicable rules table in Section C.1. implements these under an OAC rule 3745-31-05(D) federally enforceable restriction.

   Pursuant to Part D of Title I of the Clean Air Act (CAA), Ohio EPA is required to establish a State Implementation Plan (SIP) for the attainment and maintenance of the NAAQS. This permit is part of Ohio's SIP for attainment and maintenance of the 2015 ozone NAAQS and will be submitted to the United States Environmental Protection Agency (U.S. EPA) as a modification of the SIP.

3. Facility Emissions and Attainment Status:

   Charter Manufacturing Company is a Title V facility located in Cuyahoga County.

   Cuyahoga County was designated as "serious" nonattainment for the 2015 ozone NAAQS but is now a maintenance county. The county is currently designated attainment for all NAAQS (criteria) pollutants which include ozone, $PM_{2.5}$, PM_{10}, CO, NO_2, lead and SO_2.

4. Source Emissions:

   The affected emissions unit that will be implementing the VOC RACT requirement is the electric arc furnace (P900). The VOC RACT determination for this emissions unit under OAC rule 3745-21-11(B) is the following:

   a) VOC RACT emission limit of 22.0 lbs/hr for emissions unit P900;

   b) Use of the current Ohio EPA-approved scrap management plan to help minimize VOC emissions; and

   c) Utilizing the current Direct Evacuation Control (DEC) system with adjustable air gap and water-cooled elbow and duct that allows for efficient post-furnace combustion of VOC emissions.

5. Conclusion:

This permit modification establishes the VOC RACT emission limit as proposed by the Charter Manufacturing Company in their VOC RACT study as part of the requirements for the 2015 ozone NAAQs nonattainment and maintenance areas under the reclassification to serious nonattainment for the Cleveland area. The VOC RACT emission limit established in this permit shall apply immediately upon final issuance of this permit (P0141210).

6. Please provide additional notes or comments as necessary:

None

7. Total Permit Allowable Emissions Summary (for informational purposes only):

Pollutant	Tons Per Year
$PM_{2.5}$ (filterable)	13.92
PM_{10} (filterable)	14.28
PM (filterable)	18.84
PM/PM_{10}/$PM_{2.5}$ (condensable)	12.24
NOx	138.96
VOC	84.24
lead	0.17
SO_2	314.0
CO	1364.20

DRAFT

Division of Air Pollution Control
Permit-to-Install
for
Charter Manufacturing Company, Inc.

Facility ID:	1318171623
Permit Number:	P0141210
Permit Type:	Administrative Modification
Issued:	09/10/2026
Effective:	To be entered upon final issuance

Division of Air Pollution Control

Permit-to-Install

for

Charter Manufacturing Company, Inc.

Table of Contents

Authorization

Facility ID:	1318171623
Facility Description:	Steel Billet manufacturing.
Application Number(s):	M0008872
Permit Number:	P0141210
Permit Type:	Permit-To-Install
Permit Fee:	$0.00 *DO NOT send payment at this time, subject to change before final issuance*
Issue Date:	09/10/2026
Effective Date:	To be entered upon final issuance

This document constitutes issuance of a Permit-to-Install for the emissions unit(s) identified on the following page to:

Charter Manufacturing Company, Inc.
4300 East 49th Street
Cuyahoga Heights, OH 44125-1004

Ohio Environmental Protection Agency (EPA) District Office or local air agency responsible for processing and administering your permit:

Cleveland Division of Air Quality
2nd Floor
75 Erieview Plaza
Cleveland, OH 44114
(216)664-2297

The above-named entity is hereby granted this Permit-to-Install for the air contaminant source(s) (emissions unit(s)) listed in this section pursuant to Chapter 3745-31 of the Ohio Administrative Code. Issuance of this permit does not constitute expressed or implied approval or agreement that, if constructed or modified in accordance with the plans included in the application, the described emissions unit(s) will operate in compliance with applicable State and Federal laws and regulations and does not constitute expressed or implied assurance that if constructed or modified in accordance with those plans and specifications, the above described emissions unit(s) of pollutants will be granted the necessary permits to operate (air) or NPDES permits as applicable.

This permit is granted subject to the conditions attached hereto.

Ohio Environmental Protection Agency

John Logue
Director

Authorization (continued)

Permit Number: P0141210

Permit Description: Agency-initiated administrative modification to incorporate RACT standards. Pursuant to Part D of Title I of the Clean Air Act (CAA), Ohio EPA is required to establish a State Implementation Plan (SIP) for the attainment and maintenance of the NAAQS. The above-mentioned permit is a part of Ohio's SIP for attainment and maintenance of the 2015 ozone NAAQS and will be submitted to United States Environmental Protection Agency (U.S. EPA) as a modification of the SIP.

Permits for the following Emissions Unit(s) or groups of Emissions Units are in this document as indicated below:

Emissions Unit ID:	**P900**
Company Equipment ID:	Electric Arc Furnace (EAC)
Superseded Permit Number:	P0120585
General Permit Category and Type:	Not Applicable

List of Commonly Used Abbreviations

AP-42 = U.S. EPA's Compilation of Air Pollution Emissions Factors	HVLP = high volume, low pressure	PER = Permit Evaluation Report
ASTM = American Society for Testing and Materials	LAER = lowest achievable emission rate	PM = particulate matter
BACT = Best Available Control Technology	lb(s)/hr = pound(s) per hour	PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns
BAT = Best Available Technology	LDAR = leak detection and repair	$PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
CAA = Clean Air Act	LPG = liquefied petroleum gas/propane	ppb = parts per billion
CAM = compliance assurance monitoring	MACT = maximum achievable control technology	ppm = parts per million
CEMS = continuous emissions monitoring system	MAGLC = maximum acceptable ground level concentration	PSD = Prevention of Significant Deterioration
CFC = chlorofluorocarbon	mg/m3 = milligrams per cubic meter	psi = pounds per square inch
CFR = Code of Federal Regulations	MM = million	psia = pounds per square inch absolute
CH_4 = methane	MMBtu = million British Thermal Units	PTE = potential-to-emit
CI = compression ignition	MSDS = material safety data sheet	PTI = Permit-to-Install
CO = carbon monoxide	MSW = municipal solid waste	PTIO = Permit-to-Install and Operate
CO_2 = carbon dioxide	NAAQS = National Ambient Air Quality Standard	PTO = Permit-to-Operate
COM = continuous opacity monitor	NESHAP = National Emission Standard for Hazardous Air Pollutants	PWR = process weight rate
DAPC = Division of Air Pollution Control	NG = natural gas	RACM = reasonably available control measures
DO/LAA = District Office/Local Air Agency	ng/m3 = nanograms per cubic meter	RACT = reasonably available control technology
dscf = dry standard cubic foot	NH_3 = ammonia	RATA = relative accuracy test audit
EAC = emissions activity category	NMHC = non-methane hydrocarbons	RTO = regenerative thermal oxidizer
eDocs = electronic documents database	NMOC = non-methane organic compound	SB265 = Senate Bill 265
ERAC = Environmental Review Appeals Commission	NO = nitrogen oxide	scfm = standard cubic feet per minute
ESP = electrostatic precipitator	NO_2 = nitrogen dioxide	SI = spark ignition
EU = emissions unit	NO_x = nitrogen oxides	SIP = State Implementation Plan
FEPTIO = Federally Enforceable Permit-to-Install and Operate	NSPS = New Source Performance Standard	SO_2 = sulfur dioxide
FER = Fee Emissions Report	NSR = New Source Review	SSMP = startup, shutdown, and malfunction plan
FR = Federal Register	NTV = Non-Title V	TDS = total dissolved solids
GACT = generally achievable control technology	O&M = operation and maintenance	TLV = threshold limit value
GHG = greenhouse gases	OAC = Ohio Administrative Code	TO = thermal oxidizer
gr/dscf = grains per dry standard cubic foot	OC = organic compound	TPH = ton(s) per hour
H_2S = hydrogen sulfide	Ohio EPA = Ohio Environmental Protection Agency	TPY = ton(s) per year
H_2SO_4 = sulfuric acid	ORC = Ohio Revised Code	TSP = total suspended particulates
HAP = hazardous air pollutant	Pb = lead	VE = visible particulate emissions
HCl = hydrogen chloride	PBR = Permit-By-Rule	VMT = vehicle miles traveled
HF = hydrogen fluoride	PCB = polychlorinated biphenyl	VOC = volatile organic compound
Hg = mercury	PE = particulate emissions	WPP = work practice plan
hp = horsepower	PEMS = predictive emissions monitoring system	µg/m3 = micrograms per cubic meter

A. Standard Terms and Conditions

1. Federally Enforceable Standard Terms and Conditions

a) All Standard Terms and Conditions are federally enforceable, with the exception of those listed below which are enforceable under state law only:

(1) Standard Term and Condition A.2.a), Severability Clause

(2) Standard Term and Condition A.3.c) through A. 3.e), General Requirements

(3) Standard Term and Condition A.6.c), Compliance Requirements

(4) Standard Term and Condition A.9., Reporting Requirements

(5) Standard Term and Condition A.10., Applicability

(6) Standard Term and Condition A.11.b) through A.11.e), Construction of New Source(s) and Authorization to Install

(7) Standard Term and Condition A.14., Public Disclosure

(8) Standard Term and Condition A.15., Additional Reporting Requirements When There Are No Deviations of Federally Enforceable Emission Limitations, Operational Restrictions, or Control Device Operating Parameter Limitations

(9) Standard Term and Condition A.16., Fees

(10) Standard Term and Condition A.17., Permit Transfers

2. Severability Clause

a) A determination that any term or condition of this permit is invalid shall not invalidate the force or effect of any other term or condition thereof, except to the extent that any other term or condition depends in whole or in part for its operation or implementation upon the term or condition declared invalid.

b) All terms and conditions designated in parts B. and C. of this permit are federally enforceable as a practical matter, if they are required under the Act, or any of its applicable requirements, including relevant provisions designed to limit the potential to emit of a source, are enforceable by the Administrator of the U.S. EPA and the state and by citizens (to the extent allowed by section 304 of the Act) under the Act. Terms and conditions in parts B and C of this permit shall not be federally enforceable and shall be enforceable under state law only, only if specifically identified in this permit as such.

3. General Requirements

a) Any noncompliance with the federally enforceable terms and conditions of this permit constitutes a violation of the Act and is grounds for enforcement action or for permit revocation, revocation and re-issuance, or modification.

b) It shall not be a defense for the permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the federally enforceable terms and conditions of this permit.

c) This permit may be modified, revoked, or revoked and reissued, for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or revocation, or of a notification of planned changes or anticipated noncompliance does not stay any term and condition of this permit.

d) This permit does not convey any property rights of any sort, or any exclusive privilege.

e) The permittee shall furnish to the Director of the Ohio EPA, or an authorized representative of the Director, upon receipt of a written request and within a reasonable time, any information that may be requested to determine whether cause exists for modifying or revoking this permit or to determine compliance with this permit. Upon request, the permittee shall also furnish to the Director or an authorized representative of the Director, copies of records required to be kept by this permit. For information claimed to be confidential in the submittal to the Director, if the Administrator of the U.S. EPA requests such information, the permittee may furnish such records directly to the Administrator along with a claim of confidentiality.

4. Monitoring and Related Record Keeping and Reporting Requirements

a) Except as may otherwise be provided in the terms and conditions for a specific emissions unit, the permittee shall maintain records that include the following, where applicable, for any required monitoring under this permit:

(1) The date, place (as defined in the permit), and time of sampling or measurements.

(2) The date(s) analyses were performed.

(3) The company or entity that performed the analyses.

(4) The analytical techniques or methods used.

(5) The results of such analyses.

(6) The operating conditions existing at the time of sampling or measurement.

b) Each record of any monitoring data, testing data, and support information required pursuant to this permit shall be retained for a period of five years from the date the record was created. Support information shall include, but not be limited to all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation, and copies of all reports required by this permit. Such records may be maintained in computerized form.

c) Except as may otherwise be provided in the terms and conditions for a specific emissions unit, the permittee shall submit required reports in the following manner:

(1) Reports of any required monitoring and/or recordkeeping of federally enforceable information shall be submitted to the Cleveland Division of Air Quality.

(2) Quarterly written reports of (i) any deviations from federally enforceable emission limitations, operational restrictions, and control device operating parameter limitations, excluding deviations resulting from malfunctions reported in accordance with OAC rule 3745-15-06, that have been detected by the testing, monitoring and recordkeeping requirements specified in this permit, (ii) the probable cause of such deviations, and (iii) any corrective actions or preventive measures taken, shall be made to the Cleveland Division of Air Quality. The written reports shall be submitted quarterly, by January 31, April 30, July 31, and October 31 of each year and shall cover the previous calendar quarters. See A.15. below if no deviations occurred during the quarter.

(3) Written reports, which identify any deviations from the federally enforceable monitoring, recordkeeping, and reporting requirements contained in this permit shall be submitted to the Cleveland Division of Air Quality every six months, by January 31 and July 31 of each year for the previous six calendar months. If no deviations occurred during a six-month period, the permittee shall submit a semiannual report, which states that no deviations occurred during that period.

(4) This permit is for an emissions unit located at a Title V facility. Each written report shall be signed by a responsible official certifying that, based on information and belief formed after reasonable inquiry, the statements and information in the report are true, accurate, and complete.

d) The permittee shall report actual emissions pursuant to OAC Chapter 3745-78 for the purpose of collecting Air Pollution Control Fees.

5. Scheduled Maintenance/Malfunction Reporting

Any scheduled maintenance of air pollution control equipment shall be performed in accordance with paragraph (A) of OAC rule 3745-15-06. The malfunction, i.e., upset, of any emissions units or any associated air pollution control system(s) shall be reported to the Cleveland Division of Air Quality in accordance with paragraph (B) of OAC rule 3745-15-06. (The definition of an upset condition shall be the same as that used in OAC rule 3745-15-06(B)(1) for a malfunction.) The verbal and written reports shall be submitted pursuant to OAC rule 3745-15-06.

Except as provided in that rule, any scheduled maintenance or malfunction necessitating the shutdown or bypassing of any air pollution control system(s) shall be accompanied by the shutdown of the emission unit(s) that is (are) served by such control system(s).

6. Compliance Requirements

a) All applications, notifications or reports required by terms and conditions in this permit to be submitted or "reported in writing" are to be submitted to Ohio EPA through the Ohio EPA's eBusiness Center: Air Services web service ("Air Services"). Ohio EPA will accept hard copy submittals on an as-needed basis if the permittee cannot submit the required documents through the Ohio EPA eBusiness Center. In the event of an alternative hard copy submission in lieu of the eBusiness Center, the post-marked date or the date the document is delivered in person will be recognized as the date submitted. Electronic submission of applications, notifications or reports required to be submitted to Ohio EPA fulfills the requirement to submit the required information to the Director, the appropriate Ohio EPA District Office or contracted local air agency, and/or any other individual or organization specifically identified as an additional recipient identified in this permit unless otherwise specified. Consistent with OAC rule 3745-15-03, the electronic signature date shall constitute the date that the required application, notification or report is considered to be "submitted". Any document requiring signature may be represented by entry of the personal identification number (PIN) by responsible official as part of the electronic submission process or by the scanned attestation document signed by the Authorized Representative that is attached to the electronically submitted written report.

Any document (including reports) required to be submitted and required by a federally applicable requirement in this permit shall include a certification by a Responsible Official that, based on information and belief formed after reasonable inquiry, the statements in the document are true, accurate, and complete

b) Upon presentation of credentials and other documents as may be required by law, the permittee shall allow the Director of the Ohio EPA or an authorized representative of the Director to:

(1) At reasonable times, enter upon the permittee's premises where a source is located, or the emissions-related activity is conducted, or where records must be kept under the conditions of this permit.

(2) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit, subject to the protection from disclosure to the public of confidential information consistent with ORC section 3704.08.

(3) Inspect at reasonable times any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under this permit.

(4) As authorized by the Act, sample or monitor at reasonable times substances or parameters for the purpose of assuring compliance with the permit and applicable requirements.

c) The permittee shall submit progress reports to the Cleveland Division of Air Quality concerning any schedule of compliance for meeting an applicable requirement. Progress reports shall be submitted semiannually or more frequently if specified in the applicable requirement or by the Director of the Ohio EPA. Progress reports shall contain the following:

(1) Dates for achieving the activities, milestones, or compliance required in any schedule of compliance, and dates when such activities, milestones, or compliance were achieved.

(2) An explanation of why any dates in any schedule of compliance were not or will not be met, and any preventive or corrective measures adopted.

7. Best Available Technology

As specified in OAC Rule 3745-31-05, new sources that must employ Best Available Technology (BAT) shall comply with the Applicable Emission Limitations/Control Measures identified as BAT for each subject emissions unit.

8. Air Pollution Nuisance

The air contaminants emitted by the emissions units covered by this permit shall not cause a public nuisance, in violation of OAC rule 3745-15-07.

9. Reporting Requirements

The permittee shall submit required reports in the following manner:

a) Reports of any required monitoring and/or recordkeeping of state-only enforceable information shall be submitted to the Cleveland Division of Air Quality.

b) Except as otherwise may be provided in the terms and conditions for a specific emissions unit, quarterly written reports of (a) any deviations (excursions) from state-only required emission limitations, operational restrictions, and control device operating parameter limitations that have been detected by the testing, monitoring, and recordkeeping requirements specified in this permit, (b) the probable cause of such deviations, and (c) any corrective actions or preventive measures which have been or will be taken, shall be submitted to the Cleveland Division of Air Quality. If no deviations occurred during a calendar quarter, the permittee shall submit a quarterly report, which states that no deviations occurred during that quarter. The reports shall be submitted quarterly, by January 31, April 30, July 31, and October 31 of each year and shall cover the previous calendar quarters. (These quarterly reports shall exclude deviations resulting from malfunctions reported in accordance with OAC rule 3745-15-06.)

10. Applicability

This permit-to-install is applicable only to the emissions unit(s) identified in the permit-to-install. Separate application must be made to the Director for the installation or modification of any other emissions unit(s) not exempt from the requirement to obtain a permit-to-install.

11. Construction of New Sources(s) and Authorization to Install

a) This permit does not constitute an assurance that the proposed source will operate in compliance with all Ohio laws and regulations. This permit does not constitute expressed or implied assurance that the proposed facility has been constructed in accordance with the application and terms and conditions of this permit. The action of beginning and/or completing construction prior to obtaining the Director's approval constitutes a violation of OAC rule 3745-31-02. Furthermore, issuance of this permit does not constitute an assurance that the proposed source will operate in compliance with all Ohio laws and regulations. Issuance of this permit is not to be construed as a waiver of any rights that the Ohio Environmental Protection Agency (or other persons) may have against the applicant for starting construction prior to the effective date of the permit. Additional facilities shall be installed upon orders of the Ohio Environmental Protection Agency if the proposed facilities cannot meet the requirements of this permit or cannot meet applicable standards.

b) If applicable, authorization to install any new emissions unit included in this permit shall terminate within eighteen months of the effective date of the permit if the owner or operator has not undertaken a continuing program of installation or has not entered into a binding contractual obligation to undertake and complete within a reasonable time a continuing program of installation. This deadline may be extended once by twelve months if application is made to the Director within a reasonable time before the termination date and the permittee shows good cause for any such extension.

c) The permittee may notify Ohio EPA of any emissions unit that is permanently shut down (i.e., the emissions unit has been physically removed from service or has been altered in such a way that it can no longer operate without a subsequent "modification" or "installation" as defined in OAC Chapter 3745-31) by submitting a certification from the authorized official that identifies the date on which the emissions unit was permanently shut down. Authorization to operate the affected emissions unit shall cease upon the date certified by the authorized official that the emissions unit was permanently shut down. At a minimum, notification of permanent shut down shall be made or confirmed by marking the affected emissions unit(s) as "permanently shut down" in "Air Services" along with the date the emissions unit(s) was permanently removed and/or disabled. Submitting the facility profile update electronically will constitute notifying the Director of the permanent shutdown of the affected emissions unit(s).

d) The provisions of this permit shall cease to be enforceable for each affected emissions unit after the date on which an emissions unit is permanently shut down (i.e., emissions unit has been physically removed from service or has been altered in such a way that it can no longer operate without a subsequent "modification" or "installation" as defined in OAC Chapter 3745-31). All records relating to any permanently shut down emissions unit, generated while the emissions unit was in operation, must be maintained in accordance with law. All reports required by this permit must be submitted for any period an affected emissions unit operated prior to permanent shut down. At a minimum, the permit requirements must be evaluated as part of the reporting requirements identified in this permit covering the last period the emissions unit operated.

Unless otherwise exempted, no emissions unit certified by the responsible official as being permanently shut down may resume operation without first applying for and obtaining a permit pursuant to OAC Chapter 3745-31 and OAC Chapter 3745-77 if the restarted operation is subject to one or more applicable requirements.

e) The permittee shall comply with any residual requirements related to this permit, such as the requirement to submit a deviation report, air fee emission report, or any other reporting required by this permit for the period the operating provisions of this permit were enforceable, or as required by regulation or law. All reports shall be submitted in a form and manner prescribed by the Director. All records relating to this permit must be maintained in accordance with law.

12. Permit-To-Operate Application

The permittee is required to apply for a Title V permit pursuant to OAC Chapter 3745-77. The permittee shall submit a complete Title V permit application or a complete Title V permit modification application within twelve months after commencing operation of the emissions units covered by this permit. However, if operation of the proposed new or modified source(s) as authorized by this permit would be prohibited by the terms and conditions of an existing Title V permit, a Title V permit modification of such new or modified source(s) pursuant to OAC rule 3745-77-04(D) and OAC rule 3745-77-08(C)(3)(d) must be <u>obtained before</u> operating the source in a manner that would violate the existing Title V permit requirements.

13. Construction Compliance Certification

The applicant shall identify the following dates in the "Air Services" facility profile for each new emissions unit identified in this permit.

a) Completion of initial installation date shall be entered upon completion of construction and prior to start-up.

b) Commence operation after installation or latest modification date shall be entered within 90 days after commencing operation of the applicable emissions unit.

14. Public Disclosure

The facility is hereby notified that this permit, and all agency records concerning the operation of this permitted source, are subject to public disclosure in accordance with OAC rule 3745-49-03.

15. Additional Reporting Requirements When There Are No Deviations of <u>Federally Enforceable</u> Emission Limitations, Operational Restrictions, or Control Device Operating Parameter Limitations

If no deviations occurred during a calendar quarter, the permittee shall submit a quarterly report, which states that no deviations occurred during that quarter. The reports shall be submitted quarterly by January 31, April 30, July 31, and October 31 of each year and shall cover the previous calendar quarters.

16. Fees

The permittee shall pay fees to the Director of the Ohio EPA in accordance with ORC section 3745.11 and OAC Chapter 3745-78. The permittee shall pay all applicable permit-to-install fees within 30 days after the issuance of any permit-to-install. The permittee shall pay all applicable permit-to-operate fees within thirty days of the issuance of the invoice.

17. Permit Transfers

Any transferee of this permit shall assume the responsibilities of the prior permit holder. The new owner must update and submit the ownership information via the "Owner/Contact Change" functionality in "Air Services" once the transfer is legally completed. The change must be submitted through "Air Services" within thirty days of the ownership transfer date.

18. Risk Management Plans

If the permittee is required to develop and register a risk management plan pursuant to section 112(r) of the Clean Air Act, as amended, 42 U.S.C. 7401 et seq. ("Act"), the permittee shall comply with the requirement to register such a plan.

19. Title IV Provisions

If the permittee is subject to the requirements of 40 CFR Part 72 concerning acid rain, the permittee shall ensure that any affected emissions unit complies with those requirements. Emissions exceeding any allowances that are lawfully held under Title IV of the Act, or any regulations adopted thereunder, are prohibited.

B. Facility Wide Terms and Conditions

1. All the following facility-wide terms and conditions are federally enforceable with the exception of those listed below which are enforceable under state law only.

   a) None.

2. The following emissions unit contained in this permit is subject to 40 CFR Part 63, Subpart YYYYY: P900. The complete MACT requirements, including the General Provisions may be accessed via the internet from the Electronic Code of Federal Regulations (e-CFR) website http://www.ecfr.gov or by contacting the Cleveland Division of Air Quality.

3. For the dust-handling system located at this facility, including dust-handling equipment associated with P900 and F004, the permittee shall not discharge into the atmosphere any gases that exhibit 10 percent opacity or greater. In accordance with 40 CFR Part 60, Subpart AAa, the definition of "dust-handling system" is as follows:

   Dust-handling system means equipment used to handle particulate matter collected by the control device for an electric arc furnace or AOD vessel subject to this subpart. For the purposes of this subpart, the dust-handling system shall consist of the control device dust hoppers, the dust-conveying equipment, any central dust storage equipment, the dust-treating equipment (e.g., pug mill, pelletizer), dust transfer equipment (from storage to truck), and any secondary control devices used with the dust transfer equipment.

   Compliance shall be determined through visible emission observations performed in accordance with 40 CFR Part 60, Appendix A, Method 9 and the procedures specified in 40 CFR Part 60 Subpart AAa.

4. This facility has emission limitations that have been established in previous permits for the total amount of emissions that are emitted through the Melt Shop baghouse. These emission limits (with the exception of $PM_{2.5}$) have been established as best available control technology (BACT) through OAC rules 3745-31-10 through 20 in accordance with the Prevention of Significant Deterioration requirements, and lowest achievable emission rate (LAER) for SO_2 through OAC rules 3745-31-21 through 27 in accordance with the Nonattainment New Source Review requirements. These BACT limits were updated through permit P0120585 to reflect the changed emission profile resulting from the Melt Shop Expansion Project. The BACT and LAER limits included in this permit supersede the limits in PTI #13-04176. The emission limits for $PM_{2.5}$ have been established as BAT through OAC rule 3745-31-05(A)(3).

   a) The emissions from emissions units P032-P038, P041, P048, and P900-P902 that vent to the Melt Shop Baghouse shall not exceed the following BACT/BAT emission limits from the baghouse outlet:

      PM emissions shall not exceed 4.31 lbs/hr and 0.00069 grains/dscf (filterable)

      PM_{10} emissions shall not exceed 3.27 lbs/hr and 0.00052 grains/dscf (filterable)

      $PM_{2.5}$ emissions shall not exceed 3.19 lbs/hr and 0.00051 grains/dscf (filterable)

      Nitrogen oxide (NO_x) emissions shall not exceed 47.09 lbs/hr

      Volatile organic compounds (VOC) emissions shall not exceed 22.71 lbs/hr

      Lead (Pb) emissions shall not exceed 0.03 lb/hr

      Mercury (Hg) emissions shall not exceed 0.052 lb/hr

      3 percent opacity, as a 6-minute average, from the Melt Shop baghouse stack exit

These lb/hr, gr/dscf, and opacity BACT limits were originally established through the PSD PTI 13-04176 issued on 6/10/2004, with the exception of the $PM_{2.5}$ limit which was first included as part of permit modification P0120585 as a BAT limit. The ton/year limits have been eliminated since the annual emissions increased as a result of permit modification P0120585. The PM, PM_{10}, $PM_{2.5}$, and lead limits have been included and adjusted based on updated information from the permittee in their permit application. These limits supersede the limits in PTI 13-04176.

b) The emissions from emissions units P032-P038, P041, P043, P048, and P900-P902 that vent to the Melt Shop Baghouse shall not exceed the following BACT/LAER (for SO_2) from the baghouse outlet:

Sulfur dioxide (SO_2) emissions shall not exceed 166.16 lbs/hr, 1.51 lbs/ton, and 314 tons per year per rolling 12-month period.

For purposes of demonstrating compliance with these SO_2 emissions limits, the permittee has developed the following groupings of steel grades:

(1) "low-sulfur steel grades" – no sulfur addition and carbon specification less than 0.6% carbon per heat with emission factor in lb SO_2/ton of steel determined from the most recent stack test that demonstrated compliance;

(2) "mid-sulfur steel grades" – sulfur addition to achieve a sulfur specification for the steel of less than 0.1% and carbon specification greater than or equal to 0.6% carbon per heat with emission factor in lb SO_2/ton of steel determined from the most recent stack test that demonstrated compliance; and

(3) "high-sulfur steel grades" – sulfur addition to achieve a sulfur specification for the steel of greater than or equal to 0.1% and less than or equal to 0.35% with emission factor in lb SO_2/ton of steel determined from the most recent stack test that demonstrated compliance.

The terms "low-sulfur steel grades", "mid-sulfur steel grades," and "high-sulfur steel grades" are not industry standard terms, but rather reflect the relative magnitude of SO_2 emissions resulting from the addition of sulfur and/or carbon to meet product specifications.

c) The emissions from emissions units P032-P038, P041, P048, and P900-P902 that vent to the Melt Shop Baghouse shall not exceed the following BACT limit (for CO) from the baghouse outlet:

Carbon monoxide (CO) emissions shall not exceed 397.06 lbs/hr

d) Visible emissions of fugitive dust from the Melt Shop building shall not exceed 6 percent opacity, as a 6-minute average.

This visible emission limitation was established as BACT through the PSD PTI 13-04176 and remains in effect.

e) Compliance with the lb/hr, lb/ton, and gr/dscf emission limits above shall be based upon the results of the emission testing specified in B.4.g) below. The emission testing shall be performed in accordance with the requirements of 40 CFR Part 60 Subpart AAa and 40 CFR Part 63 Subpart YYYYY

f) Compliance with the stack and fugitive opacity limitations above shall be determined through visible emission observations performed in accordance with 40 CFR Part 60, Appendix A, Method 9 and the procedures specified in OAC rule 3745-17-03(B).

g) Emissions testing to demonstrate compliance with the melt shop particulate, VOC, and lead (Pb) limits shall be conducted in accordance with the test schedule set forth in the permittee's Title V permit (approximately every 2.5 years after issuance of the Title V permit).

Emission testing shall be conducted to verify the emission factors in lb SO2/ton for low-sulfur grade, mid-sulfur grade, and high-sulfur steel grade identified in term B.4.b) above, and to demonstrate compliance with the SO_2 limit of 166.16 lbs/hr and 1.51 lb/ton (when producing "high-sulfur steel grade") approximately every 2.5 years in accordance with the permittee's Title V permit.

The test(s) shall be conducted while emissions units P032-P038, P041, P048, and P900-P902 are operating simultaneously at or near their maximum capacity, unless otherwise specified or approved by the Cleveland DAQ. The tests shall be conducted in accordance with the requirements of 40 CFR Part 60.275a.

For the sulfur dioxide testing, the permittee shall perform three test runs for each category of steel that is produced: low-sulfur, mid-sulfur, and high-sulfur. The tests shall be performed for a grade of steel within each "bucket" category (low, mid, high) with the highest upper bound sulfur content customer specification being produced for the category being tested for the duration of the test (provided there is a customer order for such grade of steel).

During performance tests, the permittee shall not add gaseous diluents to the effluent gas stream after the fabric in any pressurized fabric filter collector unless the amount of dilution is separately determined and considered in the determination of emissions.

The following test methods shall be employed to demonstrate compliance with the emission limitations:

Methods 1 through 5 of 40 CFR Part 60, Appendix A for particulates;

Methods 1 through 4 and 6C of 40 CFR Part 60, Appendix A for SO_2;

Methods 1 through 4 and 12 or 29 of 40 CFR Part 60, Appendix A for lead (Pb); and

Methods 1 through 4 and 25 or 25a of 40 CFR Part 60, Appendix A for VOC.

Alternative U.S. EPA approved test methods may be used with prior approval from the Ohio EPA.

The performance test protocol (i.e., Ohio EPA Intent to Test) shall specify the baghouse pressure set point that will be utilized during the test. The performance test report of results shall include data that proves the baghouse was tested at the requested set point.

During the emissions testing, the emissions unit shall be operated under operational conditions approved in advance by the Cleveland DAQ. Operational conditions that may need to be approved include, but are not limited to, the production rate, the type of material processed, material make-up (solvent content, etc.), or control equipment operational limitations (burner temperature, precipitator voltage, etc.). In general, testing shall be done under "worst case" conditions expected during the life of the permit. As part of the information provided in the "Intent to Test" notification form described below, the permittee shall provide a description of the emissions unit operational conditions they will meet during the emissions testing and describe why they believe "worst case" operating conditions will be met. Prior to conducting the test(s), the permittee shall confirm with the Cleveland DAQ that the proposed operating conditions constitute "worst case". Failure to test under the approved conditions may result in Ohio EPA not accepting the test results as a demonstration of compliance.

Not later than 30 days prior to the proposed test date(s), the permittee shall submit an "Intent to Test" notification to the Cleveland DAQ. The "Intent to Test" notification shall describe in detail the proposed test methods and procedures, the emissions unit operating parameters, the time(s) and date(s) of the test(s), and the person(s) who will be conducting the test(s). Failure to submit such notification for review and approval prior to the test(s) may result in the Cleveland DAQ's refusal to accept the results of the emission test(s).

Personnel from the Cleveland DAQ shall be permitted to witness the test(s), examine the testing equipment, and acquire data and information necessary to ensure that the operation of the emissions unit and the testing procedures provide a valid characterization of the emissions from the emissions unit and/or the performance of the control equipment.

A comprehensive written report on the results of the emissions test(s) shall be signed by the person or persons responsible for the tests and submitted to the Cleveland DAQ within 30 days following completion of the test(s). The permittee may request additional time for the submittal of the written report, where warranted, with prior approval from the Cleveland DAQ.

h) Compliance with the annual sulfur dioxide emission limit in B.4.b) for emissions units P032 – P038, P041, P043, P048, and P900 – P902 combined shall be demonstrated using the following equation:

Total annual SO_2 emissions per rolling 12-months = ((lb SO_2/ton steel * a) + (lb SO_2/ton steel * b) + (lb SO_2/ton steel * c)) / (2000 lbs/ton) $\leq$ 314 tons SO_2 per rolling 12-months

Where:

a = tons of low-sulfur steel grades produced by the melt shop in the preceding 12-month period

b = tons of mid-sulfur steel grades produced by the melt shop in the preceding 12-month period

c = tons of high-sulfur steel grades produced by the melt shop in the preceding 12-month period

The permittee shall use the lb SO_2/ton steel emission factor determined from the most recent performance test that demonstrated compliance in the above formula for each category of steel. The following emission factors were determined from stack testing:

0.103 lb SO_2/ton steel for low-sulfur grade steel (March 2018 stack test);

0.23 lb SO_2/ton steel for mid-sulfur grade steel (March 2018 stack test); and

1.246 lb SO_2/ton steel for high-sulfur grade steel (June 2023 stack test).

The permittee shall maintain monthly records for the melt shop of the tons of steel produced for each category of steel (i.e., low-sulfur, mid-sulfur, and high-sulfur) for each calendar month, the rolling, 12-month summation of the steel produced for each category, and the rolling, 12-month SO_2 emission totals.

The permittee shall submit quarterly deviation (excursion) reports that identify the following:

All exceedances of the total annual rolling 12-month SO_2 emission limitation for emissions units P032 – P038, P041, P043, P048, and P900 – P902 combined.

The quarterly deviation (excursion) reports shall be submitted in accordance with the reporting requirements of the Standard Terms and Conditions of this permit.

5. OAC rule 3745-21-11(B) VOC RACT Requirements

As required by the reclassification to serious nonattainment for ozone under the 2015 ozone National Ambient Air Quality Standards (NAAQS) promulgated by U.S. EPA, and pursuant to OAC rule 3745-21-11(B) and the VOC Reasonable Available Control Technology (RACT) Study submitted by The Charter Manufacturing Company on March 31, 2026 (subsequently revised on 4/30/2026, 6/11/2026, 7/17/2026, and 8/6/2026):

"The Charter Manufacturing Company" (Facility ID: 1318171623) or any subsequent owner or operator of "The Charter Manufacturing Company" facility located at 4300 East 49th Street, Cuyahoga Heights, Ohio shall comply with the following requirements for emissions unit P900:

a) The VOC emissions shall not exceed 22.0 lbs/hr from emissions unit P900. This emission limit applies immediately upon final issuance of this permit (P0141210).

b) Current use of the Ohio EPA-approved scrap management plan to help minimize VOC emissions – see Section C term c)(5) for emissions unit P900.

c) Current use of a Direct Evacuation Control (DEC) system with adjustable air gap and water-cooled elbow and duct allowing for efficient post-furnace VOC combustion.

6. Monitoring and/or Recordkeeping Requirements

a) In order to ensure emissions unit P900 and the associated DEC system with adjustable gap continues to operate as designed, the permittee shall operate this emissions unit in accordance with the manufacturer's recommendations, instructions, and operating manual(s) with any modifications deemed necessary by the permittee. These manufacturer's recommendations, instructions, and operating manual(s), with any modifications documents, shall be maintained for the life of this emissions unit.

The permittee shall perform the recommended maintenance at the recommended intervals. The permittee shall keep records of the maintenance performed on P900 and associated DEC system with adjustable air gap and shall retain them for a period of five years from the date the record was created.

7. Testing Requirements

a) <u>Emission Limitation:</u>

VOC emissions shall not exceed 22.0 lbs/hr from emissions unit P900

<u>Applicable Compliance Method:</u>

Compliance with this emission limit shall be demonstrated through stack testing in accordance with the methods and procedures specified in B.4.g) above.

C. Emissions Unit Terms and Conditions

1. P900, Electric Arc Furnace (EAF)

Operations, Property and/or Equipment Description:

Electric Arc Furnace (EAF), 110 TPH capacity, for the melting of scrap steel with direct evacuation control (DEC) for capture and control of CO and VOC emissions, and a baghouse for control of particulate emissions. The P900 Melt Shop baghouse capture system includes a furnace roof control (Direct Evacuation Capture) system, a common roof canopy, and a scavenger canopy.

a) The following emissions unit terms and conditions are federally enforceable with the exception of those listed below which are enforceable under state law only.

(1) None.

b) Applicable Emissions Limitations and/or Control Requirements

(1) The specific operation(s), property, and/or equipment that constitute each emissions unit along with the applicable rules and/or requirements and with the applicable emissions limitations and/or control measures are identified below. Emissions from each unit shall not exceed the listed limitations, and the listed control measures shall be specified in narrative form following the table.

	Applicable Rules/Requirements	Applicable Emissions Limitations/Control Measures
a.	ORC 3704.03(T) OAC rule 3745-31-05(A)(3) See g)(1) below.	PM (filterable) emissions shall not exceed 1.57 tons/month averaged over a 12-month rolling period (total for melt shop baghouse). PM_{10} (filterable) emissions shall not exceed 1.19 tons/month averaged over a 12-month rolling period (total for melt shop baghouse). $PM_{2.5}$ (filterable) emissions shall not exceed 1.16 tons/month averaged over a 12-month rolling period (total for melt shop baghouse). $PM/PM_{10}/PM_{2.5}$ (condensable) emissions shall not exceed 1.02 tons/month averaged over a 12-month rolling period. Nitrogen oxide (NO_x) emissions shall not exceed 11.58 tons/month averaged over a 12-month rolling period. Volatile organic compound (VOC) emissions shall not exceed 7.02 tons/month averaged over a 12-month rolling period. The requirements of this rule also include compliance with the requirements OAC rules

	Applicable Rules/Requirements	Applicable Emissions Limitations/Control Measures
		3745-31-10 through 20 for SO_2 and CO in b)(1)e. and f. and NSPS 40 CFR Part 60 Subpart AAa.
b.	OAC rule 3745-31-05(A)(3)(a)(ii)	The Best Available Technology (BAT) requirements under OAC rule 3745-31-05(A)(3) do not apply to the mercury and lead emissions from this emissions unit since the potential to emit is less than 10 tons/year.
c.	OAC rules 3745-31-10 through 20 (PSD) These lb/hr BACT limits were originally established through the PSD PTI 13-04176 and remain in effect. The ton/year limits have been replaced with new BAT limits since BACT was not triggered for these pollutants for permit modification P0120585.	Emissions from the EAF shall not exceed the following: PM emissions shall not exceed 13.05 lbs/hr (filterable, stack and fugitive combined). PM_{10} emissions shall not exceed 9.91 lbs/hr (filterable, stack and fugitive combined). Nitrogen oxide (NO_x) emissions shall not exceed 36.30 lbs/hr. Volatile organic compound (VOC) emissions shall not exceed 22.0 lbs/hr. Lead (Pb) emissions shall not exceed 0.04 lb/hr and 0.17 TPY (for all units controlled by the melt shop baghouse combined). See b)(2)b. below. Total hourly emissions of these pollutants from the Melt Shop baghouse shall not exceed the limits identified in section B.4 .
d.	OAC rules 3745-31-10 through 20 (PSD) OAC rules 3745-31-21 through 27 (Nonattainment NSR) SO_2 emissions exceeded the significant threshold for permit modification P0120585 and are subject to BACT and LAER.	The following limits apply to P043, P900, and P901 combined: Sulfur dioxide (SO_2) emissions shall not exceed 166.1 lbs/hr and 1.51 lbs/ton of steel produced. Total annual emissions of SO_2 from the Melt Shop baghouse shall not exceed the limit identified in section B.4..

	Applicable Rules/Requirements	Applicable Emissions Limitations/Control Measures
e.	OAC rules 3745-31-10 through 20 (PSD) CO emissions exceeded the significant threshold for permit modification P0120585 and are subject to BACT.	Carbon monoxide (CO) emissions shall not exceed 356.4 lbs/hr and 1364.20 tons per rolling 12-month period. See b)(2)d. below. Total hourly emissions of CO from the Melt Shop baghouse shall not exceed the limit identified in section B.4..
f.	OAC rule 3745-17-07(A)(1)	The stack opacity limitation specified by this rule is less stringent than the stack opacity limitation established pursuant to OAC rules 3745-31-10 through 20 per section B.4..
g.	OAC rule 3745-17-11(B)	The particulate emission limitation specified by this rule is less stringent than the particulate emission limitation established pursuant to OAC rules 3745-31-10 through 20 per b)(1)d.
h.	OAC rule 3745-18-06(E)(1)	The sulfur dioxide emission limitation specified by this rule is less stringent than the sulfur dioxide emission limitation established pursuant to OAC rules 3745-31-21 through 27 per b)(1)e..
i.	OAC rule 3745-21-11(B)	The VOC RACT determination in accordance with this rule is equivalent to the VOC RACT emission limit established pursuant to OAC rule 3745-31-05(D).
j.	OAC rule 3745-31-05(D) (federally enforceable requirements to comply with OAC rule 3745-21-11(B))	See Facility-Wide Terms and Conditions B.5 through B.7. above.
k.	NSPS 40 CFR Part 60, Subpart AAa	The particulate emission limitation specified by this rule is less stringent than the particulate emission limitation established pursuant to OAC rules 3745-31-10 through 20 per section B.4..

	Applicable Rules/Requirements	Applicable Emissions Limitations/Control Measures
		The opacity limitations specified by this rule are equivalent to the opacity limitations established pursuant to OAC rules 3745-31-10 through 20 per section B.4..
l.	40 CFR Part 63, Subpart YYYYY	The particulate emission limitation specified by this rule is less stringent than the particulate emission limitation established pursuant to OAC rules 3745-31-10 through 20 per section B.4.. The fugitive dust opacity limitation for the Melt Shop building specified by this rule is equivalent to the fugitive dust opacity limitation established pursuant to OAC rules 3745-31-10 through 20 per section B.4..
m.	40 CFR Part 63, Subpart A	Table 1 to Subpart YYYYY of 40 CFR Part 63 - Applicability of General Provisions to Subpart YYYYY.

(2) Additional Terms and Conditions

a. Mercury emissions shall be controlled by using the baghouse and by restricting the amount of mercury containing scrap used in the process. For purposes of this permit to install, "mercury containing scrap" is defined as #2 bundles or shredded (frag) scrap consisting in part of either automobile or white goods scrap obtained from a source where the readily accessible mercury containing devices have not been removed prior to crushing or shredding.

b. The permittee performed a Best Available Control Technology (BACT) review for NO_x, CO, PM/PM_{10}, lead, and VOC through PTI 13-04176 issued on 6/10/2004, with the exception of the $PM_{2.5}$ limit which is included in PTI #P0120585 as a BAT limit. The emissions limits based on the BACT requirements are listed under OAC rules 3745-31-10 through 20 in b)(1)d. above. The following determinations were made for this emissions unit:

PM - Use of a baghouse with an emission limit of 0.00069 gr/dscf of exhaust gases

PM_{10} - Use of a baghouse with an emission limit of 0.00052 gr/dscf of exhaust gases

$PM_{2.5}$ - Use of a baghouse with an emission limit of 0.00051 gr/dscf of exhaust gases

Lead -Use of a baghouse with an emission limit of 0.03 lb/hr

NO_x -Use of Direct Evacuation Control (DEC) system, low NO_x oxy-fuel burners and monitoring of specific process variables.

VOC -Use of Direct Evacuation Control (DEC) system

CO -Use of Direct Evacuation Control (DEC) system

The PM, PM_{10}, $PM_{2.5}$, and lead limits have been included and adjusted based on updated information from the permittee in their permit application. The adjusted limits in PTI #P0120585 supersede the limits established in PTI #13-04176.

c. The permittee performed a Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) review for SO_2 for permit modification P0120585 issued on 10/2/2017. The emissions limits based on the BACT/LAER requirements are listed under OAC rules 3745-31-10 through 20 in b)(1)e. above. The following determinations have been made for this emissions unit:

SO_2 –use of good operating practices per c)(9) below and compliance with the BACT/LAER emission limits in section B.4.b).

See section B.4.b) for BACT/LAER emission limits for SO_2.

d. The permittee performed a Best Available Control Technology (BACT) review for CO for permit modification P0120585 issued on 10/2/2017. The emissions limits based on the BACT requirements are listed under OAC rules 3745-31-10 through 20 in b)(1)f. above. The following determination has been made for this emissions unit:

CO – Use of Direct Evacuation Control (DEC) system with adjustable air gap and water-cooled elbow and duct with emission limit of 3.24 lbs CO/ton of steel.

e. The permittee shall employ the lowest achievable emission rate (LAER) measures for fugitive sulfur dioxide emissions escaping the melt shop building. Escaping visible fugitive dust emissions shall be used as the indicator for the existence of conditions that are also conducive to the escape of fugitive sulfur dioxide emissions, if present. The LAER measures shall be sufficient to minimize or eliminate visible emissions of fugitive dust from the door opening at the west end of the melt shop through which scrap cars enter and exit (“west end door” or “west end melt shop door”). The permittee shall operate the west end door when the EAF (P900) is in operation such that it remains closed to 6 feet above grade or less except when scrap cars are entering or exiting the melt shop. The presence of visible emissions of fugitive dust escaping the west end door is not a deviation of the LAER requirement provided the permittee complies with this additional term and condition and the operating restrictions, monitoring and recordkeeping, and reporting requirements set forth in, c)(8), d)(17) through d)(19), and e)(7) and e)(8) below.

c) Operational Restrictions

(1) The minimum inlet plenum pressure across the Melt Shop baghouse, when this emissions unit is operating, shall be maintained at or above 4.0 inches of water, based on 15-minute averages. This baghouse inlet plenum pressure shall be monitored and recorded at least every 15 seconds.

(2) The cleaning "set point"* for the baghouse shall be maintained at or below a maximum of 8.0 inches of water. Charter Steel may use a higher cleaning set point for the baghouse if subsequent particulate emission performance tests demonstrate compliance at the requested higher set point.

* The cleaning "set point" is an inlet plenum pressure reading across all of the baghouse compartments. The baghouse compartments are on a continuous automatic cleaning cycle rotation. Once the inlet plenum transmitter reading falls below the established cleaning "set point", then the cleaning cycle stops. In essence, sufficient cleaning has occurred once that cleaning "set point" has been reached. The cleaning cycle continues as long as the reading exceeds 8.0 inches. Once it goes below 8.0 inches, the cleaning cycle can stop. Typically, at least one of the 12 compartments on the baghouse is in a cleaning mode at any given time, so the cleaning cycle essentially remains on continuously. There are 300 bags in each compartment.

(3) The emissions from P900 shall be vented to the Melt Shop baghouse with the particulate and lead emissions being controlled by the melt shop baghouse.

(4) The maximum annual production rate for this emissions unit shall not exceed 842,100 tons of steel, based upon a rolling, 12-month summation of the tons of steel produced per month.

(5) The permittee shall operate this emissions unit in accordance with the Scrap Management Program (SMP) submitted to the Cleveland Division of Air Quality (Cleveland DAQ) to allow the minimal use of scrap charged in the EAF that contains mercury, lead, oils, plastics, and organic materials. The SMP shall be viewed as an operational restriction for the EAF. The SMP shall be updated as needed in conjunction with the Title V permit renewal process. Any future change to the SMP that would increase the amount of these compounds present in the scrap, or result in the emissions of an air contaminant not previously emitted, must be approved by the Cleveland DAQ.

The SMP shall include the following requirements that are potentially related to reducing VOC emissions during melting:

a. Scrap materials must be depleted to the extent practicable of undrained used oil filters, chlorinated plastics, and free organic liquids at the time of charging to the furnace.

b. Lead-containing components of scrap, such as batteries, battery cables, and wheel weights must be removed, to the extent practicable, prior to charging to the EAF.

c. No non-ferrous or non-conforming material (wood, plastics, concrete, bricks, copper, stainless steel, brass, bronze, or electric motors) per load.

d. No pressure vessels, cylinders, boxes crimped tubular or closed containers of any kind.

e. Turnings and borings within the scrap are to be free of scale, grinding dust, and excessive oxidation.

f. The maximum scrap bundle size that will be accepted is 2 feet be 2 feet by 4 feet.

The permittee shall inspect scrap material to ensure that the scrap material meets the above requirements and reject non-conforming scrap loads as needed in accordance with the SMP.

All grades of scrap shall be free of excessive dirt, oil, and grease. Heavily oiled scrap shall not be used. As part of the SMP, the permittee shall operate a radionuclide detector which will be used to inspect all incoming scrap material into the facility. Radioactive scrap material shall not be used at this facility. Any scrap material which is determined to be radioactive shall be disposed of in accordance with the Nuclear Regulatory Commission's (NRC) requirements.

(6) The following standards are requirements of the NSPS Subpart AAa and BACT. The application and enforcement of the NSPS standards are delegated to the Ohio EPA. The requirements of 40 CFR Part 60 are also federally enforceable. Visible emissions shall not exceed the following limits as a six-minute average:

a. 3 percent opacity from the baghouse exit; and,

b. 6 percent opacity from the melt shop

[Note: The melt shop opacity limit in b. above is more restrictive than the NSPS limit which only limits emissions due solely to the operation of an EAF(s) or AOD vessel(s). This limit in b. above is for visible emissions of fugitive dust from the entire melt shop building.]

(7) The permittee shall comply with the applicable restrictions required under 40 CFR Part 63, Subpart YYYYY, including the following sections:

63.10685 (a)(1)	Pollution prevention plan for metallic scrap
63.10685 (a)(2)	Restricted metallic scrap
63.10685 (b)	Mercury requirements

(8) When the EAF (P900) is in operation, the permittee shall restrict the periods of time during which the door at the west end of the melt shop is open more than 6 feet above grade to the shortest period of time practicable (both in duration and frequency) to allow scrap cars to enter or exit the melt shop, including the following:

a. If the west end melt shop door remains open more than 6 feet above grade for more than five minutes while the EAF is in operation, then an automated alarm notification shall be sent to the melt shop operators. The permittee shall take prompt action to have the west end door closed to 6 feet above grade or less.

b. In the event the west end melt shop door becomes inoperable or is obstructed such that it is stuck open more than 6 feet above grade and cannot be closed, the permittee shall comply with the malfunction provisions of OAC rule 3745-15-06, as well as the following:

i. If the west end door remains open more than 6 feet above grade for one hour or more, during normal business hours, the permittee shall notify within one hour the Ohio EPA, DAPC, Central Office SIP Manager via email and the Cleveland Division of Air Quality Enforcement Chief via the malfunction hotline. During periods other than normal business hours, the foregoing notifications may be made the next business day.

ii. The permittee shall perform visible emission checks once per heat (during melting or refining) for a minimum of five minutes in duration. If visible fugitive dust emissions are escaping through the west end door, and the door is unable to be closed to 6 feet above grade or less, the permittee shall implement corrective action(s) to eliminate or minimize the fugitive dust emissions in accordance with the permittee's malfunction abatement plan. The plan shall include provisions for the cessation of sulfur addition at the EAF as soon as practicable consistent with the orderly transition away from the production of high-sulfur grades of steel, unless the Director of Ohio EPA has approved the addition of sulfur while the west end door is inoperable.

(9) Melt Shop Sulfur-based Good Operating Practices:

The permittee shall follow the melt shop's standard operating procedures as it relates to achieving each heat's final elemental chemistry specification for sulfur content. This includes any procedures for adjusting the sulfur content in the EAF, LMF and/or VTD.

d) Monitoring and/or Recordkeeping Requirements

(1) The following are requirements of the NSPS Subpart AAa. Observations of the opacity of the visible emissions from the Melt Shop baghouse shall be performed by a certified visible emission observer as follows:

a. Visible emission observations shall be conducted at least once per day of operation. The observations shall occur when the furnace is operating in the charging, melting, tapping or refining period. These observations shall be taken in accordance with Method 9 of 40 CFR Part 60, Appendix A and, for at least three 6-minute periods, the opacity shall be recorded for point(s) where the greatest opacity visible emissions are observed, and that portion of the plume where the condensed water phase is not present in accordance with the procedures listed in Method 9 of 40 CFR Part 60, Appendix A. Where it is possible to determine that a number of visible emission sites relate to only one incident of the visible emission, only one set of three 6-minute observations will be required. In this case, Method 9 observations must be made for the site of highest opacity that directly relates to the cause (or location) of visible emissions observed during a single incident. Records shall be maintained of all shop opacity observations for visible particulate emissions.

The appropriate records shall be maintained in the permittee's files to identify the persons responsible for conducting the opacity readings and to verify that the Method 9 certifications are up to date for the responsible individuals.

(2) In accordance with NSPS Subpart AAa, the permittee shall comply with either a. or b. below:

a. Visible emission observations shall be conducted by a certified visible emission observer at least once per day when the furnace is operating in the meltdown or refining period. Shop opacity shall be determined as the arithmetic average of 24 consecutive 15-second opacity observations of emissions from the shop taken in accordance with Method 9. Where it is possible to determine that a number of visible emission sites relate to only one incident of the visible emissions, only one observation of shop opacity will be required. In this case, the shop opacity observations must be made for the site of highest opacity that directly relates to the cause (or location) of visible emissions observed during a single incident. The owner or operator shall maintain records of all shop observations made in accordance with the above requirements. The appropriate records shall be maintained in the permittee's files to identify the persons responsible for conducting the opacity readings and to verify that the Method 9 certifications are up to date for the responsible individuals; or

b. The permittee shall calibrate and maintain a monitoring device that allows the pressure in the free space inside the EAF to be monitored. The monitoring device may be installed in any appropriate location in the EAF or DEC duct prior to the introduction of ambient air such that reproducible results will be obtained. The pressure monitoring device shall have an accuracy of plus or minus 5 mm of water gauge over its normal operating range and shall be calibrated according to the manufacturer's instructions. The maximum pressure determined during the most recent compliance demonstration shall not be exceeded by the 15-minute integrated average furnace pressure when the EAF is operating in a "meltdown and refining period," as defined in 40 CFR 60.271a. Operation at higher pressures may be considered by the Ohio EPA, Division of Air Pollution Control (DAPC) to be unacceptable operation and maintenance of the control system. The permittee may petition the Ohio EPA for reestablishment of the maximum pressure limit whenever the permittee can demonstrate to the Agency's satisfaction that EAF operating conditions upon which the pressures were previously established are no longer applicable.

The permittee shall check and record on a once-per-shift basis the furnace static pressure and either (1) check and record the control system fan motor amperes and damper positions on a once-per-shift basis; (2) install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate through each separately ducted hood; or (3) install, calibrate and maintain a monitoring device that continuously records the volumetric flow rate at the control device inlet and check and record damper positions on a once-per-shift basis. The monitoring device may be installed in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring devices shall have an accuracy of plus or minus 10 percent over their normal operating range and shall be calibrated according to the manufacturer's instructions. The Ohio EPA, DAPC may require the permittee to demonstrate the accuracy of the monitoring devices relative to Methods 1 and 2 of Appendix A of 40 CFR Part 60. The values or range of values of these parameters as determined during the most recent demonstration of compliance shall be maintained at the appropriate levels for each applicable period. For fan motor amperes, the range may be set at plus or minus 15%. A range may also be set for damper positions. Operation at other than baseline values or ranges of values will be considered by the Ohio EPA, DAPC to be unacceptable operation and maintenance of the control system. The permittee may petition the Ohio EPA for reestablishment of the values or ranges of values for these parameters whenever the permittee can demonstrate to the Agency's satisfaction that the operating conditions upon which the values or ranges of values were previously established are no longer applicable.

Per 40 CFR Part 60.274a(c), the applicable periods for fan motor amperes, all damper positions, and volumetric flow rates are all periods in which a hood is operated for the purpose of capturing emissions.

Per 40 CFR Part 60.274a(g), the applicable periods for the pressure in the free space inside the furnace are the meltdown and refining period(s).

(3) The permittee shall monitor the operation of the furnace control systems and maintain records in accordance with the following requirements:

a. The permittee shall perform and maintain records of the monthly operational status inspections of the equipment that is important to the performance of the total capture systems (i.e., pressure sensors, dampers, and damper switches). This inspection shall include observations of the physical appearance of the equipment (e.g., presence of holes in ductwork or hoods, flow constrictions caused by dents or accumulated dust in ductwork, and fan erosion.) Any deficiencies shall be recorded and proper maintenance performed. The permittee may petition the Ohio EPA, DAPC to approve any alternative to monthly operational status inspections that will provide a continuous record of the operation of each emission capture system; and,

b. Upon approval by the U.S. EPA, an alternative method may be established to replace the monitoring and recordkeeping requirements found in (2)b., and (3)a. above.

(4) The permittee shall maintain monthly production records for this emissions unit. These records, at a minimum, shall contain the following information:

a. the number of hours this emissions unit was in operation; and

b. the tons of steel produced.

(5) The permittee shall maintain monthly records of the tons of steel produced during each calendar month and the rolling, 12-month summation of the steel produced.

(6) The permittee shall maintain monthly production records for the melt shop for each different category (i.e., low-sulfur grades, mid-sulfur grades, and high-sulfur grades) of steel produced. These records, at a minimum, shall contain the following information:

a. the tons of steel produced during the low-sulfur grade production;

b. the tons of steel produced during the mid-sulfur grade production; and

c. the tons of steel produced during the high-sulfur grade production.

(7) The permittee shall maintain monthly records for the melt shop of the tons of steel produced for each different category (i.e., low-sulfur grades, mid-sulfur grades, and high-sulfur grades) for each calendar month, and the rolling, 12-month summation of the steel produced for each different category.

(8) The permittee shall properly operate and maintain a continuous parameter monitoring system (CPMS) to measure the inlet plenum pressure across the Melt Shop baghouse while the emissions unit is in operation. The permittee shall record the inlet plenum pressure across the

melt shop baghouse at least every 15-seconds and monitor the 15-minute average inlet plenum pressure using the CPMS.

(9) If the minimum average inlet plenum pressure is less than 4.0 inches of water, an automated notification (email or text message) shall be sent to the Melt Shop operator and environmental engineer.

(10) If the cleaning set point for the baghouse deviates from 8.0 inches of water, or a cleaning set point established by subsequent performance testing, an automated notification (email or text message) shall be sent to the Melt Shop operator and environmental engineer.

(11) The CPMS shall be calibrated, operated, and maintained as follows:

a. Locate the pressure sensor in or as close as possible to a position that provides a representative measurement of the inlet plenum pressure and that minimizes or eliminates pulsating pressure, vibration, and internal and external corrosion;

b. Verify that the cleaning cycle is operating as designed daily (baghouse compartments are in cleaning mode if the inlet plenum pressure is above the cleaning setpoint);

c. Use a gauge with a minimum measurement sensitivity of 0.5 inch of water or a transducer with a minimum measurement sensitivity of 1 percent of the pressure range;

d. Using a manometer, check, and record gauge calibration quarterly and transducer calibration monthly; and

e. Conduct calibration checks any time the sensor exceeds the manufacturer's specified maximum operating pressure range, or immediately install a new pressure sensor.

(12) The permittee shall operate each CPMS as follows:

a. Each CPMS must complete a minimum of one cycle of operation for each successive 1-minute period;

b. The permittee must have a minimum of three of the required four data points to constitute a valid minute of detail;

c. Each CPMS must have valid data for 100 percent of every averaging period; and

d. Each CPMS must determine and record the 15-minute average of all recorded readings.

(13) The permittee shall obtain an analysis of the Melt Shop Baghouse dust on a monthly basis. At a minimum, the samples shall be analyzed for chromium, magnesium, manganese, lead, zinc, and mercury content. The results shall be reported in weight percent. This analysis shall be conducted in accordance with U.S. EPA test methods and procedures.

(14) The permittee shall identify the types of scrap received as mercury containing scrap or other scrap (including scrap from which mercury containing devices have been removed). The permittee shall record the weight of mercury containing scrap, in pounds, the weight of other scrap, in pounds, and the charge identification number, for each furnace charge. The permittee shall determine and record the percent by weight of mercury containing scrap charged to the EAF, on a daily basis.

(15) The permittee shall comply with the applicable record keeping requirements under 40 CFR Part 63, Subpart YYYYY, including the following sections:

63. 10685 (c)	Pollution prevention plan for metallic scrap Restricted metallic scrap Mercury requirements

(16) The permittee shall operate and maintain sensors at the west end melt shop door that alert the melt shop operators as to when the door is open more than 6 feet above grade for more than five minutes.

(17) The permittee shall operate and maintain a system that electronically records the period of time (date, start time and end time) whenever the west end melt shop door remains open more than 6 feet above grade while the EAF is in operation.

(18) The permittee shall maintain daily records of the following information when the door at the west end of the melt shop remains open more than 6 feet above grade for more than five minutes while the EAF is operating:

a. If visible emissions of fugitive dust are escaping through the west end door, the date and time of the visual emissions checks required in accordance with c)(8)b.ii., the corrective action(s) taken to eliminate or minimize the fugitive dust emissions, and the dates such action(s) were implemented; and

b. If the permittee did not implement any necessary corrective action(s) to eliminate or minimize the fugitive dust emissions, the permittee shall note the reason why such corrective actions were not implemented.

(19) The permittee shall maintain records demonstrating conformance with the standard operating procedures as it relates to achieving the final elemental chemistry specification for sulfur content (e.g., “consumption heat report“ and “QC report”) for a minimum of 3 years and shall make them available for inspection, if requested.

e) Reporting Requirements

(1) The permittee shall submit quarterly written deviation (excursion) reports to the Cleveland Division of Air Quality (Cleveland DAQ) of all exceedances of the opacity restrictions for the Melt Shop baghouse from b)(2)a.. For the purposes of these reports, exceedances are defined as all 6-minute periods during which the average opacity exceeds these limits.

(2) The permittee shall submit quarterly written deviation (excursion) reports to the Cleveland DAQ that identify all exceedances of the static pressure values in the EAF established in d)(2)b. above and either operation of control system fan motor amperes at values exceeding plus or minus 15 percent of the values established under d)(2)b. above or operation at flow rates lower than those established under d)(2)b. above.

(3) The permittee shall submit quarterly written deviation (excursion) reports to the Cleveland DAQ that identify all periods of time during which the inlet plenum pressure for the Melt Shop Baghouse did not comply with the minimum inlet plenum pressure reading specified in c)(1).

(4) The permittee shall submit deviation (excursion) reports to the Cleveland DAQ which identify all exceedances of the rolling, 12-month steel production rate limitation. Each report shall be submitted to the Cleveland DAQ within 30 days after the deviation occurs.

(5) If the results of monitoring or record keeping data indicate that the particulate emission limitations may have been exceeded, the permittee shall submit the results of that data, and document any corrective action taken to restore operation of the emissions unit, or its control equipment to its normal or usual manner of operation as expeditiously as practicable in accordance with good air pollution control practices for minimizing emissions. The reports shall be submitted in accordance with the Standard Terms and Conditions of this permit.

(6) The permittee shall comply with the applicable reporting requirements under 40 CFR Part 63, Subpart YYYYY, including the following sections:

63. 10685 (c)	Pollution prevention plan for metallic scrap Restricted metallic scrap Mercury requirements

(7) The permittee shall submit quarterly deviation reports that identify all periods of time when a visible emissions inspection was required for the west end melt shop door but not conducted, and when a corrective action was determined to be necessary but was not implemented in accordance with d)(19).

(8) The permittee shall submit quarterly reports that identify:

a. all periods of time when the west end melt shop door was open more than 6 feet above grade for more than five minutes while the EAF was operating due to an inoperable door or obstruction that prevented the door from being closed;

b. all periods of time when the west end melt shop door remained open more than 6 feet above grade for more than five minutes for any other reason while the EAF was operating, but was not closed to 6 feet above grade or less within 10 minutes after it was opened; and

c. all periods of time when visible emissions of fugitive dust were observed escaping through the west end door during the checks required in accordance with c)(8)b.ii..

(9) Unless other arrangements have been approved by the Director, all notifications and reports shall be submitted through the Ohio EPA's eBusiness Center: Air Services online web portal.

f) Testing Requirements

(1) Compliance with the Emissions Limitations and/or Control Requirements specified in b) of these terms and conditions shall be determined in accordance with the following methods:

a. <u>Emission Limitations:</u>

PM (filterable) emissions shall not exceed 1.57 tons/month averaged over a 12-month rolling period (total for melt shop baghouse).

PM_{10} (filterable) emissions shall not exceed 1.19 tons/month averaged over a 12-month rolling period (total for melt shop baghouse).

$PM_{2.5}$ (filterable) emissions shall not exceed 1.16 tons/month averaged over a 12-month rolling period (total for melt shop baghouse).

Applicable Compliance Method:

Compliance with the ton/month average emission limitations shall be determined by multiplying the gr/dscf for each pollutant (0.00069 gr PM/dscf, 0.00052 gr PM_{10}/dscf, and 0.00051 gr $PM_{2.5}$/dscf) by the maximum airflow rate of the baghouse (728,459 dscfm), multiply by 60 minutes/hour, divide by 7000 gr/lb, multiply by 8760 hrs/yr, and divided by 2000 lbs/ton. Then divide by 12 months to determine the monthly average emission rate. Therefore, provided compliance is maintained with the gr/dscf limitations, then compliance shall also be determined for the ton/month average emission limitation.

b. Emission Limitation:

$PM/PM_{10}/PM_{2.5}$ (condensable) emissions shall not exceed 1.02 tons/month averaged over a 12-month rolling period, for P900.

Applicable Compliance Method:

Compliance with this ton/month average emission limitation shall be determined through the use of the controlled emission factor for the EAF steel processing (0.029 lb $PM/PM_{10}/PM_{2.5}$/ton steel) from AP-42 Table 12.5.1-2 which is multiplied by the actual annual steel process rate of the emissions unit (in tons/rolling 12 months) and dividing by the factor of (2,000 lbs/ton). Then divide by 12 months to determine the monthly average emission rate.

c. Emission Limitation:

Nitrogen oxide (NO_x) emissions shall not exceed 11.58 tons/month averaged over a 12-month rolling period, for P900.

Applicable Compliance Method:

Compliance with this ton/month average emission limitation shall be determined through the use of the emission factor for the EAF steel processing (0.33 lb NO_x/ton steel) which is multiplied by the actual annual steel process rate of the emissions unit (in tons/rolling 12 months) and dividing by the factor of (2,000 lbs/ton). Then divide by 12 months to determine the monthly average emission rate.

d. Emission Limitation:

Volatile organic compound (VOC) emissions shall not exceed 7.02 tons/month averaged over a 12-month rolling period, for P900.

Applicable Compliance Method:

Compliance with this ton/month average emission limitation shall be determined through the use of the emission factor for EAF steel processing (0.2 lb VOC/ton steel) which is multiplied by the actual annual steel process rate of the emissions unit (in tons/rolling 12-months) and dividing by the factor of (2,000 lbs/ton). Then divide by 12 months to determine the monthly average emission rate.

e. Emission Limitation:

PM emissions shall not exceed 13.05 lbs/hr (filterable, stack and fugitive combined), for P900.

PM_{10} emissions shall not exceed 9.91 lbs/hr (filterable, stack and fugitive combined), for P900.

Applicable Compliance Method:

Compliance shall be based upon the results of the emission testing specified in section B.4. The emission testing shall be performed in accordance with the requirements of 40 CFR Part 60 Subpart AAa and 40 CFR Part 63 Subpart YYYYY.

f. Emission Limitation:

NO_x emissions shall not exceed 36.30 lbs/hr, for P900.

Applicable Compliance Method:

Compliance with this emission limitation may be determined through the use of the emission factor for the EAF steel processing (0.33 lb NO_x/ton steel) which is multiplied by the maximum hourly steel process rate of the emissions unit (110 tons per hour).

g. Emission Limitation:

VOC emissions shall not exceed 22.0 lbs/hr, for P900.

Applicable Compliance Method:

Compliance with this emission limitation may be determined through the use of the emission factor for EAF steel processing (0.2 lb VOC/ton steel) which is multiplied by the maximum hourly steel process rate of the emissions unit (110 tons per hour).

Compliance with this emission limit shall be demonstrated through stack testing in accordance with the methods and procedures specified in section B.4.g) above.

h. Emission Limitation:

Lead (Pb) emissions shall not exceed 0.04 lb/hr for all emissions units controlled by the melt shop baghouse combined.

Applicable Compliance Method:

Compliance shall be based upon the results of the emission testing specified in section B.4.. The emission testing shall be performed in accordance with the requirements of 40 CFR Part 60 Subpart AAa and 40 CFR Part 63 Subpart YYYYY.

i. Emission Limitation:

Lead (Pb) emissions shall not exceed 0.17 ton/year for all emissions units controlled by the melt shop baghouse combined.

Applicable Compliance Method:

The permittee performed a mass balance analysis of the Melt Shop baghouse to determine the amount of lead emissions. The permittee has identified a maximum emission rate of 0.03 lb lead/hr that includes a 20% safety factor from the meltshop baghouse. Dividing this emission rate by 110 tons steel/hr results in a controlled emission factor of 0.0003 lb lead/ton steel. Compliance with this ton/year emission limitation shall be determined through the use of the emission factor for the EAF steel processing (0.0003 lb lead/ton steel) which is multiplied by the actual annual amount of steel produced (tons per rolling 12 months) and dividing by the factor of (2,000 lbs/ton). The fugitive portion of the lead emissions is calculated as 0.5 lb lead/ton steel processed multiplied by the actual annual steel process rate of the emissions unit (tons per rolling 12 months), multiplied by the fugitive portion factor (0.05%), and dividing by the factor of 2,000 lbs/ton). Add the stack and fugitive emission rate.

j. Emission Limitation:

SO_2 emissions shall not exceed 166.1 lbs/hr and 1.51 lbs/ton of steel produced, for P043, P900, and P901 combined.

Applicable Compliance Method:

Compliance with this emission limitation may be determined through the use of the emission factor for high-sulfur grade steel processing (1.51 lb SO_2/ton steel, worst case scenario) which is multiplied by the maximum hourly steel process rate of the melt shop (110 tons per hour).

After the stack testing is completed per Section B.4.g), the permittee shall use the SO_2 emission factor (lb SO_2/ton steel) that is determined from the most recent stack test that demonstrated compliance. This includes future stack testing that will be required by the permittee's Title V permit. The emission factor determined from the most recent stack test may be multiplied by the actual hourly steel process rate of the melt shop (in tons per hour) to demonstrate compliance with the allowable hourly SO_2 emission limit.

k. Emission Limitation:

CO emissions shall not exceed 356.4 lbs/hr, for P900.

Applicable Compliance Method:

Compliance with this emission limitation may be determined through the use of the emission factor for the EAF steel processing (18.0 lbs CO/ton steel) which is multiplied by the maximum hourly steel process rate of the emissions unit (110 tons per hour) and (1 - 0.82) which is the control efficiency for the DEC control system.

18 lbs CO/ton steel x (1 – 0.82) = 3.24 lbs CO/ton steel (BACT limit)

l. Emission Limitation:

CO emissions shall not exceed 1,364.20 tons per rolling 12-month period, for P900.

Applicable Compliance Method:

Compliance with this annual emission limitation shall be determined through the use of the emission factor for the EAF steel processing (18.0 lbs CO/ton steel) which is multiplied by the actual annual steel process rate of the emissions unit (in tons/rolling

12 months), (1 - 0.82) which is the control efficiency for the DEC control system and dividing by the factor of (2,000 lbs/ton).

m. Emission Limitation:

CO emissions shall not exceed 3.24 lbs CO/ton of steel, for P900.

Applicable Compliance Method:

If required, compliance shall be determined through stack testing using USEPA test methods 1 – 4 and 10 of 40 CFR Part 60, Appendix A.

(2) Emissions testing shall be conducted in accordance with section B.4.

g) Miscellaneous Requirements

(1) The following PTIs were previously issued for emissions unit P900:

PTI #13-04176 issued on 6/10/2004;

PTI admin mod #13-04176 issued on 2/12/2008;

PTI admin mod #P0107543 issued on 3/10/2011;

PTI admin mod #P0111766 issued on 12/28/2012; and

PTI Chapter 31 mod #P0120585 issued on 10/2/2017 supersedes the above PTIs for this emissions unit.

VOC-RACT Study

Charter Steel
Cuyahoga Heights, Ohio

July 2026 Version 5

Prepared For:

Charter Steel
Cuyahoga Heights, Ohio

Prepared By:

TRC
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Cincinnati, OH 45242

TABLE OF CONTENTS

APPENDICES

Executive Summary

A Reasonably Achievable Control Technology for emissions of volatile organic compounds (VOC-RACT) study was conducted per the requirements of OAC Rule 3745-21-11(B). The VOC-RACT study focused on the VOC emitting sources at Charter Steel's Cleveland Division location, primarily the Electric Arc Furnace (EAF).

Key findings of the VOC-RACT study include the following:

- The use of a "fourth hole" duct direct shell evacuation system (DEC) and scrap management plan were both proposed as BACT in the original permit application and continue to be in use.
- The use of add-on controls, primarily post combustion reaction chamber/thermal incineration, and CO oxidation catalysts and catalytic incineration are not feasible.
- The existing controls, DEC and scrap management plan, constitutes RACT for the EAF (Emission Unit P900). Charter Steel will continue the current operations considered RACT (OAC 3745021-11(B)(16)).

1.0 Project Introduction and Overview

1.1 Project Introduction

Charter Steel, a Division of Charter Manufacturing Co., Inc. (Charter Steel), is required to develop a VOC-RACT study per Ohio Administrative Code (OAC) 3745-21-11(B) at the Cleveland Division facility located in Cuyahoga Heights, Ohio as potential VOC emissions are greater than 50 TPY.

There are several sources with the potential of generating VOC emissions. These sources include:

- VTD boiler – B008
- Emergency generators – B016 and B017
- Bar mill reheat furnace – P029
- Tundish preheaters – P032 and P033
- Ladle preheaters – P035 – P038, and P048
- Cut-off torches – P041
- Cooling Towers – P046
- Electric arc furnace (EAF) – P900
- Ladle metallurgy furnace (LMF) – P901

1.2 Facility Identification Information

Owner / Operator:	Charter Manufacturing Company, Inc. 4300 East 49th Street Cuyahoga Heights, OH 44125 (216) 883-3800
Ohio EPA Facility ID:	1318171623
Owner / Operator Representative:	Michelle Hall Environmental Manager 4300 East 49th Street Cuyahoga Heights, OH 44125 (216) 533-6203
Responsible Official:	Cary Frame Director of Operations – OH Steel 4300 East 49th Street Cuyahoga Heights, OH 44125 FrameC@chartermfg.com
Standard Industrial Classification (SIC) Codes:	3312 & 3315
North American Industry Classification System (NAICS) Code:	331111 & 331222

1.3 Source Applicability

Charter Steel, a Division of Charter Manufacturing Co., Inc. (Charter Steel), operates a melt shop and supporting operations at their Cuyahoga Heights, Ohio facility. The melt shop has a melting capacity of 110 tons per hour (TPH) and a federally enforceable limit of 842,100 tons per year (TPY).

Cuyahoga County was designated as serious nonattainment for the 2015 8-Hour Ozone Standard in 2025. Correspondingly, the major source threshold for VOCs and NOx has decreased from 100 TPY to 50 TPY for sources in Cuyahoga County. Charter Steel is currently permitted under a Title V Permit because the facility is a significant source of VOCs. The Cleveland Department of Public Health Division of Air Quality (CDAQ) has requested Charter Steel to conduct a VOC RACT study in accordance with OAC rule 3745-21-11(B).

As control of small sources is inherently not economically feasible, Charter Steel will exclude any sources with potential to emit (PTE) under 5 TPY VOC from this study. Design, installation, and operation of any VOC control technology for these small sources would be prohibitively expensive. Additionally, RACT for these small combustion emissions units would be use of natural gas only. The following is a summary of each VOC emitting source's emissions and rational for inclusion in the VOC-RACT study.

Emissions Unit	PTE VOC Emissions (TPY)	VOC-RACT Study Analysis
VOD Boiler (B008)	0.50	VOC PTE < 5 TPY, NG-fired only
Emergency Generator (B016)	0.03	VOC PTE < 5 TPY, NG-fired only
Emergency Generator (B017)	0.02	VOC PTE < 5 TPY, NG-fired only
Bar Mill Reheat Furnace (P029)	2.89	VOC PTE < 5 TPY, NG-fired only
Tundish Preheaters (P032 – P034)	0.45	VOC PTE < 5 TPY, NG-fired only
Ladle Preheaters (P035 – P038, and P048)	0.40	VOC PTE < 5 TPY, NG-fired only
Cut-off Torches (P041)	0.17	VOC PTE < 5 TPY, NG-fired only
Cooling Towers (P046)	0.66	VOC PTE < 5 TPY
Electric Arc Furnace (P900)	84.21	VOC RACT Study Applicable
Ladle Metallurgy Furnace (P901)	0.84	VOC PTE < 5 TPY, NG-fired only

VOC PTE is from the application for Title V Permit P0137173. See Appendix B for detailed VOC PTE emissions calculations.

The <5 TPY PTE units (many less than 1 TPY) are not considered in this VOC-RACT study for the following reasons:

- B008 has a VOC PTE less than 1 TPY with the most recent 2025 actual emissions less than a third of the PTE so any add-on control would have the potential of reducing less VOC emissions than that for this natural-gas fired source and be considered economically infeasible.
- P032, P034, P035, P036, P037, P038, P048, and P041 all have VOC PTE less than 1 TPY, with the most recent 2025 actual emissions less than half of the PTE so any add-on control would have the potential of reducing less than that. Additionally, these units are fugitive sources located inside the meltshop with the only exhaust ventilation going to the meltshop baghouse with a high volume of airflow that would make add-on control economically infeasible for these natural gas-fired sources.
- P901 has a VOC PTE less than 1 TPY with the most recent 2025 actual emissions approximately sixty percent of the PTE so any add-on control would have the potential of reducing VOC emissions less than that. Similar to the small natural gas-fired units in the meltshop, P901 emissions are exhausted through the meltshop baghouse with the high volume of airflow that would make add-on control economically infeasible.
- B016 and B017 are emergency generators and are defined with a maximum operation of 500 hours per year resulting in VOC PTE of 0.03 TPY and 0.02 TPY, respectively. Add-on control for these natural gas-fired sources would have negligible reductions of VOC emissions and be considered economically infeasible.
- P029 has a VOC PTE less than 3 TPY with the most recent 2025 actual approximately sixty percent of the PTE so any add-on control would have the potential of reducing VOC emissions less than that. Add-on control for this natural gas-fired source would have minimal reductions of VOC emissions and be considered economically infeasible.
- P046 has a VOC PTE less than 1 TPY with the most recent 2025 actual emissions approximately a quarter of the PTE so any add-on control would have the potential of reducing less VOC emissions. The cooling tower consists of multiple vertical exhausting fans for maximum surface area to cool the meltshop cooling water; the small amount of VOC reduction from an add-on control and the additional ductwork to capture the multiple cooling fans for this source and be considered economically infeasible.

This VOC-RACT study will focus on the Electric Arc Furnace (P900) which represents 93% of the facility VOC emissions as shown above. A plot plan of the facility which depicts the general layout of the facility as well as the location of the electric arc furnace is included as **Appendix A**.

2.0 Electric Arc Furnace Information

As outlined earlier in this study, the electric arc furnace (EAF) (Emission Unit P900) is applicable to the VOC-RACT study requirements of OAC rule 3745-21-11(B).

The electric arc furnace (P900) melts steel scrap. Scrap metal, coke, and pebble lime are charged into the EAF. The EAF is powered by alternating current and requires three electrodes. The charging and melting cycles are conducted batchwise. The combination of the heat from the arc process and chemical energy from burners and charged carbon convert the recycled scrap steel charge into molten steel.

The capture system for exhaust gases from the furnace is made up of a “fourth hole” duct direct shell evacuation system (DEC) and a canopy hood system. The “fourth hole” refers to the extra opening placed in the EAF, which routes the exhaust gases directly from the furnace to the main duct system and from there into the baghouse collector. The roof exhaust system evacuates fumes from immediately above the furnace and from the closed roof canopy located over the EAF and directs them through a duct system from the roof, which couples with the DEC for cooling and then directs the mixed gases to the baghouse collector.

Permitting calculations utilize an overall capture efficiency of 99.95% for the EAF based on engineering judgement at the time. The Melt Shop is operated nearly under negative pressure due to the high volume of air flow (788,040 scfm) that is being pulled to the large baghouse. Although 100% capture could occur, it is not claimed for the Melt Shop due to several small building openings (west scrap door and misc. overhead doors for vehicle traffic). Under normal conditions, there are no visible particulate emissions escaping the building openings. Consequently, the assumption of the 99.95% capture is reasonable.

In addition, the capture involved with the VOC being emitted from the furnace directly through the fourth hole, versus the overall capture of the Melt Shop, should be noted. VOC is directly emitted from the furnace through the fourth hole and there is a two or three-inch gap to the duct work where the flame is present. Due to the high volume of air flow in the exhaust, there is no escape of fugitive emissions through that three-inch gap. So it is Charter’s belief that there is 100% capture of the VOC from the furnace to the VOC control (the flame in the gap). However, there is some fugitive escape through the furnace cover due to the openings for the three electrodes and before the furnace roof is completely in place. These fugitive emissions are captured by the building roof canopy and exhaust system and combine with the exhaust from the DEC before jointly entering the baghouse; VOCs from the furnace would be negligible when the furnace roof isn’t in place since there is no melting of scrap occurring at this stage. With the high draw from the baghouse, all exhaust from the furnace is routed through the DEC when the furnace roof is in place except for some negligible escape through the electrode openings.

Hot gases from the “fourth hole” mix with ambient air at a duct opening near the furnace to combust gases that may evolve during the heat. The hot gases are cooled by a section of water-cooled duct and diluted with exhaust gases collected by the canopy hood system before they are conveyed to the baghouse.

The emission factor used for VOC emission calculations during permitting and actual emissions reporting takes into account the combustion control at the DEC, and as confirmed during stack testing for VOCs from the meltshop baghouse stacks (most recently in August 2016, see Appendix D). The manufacturer of the EAF stated a control of CO for the DEC of 82% and it is reasonable at the elevated temperatures of the exhaust gas when the ambient air is mixed at the duct opening to assume a comparable VOC destruction efficiency (OAC 3745-21-11(B)(7)(g)), but no documentation is available as the use of the DEC is part of the EAF and exhaust system, but not considered a stand-alone air pollution control device. There are no references to specific or minimum VOC control efficiency percentages in references to the use of a DEC system in the RBLC.

2.1 Electric Arc Furnace Identification

The following is a summary of informational requirements as detailed in OAC rule 3745-21-11(B)(1), (B)(2), (B)(4), (B)(5), and (B)(7):

Permit Number:	PTI # P0120585 & Title V P0137173 issued 4/3/2025
Company Identification (Facility ID):	1318171623
Emissions Unit Identification Number:	P900
Source Description:	Melting of scrap steel in a 110 ton per hour EAF
Installation Date:	August 2003
Normal Operating Schedule:	24 hours/day 7 days/week 48 weeks/year
Annual Production Rates *(three calendar years preceding the effective date of the rule):*	2025: 609,060 tons 2024: 525,595 tons 2023: 608,395 tons
Average Daily Production Rates *(previous three calendar years preceding the effective date of the rule)*:	2025: 1,801 tons/day 2024: 1,793 tons/day 2023: 1,919 tons/day
Control Equipment	DEC, installed with EAF on 8/1/2003
Maximum Daily Production Rates (previous three calendar years preceding the effective date of the rule):	2025: 3,219 tons/day 2024: 2,825 tons/day 2023: 2,953 tons/day
Average Daily VOC Emissions (highest of previous three calendar years preceding the effective date of the rule or any other year that may be representative of the highest average daily emissions):	2023: 383.80 lbs VOC/day

Maximum Daily VOC Emissions (highest of previous three calendar years preceding the effective date of the rule or any other year that may be more representative of the highest maximum daily emissions):	2025: 643.80 lbs VOC/day
Annual Maximum VOC emissions (highest of previous three calendar years preceding the effective date of the rule or any year period that may be more representative of the annual production rate):	2025: 60.91 tons VOC/year

See Appendix C for detailed VOC emissions calculations for the values shown in this table.

There is no existing add-on VOC control equipment on the unit other than the current DEC. VOC emission source testing was performed on P900 in August 2016, and a copy of the stack test report summary is included in Appendix D.

Best Available Control Technology (BACT) for VOC was originally defined for the EAF in PTI 13-04176 issued on June 10, 2004 as the use of a DEC system and VOC emission limit of 22.0 lb/hr. The review of the RBLC (see Section 3.4) identifies the same BACT items for and EAF as were present during the original BACT determination in 2004 and are deemed to be current. The VOC BACT limits established in PTI 13-04176 remained unchanged in the Chapter 31 modification PTI P0120585 issued on October 2, 2017. BACT is considered more stringent than RACT. There are no CTG regulations or categorical non-CTG RACT contained in chapter OAC 3745-21 that are applicable to the EAF which could be considered more stringent RACT from the BACT determination.

3.0 Electric Arc Furnace Control Measures Technical Feasibility Review and Analysis

This section describes the basic mechanisms for the formation of volatile organic compounds (VOC), and in accordance with the requirements of OAC Rule 3745-21-11(B), a set of control measures were evaluated for technical feasibility.

3.1 VOCs Overview

VOC emissions from the EAF are primarily due to presence of scrap steel contaminants. The environment inside the EAF is intentionally maintained as a reducing environment to avoid formation of FeO and the loss of high-cost alloys such as chromium, manganese, and nickel. The materials charged into the furnace may contain combustible materials such as oil, grease, plastic and paints, which burn when exposed to the high temperatures during bore-in (the initial phase of scrap melting).

The composition of the VOC emissions from this combustion of scrap steel contaminants include aromatic compounds, alkenes, and alkanes, but are highly dependent on the degree of contamination with organic matter of the scrap (OAC 3745-21-11(B)(7)(d)).

The desired final product from P900 is molten steel for further processing and casting into billets. As VOC emissions from this operation are primarily from the presence of scrap steel contaminants combusted during melting, no alternative operations that result in melting scrap steel would be considered technically feasible as a modification or replacement of the EAF; there are no alternate operations that produce molten steel which do not involve melting scrap steel (OAC 3745-21-11(B)(11)).

Hot exhaust gases containing the VOC emissions are released from the furnace's "fourth hole." These gases mix with ambient air at prescribed duct openings near the furnace to induce air into the duct and combust VOC generated during the heat. After this initial combustion, the hot gases are cooled by a section of water-cooled duct and conveyed to the baghouse for particulate control. Additional discussion of the EAF operation and the impact of those operations are presented below in conjunction with the VOC emission control technology discussion.

Coating materials and clean-up solvents are not used as part of the EAF process or elsewhere at the Charter Steel facility (OAC 3745-21-11(B)(7)(e) and (f)).

3.2 Applicable Emissions Standards

Emission Unit (EU) P900, the electric arc furnace, is currently incorporated into the facility's Title V permit. EU P900 is limited to 22.0 pounds per hour and 7.02 tons per month of VOC in accordance with OAC 3745-31-05 (PTI P0120585).

3.3 RACT/BACT/LAER Clearinghouse Review

A review of the United States Environmental Protection Agency's (USEPA) RACT/BACT/LAER Clearinghouse (RBLC), which contains determinations made around the country on acceptable control technology for various processes, shows no add on control equipment for controlling VOC emissions from emission units similar to the EAF at other facilities. VOC emissions from steel melt shops are highly dependent on the quality of the scrap melted and therefore it is difficult to compare emissions from different facilities. In most of the facilities, control of VOC emissions was proposed and implemented as oxidation (combustion) in the DEC exhaust duct and a scrap management program.

3.4 Identification of Available VOC Control Technologies or Techniques

Control of VOC emissions can be accomplished through implementation of a scrap management plan, process design and operating parameters, and through add-on emission control systems. A review of the RBLC found that add-on VOC emission control technologies have not been applied to any EAF installation or required by a permitting authority. Add-on VOC emission controls were evaluated as part of this RACT analysis through the requirement to assess technology transfer of controls used on other sources.

The following potential VOC control technology options presented in OAC Rule 3745-21-11(B)(8) are included in the BACT analysis:

- Post combustion reaction chamber/thermal incineration
- CO oxidation catalysts and catalytic incineration
- Scrap management plan
- DEC controls

The following VOC control technology options presented in OAC Rule 3745-21-11(B)(8) are considered technically infeasible without further review:

- Carbon adsorption
- Condenser
- Scrubber

The exhaust stream from the electric arc furnace can contain oils and other contaminants from the scrap steel. Carbon adsorption would not be appropriate due to fouling concerns and additional control equipment required. Similar reasons rule out a condenser. Use of a scrubber would not be appropriate because the VOC stream would likely emulsify the adsorption oil in the scrubber, complicating the control stream. Further, none of these control options are listed in the RBLC for EACs in the steel industry. These control options are therefore considered infeasible.

3.4.1 Post combustion reaction chamber/thermal incineration

The principle of thermal VOC destruction in post-combustion chambers is to raise the temperature of the EAF exhaust gases with auxiliary fuel firing to a sufficiently high temperature for a minimum time to facilitate oxidation. The combustion chamber configuration must provide effective mixing in the chamber with an acceptable residence time. This technology has no known application for an EAF in the U.S. The feasibility of these units to effectively reduce VOC emissions, without resulting in severe operational problems, is unknown.

The limitations to the application of thermal oxidation to control EAF VOC emissions are the particulate loading from the EAF causing frequent fouling and potentially severe maintenance and reliability problems for the burners due to the difficult duty if an oxidizer was installed prior to the baghouse; installation prior to the baghouse would also require a water quench and added utility demands (water and fan motor electrical) to cool the oxidized exhaust prior to particulate control in the baghouse to prevent the baghouse bags from igniting. In addition, due to the very low VOC concentration in the exhaust (approximately 5-10 ppmv), the amount of VOC generated by the natural gas combustion required to raise the over 700,000 scfm of exhaust flow to combustion temperature would offset any VOC reductions that could possibly be achieved, and generate excessive secondary pollutant emissions of NO_X and CO.

Utilizing the thermodynamic equation to determine the amount of BTU heat input required to heat the baghouse exhaust stream (788,040 scfm at an average of 161°F from the most recent VOC stack testing in 2016) to an oxidation temperature for CO (1,600°F) to generate VOC destruction greater than 90%, approximately 1,224 MMBTU/hr would be required. The average VOC concentration measured in the melt shop exhaust from the most recent VOC stack testing in 2016 was 3.85 ppm so it is not a VOC-heavy air stream that would generate a high BTU heat content in itself. Thermal oxidation from an afterburner would require approximately 1.2 MMCF/hr of natural gas combustion to achieve the BTUs required for VOC destruction at the high melt shop baghouse exhaust flow rate. At 8,760 operating hours per year, the emissions generated from 10,518 MMCF/yr of natural gas would generate an additional 28.9 tons of VOC (utilizing a factor of 5.5 lbs VOC/MMCF from USEPA's AP-42 Table 1.4-2), 262.95 tons of NOx (utilizing a factor of 50 lbs NOx/MMCF from USEPA's AP-42 Table 1.4-1 for low NOx burners), and 441.76 tons of CO (utilizing a factor of 84 lbs CO/MMCF from USEPA's AP-42 Table 1.4-1); NOx is also a contributor to ozone in the serious non-attainment area. With a 90% destruction of the actual 60.91 tons of VOC in 2025, 54.8 tons of VOC emissions would be reduced, but offset by the additional 28.92 tons of VOC generated from natural gas combustion resulting in a net reduction of approximately 26 tons of VOCs.

An afterburner with partial control, estimated 50% VOC destruction efficiency, could be achieved with a lower oxidation temperature around 500°F. Similar to the approach above for 90% VOC destruction, the lower oxidation temperature for 50% would still require additional BTU heat input to heat the baghouse exhaust stream from 161°F to 500°F, while reducing the overall tons of VOC destroyed at the lower destruction efficiency. To raise the baghouse exhaust stream to 500°F would require approximately 288.52 MMBTU/hr or 2,477.85 MMCF/yr at 8,760 operating hours per year. The emissions from 2,477.85 MMCF/yr of natural gas combustion would generate an additional 6.81 tons of VOC (utilizing a factor of 5.5 lbs VOC/MMCF from USEPA's AP-42 Table 1.4-2), 61.95 tons of NOx (utilizing a factor of 50 lbs NOx/MMCF from USEPA's AP-42 Table 1.4-1 for low NOx burners), and 104.07 tons of CO (utilizing a factor of 84 lbs CO/MMCF from USEPA's AP-42 Table 1.4-1); NOx is also a contributor to ozone in the serious non-attainment area. With a partial control of 50%

destruction, 30.46 actual tons of VOC emissions would be reduced, but offset by the additional 6.91 tons of VOC generated from natural gas combustion resulting in a net reduction of approximately 24 tons of VOCs.

With the wide temperature differential between the melt shop baghouse exhaust and temperatures required for VOC destruction, even partial oxidation would require significant natural gas combustion along with the generation of the associated VOC, NOx, and CO products of combustion emissions.

The DEC (see Section 3.4.4), with the fourth hole that allows combustion air to enter and provide oxygen, inherently acts as an afterburner by design on the EAF exhaust with CO oxidation driving post combustion control.

Based on the above discussions, the use of a post combustion chamber or other thermal oxidation device would not be conducive for post-baghouse control on the EAF due to the large amount of additional natural gas combustion along with the generation of the associated VOC, NOx, and CO products of combustion emissions; the control option would be considered technically feasible for application to an EAF and the following Section 3.4.1.1. discusses the cost effectiveness evaluation of a post-baghouse afterburner.

3.4.1.1 Cost effectiveness evaluation of a post-baghouse afterburner

As discussed in the preceding section, although not conducive for post-baghouse control on the EAF, an afterburner was identified as a technically feasible VOC control measure for the EAF. Charter Steel performed an economic feasibility evaluation on a post-baghouse afterburner and a summary of the economic evaluation is presented in the following table.

Cost Effectiveness of a Post-Baghouse Afterburner

Control Option	Total Capital Investment ($)	Total Annualized Cost ($/year)	Tons VOC Reduced (tons)	VOC Cost Effectiveness ($/Ton of VOC)
100,000 scfm unit (90% control)	*$3,040,575 (X 7)*	*$1,889,419 (x 7)*	--	--
88,040 scfm unit (90% control)	*$2,735,048*	*$1,694,535*	--	--
Total Post-Baghouse Afterburner Estimates (90% control)	$24,019,073	$14,920,468	60.91	$244,959
100,000 scfm unit (Partial 50% control)	*$3,037,553 (X 7)*	*$1,253,447 (X 7)*	--	--
88,040 scfm unit (Partial 50% control)	*$2,732,387*	*$1,134,626*	--	--
Total Post-Baghouse Afterburner Estimates (Partial 50% control)	$23,995,258	$9,908,755	30.46	$325,304

Total estimate is calculated by multiplying the 100,000 scfm unit costs by seven and adding in the 88,040 scfm unit cost. $/ton is calculated based off the total controlled VOC emissions from the 90% control or partial 50% control.

The VOC inlet concentration is very low and a high removal efficiency would be difficult to achieve. An efficiency of 90% was assumed for the afterburner for cost estimates. The VOC cost effectiveness is estimated at $197,169 per ton of VOC removal.

The cost-estimation was performed utilizing spreadsheets presented in the USEPA's Air Pollution Control Cost Manual for Thermal Oxidizers. The cost data was obtained from the Chemical Engineering Plant Cost Index (CEPCI) and cost was adjusted to 2025 dollars. Section 3, Chapter 2, part 2.5.1.1 indicates that regenerative thermal oxidizer costs included in the UESPA cost-estimation spreadsheet are limited to units with a maximum flow rate of 100,000 scfm as applications of this type of technology is rare at flow rates above 50,000 scfm. As the post-baghouse control would be required for 788,040 scfm, cost estimates using USEPAs cost-estimation spreadsheet were parsed into smaller segments (100,000 scfm maximum and 88,040 scfm) and added together (seven times the 100,000 scfm results for a total equivalent to a 700,000 scfm unit) to develop a total capital investment cost and total annualized costs. These total values were divided through by the controlled ton amounts for the VOC cost effectiveness values ($/ton of VOC removal) identified in the table.

Due to low VOC concentration in the gas streams, a minimum achievable VOC destruction efficiency of 90 percent was assumed. As a conservative basis, the highest actual emission rate in the past three years of 60.91 tons of VOC from the EAF was used, which does not consider the additional 28.9 tons of VOC from the combustion of natural gas in the afterburner necessary to increase the post-baghouse air volume to an oxidation temperature for CO (1,600°F) and to generate VOC destruction greater than 90%, as discussed in Section 3.4.1. For concentration purposes, all VOC was assumed to be propane.

The calculation methodologies used presented in Appendices E and F utilize the USEPA provided Incinerators and Oxidizers Calculation Spreadsheet, updated December 2024, as presented in the USEPA's Air Pollution Control Cost Manual which includes USEPA cost multiplier estimates for direct and indirect installation (actual Charter Steel operator/maintenance labor rates and natural gas fuel costs were utilized for the annualized operating cost estimates). This spreadsheet is intended to be used in combination with the Control Cost Manual and was utilized as a first cut to determine if the cost feasibility would be close enough to warrant contacting an afterburner vendor for a more site-specific quote. As the resulting cost per ton of removal was substantial, a vendor was not contacted to provide a site-specific equipment and installation cost. As detailed in the cost calculation spreadsheets included in Appendices E and F, and as discussed in Section 3.4.1, a large portion of the annualized cost is due to the natural gas fuel costs. As a conservative check, the USEPA estimated afterburner equipment cost was reduced by 50% which resulted in an estimated $393,881 per ton of VOC removal; still considered economically infeasible even with the significantly reduced equipment cost estimate.

Cost effectiveness from partial control was also reviewed. As a conservative basis, the highest actual emission rate in the past three years of 60.91 tons of VOC from the EAF was used, which does not consider the additional 6.81 tons of VOC from the combustion of natural gas in the afterburner necessary to increase the post-baghouse air volume to an 50% partial control of VOC (500°F) to generate partial VOC destruction of 50%, as discussed in Section 3.4.1. For concentration purposes, all VOC was assumed to be propane. For an afterburner with partial control, an estimate of 50% VOC destruction rather than the higher efficiency 90% control reduction estimated previously, the cost effectiveness estimates from the USEPA provided Incinerators and Oxidizers Calculation Spreadsheet resulted in an estimated $263,903 per ton of VOC removal as shown on the table earlier in this section. Similar to the 90% control scenario, as a conservative check, the USEPA estimated afterburner equipment cost was reduced by 50% which resulted in an estimated $179,236 per ton of VOC removal; still considered economically infeasible even with the significantly reduced equipment cost estimate.

For a detailed description of the oxidizer control technology and cost methodology, see Section 3.2, Chapter 2 (Incinerators and Oxidizers) of the Air Pollution Control Cost Manual (as updated in 2016). Appendices E and F include supporting calculations and cost-model printouts for the technology.

3.4.2 CO oxidation catalysts and catalytic incineration

Catalytic incinerators or oxidizers use a bed of catalyst that facilitates the overall combustion of combustible gases, including VOC. The catalyst increases the reaction rate and allows the chemical conversion at lower temperatures than a thermal incinerator and thus has lower auxiliary fuel requirements. There is no known application of a catalytic incineration or an oxidation catalyst to control VOC emissions from EAFs in the U.S.

The limitations to the application of catalytic oxidation to control EAF VOC emissions are - the particulate loading and trace metal emissions from the EAF causing poisoning, deactivation, and/or blinding of the catalyst, and potentially severe maintenance and reliability problems for the burners due to the difficult duty. Similar to the discussion above for thermal incineration, due to the very low VOC concentration in the exhaust (approximately 5-10 ppmv), the amount of VOC generated by the natural gas combustion required to raise the over 700,000 scfm of exhaust flow to combustion temperature would offset any VOC reductions that could possibly be achieved, and generate excessive secondary pollutant emissions of NO_X and CO.

Based on the above discussions, the use of catalytic oxidation is not considered technically feasible for application to an EAF and was precluded from further consideration in this RACT analysis.

3.4.3 Scrap management plan

The only viable and technically feasible options for controlling VOC emissions from an EAF is the combination of implementation of a scrap management plan to minimize the charge of excessively oily scrap and other combustible organic materials – plastics, other oils and greases, paints, etc., and use of the DEC with an adjustable air gap and water-cooled elbow and duct.

Charter is required to implement a scrap management to minimize the amount of mercury, lead, oils, plastics, and free organic liquids that is charged to the furnace per Title V Permit P0137173 Section 6.c)(5). The scrap management plan includes language to address, segregate, and minimize the amount of VOC contaminants in the scrap that could be charged to the furnace. The scrap management plan will serve to further reduce VOC emissions from the EAF.

Specifically, the scrap management plan identifies several restrictions of types of scrap that apply to all scrap steel purchased by Charter Steel in its EAF steelmaking process. Potentially related to reducing VOC emissions during melting, these scrap management plan restrictions include:

- Scrap materials must be depleted to the extent practicable of undrained used oil filters, chlorinated plastics, and free organic liquids at the time of charging to the furnace.
- Lead-containing components of scrap, such as batteries, battery cables, and wheel weights must be removed, to the extent practicable, prior to charging to the EAF.
- No non-ferrous or non-conforming material (wood, plastics, concrete, bricks, copper, stainless steel, brass, bronze, or electric motors) per load.
- No pressure vessels, cylinders, boxes crimped tubular or closed containers of any kind.
- Turnings and borings within the scrap are to be free of scale, grinding dust, and excessive oxidation.
- The maximum scrap bundle size that will be accepted is 2 feet be 2 feet by 4 feet.

All scrap material is to be loaded into dump trucks or loaded on rail car for crane removal by magnet to facilitate the inspection/verification requirements of the scrap management plan. If, during inspection of scrap pursuant to the scrap management plan determines that a scrap provider has not met Charter required specifications, corrective actions implemented by Charter Steel include rejecting nonconforming scrap loads unless contaminants causing the failure can be removed or segregated to the extent practicable, requiring scrap providers to sign a statement of acknowledgement of scrap specification requirements or provide comparable certification, or ultimately suspending scrap supplier vendors from providing scrap until the vendor can demonstrate that it has cured the defect that caused the failure to meet Charter Steel specifications.

3.4.4 DEC controls

A DEC system consists of a water-cooled duct connected to the EAF through the furnace roof's fourth hole. This duct is connected to the EAF baghouse. During charge melting and refining, a slight negative pressure is maintained in the furnace to withdraw exhaust gases out through the fourth hole and into the DEC duct. At the point where the DEC duct meets the fourth hole, an adjustable gap allows combustion air to enter, providing oxygen to oxidize the VOC and other combustible gases, such as hydrogen and CO, inherently acting as an afterburner by design on the EAF exhaust.

The approach of employing add-on VOC controls is technically infeasible for application to EAFs.

4.0 Summary/Conclusions

The VOC – RACT study examined all the potentially applicable technologies to reduce VOC emissions from the electric arc furnace. The study considered the following technologies:

- Post combustion reaction chamber/thermal incineration
- CO oxidation catalysts and catalytic incineration
- Scrap management plan
- DEC system

The technologies not eliminated on technical feasibility grounds, energy impact, and economic feasibility are the scrap management plan and DEC.

Charter is proposing implementation of an Ohio EPA-approved scrap management plan and DEC system with adjustable air gap and water-cooled elbow and duct allowing for efficient post-furnace VOC combustion as the only viable and technically feasible option as RACT for VOC emissions from the EAF. The proposed RACT is consistent with what is currently practiced in the steel industry and with prior USEPA analysis of VOC controls on EAF sources. Charter proposes a numeric emission limit of 22.0 lb VOC/hr based on BAT in Title V Permit P0137173. This emission limit will be achieved via the use of DEC controls and operational practices, including the implementation of the current scrap management plan. Charter Steel will continue the current operations considered RACT immediately (OAC 3745021-11(B)(16)).

Appendix A
Facility Plot Plan

LEGEND

PROPERTY BOUNDARY
(APPROXIMATE LOCATION)

N

0 400' 800'
APPROXIMATE SCALE IN FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108
Phone: 734.971.7080
www.trccompanies.com

PROJECT:	CHARTER STEEL CLEVELAND 4300 EAST 49TH STREET CLEVELAND, OHIO 44125
TITLE:	FACILITY PLOT PLAN AND GENERAL LAYOUT

DRAWN BY:	K STARK
CHECKED BY:	M BLANKESTYN
APPROVED BY:	M BLANKESTYN
DATE:	MARCH 2026
PROJ. NO.:	692928
FILE:	692928 Charter Steel Figs.dwg

FIGURE 1

11x17 --- USER: KStark --- ATTACHED XREF'S: --- ATTACHED IMAGES:
DRAWING NAME: B:_TRC\Charter Steel\692928\0001\692928 Charter Steel Figs.dwg --- PLOT DATE: March 13, 2026 - 3:16PM --- LAYOUT: Fig 1
Version: 2017-10-21

Appendix B
Detailed VOC Emissions Calculations for Section 1.3

B008

Potential Usage
842,100 Total Tons/Year

Potential Usage
180.19 MMCF/Year

Flow Diagram Designation
VTD Boiler

Maximum Capacity
100.00 Total Tons/Hour

Maximum Capacity
0.028 MMCF/Hour

Process Description:
Charter Steel - Cuyahoga Heights, OH
VTD Boiler

Facility Process Name:	Criteria Pollutants													GHG Pollutants		
VTD Boiler																
Emission Factor Basis:	PM (filt)	PM (cond)	SO2	NOx	VOC	CO	Lead	OC	Ammonia	PM10 (filt)	PM10 (cond)	PM2.5 (filt)	PM2.5 (cond)	CO2	CH4	N2O
lb/MMCF																
Emission Factors: Combustion EF's (lb/MMCF	1.90	5.70	0.60	100.00	5.50	84.00	0.0005	11.0	3.2	1.90	5.70	1.90	5.70	120,019	2.26	0.23
Process EF's (lb/MMCF)																
(source)	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 2	Note 2	Note 2
Capture Efficiency	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Control Efficiency																
Building Capt. Eff																
Stack Emission Rate:																
Hourly (lb/hr)	0.05	0.16	0.02	2.80	0.15	2.35	0.00	0.31	0.09	0.05	0.16	0.05	0.16	3,361	0.06	0.01
Annual (TPY)	**0.17**	**0.51**	**0.05**	**9.01**	**0.50**	**7.57**	**0.00**	**0.99**	**0.29**	**0.17**	**0.51**	**0.17**	**0.51**	**10,813**	**0.20**	**0.02**
Fugitive Emission Rate:																
Hourly (lb/hr)																
Annual (TPY)																

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: AP-42, Tables 1.4-1, 1.4-2, 1.4-3 & 1.4-4 and FIRE, version 6.25, SCC 1-02-006-03.
Note 2: CO2, N2O and CH4 emission factors from the GHG Reporting Rule, Part 98, Subpart C, Tables C-1 and C-2, updated 11/2013.

Comment: Annual natural gas usage based on 0.178 MCF/ton with a 20% safety factor.
Natural gas usage ratio is a conservative estimate; as tonnage increases, natural gas usage decreases

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(capture efficiency/100)x(1-control efficiency/100)
PM/PM10 fugitive emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(1-capture efficiency/100)x(1-building capture/100)x(1ton/2000 lbs)

B016

Process Identification

Emergency Generator

Process Description:

Charter Steel - Cuyahoga Heights, OH

OPERATION / PRODUCTION RELATED INFORMATION

Parameter	*value*	*units*	*Reference*
Engine rating - maximum	375	hp	Design capacity
Natural Gas heat content	1,020	Btu/cu ft	Nominal industry standard
Max. heat input	0.96	MMBtu/hr	calculated value
Annual operating hours	500	hrs/yr	Ohio EPA PBR limit
Total heat input	478	MMBtu/yr	based on PTE limit of 500 hrs/yr

EMISSION RELATED INFORMATION AND CALCULATION METHODOLOGY

Emissions based on AP-42, Sections 3.3 and 3.4 (10/96) emission factors.

Pollutant	*value*	*units*	*Reference*
PM (assumes 100 pct. PM_{10}/$PM_{2.5}$)	7.71E-05	lb/MMBtu	Section 3.2, Table 3.2-2
SO_2	5.88E-04	lb/MMBtu	Section 3.2, Table 3.2-2
NO_X	4.080	lb/MMBtu	Section 3.2, Table 3.2-2
CO	3.17E-01	lb/MMBtu	Section 3.2, Table 3.2-2
VOC (assumes NMHC)	1.18E-01	lb/MMBtu	Section 3.2, Table 3.2-2
CO_2	147.335	lb/MMBtu	40 CFR Part 98, Subpart C, Table C-1
CH_4 (methane)	0.002	lb/MMBtu	40 CFR Part 98, Subpart C, Table C-2
N_2O	0.0002	lb/MMBtu	40 CFR Part 98, Subpart C, Table C-2

POTENTIAL EMISSION CALCULATIONS - natural gas combustion for 500 hours per year

	Potential emissions	
Pollutant	**lbs/hr**	**tpy**
PM_{10} (also equivalent to TSP and $PM_{2.5}$)	7.37E-05	1.84E-05
SO_2	5.62E-04	1.40E-04
NO_X	3.90	0.97
CO	0.30	0.08
VOC/OC	0.11	0.03
CO_2	140.76	35.19
CH_4	2.11E-03	5.3E-04
N_2O	2.11E-04	5.3E-05

B017

Process Identification

Emergency Generator

Process Description:

Charter Steel - Cuyahoga Heights, OH

OPERATION / PRODUCTION RELATED INFORMATION

Parameter	*value*	*units*	*Reference*
Engine rating - maximum	201	hp	Design capacity
Natural Gas heat content	1,020	Btu/cu ft	Nominal industry standard
Max. heat input	0.51	MMBtu/hr	calculated value
Annual operating hours	500	hrs/yr	Ohio EPA PBR limit
Total heat input	256	MMBtu/yr	based on PTE limit of 500 hrs/yr

EMISSION RELATED INFORMATION AND CALCULATION METHODOLOGY

Emissions based on AP-42, Sections 3.3 and 3.4 (10/96) emission factors.

Pollutant	*value*	*units*	*Reference*
PM (assumes 100 pct. $PM_{10}/PM_{2.5}$)	7.71E-05	lb/MMBtu	Section 3.2, Table 3.2-2
SO_2	5.88E-04	lb/MMBtu	Section 3.2, Table 3.2-2
NO_X	4.080	lb/MMBtu	Section 3.2, Table 3.2-2
CO	3.17E-01	lb/MMBtu	Section 3.2, Table 3.2-2
VOC (assumes NMHC)	1.18E-01	lb/MMBtu	Section 3.2, Table 3.2-2
CO_2	147.335	lb/MMBtu	40 CFR Part 98, Subpart C, Table C-1
CH_4 (methane)	0.002	lb/MMBtu	40 CFR Part 98, Subpart C, Table C-2
N_2O	0.0002	lb/MMBtu	40 CFR Part 98, Subpart C, Table C-2

POTENTIAL EMISSION CALCULATIONS - natural gas combustion for 500 hours per year

	Potential emissions	
Pollutant	**lbs/hr**	**tpy**
PM_{10} (also equivalent to TSP and $PM_{2.5}$)	3.95E-05	9.87E-06
SO_2	3.01E-04	7.52E-05
NO_X	2.09	0.52
CO	0.16	0.04
VOC/OC	0.06	0.02
CO_2	75.41	18.85
CH_4	1.13E-03	2.8E-04
N_2O	1.13E-04	2.8E-05

P029

Potential Usage
876,000 Total Tons/Year

Potential Usage
1,050.27 MMCF/Year
Note 4

Flow Diagram Designation
Bar Mill Reheat Furnace

Potential Usage
150.0 Tons/Hour

Maximum Capacity
0.162 MMCF/Hour

Process Description:
Charter Steel - Cuyahoga Heights, OH
Bar Mill Reheat Furnace

Facility Process Name:		Criteria Pollutants													GHG Pollutants		
	Bar Mill Reheat Furnace																
Emission Factor Basis:		**PM (filt)**	**PM (cond)**	**SO2**	**NOx**	**VOC**	**CO**	**Lead**	**OC**	**Ammonia**	**PM10 (filt)**	**PM10 (cond)**	**PM2.5 (filt)**	**PM2.5 (cond)**	**CO2**	**CH4**	**N2O**
Emission Factors:	Combustion EF's (lb/MMCF	1.90	5.70	0.60	112.20	5.50	84.00	0.0005	11.0	3.2	1.90	5.70	1.90	5.70	120,019	2.26	0.23
(source)		Note 1	Note 1	Note 1	Note 2	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 3	Note 3	Note 3
	Capture Efficiency	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Control Efficiency																
Stack Emission Rate:																	
	Hourly (lb/hr)	0.31	0.92	0.10	18.15	0.89	13.59	0.00	1.78	0.52	0.31	0.92	0.31	0.92	19,415	0.37	0.04
	Annual (TPY)	**1.00**	**2.99**	**0.32**	**58.92**	**2.89**	**44.11**	**0.00**	**5.78**	**1.68**	**1.00**	**2.99**	**1.00**	**2.99**	**63,026**	**1.19**	**0.12**

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: AP-42, Tables 1.4-1, 1.4-2, 1.4-3 & 1.4-4 and FIRE, version 6.25, SCC 1-02-006-03.
Note 2: Per stack test conducted on 3/9/2011 & 4/6/2011 for NOx RACT verification (0.11 lb NOx/MMBTU).
Note 3: CO2, N2O and CH4 emission factors from the GHG Reporting Rule, Part 98, Subpart C, Tables C-1 and C-2, updated 11/2013.
Note 4: Natural gas usage calculated using a MMCF/ton ratio developed from actual 2010 usage (highest MMCF/ton in past five years).
Natural gas usage ratio is a conservative estimate; as tonnage increases, natural gas usage decreases.

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)= (annual throughput)x(PM/PM10 Emissions factor)x(capture efficiency/100)x(1-control efficiency/100)

P032 - P034

Potential Usage
842,100 Total Tons/Year

Potential Usage
162.58 MMCF/Year

Flow Diagram Designation
Tundish Preheaters #1 - #3

Maximum Capacity
0.035 MMCF/Hour (3 total Tundish preheaters)

Process Description:
Charter Steel - Cuyahoga Heights, OH
Tundish Preheaters #1 - #3

Facility Process Name:			**Criteria Pollutants**													**GHG Pollutants**		
	Tundish Preheaters #1 - #3																	
Emission Factor Basis:			**PM (filt)**	**PM (cond)**	**SO2**	**NOx**	**VOC**	**CO**	**Lead**	**OC**	**Ammonia**	**PM10 (filt)**	**PM10 (cond)**	**PM2.5 (filt)**	**PM2.5 (cond)**	**CO2**	**CH4**	**N2O**
	lb/mmcf																	
Emission Factors:		Combustion EF's (lb/MMCF	1.90	5.70	0.60	100.00	5.50	84.00	0.0005	11.0	3.2	1.90	5.70	1.90	5.70	120,019	2.26	0.23
		Process EF's (lb/ton)																
(source)			Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 2	Note 2	Note 2
		Capture Efficiency	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95
		Control Efficiency																
		Building Capt. Eff																
Stack Emission Rate:																		
	Hourly (lb/hr)		0.07	0.20	0.02	3.53	0.19	2.96	0.00	0.39	0.11	0.07	0.20	0.07	0.20	4,234	0.08	0.01
	Annual (TPY)		**0.15**	**0.46**	**0.05**	**8.12**	**0.45**	**6.82**	**0.00**	**0.89**	**0.26**	**0.15**	**0.46**	**0.15**	**0.46**	**9,751**	**0.18**	**0.02**
Fugitive Emission Rate:																		
	Hourly (lb/hr)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	0.00	0.00
	Annual (TPY)		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5**	**0.00**	**0.00**

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: AP-42, Tables 1.4-1, 1.4-2, 1.4-3 & 1.4-4 and FIRE, version 6.25, SCC 1-02-006-03.
Note 2: CO2, N2O and CH4 emission factors from the GHG Reporting Rule, Part 98, Subpart C, Tables C-1 and C-2, updated 11/2013.

Comment: Annual natural gas usage based on 0.161 MCF/ton with a 20% safety factor.
Natural gas usage ratio is a conservative estimate; as tonnage increases, natural gas usage decreases

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(capture efficiency/100)x(1-control efficiency/100)*(1ton/2000lbs)
PM/PM10 fugitive emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(1-capture efficiency/100)x(1-building capture/100)x(1ton/2000 lbs)

P035 - P038, P048

Potential Usage
842,100 Total Tons/Year

Potential Usage
147.09 MMCF/Year

Flow Diagram Designation
Ladle Preheaters #1 - #5

Maximum Capacity
0.049 MMCF/Hour

Process Description:
Charter Steel - Cuyahoga Heights, OH
Ladle Preheaters #1 - #5

Facility Process Name:		Criteria Pollutants													GHG Pollutants		
Ladle Preheaters #1 - #5																	
Emission Factor Basis:		**PM (filt)**	**PM (cond)**	**SO2**	**NOx**	**VOC**	**CO**	**Lead**	**OC**	**Ammonia**	**PM10 (filt)**	**PM10 (cond)**	**PM2.5 (filt)**	**PM2.5 (cond)**	**CO2**	**CH4**	**N2O**
lb/mmcf																	
Emission Factors:	Combustion EF's (lb/MMCF	1.90	5.70	0.60	100.00	5.50	84.00	0.0005	11.0	3.2	1.90	5.70	1.90	5.70	120,019	2.26	0.23
	Process EF's (lb/ton)																
(source)		Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 2	Note 2	Note 2
	Capture Efficiency	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95
	Control Efficiency																
	Building Capt. Eff																
Stack Emission Rate:																	
	Hourly (lb/hr)	0.09	0.28	0.03	4.90	0.27	4.12	0.00	0.54	0.16	0.09	0.28	0.09	0.28	5,880	0.11	0.01
	Annual (TPY)	**0.14**	**0.42**	**0.04**	**7.35**	**0.40**	**6.17**	**0.00**	**0.81**	**0.24**	**0.14**	**0.42**	**0.14**	**0.42**	**8,823**	**0.17**	**0.02**
Fugitive Emission Rate:																	
	Hourly (lb/hr)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3	0.00	0.00
	Annual (TPY)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4**	**0.00**	**0.00**

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: AP-42, Tables 1.4-1, 1.4-2, 1.4-3 & 1.4-4 and FIRE, version 6.25, SCC 1-02-006-03.
Note 2: CO2, N2O and CH4 emission factors from the GHG Reporting Rule, Part 98, Subpart C, Tables C-1 and C-2, updated 11/2013.

Comment: Annual natural gas usage based on 0.146 MCF/ton with a 20% safety factor.
Natural gas usage ratio is a conservative estimate; as tonnage increases, natural gas usage decreases

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(capture efficiency/100)x(1-control efficiency/100)*(1ton/2000lbs)
PM/PM10 fugitive emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(1-capture efficiency/100)x(1-building capture/100)x(1ton/2000 lbs)

P041

Potential Usage
842,100 Total Tons/Year

Potential Usage
60.46 MMCF/Year

Flow Diagram Designation
Cut off Torches

Maximum Capacity
0.007 MMCF/Hour

Process Description:
Charter Steel - Cuyahoga Heights, OH
Cut off Torches

Facility Process Name:			Criteria Pollutants												GHG Pollutants		
	Cut off Torches																
Emission Factor Basis:			PM (filt)	PM (cond)	SO2	NOx	VOC	CO	Lead	OC	Ammonia	PM10 (filt)	PM10 (cond)	PM2.5 (filt)	PM2.5 (cond)	CO2	CH4	N2O
	lb/mmcf																
Emission Factors:		Combustion EF's (lb/MMCF	1.90	5.70	0.60	100.00	5.50	84.00	0.0005	11.0	3.2	1.90	5.70	1.90	5.70	120,019	2.26	0.23
		Process EF's (lb/ton)																
(source)			Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 2	Note 2	Note 2
		Capture Efficiency	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95
		Control Efficiency																
		Building Capt. Eff																
Stack Emission Rate:																		
	Hourly (lb/hr)		0.01	0.04	0.00	0.69	0.04	0.58	0.00	0.08	0.02	0.01	0.04	0.01	0.04	828	0.02	0.00
	Annual (TPY)		**0.06**	**0.17**	**0.02**	**3.02**	**0.17**	**2.54**	**0.00**	**0.33**	**0.10**	**0.06**	**0.17**	**0.06**	**0.17**	**3,626**	**0.07**	**0.01**
Fugitive Emission Rate:																		
	Hourly (lb/hr)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
	Annual (TPY)		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2**	**0.00**	**0.00**

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: AP-42, Tables 1.4-1, 1.4-2, 1.4-3 & 1.4-4 and FIRE, version 6.25, SCC 1-02-006-03.
Note 2: CO2, N2O and CH4 emission factors from the GHG Reporting Rule, Part 98, Subpart C, Tables C-1 and C-2, updated 11/2013.

Comment: Annual natural gas usage based on 0.096 MCF/ton with a 20% safety factor.
Natural gas usage ratio is a conservative estimate; as tonnage increases, natural gas usage decreases

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(capture efficiency/100)x(1-control efficiency/100)*(1ton/2000lbs)
PM/PM10 fugitive emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(1-capture efficiency/100)x(1-building capture/100)x(1ton/2000 lbs)

P046

Flow Diagram Designation
Cooling Towers

Process Description:
Charter Steel - Cuyahoga Heights, OH
Cooling Towers

TDS concentration
1,501.2 mg/L

OC concentration
150.1 mg/L

Drift Rate
454.2 liters/hr

Circulation Rate
25000 gal/min

Number of Concentration Cycles
3

3.785 liters= 1 gallon
1 lb =453592 mg

Facility Process Name:	**Criteria Pollutants**												
Cooling Towers													
Emission Factor Basis:	**PM (filt)**	**PM (cond)**	**SO2**	**NOx**	**VOC**	**CO**	**Lead**	**OC**	**Ammonia**	**PM10 (filt)**	**PM10 (cond)**	**PM2.5 (filt)**	**PM2.5 (cond)**
lb/hr													
Emission Factors: Combustion EF's (lb/MMCF)													
Process EF's (lb/hour)	1.503				0.15			0.150		1.503		1.503	
(source)		Note 2			Note 1			Note 1		Note 3	Note 2	Note 3	Note 2
Capture Efficiency	100.00	100.00			100.00			100.00		100.00	100.00	100.00	100.00
Control Efficiency													
Building Capt. Eff													
Stack Emission Rate:													
Hourly (lb/hr)	1.50				0.15			0.15		1.50		1.50	
Annual (TPY)	**6.58**				**0.66**			**0.66**		**6.58**		**6.58**	
Fugitive Emission Rate:													
Hourly (lb/hr)													
Annual (TPY)													

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: Assumes OC = VOC
Note 2: Assumes all particulate is filterable.
Note 3: PM10 / PM2.5 particulate distribution from USEPA's PMCalculator software.

Comment: The Cooling Towers are not considered an affected source for the modification (no changes to operation).

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)= PM/PM10 Emissions factor[lb/hour]*[Operating schedule [hrs/year]]
OC stack emissions(TPY)= OC Emissions factor[lb/hour]*[Operating schedule [hrs/year]]

PM/PM10 Emissions factor= Circulation Rate * # of Conc. Cycles * TDS * (1 lb/ 453, 592 mg)
OC Emissions factor= Circulation Rate * # of Conc. Cycles * OC * (1 lb/ 453, 592 mg)

P900

Potential Usage (High)	Potential Usage (Mid)	Potential Usage (Low)
91,000 Total Tons/Year (High)	383,000 Total Tons/Year (Mid)	368,100 Total Tons/Year (Low)

	TPY	% of Total
High	91,000	11%
Mid	383,000	45%
Low	368,100	44%

Flow Diagram Designation
EAF (normal and resulfurized)

Maximum Capacity (High)	Maximum Capacity (Mid)	Maximum Capacity (Low)
110.00 Total Tons/Hour (High)	110.00 Total Tons/Hour (Mid)	110.00 Total Tons/Hour (Low)

Process Description:
Charter Steel - Cuyahoga Heights, OH
EAF (normal and resulfurized)

"High" = Sulfur addition >= 0.1%.
"Mid" = Sulfur addition <0.1% and carbon injection >= 1,000.
"Low" = No sulfur addition and carbon injection <1,000.

Total Steel (Tons/Hour) 110.00
Total Steel (Tons/Year) 842,100

Facility Process Name:		Criteria Pollutants														GHG Pollutants
EAF (normal and resulfurized)				High	Mid	Low										
Emission Factor Basis:		PM (filt)	PM (cond)	SO2	SO2	SO2	NOx	VOC	CO	Lead	OC	Ammonia	PM10 (filt)	PM10 (cond)	PM2.5 (filt)	PM2.5 (cond)	CO2
lb/ton																
Emission Factors:																
	Process EF's (lb/ton)	11.30	0.029	1.51	0.75	0.40	0.33	0.20	18.00	0.5	0.20		8.59	0.029	8.36	0.029	358.542
(source)		Note 1	Note 4	Note 3	Note 3	Note 3	Note 3	Note 3	Note 1	Note 7	Note 2		Note 5	Note 4	Note 5	Note 4	Note 6
	Capture Efficiency	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95		99.95	99.95	99.95	99.95	99.95
	Control Efficiency	99.00							82.00	99.00			99.00		99.00		
	Building Capt. Eff																
Stack Emission Rate:																
	Hourly (lb/hr)	12.42	3.19	166.02	82.46	43.98	36.28	21.99	356.22		21.99		9.44	3.19	9.19	3.19	39,420
	Annual (TPY)	**47.55**	**12.20**	**68.67**	**143.55**	**73.58**	**138.88**	**84.17**	**1363.52**		**84.17**		**36.14**	**12.20**	**35.19**	**12.20**	**150,888**
Fugitive Emission Rate:																
	Hourly (lb/hr)	0.62	0.00	0.08	0.04	0.02	0.02	0.01	0.99	0.03	0.01		0.47	0.00	0.46	0.00	19.72
	Annual (TPY)	**2.38**	**0.01**	**0.03**	**0.07**	**0.04**	**0.07**	**0.04**	**3.79**	**0.11**	**0.04**		**1.81**	**0.01**	**1.76**	**0.01**	**75.48**

Potential Operating Schedule
24 Hours/Day
8,760 Hours/Year

Note 1: Factor from FIRE (ver 6.25) for SCC 3-03-009-04
Note 2: Assumes OC = VOC
Note 3: Developed from sulfur addition and carbon injection chemistries. SO2 hourly rate is the maximum of the three categories (only run one grade at a time).
Note 4: Condensible particulate factor from AP-42, Table 12.5.1-2 (baghouse controlled factor).
Note 5: PM10 / PM2.5 particulate distribution from AP-42, Table 12.5-2.
Note 6: Developed from mass balance ratio (maximum from 2013 & 2014 GHG reporting)
Note 7: Lead emissions included with the baghouse calculations

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(capture efficiency/100)x(1-control efficiency/100)

P901

Potential Usage
842,100 Total Tons/Year

Flow Diagram Designation
LMF

Maximum Capacity
110.00 Total Tons/Hour

Process Description:
Charter Steel - Cuyahoga Heights, OH
LMF

Facility Process Name:			Criteria Pollutants												
	LMF														
Emission Factor Basis:			PM (filt)	PM (cond)	SO2	NOx	VOC	CO	Lead	OC	Ammonia	PM10 (filt)	PM10 (cond)	PM2.5 (filt)	PM2.5 (cond)
	lb/ton														
Emission Factors:		Combustion EF's (lb/MMCF)													
		Process EF's (lb/ton)	2.0			0.015	0.002	0.3		0.002		1.52		1.48	
(source)			Note 1	Note 3		Note 1	Note 1	Note 1	Note 5	Note 2		Note 4	Note 3	Note 4	Note 3
		Capture Efficiency	99.95			99.95	99.95	99.95	99.95	99.95		99.95		99.95	
		Control Efficiency	99.00						99.00			99.00		99.00	
		Building Capt. Eff													
Stack Emission Rate:															
	Hourly (lb/hr)		2.20			1.65	0.22	32.98		0.22		1.67		1.63	
	Annual (TPY)		**8.42**			**6.31**	**0.84**	**126.25**		**0.84**		**6.40**		**6.23**	
Fugitive Emission Rate:															
	Hourly (lb/hr)		0.11			0.00	0.00	0.02		0.00		0.08		0.08	
	Annual (TPY)		**0.42**			**0.00**	**0.00**	**0.06**		**0.00**		**0.32**		**0.31**	

Potential Operating Schedule
48 Hours/Day
17,520 Hours/Year
(2 LRF stations)

Note 1: Potential developed by Voest Alpine (equipment manufacturer). Included in PTI P0107543 (issued 3/10/2011).
Note 2: Assumes OC = VOC
Note 3: Condensible particulate included with EAF.
Note 4: PM10 / PM2.5 particulate distribution from AP-42, Table 12.5-2.
Note 5: Lead emissions included with the baghouse calculations

EXAMPLE CALCULATIONS:
PM/PM10 stack emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(capture efficiency/100)x(1-control efficiency/100)
PM/PM10 fugitive emissions(TPY)=(annual throughput)x(PM/PM10 emission factor)x(1-capture efficiency/100)x(1-building capture/100)x(1ton/2000 lbs)

Appendix C
Detailed VOC Emissions Calculations for Section 2.1

Charter Steel
VOC RACT Study
Emission Calculation Detail for Section 2.1

	Highest Daily Average Tons of Production in 2022 - 2025 (tons/day)		VOC Emission Factor (lbs VOC/ton)[1]	Average Daily VOC Emissions (lbs/day)
P900	1,919	from 2023	0.20	383.80

	Highest Daily Maximum Tons of Production in 2022 - 2025 (tons/day)		VOC Emission Factor (lbs VOC/ton)[1]	Maximum Daily VOC Emissions (lbs/day)
P900	3,219	from 2025	0.20	643.80

	Highest Annual Tons of Production in 2022 - 2025 (tons/year)		VOC Emission Factor (lbs VOC/ton)[1]	Maximum Annual VOC Emissions (tons/year)
P900	609,060	from 2025	0.20	60.91

Note 1: Developed from sulfur addition and carbon injection chemistries.

<u>Example calculation</u>
VOC emissions (lbs/day) = daily throughput x VOC emission factor
VOC emissions (tons/year) = annual throughput x VOC emission factor x (1 ton / 2000 lbs)

Appendix D
2016 EAF Stack Testing Summary Pages

Compliance Stack Emission Test Report

Determination of Filterable Particulate Matter, Sulfur Dioxide, Nitrogen Oxides, Carbon Monoxide, Volatile Organic Compounds, Lead, Mercury, and Visible Emissions

EPA Methods 1, 2, 3, 3A, 4, 5, 6C, 7E, 9, 10, 25A, and 29

Melt Shop Operations (P032-P038, P047, P041, and P900-P902) and Bar Mill Reheat Furnace (BMRF) (P029)

Test Date(s): August 11-12, 2016 and August 15-16, 2016
Source Location: Cuyahoga Hts, Ohio

Report Number: 160809.1.0
Report Date: September 16, 2016
Scope ID: 10737

Prepared For:

Charter Steel
4300 East 49th St.
Cuyahoga Heights, Ohio 44125

Prepared By:

Air Compliance Testing, Inc.
A Division of Montrose Air Quality Services

PO Box 41156
Cleveland OH 44141-0156
Phone: (800) EPA-AIR1 (372-2471)

Air Compliance Testing, Inc.

STATEMENT OF REVIEW AND CERTIFICATION

I the undersigned, CERTIFY that:

- To the best of our knowledge, the report has been checked for completeness, and the results presented are accurate, error-free, legible, representative of the actual emissions measured during the test, and conform to the requirements of ASTM D7036-04, "Standard Practice for Competence of Air Emission Testing Bodies (AETBs)."

- The results of the Compliance Stack Emission Test Report emission testing conducted on August 11-12, 2016 and August 15-16, 2016 are a product of the application of the United States Environmental Protection Agency (US EPA) Stationary Source Sampling Methods listed in 40 CFR Part 60, Appendix A, that were in effect at the time of this test.

- All raw data, calculations, and other materials necessary to confirm and validate the reported emissions results and observations have been reviewed to ensure data quality and completeness.

Robert J. Lisy, Jr., District Manager

9/16/2016

Date

Table of Contents

Appendix Table of Contents

1.0 INTRODUCTION

1.1 Summary of Test Program

Charter Steel (Facility ID: 13-18-17-1623), located in Cuyahoga Heights, Ohio, contracted Air Compliance Testing, Inc. of Cleveland, Ohio to conduct compliance stack emission testing for their Melt Shop Operations and the Bar Mill Reheat Furnace (BMRF) (P029). Testing was performed to satisfy the emissions testing requirements pursuant to Ohio Environmental Protection Agency (OEPA) Title V Permit No. P0104583. The testing was performed on August 11-12, 2016 and August 15-16, 2016.

Melt Shop Operations

Simultaneous sampling was performed at the Melt Shop Baghouse Exhaust Stack No. 1 and Melt Shop Baghouse Exhaust Stack No. 2 to determine the emissions of filterable particulate matter (PM), sulfur dioxide (SO_2), nitrogen oxides (NO_x) as (NO_2), carbon monoxide (CO), volatile organic compounds (VOC), lead (Pb), and mercury (Hg). In addition, opacity observations were performed at the Melt Shop Baghouse exhaust stacks to determine the percent opacity of visible emissions (VEs). Testing was conducted while Melt Shop Operations (i.e., emissions units P032 - P038, P047, P041, and P900- P902) were operating at or near maximum capacity. During this test, the emissions from Melt Shop Operations were controlled by the Melt Shop Baghouse.

BMRF

Sampling was performed at the P029 Exhaust Stack to determine the emissions of nitrogen oxides (NO_x) (as NO_2). Testing was conducted while P029 was operating at or near maximum capacity. During this test, emissions from P029 were uncontrolled.

The test methods that were conducted during this test were EPA Methods 1, 2, 3, 3A, 4, 5, 6C, 7E, 9, 10, 25A, and 29.

1.2 Key Personnel

The key personnel who coordinated this test program (and their phone numbers) were:

Jay Lawniczak, Senior Environmental Engineer, Charter Steel, 216-429-7675

Yismaw Desta, Cleveland Division of Air Quality, 216-664-7454

Peter Becker QI, Field Project Manager, Air Compliance Testing, Inc., 800-372-2471

2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 Objectives and Test Matrix

The purpose of this test was to determine the emissions of filterable PM, SO_2, NO_x (as NO_2), CO, VOC, Pb, and Hg and the percent opacity of VEs at the baghouse associated with the Melt Shop during operations at or near maximum capacity. The purpose of this test was also to determine the emissions of NO_x (as NO_2) at the P029 Exhaust Stack while the BMRF operated at or near maximum capacity. Testing was performed to satisfy the emissions testing requirements pursuant to OEPA Title V Permit No. P0104583.

The specific test objectives for this test are as follows:

Melt Shop Baghouse Exhaust Stack No. 1 and No. 2

Simultaneously measure the concentrations of filterable PM, SO_2, NO_x, CO, total gaseous organics (TGO), Pb, and Hg at Melt Shop Baghouse Exhaust Stack No. 1 and Melt Shop Baghouse Exhaust Stack No. 2.

Measure the dry standard and actual volumetric flow rate of the stack gas at Melt Shop Baghouse Exhaust Stack No. 1 and Melt Shop Baghouse Exhaust Stack No. 2.

Utilize the above variables to determine the emissions of filterable PM, SO_2, NO_x (as NO_2), CO, VOC, Pb, and Hg at the baghouse associated with the Melt Shop during operations at or near maximum capacity.

Determine the VEs (as %-opacity) at the baghouse associated with the Melt Shop during operations at or near maximum capacity.

P029 Exhaust Stack

Measure the concentrations of oxygen (O_2), carbon dioxide (CO_2), and NO_x at the P029 Exhaust Stack.

Measure the dry standard and actual volumetric flow rate of the stack gas at the P029 Exhaust Stack.

Utilize the above variables to determine the emissions of NO_x (as NO_2) at the P029 Exhaust Stack during operations at or near its maximum capacity.

Tables 2.1.1 - 2.1.3 present the sampling and analytical matrix log for this test.

2.2 Field Test Changes and Problems

No field test changes or problems occurred during the performance of this test that would bias the accuracy of the results of this test.

2.3 Presentation of Results

Melt Shop Operations

Two (2) sampling trains were utilized during each run at the Melt Shop Baghouse Exhaust Stack No. 1 and Melt Shop Baghouse Exhaust Stack No. 2 to determine the emissions of filterable PM, SO_2, NO_x (as NO_2), CO, VOC, Pb. and Hg. One sampling train measured the stack gas volumetric flow rate, dry molecular weight, moisture content, and the concentration of filterable PM, Pb, and Hg. A second sampling train measured the stack gas concentration of SO_2, NO_x, CO, and TGO.

Table 2.2 displays the emissions summary of filterable PM, SO_2, NO_x (as NO_2), CO, VOC, Pb, and Hg measured at the baghouse associated with the Melt Shop during operations at or near maximum capacity.

Table 2.3 displays the emissions of filterable PM, SO_2, NO_x (as NO_2), CO, VOC, Pb, and Hg measured at the Melt Shop Baghouse Exhaust Stack No. 1 and Melt Shop Baghouse Exhaust Stack No. 2 during operations at or near maximum capacity.

Table 2.3 also displays the maximum 6-minute average of opacity measured at the Melt Shop Baghouse Exhaust Stack No. 1 and Melt Shop Baghouse Exhaust Stack No. 2 during operations at or near maximum capacity.

Concentration values in Tables 2.2 and 2.3 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Mass emission rates denoted with a '<' in Tables 2.2 and 2.3 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

The graphs that present the raw, uncorrected concentration data measured in the field by the EPA Method 6C, 7E, 10, and 25A sampling system at both Melt Shop baghouse exhaust stacks are located in the Field Data section of the Appendix.

BMRF

Two (2) sampling trains were utilized during each run at the P029 Exhaust Stack to determine the emissions of NO_x (as NO_2). One sampling train measured the stack gas moisture content. A second sampling train measured the stack gas concentration of O_2, CO_2, and NO_x. The stack gas volumetric flow rate was determined during each concentration run.

Table 2.4 displays the emissions of NO_x (as NO_2) measured at the P029 Exhaust Stack during operations at or near maximum capacity.

Since more than 10% of the individual differential pressure (dp) readings recorded at the P029 Exhaust Stack during each run were below 0.05 in-H_2O, a more sensitive dp gauge was utilized at this location as per EPA Method 2, Section 6.2. The more sensitive differential pressure gauge had divisions of 0.005 in-H_2O in the inclined scale.

The graphs that present the raw, uncorrected concentration data measured in the field by the EPA Method 3A and 7E sampling system at the P029 Exhaust Stack are located in the Field Data section of the Appendix.

			EPA TEST METHODS UTILIZED				
			M1/M2 (Flow)	M3 (Dry Mol. Wt.)	M4 (%H_2O)	M5 (Filterable PM)	M29 (Metals)
Date	Run No.	Sampling Location	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/15/2016	1	Melt Shop Baghouse Exhaust Stack No. 1	8:12 - 12:49 240	8:12 - 12:49 240	8:12 - 12:49 240	8:12 - 12:49 240	8:12 - 12:49 240
8/15/2016	2	Melt Shop Baghouse Exhaust Stack No. 1	15:04 - 19:58 240	15:04 - 19:58 240	15:04 - 19:58 240	15:04 - 19:58 240	15:04 - 19:58 240
8/16/2016	3	Melt Shop Baghouse Exhaust Stack No. 1	8:30 - 13:04 240	8:30 - 13:04 240	8:30 - 13:04 240	8:30 - 13:04 240	8:30 - 13:04 240

All times are Eastern Daylight Time.

			EPA TEST METHODS UTILIZED				
			M6C (SO_2)	M7E (NO_x)	M10 (CO)	M25A (TGO)	M9 (VEs)
Date	Run No.	Sampling Location	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/15/2016	1	Melt Shop Baghouse Exhaust Stack No. 1	10:02 - 11:35 60	10:02 - 11:35 60	10:02 - 11:35 60	10:02 - 11:35 60	10:14 - 11:14 60
8/15/2016	2	Melt Shop Baghouse Exhaust Stack No. 1	16:05 - 17:41 60	16:05 - 17:41 60	16:05 - 17:41 60	16:05 - 17:41 60	16:26 - 17:26 60
8/16/2016	3	Melt Shop Baghouse Exhaust Stack No. 1	9:15 - 10:45 60	9:15 - 10:45 60	9:15 - 10:45 60	9:15 - 10:45 60	10:27 - 11:27 60

All times are Eastern Daylight Time.

Table 2.1.1 - Sampling and Analytical Matrix - Melt Shop Baghouse Exhaust Stacks

			EPA TEST METHODS UTILIZED				
			M1/M2 (Flow)	M3 (Dry Mol. Wt.)	M4 (%H_2O)	M5 (Filterable PM)	M29 (Metals)
Date	Run No.	Sampling Location	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/15/2016	1	Melt Shop Baghouse Exhaust Stack No. 2	8:12 - 13:12 240	8:12 - 13:12 240	8:12 - 13:12 240	8:12 - 13:12 240	8:12 - 13:12 240
8/15/2016	2	Melt Shop Baghouse Exhaust Stack No. 2	15:04 - 19:58 240	15:04 - 19:58 240	15:04 - 19:58 240	15:04 - 19:58 240	15:04 - 19:58 240
8/16/2016	3	Melt Shop Baghouse Exhaust Stack No. 2	8:30 - 13:04 240	8:30 - 13:04 240	8:30 - 13:04 240	8:30 - 13:04 240	8:30 - 13:04 240

All times are Eastern Daylight Time.

			EPA TEST METHODS UTILIZED				
			M6C (SO_2)	M7E (NO_x)	M10 (CO)	M25A (TGO)	M9 (VEs)
Date	Run No.	Sampling Location	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/15/2016	1	Melt Shop Baghouse Exhaust Stack No. 2	10:02 - 11:35 60	10:02 - 11:35 60	10:02 - 11:35 60	10:02 - 11:35 60	10:14 - 11:14 60
8/15/2016	2	Melt Shop Baghouse Exhaust Stack No. 2	16:05 - 17:41 60	16:05 - 17:41 60	16:05 - 17:41 60	16:05 - 17:41 60	16:26 - 17:26 60
8/16/2016	3	Melt Shop Baghouse Exhaust Stack No. 2	9:15 - 10:45 60	9:15 - 10:45 60	9:15 - 10:45 60	9:15 - 10:45 60	10:27 - 11:27 60

All times are Eastern Daylight Time.

Table 2.1.2 - Sampling and Analytical Matrix - Melt Shop Baghouse Exhaust Stacks

			EPA TEST METHODS UTILIZED				
			M1/M2 (Pre Flow)	M1/M2 (Post Flow)	M3A (O_2/CO_2)	M4 (%H_2O)	M7E (NO_x)
Date	Run No.	Sampling Location	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
8/11/2016	1	P029 Exhaust Stack	8:29 - 8:37 8	11:04 - 11:14 10	8:23 - 10:38 60	8:23 - 10:37 60	8:23 - 10:38 60
8/11/2016	2	P029 Exhaust Stack	11:04 - 11:14 10	12:10 - 12:15 5	10:51 - 11:58 60	10:51 - 11:58 60	10:51 - 11:58 60
8/12/2016	3	P029 Exhaust Stack	7:57 - 8:07 10	8:41 - 8:56 15	7:51 - 8:59 60	7:51 - 8:59 60	7:51 - 8:59 60

All times are Eastern Daylight Time.

Table 2.1.3 - Sampling and Analytical Matrix - P029 Exhaust Stack

	Melt Shop Baghouse Combined Exhaust Stacks			
	Run 1	**Run 2**	**Run 3**	**Average**
Filterable Particulate Matter Mass Emission Rate (lb/hr)	2.90	3.10	2.38	2.79
Lead Mass Emission Rate (lb/hr)	0.0011	0.0011	0.0013	0.0012
Mercury Mass Emission Rate (lb/hr)	<0.0053	<0.0059	<0.0087	<0.0066
Sulfur Dioxide Mass Emission Rate (lb/hr)	<16.3	<15.0	<15.4	<15.5
Nitrogen Oxides Mass Emission Rate (lb/hr) (as NO_2)	<22.1	<21.6	<22.1	<21.9
Carbon Monoxide Mass Emission Rate (lb/hr)	94.8	113.6	143.3	117.2
Total Gaseous Organic Mass Emission Rate (lb/hr as propane)	22.4	18.9	19.7	20.3
Stack Gas Average Flow Rate (dscfm)	772,429	752,073	770,042	764,848

The "<" symbol indicates that compound was not present in quantities above the Minimum Detection Limit (MDL) of the analytical method.

Table 2.2 - Emissions Summary

	Melt Shop Baghouse Exhaust Stack No. 1				Melt Shop Baghouse Exhaust Stack No. 2			
	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
Filterable Particulate Matter Emissions (lb/hr)	1.7	1.9	1.2	1.6	1.2	1.2	1.1	1.2
Filterable Particulate Matter Concentration (grains/dscf)	0.00051	0.00061	0.00039	0.00050	0.00037	0.00036	0.00033	0.00035
Lead Emissions (lb/hr)	0.00060	0.00053	0.00065	0.00059	0.00054	0.00052	0.00068	0.00058
Lead Concentration (mg/dscm)	0.00043	0.00039	0.00046	0.00043	0.00036	0.00036	0.00046	0.00039
Mercury Emissions (lb/hr)*	<0.0025	<0.0028	<0.0042	<0.0032	<0.0028	<0.0031	<0.0045	<0.0035
Mercury Concentration (mg/dscm)*	<0.0017	<0.0021	<0.0030	<0.0023	<0.0019	<0.0021	<0.0030	<0.0024
Sulfur Dioxide Emissions (lb/hr)*	8.4	< 7.3	< 7.4	< 7.7	<7.9	<7.7	<7.9	<7.8
Sulfur Dioxide Concentration (ppmvd)*	2.2	< 2.0	< 2.0	< 2.1	< 2.0	< 2.0	< 2.0	<2.0
Nitrogen Oxides Emissions (lb/hr) (as NO_2)*	< 10.8	< 10.5	< 10.7	< 10.7	< 11.3	< 11.0	< 11.4	< 11.2
Nitrogen Oxides Concentration (ppmvd)*	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Carbon Monoxide Emissions (lb/hr)	44.7	56.4	70.0	57.0	50.1	57.2	73.3	60.2
Carbon Monoxide Concentration (ppmvd)	27.2	35.2	43.0	35.1	29.0	34.0	42.4	35.1
VOC Emissions (lb/hr as propane)	11.3	9.4	10.1	10.3	11.1	9.5	9.6	10.1
Total Gaseous Organic Concentration (ppmvd as propane)	4.4	3.7	3.9	4.0	4.1	3.6	3.5	3.7
Maximum Six-Minute Average of Visible Emissions (% opacity)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Stack Gas Average Flow Rate (acfm)	466,941	457,973	462,144	462,352	489,660	480,617	490,940	487,073
Stack Gas Average Flow Rate (scfm)	388,638	377,878	384,582	383,699	407,956	396,498	408,570	404,341
Stack Gas Average Flow Rate (dscfm)	376,435	366,957	373,397	372,263	395,993	385,116	396,646	392,585
Stack Gas Average Velocity (fpm)	2,754	2,702	2,726	2,727	2,902	2,848	2,909	2,886
Stack Gas Average Static Pressure (in-H_2O)	-0.53	-0.50	-0.51	-0.51	-0.80	-0.30	-0.46	-0.52
Stack Gas Average Temperature (°F)	160	166	156	161	159	166	156	161
Stack Gas Percent by Volume Moisture (%H_2O)	3.14	2.89	2.91	2.98	2.93	2.87	2.92	2.91
Measured Stack Inner Diameter (in) †	176.5 X 176.1	176.5 X 176.1	176.5 X 176.1	176.5 X 176.1	176.0 X 175.80	176.0 X 175.80	176.0 X 175.80	176.0 X 175.80
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	0.00	0.67	0.50	0.39	0.00	0.50	0.17	0.22
Percent by Volume Oxygen in Stack Gas (%-dry)	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Percent by Volume Nitrogen in Stack Gas (%-dry)	80.00	79.33	79.50	79.61	80.00	79.50	79.83	79.78

*The "<" symbol indicates that compound was not present in quantities above the Minimum Detection Limit (MDL) of the analytical method.

† The Melt Shop Baghouse Exhaust Stacks No .1 and No. 2 were elliptical in shape.

Table 2.3 - Emission Results

	P029 Exhaust Stack			
	Run 1	**Run 2**	**Run 3**	**Average**
Natural Gas Usage Rate (Mcf/hr)*	126	125	114	122
Nitrogen Oxides Emissions (lb/hr) (as NO_2)	8.0	6.1	8.8	7.6
Nitrogen Oxides Concentration (ppmvd)	47.9	39.1	56.3	47.8
Stack Gas Average Flow Rate (acfm)	58,659	55,385	54,668	56,237
Stack Gas Average Flow Rate (scfm)	28,568	26,568	26,931	27,356
Stack Gas Average Flow Rate (dscfm)	23,340	21,673	21,843	22,285
Stack Gas Average Velocity (fpm)	1,146	1,082	1,068	1,098
Stack Gas Average Static Pressure (in-H_2O)	-0.68	-0.71	-0.71	-0.70
Stack Gas Average Temperature (°F)	597	613	579	596
Stack Gas Percent by Volume Moisture (%H_2O)	18.3	18.4	18.9	18.5
Measured Stack Inner Diameter (in)†	95.8 X 98.0	95.8 X 98.0	95.8 X 98.0	95.8 X 98.0
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	9.33	9.41	10.14	9.63
Percent by Volume Oxygen in Stack Gas (%-dry)	4.24	4.21	3.18	3.88
Percent by Volume Nitrogen in Stack Gas (%-dry)	86.4	86.4	86.7	86.5

* Process Data was provided bt Charter Steel personnel.

† The P029 Exhaust Stack was elliptical in shape.

Table 2.4 - Emission Results

3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 Process Description and Operation

Charter Steel is a supplier of carbon and alloy steel bar and rod products. Scrap metal is taken to a melt shop where it is charged into a furnace and melted. Deoxidizing and alloying elements are added to create specific carbon and alloy properties. The molten steel is transferred from the furnace to a refining station where it is chemically balanced and impurities are removed. The refined molten steel is cast into billets. These billets are heated, fed into a finishing mill, and shaped to the necessary tolerances in order to produce steel rods or wire. The steel rods or wire are then fed through a Pickling Line to remove surface oxides that have formed during the milling process. As product enters the Pickling Line, it is cleaned with an alkaline solution and then immersed in a HCl acid bath. Upon emerging from the acid bath, the product is thoroughly washed, lubricated, and coated. The Bar Mill Reheat Furnace (P029), Electric Arc Furnace (Melt Shop), Ladle Metallurgy Furnace (P901), Continuous Caster (P902), Natural Gas Cut-Off Torch (P041), Tundish Preheaters No. 1 (P032), No. 2 (P033), No.3 (P034), and No. 4 (P047), and the Natural Gas-Fired Ladle Preheaters and Dryers (P035, P036, P037, and P038) were in operation during the performance of this test event.

Figures 3.1.1 and 3.1.2 depict the process and sampling location.

3.2 Control Equipment Description

During this test, emissions from Melt Shop were controlled by a baghouse and the emissions from BMRF were uncontrolled.

3.3 Flue Gas Sampling Locations

3.3.1 Melt Shop Baghouse Exhaust Stack No. 1

The Melt Shop Baghouse Exhaust Stack No. 1, located at the East side of the baghouse, was elliptical in shape with measured inner diameters of 176.1-inches and 176.5-inches. The stack was oriented in the vertical plane and was accessed from a permanent platform. Four (4) 5.9-inch I.D. sampling ports were located 90° apart from one another at a location that met EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 4.63° was measured. Therefore, the sampling location also met EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, dry molecular weight, moisture content, filterable PM, SO_2, NO_x, CO, TGO, Pb, and Hg emissions.

3.3.2 Melt Shop Baghouse Exhaust Stack No. 2

The Melt Shop Baghouse Exhaust Stack No. 2, located at the West side of the baghouse, was elliptical in shape with measured inner diameters of 176.0-inches and 175.8-inches. The stack was oriented in the vertical plane and was accessed from a permanent platform. Four (4) 6.0-inch I.D. sampling ports were located 90° apart from one another at a location that met EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 7.29° was measured. Therefore, the sampling location also met EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, dry molecular weight, moisture content, filterable PM, SO_2, NO_x, CO, TGO, Pb, and Hg emissions.

3.3.3 P029 Exhaust Stack

The P029 Exhaust Stack was elliptical in shape with measured inner diameters of 95.8-inches and 98.0-inches. The stack was oriented in the vertical plane and was accessed from a permanent platform. Two (2) 4.0-inch I.D. sampling ports were located 90° apart from one another at a location that met EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 4.69° was measured. Therefore, the sampling location also met EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate, O_2, CO_2, and NO_x concentration determination. A single point in the stack was utilized to determine moisture content of the stack gas.

Figures 3.2.1 - 3.4.2 schematically illustrate the traverse point and sample port locations utilized.

3.4 Process Sampling Location

The EPA Reference Test Methods performed did not specifically require that process samples were to be taken during the performance of this testing event. It is in the best knowledge of Air Compliance Testing that no process samples were obtained and therefore no process sampling location was identified in this report.

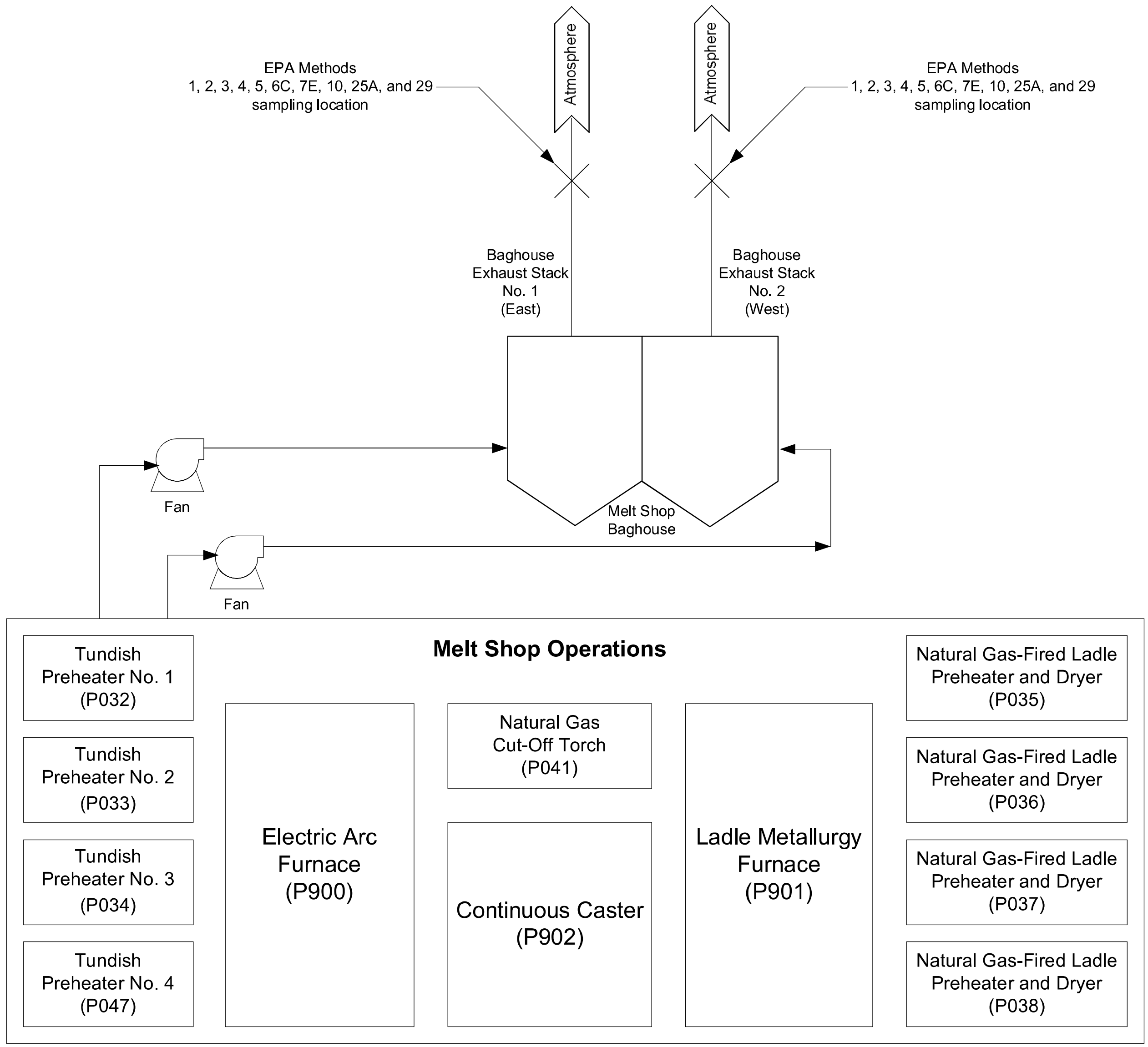


Figure 3.1.1 - Melt Shop Operations - Process and Sampling Location Schematic

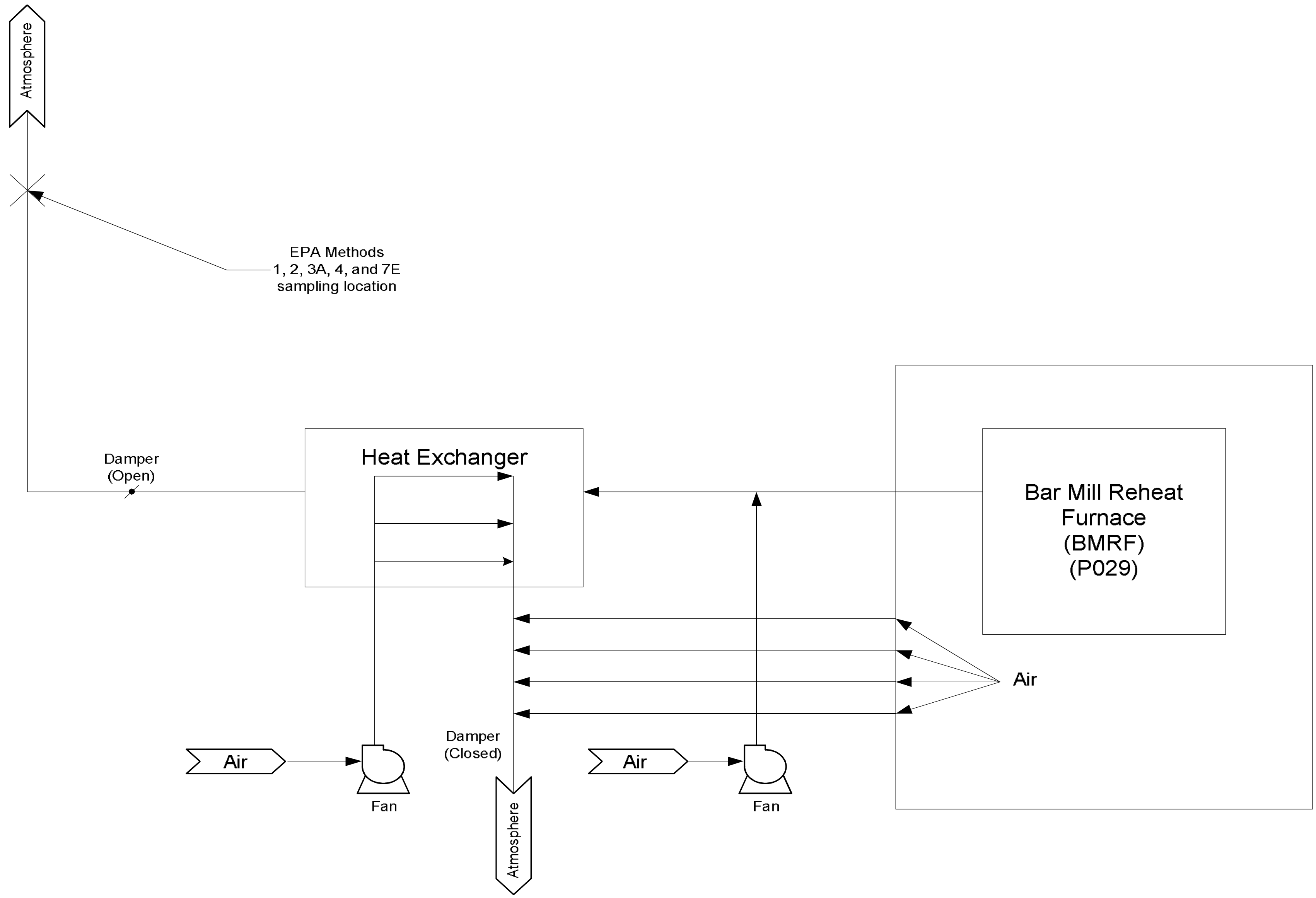
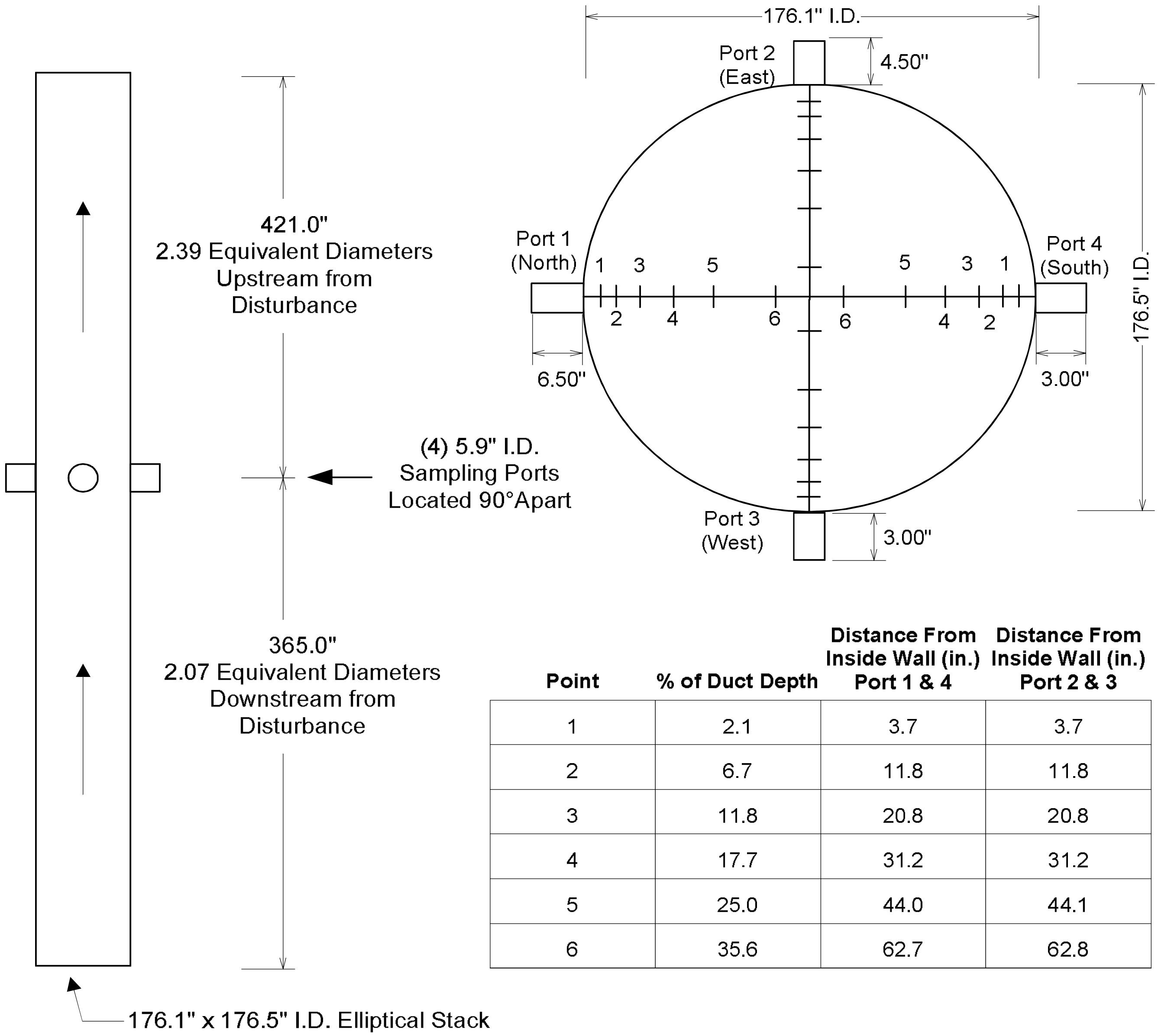
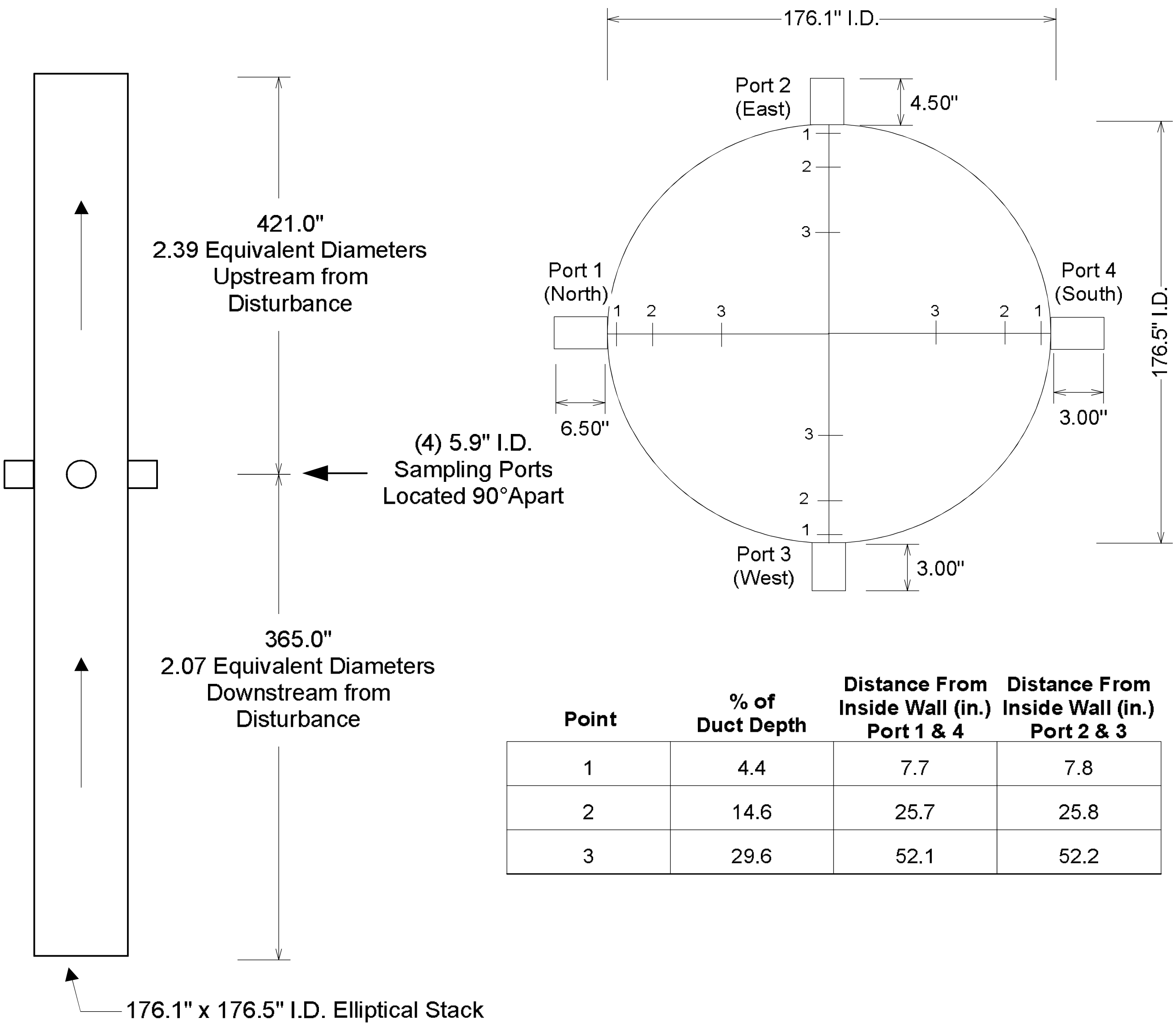


Figure 3.1.2 - P029 Process and Sampling Location Schematic



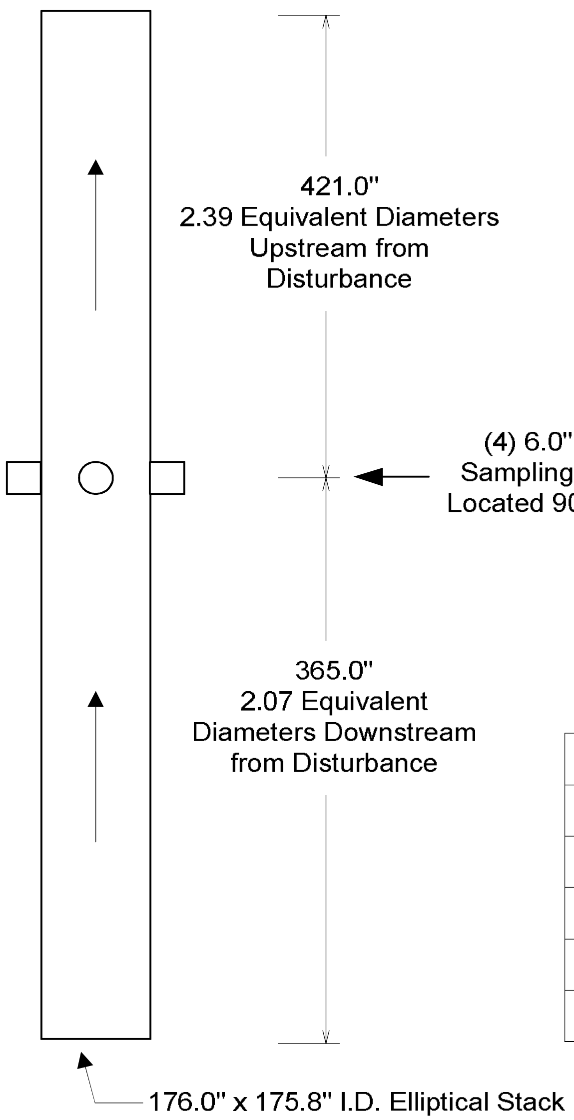
Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1 & 4	Distance From Inside Wall (in.) Port 2 & 3
1	2.1	3.7	3.7
2	6.7	11.8	11.8
3	11.8	20.8	20.8
4	17.7	31.2	31.2
5	25.0	44.0	44.1
6	35.6	62.7	62.8

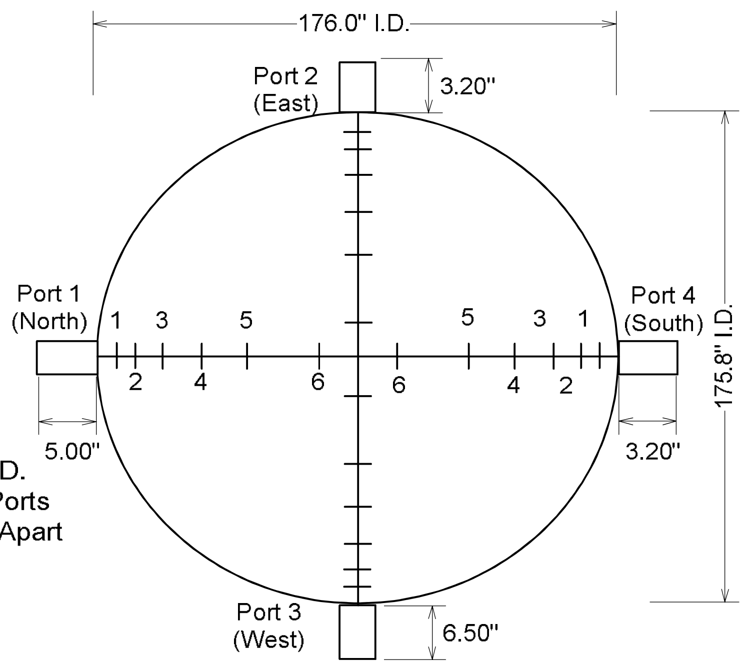
Figure 3.2.1 - Melt Shop Baghouse Exhaust Stack No. 1 Flow - Traverse Point Location Drawing



Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1 & 4	Distance From Inside Wall (in.) Port 2 & 3
1	4.4	7.7	7.8
2	14.6	25.7	25.8
3	29.6	52.1	52.2

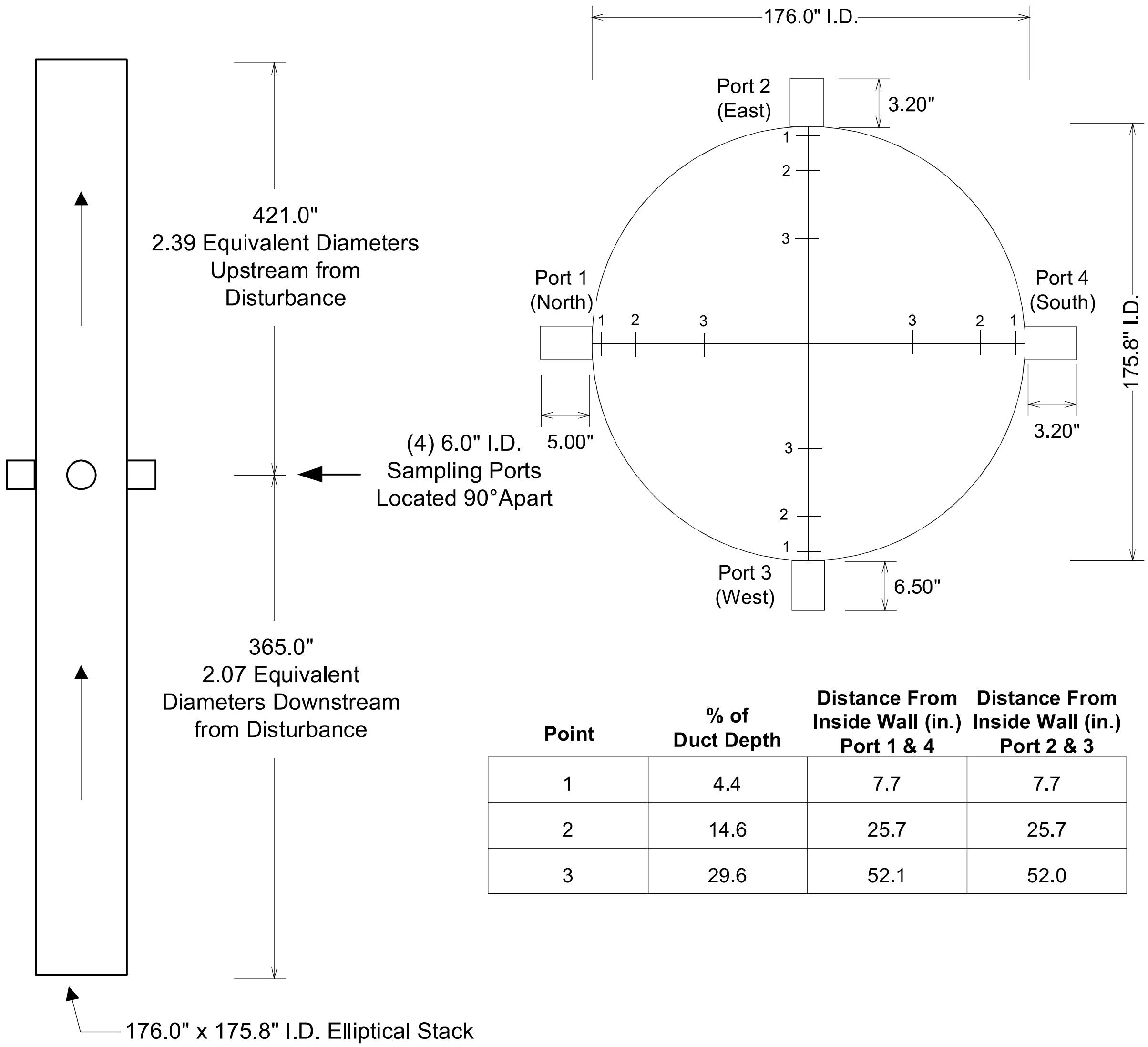
Figure 3.2.2 - Melt Shop Baghouse Exhaust Stack No. 1 CEMS Traverse Point Location Drawing





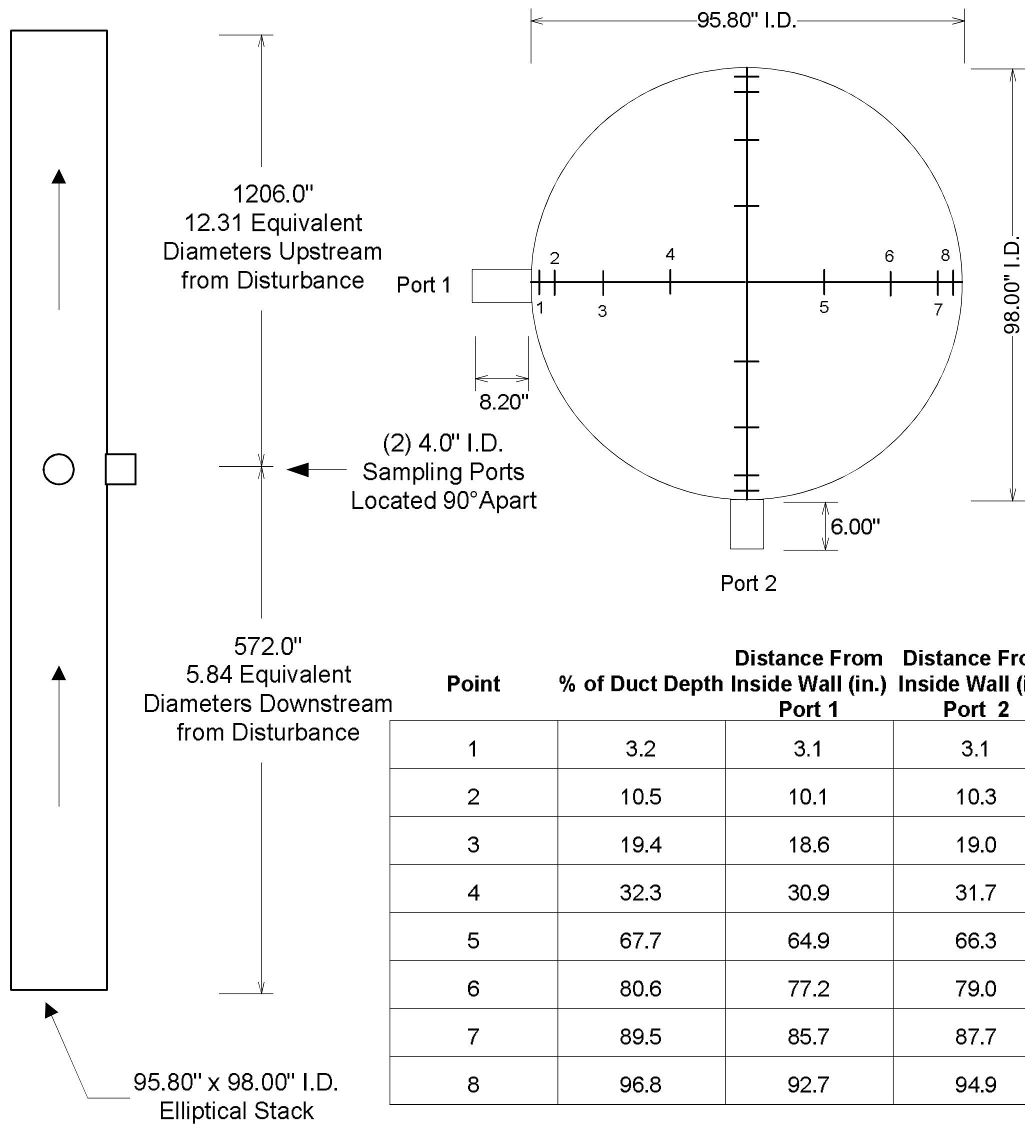
Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1 & 4	Distance From Inside Wall (in.) Port 2 & 3
1	2.1	3.7	3.7
2	6.7	11.8	11.8
3	11.8	20.8	20.7
4	17.7	31.2	31.1
5	25.0	44.0	44.0
6	35.6	62.7	62.6

Figure 3.3.1 - Melt Shop Baghouse Exhaust Stack No. 2 Flow - Traverse Point Location Drawing



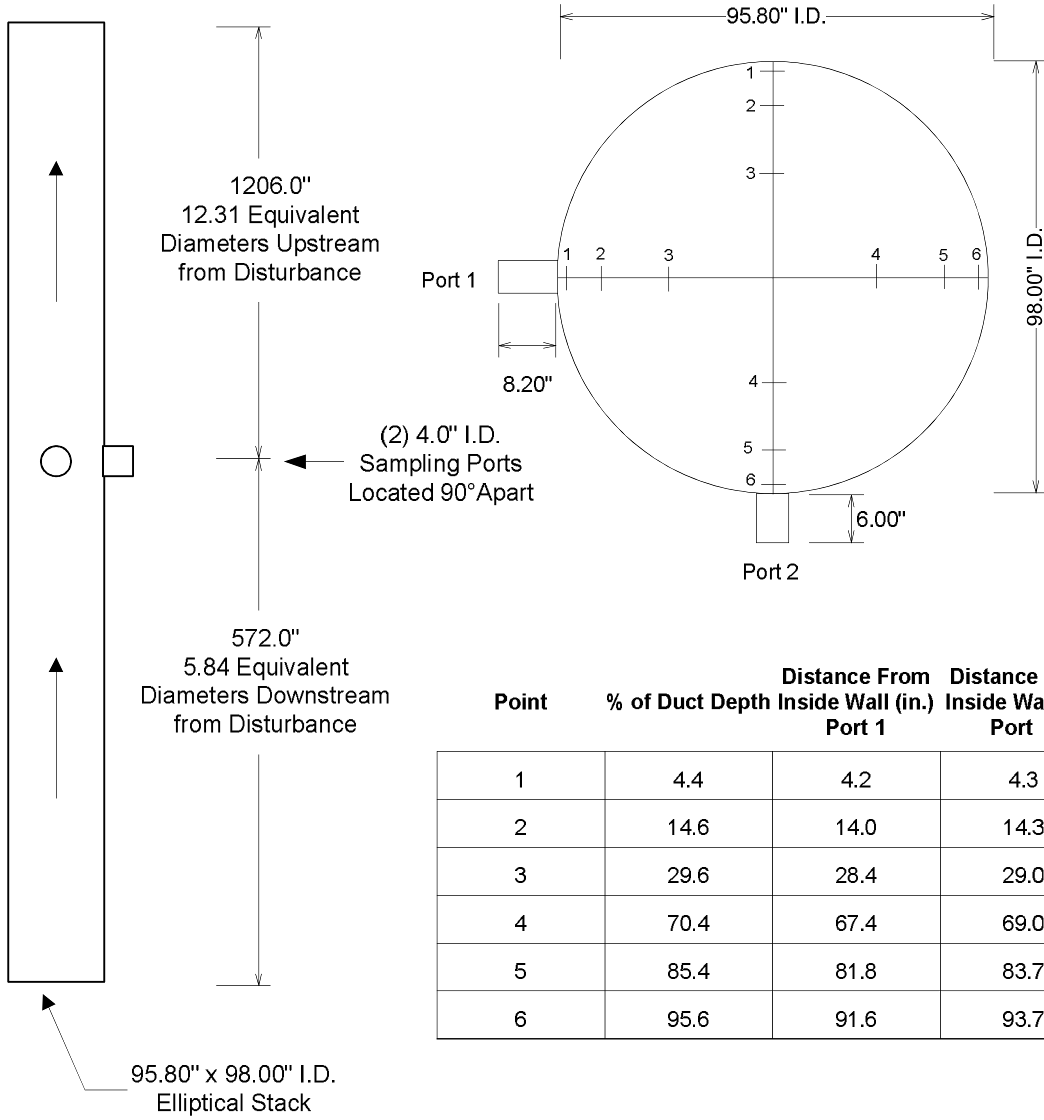
Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1 & 4	Distance From Inside Wall (in.) Port 2 & 3
1	4.4	7.7	7.7
2	14.6	25.7	25.7
3	29.6	52.1	52.0

Figure 3.3.2 - Melt Shop Baghouse Exhaust Stack No. 2 CEMS Traverse Point Location Drawing



Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1	Distance From Inside Wall (in.) Port 2
1	3.2	3.1	3.1
2	10.5	10.1	10.3
3	19.4	18.6	19.0
4	32.3	30.9	31.7
5	67.7	64.9	66.3
6	80.6	77.2	79.0
7	89.5	85.7	87.7
8	96.8	92.7	94.9

Figure 3.4.1 - P029 Exhaust Stack Traverse Point Location Drawing



Point	% of Duct Depth	Distance From Inside Wall (in.) Port 1	Distance From Inside Wall (in.) Port 2
1	4.4	4.2	4.3
2	14.6	14.0	14.3
3	29.6	28.4	29.0
4	70.4	67.4	69.0
5	85.4	81.8	83.7
6	95.6	91.6	93.7

Figure 3.4.2 - P029 Exhaust Stack CEMS Traverse Point Location Drawing

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Test Methods

4.1.1 EPA Method 1: *"Sample and Velocity Traverses for Stationary Sources"*

Principle: To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.2 EPA Method 2: *"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S)"*

Principle: The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.3 EPA Method 3: *"Gas Analysis for the Determination of Dry Molecular Weight"*

Principle: A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2, percent O_2, and if necessary, for percent CO. For dry molecular weight determination a Fyrite analyzer is used for the analysis. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.4 EPA Method 3A: *"Determination of Oxygen and / or Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"*

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.5 EPA Method 4: *"Determination of Moisture Content in Stack Gases"*

Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.6 EPA Method 5: *"Determination of Particulate Emissions from Stationary Sources (Filterable PM only)"*

Principle: Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The PM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after the removal of uncombined water. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.7 EPA Method 6C: *"Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental AnalyzerProcedure) (Concentrations assumed less than 10,000 ppm)"*

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer for determination of SO_2 concentration. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.8 EPA Method 7E: *"Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure) (Concentrations assumed less than 2,000ppm)"*

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer for determination of NO_x concentration. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.9 EPA Method 9: *"Visual Determination of the Opacity of Emissions from Stationary Sources"*

Principle: The opacity of emissions from stationary sources is determined visually by a qualified observer. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.10 EPA Method 10: *"Determination of Carbon Monoxide Emissions from Stationary Sources (Concentrations assumed less than 10,000 ppm)"*

Principle: A gas sample is continuously extracted from the effluent stream. A portion of the sample stream is conveyed to an instrumental analyzer for determination of CO concentration. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.11 EPA Method 25A: *"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer (Concentrations assumed less than 10,000 ppm, Propane/Nitrogen Calibration Gases)"*

Principle: A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.12 EPA Method 29: *"Determination of Metals Emissions from Stationary Sources"*

Principle: A stack sample is withdrawn isokinetically from the source, particulate emissions are collected in the probe and on a heated filter, and gaseous emissions are then collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all metals including Hg) and an aqueous acidic solution of potassium permanganate (analyzed only for Hg). The recovered samples are digested, and appropriate fractions are analyzed for Hg by cold vapor atomic absorption spectroscopy (CVAAS) and for Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Ag, Tl, and Zn by inductively coupled argon plasma emission spectroscopy (ICAP) or atomic absorption spectroscopy (AAS). Graphite furnace atomic absorption spectroscopy (GFAAS) is used for analysis of Sb, As, Cd, Co, Pb, Se, and Tl if these elements require greater analytical sensitivity than can be obtained by ICAP. Additionally, if desired, the tester may use AAS for analysis of all listed metals if the resulting in-stack method detection limits meet the goal of the testing program. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

The sampling trains utilized during this testing project are depicted in Figures 4.1- 4.4.

4.2 Procedures for Obtaining Process Data

Process data was recorded by Charter Steel personnel utilizing their typical record keeping procedures. Recorded process data was provided to Air Compliance Testing, Inc. personnel at the conclusion of this test event. The process data from Melt Shop Operations is located in the Process Data section of the Appendix. The process data from P029 is located in Table 2.3 and in the Process Data section of the Appendix.

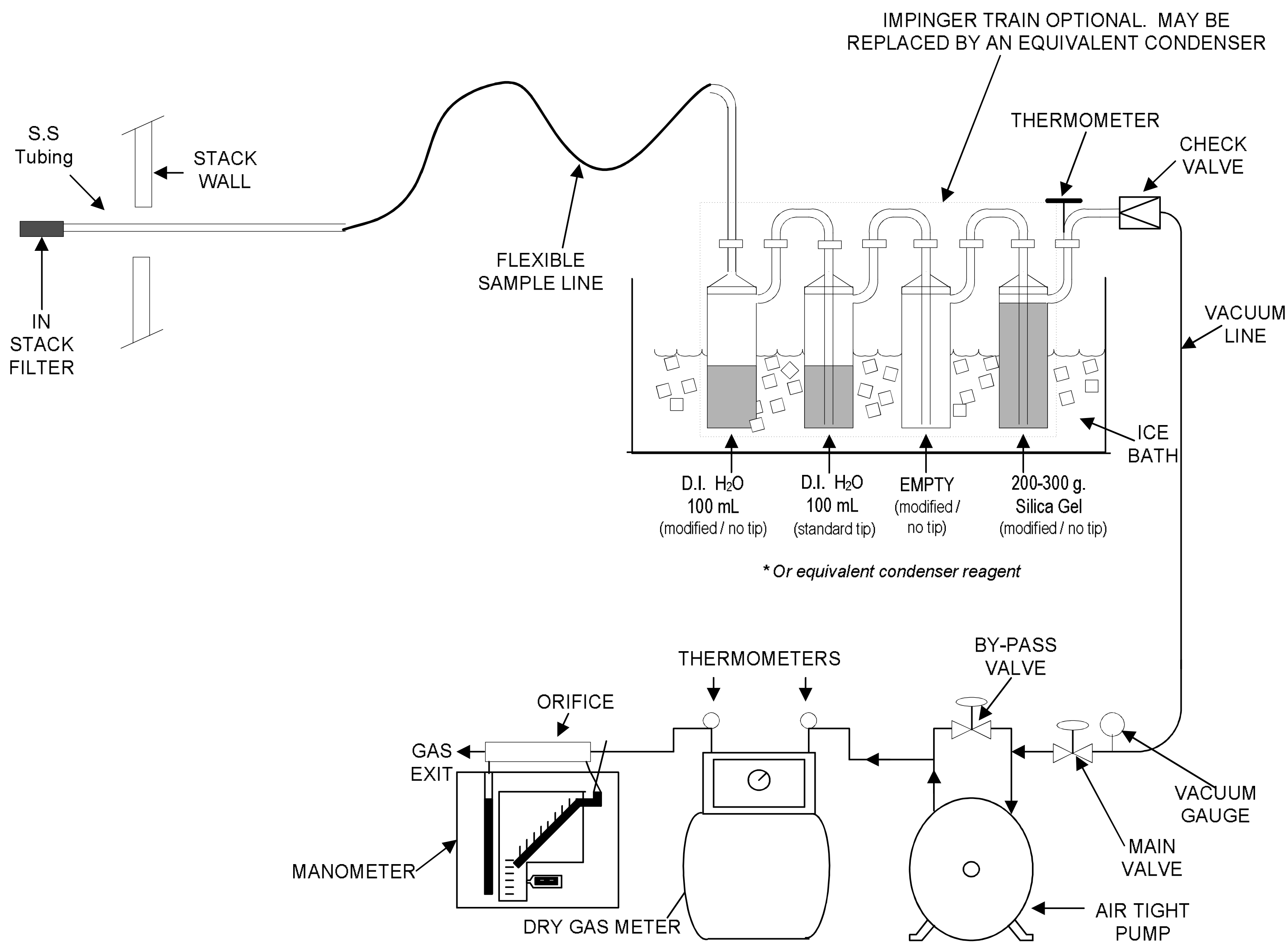


Figure 4.1 - EPA Method 4 Sampling Train Schematic

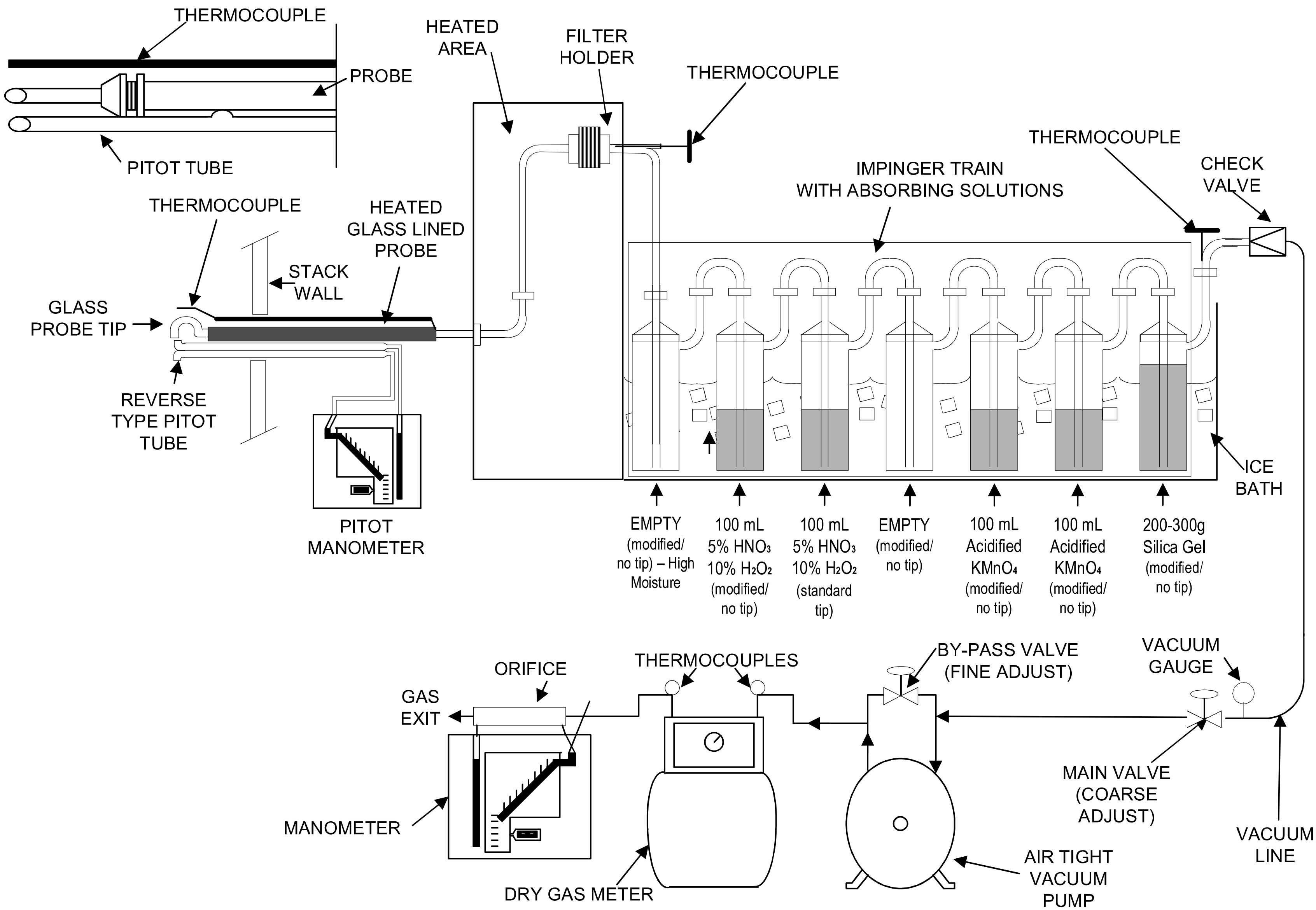


Figure 4.2 - EPA Method 5 and 29 Sampling Train Schematic

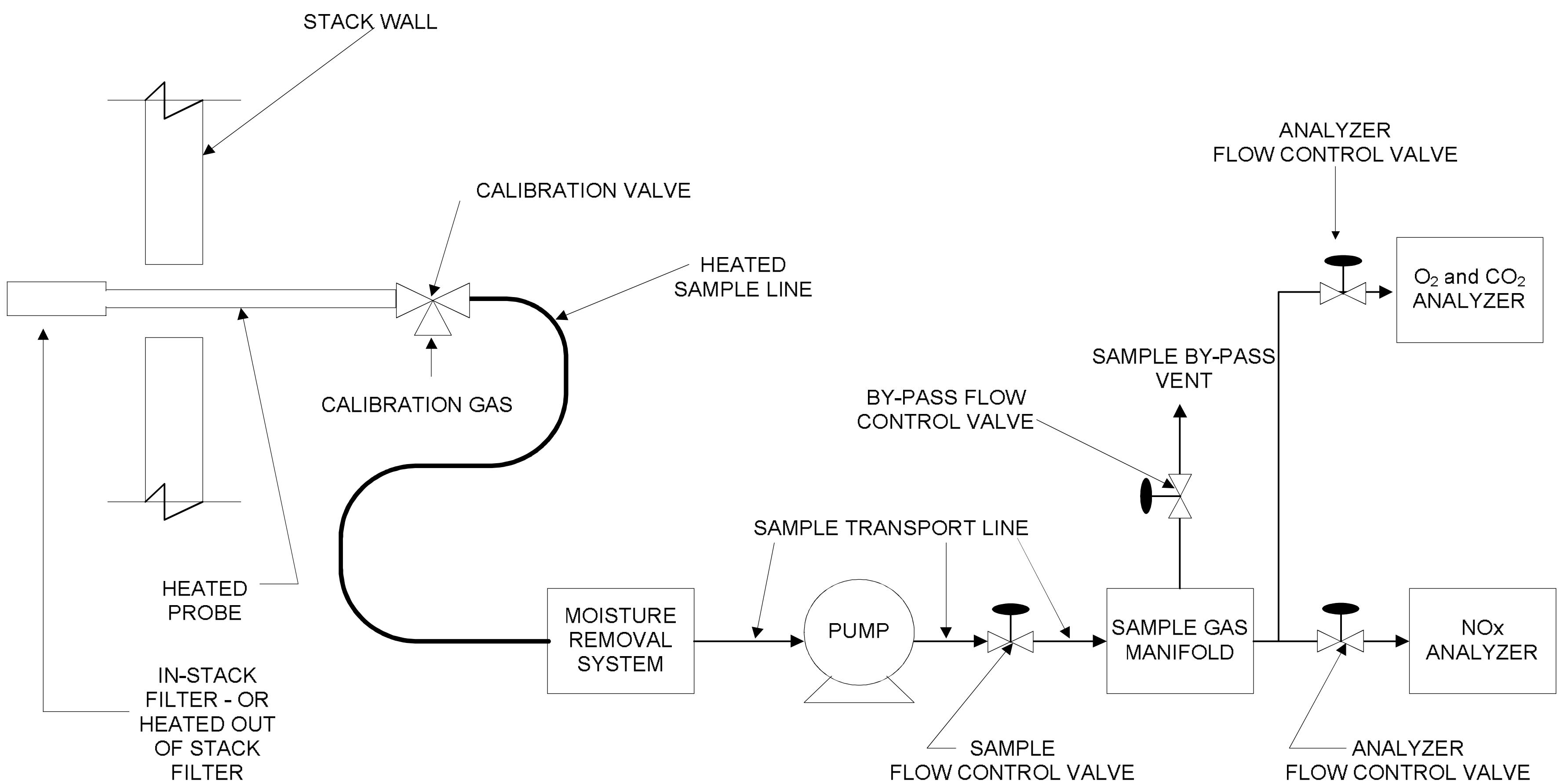


Figure 4.3 - EPA Method 3A and 7E Sampling Train Schematic

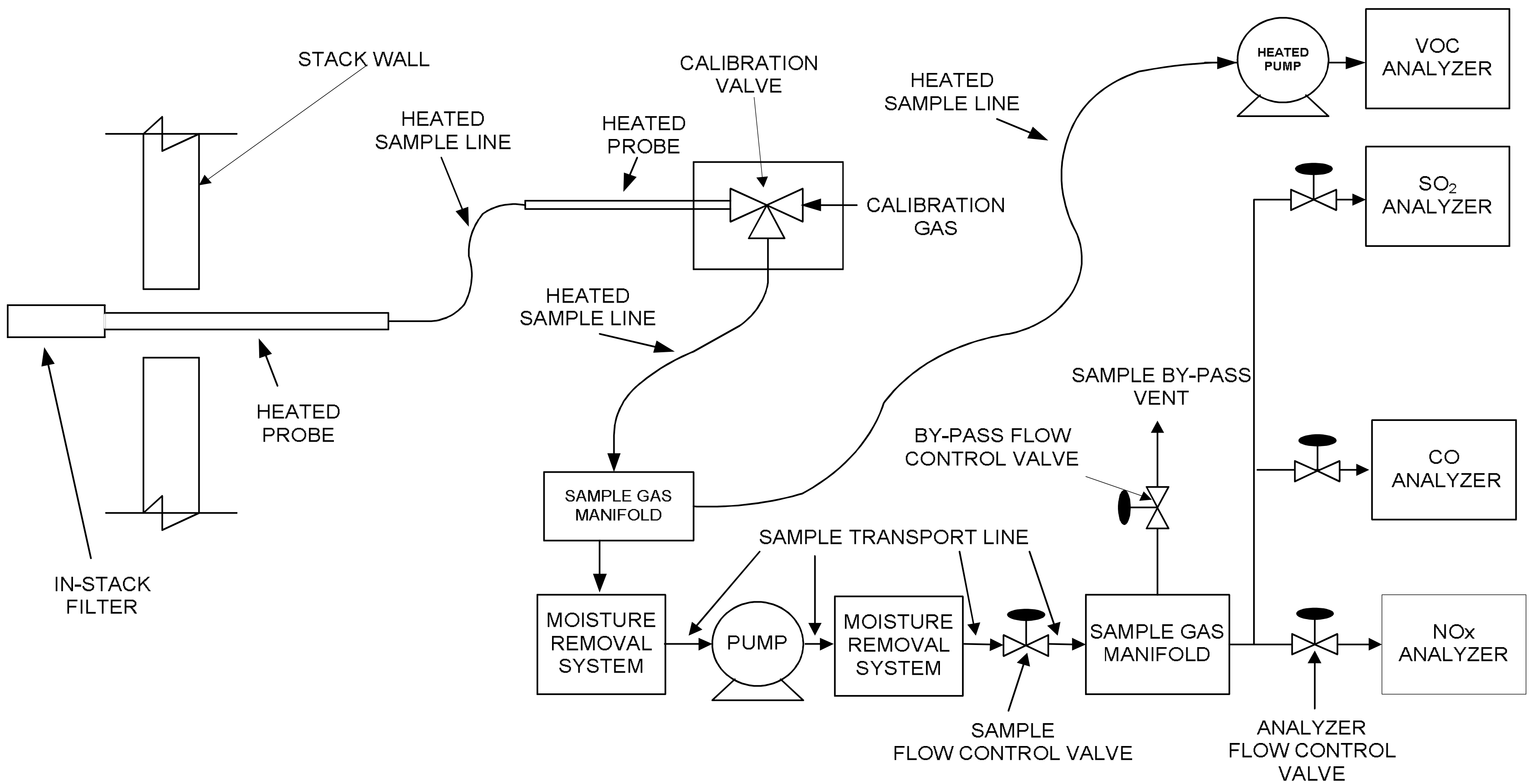


Figure 4.4 - EPA Method 6C, 7E, 10, and 25A Sampling Train Schematic

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA Audits

Tables 5.1 - 5.11.2 illustrate the QA audits that were performed during this test.

All meter boxes and sampling trains used during sampling performed within the requirements of their respective methods as is shown in Tables 5.1 and 5.2. All pre-test and post-test leak checks were well below the applicable limit. Minimum metered volumes and percent isokinetics were also met where applicable.

Table 5.3 displays the EPA Method 3 Fyrite Audits which were performed during this test in accordance with EPA Method 3, Section 10.1 requirements. As shown, all Fyrite analyzer results were within ±0.5% of the respective Audit Gas concentrations.

Tables 5.4.1 - 5.7.2 illustrate the oxygen, carbon dioxide, sulfur dioxide, nitrogen oxides, and carbon monoxide calibration audits which were performed during this test (and integral to performing EPA Method 3A, 6C, 7E, and 10 correctly) were all within the Measurement System Performance Specifications of ±3% of span for the Zero and Calibration Drift Checks, ±5% of span for the System Calibration Bias Checks, and ±2% of span for the Calibration Error Checks.

Tables 5.8 illustrate the FIA calibration audits which were performed during this test (and integral to performing EPA Method 25A correctly) were, except where noted, within the Measurement System Performance Specifications of ±3% of span for the Zero and Calibration Drift Checks, and ±5% of the respective cylinder concentrations for the Calibration Error Checks.

Table 5.9 displays the NO_2 to NO converter efficiency check. The converter efficiency check was conducted as per the procedures contained in EPA Method 7E, Section 8.2.4.1 which require a conversion of at least 90%. As shown, an average converter efficiency of 92.65% was achieved for the NO_x analyzer utilized at the Melt Shop Baghouse Exhaust Stack No. 2. Also, an average converter efficiency of 94.56% was achieved for the NO_x analyzer utilized at the Melt Shop baghouse exhaust stacks.

Table 5.10 displays the EPA Method 205 field evaluation of the calibration gas dilution system utilized during this test event. As shown, the average concentration output at each dilution level was within ±2% of the predicted value. The average concentration output of the mid-level gas was also within ±2% of the certified concentration.

Table 5.11.1 displays the results of the EPA Method 29 Audit Sample analysis, and Table 5.11.2 displays the laboratory QA results for EPA Method 29. The spike recovery for Hg was within its normal range of 85% to 115%, and the spike recoveries for Pb were within their normal ranges of 70% to 130%.

John Hoard was certified on March 29, 2016 as a Visible Emissions Evaluator. The expiration date is six months from the issue date.

For quality assurance, the observer obtained a view of the emissions with the best available contrasting background and with the sun oriented in the 140° sector to their back. Readings were taken every 15 seconds and made to the nearest 5% opacity.

5.2 QA/QC Problems

No QA/QC problems occurred during this test event.

5.3 Measurement Uncertainty Statement

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Air Compliance Testing, Inc. (ACT) personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, ACT personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and American Society for Testing and Materials (ASTM) D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

	Melt Shop Baghouse Exhaust Stack No. 1		
Method 29 Sampling Train	**Run 1**	**Run 2**	**Run 3**
Leak Rate Observed (Pre/Post) (cfm)	0.000 / 0.001	0.001 / 0.005	0.007 / 0.002
Applicable Method Allowable Leak Rate (cfm)	< 0.020 / < 0.020	< 0.020 / < 0.020	< 0.020 / < 0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	186.903	184.885	186.355
Recommended Volume of Dry Gas Collected (dscf)	160.000	160.000	160.000
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	102.1	102.7	101.8
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes

	Melt Shop Baghouse Exhaust Stack No. 2		
Method 29 Sampling Train	**Run 1**	**Run 2**	**Run 3**
Leak Rate Observed (Pre/Post) (cfm)	0.000 / 0.000	0.000 / 0.000	0.000 / 0.000
Applicable Method Allowable Leak Rate (cfm)	< 0.020 / < 0.020	< 0.020 / < 0.020	< 0.020 / < 0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	192.910	201.978	198.716
Recommended Volume of Dry Gas Collected (dscf)	160.000	160.000	160.000
Acceptable	Yes	Yes	Yes
Percent of Isokinetic Sampling Rate (%)	98.9	100.8	101.7
Applicable Method Allowable Isokinetic Sampling Rate (%)	100 ± 10	100 ± 10	100 ± 10
Acceptable	Yes	Yes	Yes

	P029 Exhaust Stack		
Method 4 Sampling Train	**Run 1**	**Run 2**	**Run 3**
Leak Rate Observed (Pre/Post) (cfm)	0.000 / 0.000	0.000 / 0.000	0.000 / 0.000
Applicable Method Allowable Leak Rate (cfm)	< 0.020 / < 0.020	< 0.020 / < 0.020	< 0.020 / < 0.020
Acceptable	Yes	Yes	Yes
Volume of Dry Gas Collected (dscf)	33.526	33.315	33.237
Recommended Volume of Dry Gas Collected (dscf)	21.000	21.000	21.000
Acceptable	Yes	Yes	Yes

Table 5.1 - Sampling Train Audit Results

Melt Shop Baghouse Exhaust Stack No. 1 - EPA Method 29 Sampling Train				
Pre-Test Dry Gas Meter Calibration Factor (Y)	**Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)**	**Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)**	**Applicable Method Allowable Difference (%)**	**Acceptable**
1.0008	1.0107	-0.99%	5.00%	Yes

Melt Shop Baghouse Exhaust Stack No. 2 - EPA Method 29 Sampling Train				
Pre-Test Dry Gas Meter Calibration Factor (Y)	**Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)**	**Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)**	**Applicable Method Allowable Difference (%)**	**Acceptable**
0.9973	1.0327	-3.55%	5.00%	Yes

P029 Exhaust Stack - EPA Method 4 Sampling Train				
Pre-Test Dry Gas Meter Calibration Factor (Y)	**Average Post-Test Dry Gas Meter Calibration Check Value (Yqa)**	**Post Test Dry Gas Meter Calibration Check Value Difference From Pre-Test Calibration Factor (%)**	**Applicable Method Allowable Difference (%)**	**Acceptable**
0.9874	1.0169	-2.99%	5.00%	Yes

Table 5.2 - Dry Gas Meter Audit Results

	%CO_2	%O_2
Audit Gas Concentration (%)	**6.1**	**5.9**
Fyrite Response 1 (%)	6.0	6.0
Fyrite Response 2 (%)	6.0	6.0
Fyrite Response 3 (%)	6.0	6.0
Average (%)	6.0	6.0
Average Within ±0.5%	Yes	Yes

Audit Gas Cylinder Number: CC37995

Table 5.3 - EPA Method 3 Audit Results

	P029 Exhaust Stack					
Oxygen Analyzer (% as O_2)	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (%)	18.0	YES	18.0	YES	18.0	YES
Initial System Calibration Response for Zero Gas (%)	0.21	N/A	0.17	N/A	0.20	N/A
Final System Calibration Response for Zero Gas (%)	0.17	N/A	0.16	N/A	-0.02	N/A
Actual Concentration of the Upscale Calibration Gas (%)	9.00	N/A	9.00	N/A	9.00	N/A
Initial System Calibration Response for Upscale Gas (%)	9.09	N/A	9.00	N/A	9.02	N/A
Final System Calibration Response for Upscale Gas (%)	9.00	N/A	8.99	N/A	8.81	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	1.17	YES	0.94	YES	2.22	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.94	YES	0.89	YES	1.00	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.06	YES	-0.56	YES	-0.61	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.56	YES	-0.61	YES	-1.78	YES
System Drift for Zero Gas (% of Span)	-0.22	YES	-0.06	YES	-1.22	YES
System Drift for Upscale Gas (% of Span)	-0.50	YES	-0.06	YES	-1.17	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.00	YES	0.00	YES	-1.11	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.56	YES	0.56	YES	0.72	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.00	YES	0.00	YES	0.11	YES

Table 5.4.1 - EPA Method 3A (O2) Analyzer Calibration and QA

	P029 Exhaust Stack					
Carbon Dioxide Analyzer (% as CO_2)	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (%)	18	YES	18	YES	18	YES
Initial System Calibration Response for Zero Gas (%)	0.00	N/A	-0.03	N/A	-0.05	N/A
Final System Calibration Response for Zero Gas (%)	-0.03	N/A	-0.02	N/A	-0.01	N/A
Actual Concentration of the Upscale Calibration Gas (%)	9.00	N/A	9.00	N/A	9.00	N/A
Initial System Calibration Response for Upscale Gas (%)	8.79	N/A	8.73	N/A	8.70	N/A
Final System Calibration Response for Upscale Gas (%)	8.73	N/A	8.72	N/A	8.78	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.22	YES	0.06	YES	0.17	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.06	YES	0.11	YES	0.39	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.61	YES	-0.94	YES	-1.44	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.94	YES	-1.00	YES	-1.00	YES
System Drift for Zero Gas (% of Span)	-0.17	YES	0.06	YES	0.22	YES
System Drift for Upscale Gas (% of Span)	-0.33	YES	-0.06	YES	0.44	YES
Analyzer Calibration Error for Zero Gas (% of Span)	-0.22	YES	-0.22	YES	-0.44	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.56	YES	-0.56	YES	-0.22	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.00	YES	0.00	YES	-0.39	YES

Table 5.4.2 - EPA Method 3A (CO2) Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 1					
Sulfur Dioxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	100	YES	100	YES	100	YES
Initial System Calibration Response for Zero Gas (ppm)	1.21	N/A	1.76	N/A	0.14	N/A
Final System Calibration Response for Zero Gas (ppm)	1.76	N/A	1.80	N/A	0.24	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	50.0	N/A	50.0	N/A	50.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	50.1	N/A	48.4	N/A	47.2	N/A
Final System Calibration Response for Upscale Gas (ppm)	48.4	N/A	50.9	N/A	49.9	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	1.34	YES	1.89	YES	0.17	YES
Final System Calibration Bias for Zero Gas (% of Span)	1.89	YES	1.93	YES	0.27	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.75	YES	-0.97	YES	-2.37	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.97	YES	1.57	YES	0.35	YES
System Drift for Zero Gas (% of Span)	0.55	YES	0.04	YES	0.10	YES
System Drift for Upscale Gas (% of Span)	-1.72	YES	2.54	YES	2.72	YES
Analyzer Calibration Error for Zero Gas (% of Span)	-0.13	YES	-0.13	YES	-0.03	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.64	YES	-0.64	YES	-0.41	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.11	YES	-0.11	YES	0.70	YES

Table 5.5.1 - EPA Method 6C Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 2					
Sulfur Dioxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	100	YES	100	YES	100	YES
Initial System Calibration Response for Zero Gas (ppm)	0.41	N/A	2.87	N/A	-0.38	N/A
Final System Calibration Response for Zero Gas (ppm)	2.87	N/A	2.02	N/A	1.32	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	50.0	N/A	50.0	N/A	50.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	47.6	N/A	49.3	N/A	49.8	N/A
Final System Calibration Response for Upscale Gas (ppm)	49.3	N/A	48.2	N/A	47.0	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.30	YES	2.76	YES	-0.46	YES
Final System Calibration Bias for Zero Gas (% of Span)	2.76	YES	1.91	YES	1.24	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.55	YES	1.24	YES	0.73	YES
Final System Calibration Bias for Upscale Gas (% of Span)	1.24	YES	0.12	YES	-2.06	YES
System Drift for Zero Gas (% of Span)	2.46	YES	-0.85	YES	1.70	YES
System Drift for Upscale Gas (% of Span)	1.79	YES	-1.12	YES	-2.79	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.11	YES	0.11	YES	0.08	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-1.90	YES	-1.90	YES	-0.93	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.08	YES	-0.08	YES	-0.25	YES

Table 5.5.2 - EPA Method 6C Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 1					
Nitrogen Oxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	200	YES	200	YES	200	YES
Initial System Calibration Response for Zero Gas (ppm)	0.6	N/A	0.5	N/A	0.1	N/A
Final System Calibration Response for Zero Gas (ppm)	0.5	N/A	0.4	N/A	0.6	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	100.0	N/A	100.0	N/A	100.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	98.2	N/A	100.9	N/A	101.0	N/A
Final System Calibration Response for Upscale Gas (ppm)	100.9	N/A	100.1	N/A	98.5	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.12	YES	0.05	YES	0.22	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.05	YES	-0.01	YES	0.49	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-1.89	YES	-0.54	YES	0.44	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-0.54	YES	-0.91	YES	-0.80	YES
System Drift for Zero Gas (% of Span)	-0.07	YES	-0.05	YES	0.27	YES
System Drift for Upscale Gas (% of Span)	1.35	YES	-0.38	YES	-1.24	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.20	YES	0.20	YES	-0.19	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.97	YES	0.97	YES	0.05	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	1.19	YES	1.19	YES	1.27	YES

Table 5.6.1 - EPA Method 7E Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 2					
Nitrogen Oxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	200	YES	200	YES	200	YES
Initial System Calibration Response for Zero Gas (ppm)	0.9	N/A	0.5	N/A	-0.1	N/A
Final System Calibration Response for Zero Gas (ppm)	0.5	N/A	1.0	N/A	0.5	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	100.0	N/A	100.0	N/A	100.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	100.1	N/A	97.5	N/A	93.0	N/A
Final System Calibration Response for Upscale Gas (ppm)	97.5	N/A	95.0	N/A	94.5	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.47	YES	0.27	YES	-0.04	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.27	YES	0.52	YES	0.25	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.31	YES	-1.00	YES	-2.58	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-1.00	YES	-2.21	YES	-1.87	YES
System Drift for Zero Gas (% of Span)	-0.20	YES	0.25	YES	0.29	YES
System Drift for Upscale Gas (% of Span)	-1.32	YES	-1.21	YES	0.71	YES
Analyzer Calibration Error for Zero Gas (% of Span)	-0.03	YES	-0.03	YES	0.00	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	-0.27	YES	-0.27	YES	-0.91	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.27	YES	-0.27	YES	-0.47	YES

Table 5.6.2 - EPA Method 7E Analyzer Calibration and QA

	P029 Exhaust Stack					
Nitrogen Oxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	200	YES	200	YES	200	YES
Initial System Calibration Response for Zero Gas (ppm)	0.6	N/A	0.9	N/A	0.5	N/A
Final System Calibration Response for Zero Gas (ppm)	0.9	N/A	0.1	N/A	0.9	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	100.0	N/A	100.0	N/A	100.0	N/A
Initial System Calibration Response for Upscale Gas (ppm)	100.5	N/A	102.8	N/A	101.2	N/A
Final System Calibration Response for Upscale Gas (ppm)	102.8	N/A	101.2	N/A	101.0	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.10	YES	0.23	YES	-0.05	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.23	YES	-0.14	YES	0.12	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	0.09	YES	1.24	YES	-0.35	YES
Final System Calibration Bias for Upscale Gas (% of Span)	1.24	YES	0.42	YES	-0.45	YES
System Drift for Zero Gas (% of Span)	0.14	YES	-0.37	YES	0.17	YES
System Drift for Upscale Gas (% of Span)	1.15	YES	-0.82	YES	-0.10	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.20	YES	0.20	YES	0.31	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.16	YES	0.16	YES	0.94	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	1.50	YES	1.50	YES	1.29	YES

Table 5.6.3 - EPA Method 7E Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 1					
Carbon Monoxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	500	YES	500	YES	500	YES
Initial System Calibration Response for Zero Gas (ppm)	3.29	N/A	3.28	N/A	3.56	N/A
Final System Calibration Response for Zero Gas (ppm)	3.28	N/A	2.36	N/A	3.60	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	250	N/A	250	N/A	250	N/A
Initial System Calibration Response for Upscale Gas (ppm)	251	N/A	250	N/A	252	N/A
Final System Calibration Response for Upscale Gas (ppm)	250	N/A	242	N/A	249	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.18	YES	0.18	YES	0.21	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.18	YES	0.00	YES	0.22	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-0.81	YES	-1.01	YES	-0.58	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-1.01	YES	-2.54	YES	-1.09	YES
System Drift for Zero Gas (% of Span)	0.00	YES	-0.18	YES	0.01	YES
System Drift for Upscale Gas (% of Span)	-0.20	YES	-1.54	YES	-0.51	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.48	YES	0.48	YES	0.50	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.98	YES	0.98	YES	0.93	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	-0.35	YES	-0.35	YES	0.35	YES

Table 5.7.1 - EPA Method 10 Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 2					
Carbon Monoxide Analyzer	**Run 1**	**Acceptable**	**Run 2**	**Acceptable**	**Run 3**	**Acceptable**
Analyzer Span During Test Run (ppm)	500	YES	500	YES	500	YES
Initial System Calibration Response for Zero Gas (ppm)	3.82	N/A	1.81	N/A	5.88	N/A
Final System Calibration Response for Zero Gas (ppm)	1.81	N/A	0.81	N/A	3.42	N/A
Actual Concentration of the Upscale Calibration Gas (ppm)	250	N/A	250	N/A	250	N/A
Initial System Calibration Response for Upscale Gas (ppm)	246	N/A	244	N/A	240	N/A
Final System Calibration Response for Upscale Gas (ppm)	244	N/A	241	N/A	241	N/A
Initial System Calibration Bias for Zero Gas (% of Span)	0.41	YES	0.01	YES	0.82	YES
Final System Calibration Bias for Zero Gas (% of Span)	0.01	YES	-0.19	YES	0.33	YES
Initial System Calibration Bias for Upscale Gas (% of Span)	-1.39	YES	-1.87	YES	-2.16	YES
Final System Calibration Bias for Upscale Gas (% of Span)	-1.87	YES	-2.37	YES	-2.00	YES
System Drift for Zero Gas (% of Span)	-0.40	YES	-0.20	YES	-0.49	YES
System Drift for Upscale Gas (% of Span)	-0.48	YES	-0.50	YES	0.16	YES
Analyzer Calibration Error for Zero Gas (% of Span)	0.36	YES	0.36	YES	0.36	YES
Analyzer Calibration Error for Mid-Level Gas (% of Span)	0.58	YES	0.58	YES	0.19	YES
Analyzer Calibration Error for High-Level Gas (% of Span)	0.61	YES	0.61	YES	0.22	YES

Table 5.7.2 - EPA Method 10 Analyzer Calibration and QA

	Melt Shop Baghouse Exhaust Stack No. 1					
	Run 1	**Acceptable per Method 25A**	**Run 2**	**Acceptable per Method 25A**	**Run 3**	**Acceptable per Method 25A**
Analyzer Span During Test Run (ppmv as propane)	100.0	YES	100.0	YES	100.0	YES
Average Stack Gas Concentration (ppmv as propane)	4.2	YES	3.6	YES	3.8	YES
Zero Drift (% of Span)	0.56	YES	-0.06	YES	0.89	YES
Calibration Drift for Mid-Level Gas (% of Span)	0.02	YES	-0.25	YES	0.82	YES
Calibration Error for Low-Level Gas (% of Cal. Gas Tag Value)	-3.12	YES	-2.44	YES	-1.92	YES
Calibration Error for Mid-Level Gas (% of Cal. Gas Tag Value)	-1.66	YES	0.80	YES	0.58	YES

	Melt Shop Baghouse Exhaust Stack No. 2					
	Run 1	**Acceptable per Method 25A**	**Run 2**	**Acceptable per Method 25A**	**Run 3**	**Acceptable per Method 25A**
Analyzer Span During Test Run (ppmv as propane)	100.0	YES	100.0	YES	100.0	YES
Average Stack Gas Concentration (ppmv as propane)	4.0	YES	3.5	YES	3.4	YES
Zero Drift (% of Span)	-0.06	YES	0.64	YES	-0.17	YES
Calibration Drift for Mid-Level Gas (% of Span)	-0.25	YES	-0.11	YES	0.48	YES
Calibration Error for Low-Level Gas (% of Cal. Gas Tag Value)	-1.28	YES	-2.08	YES	-2.28	YES
Calibration Error for Mid-Level Gas (% of Cal. Gas Tag Value)	-2.02	YES	1.08	YES	0.80	YES

Table 5.8 - EPA Method 25A Instrument Calibration and QA

Date / Time	Certified Cylinder Concentration (ppm NO2)	Analyzer Concentration (ppm NOx)	Conversion Efficiency (%)	Required Conversion Efficiency (%)	Acceptable (yes/no)
8/10/2016 11:02	51.46	47.10	91.53	90.00	Yes
8/10/2016 11:03	51.46	47.53	92.37	90.00	Yes
8/10/2016 11:04	51.46	47.88	93.05	90.00	Yes
8/10/2016 11:05	51.46	48.19	93.64	90.00	Yes
AVERAGE	51.46	47.68	92.65	90.00	Yes

Analyzer Serial Number: 42CHL-66127-351

Cylinder Number: CC500149

Date / Time	Certified Cylinder Concentration (ppm NO2)	Analyzer Concentration (ppm NOx)	Conversion Efficiency (%)	Required Conversion Efficiency (%)	Acceptable (yes/no)
8/10/2016 11:02	51.46	48.05	93.37	90.00	Yes
8/10/2016 11:03	51.46	48.46	94.18	90.00	Yes
8/10/2016 11:04	51.46	48.91	95.05	90.00	Yes
8/10/2016 11:05	51.46	49.22	95.65	90.00	Yes
AVERAGE	51.46	48.66	94.56	90.00	Yes

Analyzer Serial Number: U1032

Cylinder Number: CC500149

Table 5.9 - NOx Converter Efficiency Check

	Calibration Tag Value (%)	Dilution Ratio	Predicted Diluted Value (%)	Injection 1 Response (%)	Injection 2 Response (%)	Injection 3 Response (%)	Average Response (%)	Difference From Predicted (%)	Acceptable (yes/no)
Dilution Level 1	23.11	1.284	18.00	18.02	18.02	18.02	18.02	-0.11	yes
Dilution Level 2	23.11	2.101	11.00	11.03	11.04	11.00	11.02	-0.21	yes
Mid-Level Gas	10.91	-	-	10.94	10.95	10.95	10.95	-0.34	yes

Analyzer Serial Number: U10034

Dilution System Serial Number: 2916

Table 5.10 - EPA Method 205 Gas Dilution System Calibration and QA

EPA Audit Sample I.D.	AUDIT-080116J-1428	AUDIT-080116J-1427
Reported Concentration as 1B Mercury (µg)		29.7
Reported Concentration as 2B Mercury (µg/L)	51.0	

EPA Audit Sample I.D.	AUDIT-080116J-1425	AUDIT-080116J-1426
Reported Concentration as Front Half Lead (µg)	65.3	-
Reported Concentration as Back Half Lead (µg)	-	2.65

Table 5.11.1 - EPA Method 29 Audit Results

	Lead
Front Spike, % Recovery (Expected Range 70% - 130%)	97
Recovery within Expected Range	Yes
Back Spike, % Recovery (Expected Range 70% - 130%)	96
Recovery within Expected Range	Yes
Front Duplicate, %RPD (Expected difference within 20%)	2.7
Duplicate within Expected Range	Yes
Back Duplicate, %RPD (Expected difference within 20%)	1.8
Duplicate within Expected Range	Yes

	1B Mercury	**2B Mercury**	**3A Mercury**	**3B Mercury**	**3C Mercury**
Spike, % Recovery (Expected Range 85% - 115%)	103	97	100	93	97
Recovery within Expected Range	Yes	Yes	Yes	Yes	Yes
Duplicate, %RPD (Expected difference within 20%)	13	1.0	0.49	0.41	0.49
Duplicate within Expected Range	Yes	Yes	Yes	Yes	Yes

Table 5.11.2 - EPA Method 29 Laboratory QA

Appendix E
Cost Calculations for an Afterburner to Control EAF VOC Emissions (90% Control Efficiency)

Data Inputs

Select the type of oxidizer

Enter the following information for your emission source:

Composition of Inlet Gas Stream				
Pollutant Name	Concentration (ppmv)	Lower Explosive Limit (LEL) (ppmv)*	Heat of Combustion (Btu/scf)	Molecular Weight
Propane	3	21,000	2,353	44.09

Note: The lower explosion limit (LEL), heat of combustion and molecular weight for some commonly used VOC/HAP are provided in the table below. In addition, the heat of combustion to be entered in column D is a lower heating value (LHV), not a higher heating value (HHV).

Enter the design data for the proposed oxidizer:

Number of operating hours/year	8,760	hours/year	Percent Energy Recovery (HR) =
Inlet volumetric flow rate(Q_{wi}) at 77°F and 1 atm.	100,000	scfm	
Pressure drop (ΔP)	19	inches of water	* 19 inches of water is a default pressure drop for thermal oxidizers. User should enter actual value, if known.
Motor/Fan Efficiency (ε)	60	percent*	* 60% is a default fan efficiency. User should enter actual value, if known.
Inlet Waste Gas Temperature (T_{wi})	100	°F*	* 100°F is a default temperature. User should enter actual value, if known.
Operating Temperature (T_{fi})	1,600	°F*	* Note: Default value for Tfi is 2000°F for thermal regenerative oxidizers. Use actual value if known. Tfi for regenerative oxidizers typically between 1800 and 2000°F.
Destruction and Removal Efficiency (DRE)	90	percent	
Estimated Equipment Life	20	Years*	* 20 years is the typical equipment life. User should enter actual value, if known.
Heat Loss (η)	1	percent*	* 1 percent is a default value for the heat loss. User should enter actual value, if known. Heat loss is typically between 0.2 and 1.5%.

0 p
35 p
50 p
70 p

Catalyst Data:

Estimated catalyst life (y)	0	years
Catalyst Unit Cost (CC)	0	$/ft³
Space velocity for catalyst (Φ)	0	/hour

Enter the cost data:

Desired dollar-year	2025				
CEPCI* for 2025	829.3	Enter the CEPCI value for 2025	536.4	2016 CEPCI	*Enter dollar year first.
Annual Interest Rate (i)	5.50	%			* The default rate of 5.50% is the current bank prime rate, which is a nominal (or market) G45interest rate.
Electricity ($Cost_{elect}$)	0.0641	$/kWh			* $0.0641/kWh is a default price for electicity. User should enter actual value, if known.
Natural Gas Fuel Cost ($Cost_{fuel}$)	0.0102	$/scf			
Operator Labor Rate	$50.00	per hour			
Maintenance Labor rate	$60.00	per hour			
Contingency Factor (CF)	10.0	Percent			* 10 percent of the total capital investment F45is a default value for construction contingencies. User may enter values between 5 and 15 percent.

* CEPCI is the Chemical Engineering Plant Cost Escalation/De-escalation Index. The use of CEPCI in this spreadsheet is not an endorsement of the index for purposes of cost escalation or de-escalation, but is there merely to allow for availability of a well-known cost index to spreadsheet users. Use of other well-known cost indexes (e.g., M&S) is acceptable.

Data Sources for Default Values Used in Calculations:

Parameters for Common Compounds:

Compound	LEL (ppmv)	Heat of Combustion (Btu/scf)	Molecular Weight
Methane*	50,000	911	16.04
Ethane	30,000	1,631	30.07
Propane	21,000	2,353	44.09
Butane	19,000	3,101	58.12
Pentane	14,000	3,709	72.15
Hexane	11,000	4,404	86.17
Octane	10,000	5,796	114.23
Nonane	8,000	6,493	128.25
Decane	8,000	7,190	142.28
Ethylene**	27,000	1,499	28.05
Propylene	20,000	2,182	42.08
Cyclohexane	13,000	4,180	84.16
Benzene**	14,000	3,475	78.11
Toluene**	11,000	4,274	92.14
Methyl Chloride (Chloromethane)**	82,500	705	50.49

Footnotes
* Greenhouse gas.
** Hazardous air pollutant.

Data Element	Default Value	Sources for Default Values used in the calculation . . .	If you used your own site-specific values, please enter the value used and the reference source . . .	Recommended data sources for site-specific information
Electricity Cost ($/kWh)	0.0641	Average annual electricity cost for industrial plants is based on 2016 price data compiled by the U.S. Energy Information Administration from data reported on Form EIA-861 and 861S, (https://www.eia.gov/electricity/annual/html/epa_02_04.html).		Plant's utility bill or use U.S. Energy Information Administration (EIA) data for most recent year. Available at http://www.eia.gov/electricity/data.cfm#sales.
Fuel Cost ($/Mscf)	3.51	Annual average price paid for natural gas by industrial facilities in 2016 from the U.S. Energy Information Administration. Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.		Check with fuel supplier or use U.S. Energy Information Administration (EIA) data for most recent year." Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.
Operator Labor ($/hour)	26.61	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for operators based on data for plant and System Operators – other (51-8099).		Use plant-specific labor rate.
Maintenance Labor ($/hour)	27.40	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for maintenance workers based on electrical and electronics commercial and industrial equipment repairers (49-2094).		Use plant-specific labor rate.

Design Parameters

The following design parameters for the oxidizer were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Composition of Inlet Gas Stream		
Pollutant Name	**Concentration in Waste Stream (ppmv) From Data Inputs Tab**	**Adjusted Concentration with Dilution Air (ppmv)**
Propane	3	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
Total	3	0

Constants used in calculations:

Temperature of auxiliary fuel (T_{af}) =	Reference Temperature (T_{ref}) =	77.0	°F
Density of auxiliary Fuel at 77 °F (ρ_{af}) =		0.0408	lb/ft^3
Heat Input of auxiliary fuel ($-\Delta h_{caf}$) =		21,502	Btu/lb
Density of waste gas at 77 °F (ρ_{wi}) =		0.0739	lb/ft^3
Mean Heat Capacity of Air (C_{pmair})	(For thermal oxidizers)	0.255	Btu/lb °F

Parameter	Equation	Calculated Value	Units	Value	Units
Sum of volume fraction of combustible components =	$= (\sum x_i) =$	3	ppmv		
Lower Explosive Limit of waste gas (LEL_{mix})	$= [\sum((x_j)/((\sum x_i) \times LEL_j))]^{-1} =$	21,000	ppmv		
	Where x_j is the volume fraction and LEL_j the lower explosive limit for each combustible component in the waste gas.				
% LEL_{mix}	= (Total Combustible Conc. In Mixture/LEL_{mix}) × 100 =	0.01	percent	* Note: Since the LEL of the waste gas stream is below 25%, no dilution air is needed.	
Dilution Factor	$= (LEL_{mix} \times 0.249)/(\sum x_i) =$	Not applicable			
Lower Explosive Limit (LEL) of waste gas after addition of dilution air	= (Total Adjusted Conc. With Dilution Air/LEL_{mix}) × 100 =	Not Applicable			
Inlet volumetric flow rate(Qwi) at 77°F and 1 atm.	(From Data Entry Tab) =	100,000	scfm		
Oxygen Content of gas stream	$= 100 - (\sum x_j \times 100/10^6) =$	20.90	percent		
Fan Power Consumption (FP)	$= [(1.17 \times 10^{-4}) \times Q_{wi} \times \Delta P]/\varepsilon$	370.5	kW		
Q_{wo}	$\approx Q_{wi} =$	100,000	scfm		
Operating temperature of oxidizer (T_{fi})	(From Data Entry Tab)	1,600	°F		
Temperature of waste gas at outlet to preheater (T_{wo})	= Heat Recovery × ($T_{fi} - T_{wi}$) + T_{wi} =	100	°F	Note: this temperature is relevant for incinerators, but not for the RTOs (both regenerative and recuperative).	
Temperature of flue gas exiting the regenerative oxidizer (T_{fo})	$= T_{fi} - 0.95(T_{fi} - T_{wi}) =$	175	°F		
Heat Input of waste gas ($-\Delta h_{cwi}$)	$= \sum (-\Delta h_{ci})\, x_i$ Where ($-\Delta h_{ci}$) is the heat of combustion and x_i the fraction of component "i" at 77 °F.	0.01	Btu/scf	0.1	Btu/lb
Estimated Auxiliary Fuel Flow (Q_{af}) at 77 °F and 1 atm.	(Calculated using Equation 2.45 in Appendix B)	162.71	scfm		
Auxiliary fuel Energy Input =		142,741	Btu/min		
Minimum Energy required for combustion stabilization =	= 5% × Total Energy Input = $0.05 \times \rho_{fi} \times Q_{fi} \times C_{pmfi} \times (T_{fi} - T_{ref})$ =	139,789	Btu/min		
Is the calculated auxiliary fuel sufficient to stabilize combustion? (Note: If the auxiliary fuel energy input > 5% of Total Energy Input, then the auxilary fuel is sufficient.)		Yes			
Auxiliary fuel flow (Qaf) at 77°F and 1 atm. =		163	scfm		
Total Volumetric Throughput (Q_{tot}) at 77 °F and 1 atm.	$= Q_{fi} = Q_{wo} + Q_a + Q_{af} = Q_{wi} + Q_{af} =$	100,163	scfm		

Capital Recovery Factor:

Parameter	Equation	Calculated Value
Capital Recovery Factor (CRF) =	$i\,(1+i)^n/(1+i)^n - 1 =$ Where n = Equipment Life and i= Interest Rate	0.0837

Cost Estimate

Direct Costs		
Total Purchased equipment costs (in 2025 dollars)		
Incinerator + auxiliary equipment[a] (A) =		
Equipment Costs (EC) for Regenerative Oxidizer	=(2.204 x 100,000 + 11.57 Qtot) x (2025 CEPI/1999 CEPCI) =	$2,576,759 in 2025 dollars
Instrumentation[b] =	0.10 × A =	$257,676
Sales taxes =	0.03 × A =	$77,303
Freight =	0.05 × A =	$128,838
	Total Purchased equipment costs (B) =	$3,040,575 in 2025 dollars

Footnotes

a - Auxiliary equipment includes equipment (e.g., duct work) normally not included with unit furnished by incinerator vendor.

b - Includes the instrumentation and controls furnished by the incinerator vendor.

Direct Installation Costs (in 2025 dollars)		
Foundations and Supports =	0.08 × B =	$243,246
Handling and Erection =	0.14 × B =	$425,681
Electrical =	0.04 × B =	$121,623
Piping =	0.02 × B =	$60,812
Insulation for Ductwork =	0.01 × B =	$30,406
Painting =	0.01 × B =	$30,406
Site Preparation (SP) =		$0
Buildings (Bldg) =		$0
	Total Direct Installaton Costs =	$912,173
Total Direct Costs (DC) =	B + C + SP + Bldg =	$3,952,748 in 2025 dollars
Total Indirect Installation Costs (in 2025 dollars)		
Engineering =	0.10 × B =	$304,058
Construction and field expenses =	0.05 × B =	$152,029
Contractor fees =	0.10 × B =	$304,058
Start-up =	0.02 × B =	$60,812
Performance test =	0.01 × B =	$30,406
	Total Indirect Costs (IC) =	$851,361
Continency Cost (C) =	CF(IC+DC)=	$480,411
Total Capital Investment =	**DC + IC +C =**	**$5,284,520 in 2025 dollars**
Direct Annual Costs		
Annual Electricity Cost	= Annual Electricity Usage × Operating Hours/year × Electricity Price =	$208,042
Annual Fuel Costs for Natural Gas	= $Cost_{fuel}$ × Fuel Usage Rate × 60 min/hr × Operating hours/year	$872,301
Operating Labor	Operator = 0.5hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$27,375
	Supervisor = 15% of Operator	$4,106
Maintenance Costs	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$32,850
	Materials = 100% of maintenance labor	$32,850
Direct Annual Costs (DC) =		**$1,177,524 in 2025 dollars**
Indirect Annual Costs		
Overhead	= 60% of sum of operating, supervisor, maintenance labor and maintenance materials	$58,309
Administrative Charges	= 2% of TCI	$105,690
Property Taxes	= 1% of TCI	$52,845
Insurance	= 1% of TCI	$52,845
Capital Recovery	= CRF[TCI-1.08(cat. Cost)]	$442,205
Indirect Annual Costs (IC) =		**$711,895 in 2025 dollars**
Total Annual Cost =	**DC + IC =**	**$1,889,419 in 2025 dollars**

Cost Effectiveness

Cost Effectiveness = (Total Annual Cost)/(Annual Quantity of VOC/HAP Pollutants Destroyed)

Total Annual Cost (TAC) =	$1,889,419 per year in 2025 dollars
VOC/HAP Pollutants Destroyed =	7.0 tons/year
Cost Effectiveness =	$271,610 per ton of pollutants removed in 2025 dollars

Data Inputs

Select the type of oxidizer

Enter the following information for your emission source:

Composition of Inlet Gas Stream				
Pollutant Name	**Concentration (ppmv)**	**Lower Explosive Limit (LEL) (ppmv)***	**Heat of Combustion (Btu/scf)**	**Molecular Weight**
Propane	3	21,000	2,353	44.09

Note: The lower explosion limit (LEL), heat of combustion and molecular weight for some commonly used VOC/HAP are provided in the table below. In addition, the heat of combustion to be entered in column D is a lower heating value (LHV), not a higher heating value (HHV).

Enter the design data for the proposed oxidizer:

Number of operating hours/year	8,760	hours/year	Percent Energy Recovery (HR) =
Inlet volumetric flow rate(Q_{wi}) at 77°F and 1 atm.	88,040	scfm	
Pressure drop (ΔP)	19	inches of water	* 19 inches of water is a default pressure drop for thermal oxidizers. User should enter actual value, if known.
Motor/Fan Efficiency (ε)	60	percent*	* 60% is a default fan efficiency. User should enter actual value, if known.
Inlet Waste Gas Temperature (T_{wi})	100	°F*	* 100°F is a default temperature. User should enter actual value, if known.
Operating Temperature (T_{fi})	1,600	°F*	* Note: Default value for Tfi is 2000°F for thermal regenerative oxidizers. Use actual value if known. Tfi for regenerative oxidizers typically between 1800 and 2000°F.
Destruction and Removal Efficiency (DRE)	90	percent	
Estimated Equipment Life	20	Years*	* 20 years is the typical equipment life. User should enter actual value, if known.
Heat Loss (η)	1	percent*	* 1 percent is a default value for the heat loss. User should enter actual value, if known. Heat loss is typically between 0.2 and 1.5%.

0 p
35 p
50 p
70 p

Catalyst Data:

Estimated catalyst life (y)	0	years
Catalyst Unit Cost (CC)	0	$/ft³
Space velocity for catalyst (Φ)	0	/hour

Enter the cost data:

Desired dollar-year	2025				
CEPCI* for 2025	829.3	Enter the CEPCI value for 2025	536.4	2016 CEPCI	*Enter dollar year first.
Annual Interest Rate (i)	5.50	%			* The default rate of 5.50% is the current bank prime rate, which is a nominal (or market) G45interest rate.
Electricity ($Cost_{elect}$)	0.0641	$/kWh			* $0.0641/kWh is a default price for electicity. User should enter actual value, if known.
Natural Gas Fuel Cost ($Cost_{fuel}$)	0.0102	$/scf			
Operator Labor Rate	$50.00	per hour			
Maintenance Labor rate	$60.00	per hour			
Contingency Factor (CF)	10.0	Percent			* 10 percent of the total capital investment F45is a default value for construction contingencies. User may enter values between 5 and 15 percent.

* CEPCI is the Chemical Engineering Plant Cost Escalation/De-escalation Index. The use of CEPCI in this spreadsheet is not an endorsement of the index for purposes of cost escalation or de-escalation, but is there merely to allow for availability of a well-known cost index to spreadsheet users. Use of other well-known cost indexes (e.g., M&S) is acceptable.

Data Sources for Default Values Used in Calculations:

Parameters for Common Compounds:

Compound	LEL (ppmv)	Heat of Combustion (Btu/scf)	Molecular Weight
Methane*	50,000	911	16.04
Ethane	30,000	1,631	30.07
Propane	21,000	2,353	44.09
Butane	19,000	3,101	58.12
Pentane	14,000	3,709	72.15
Hexane	11,000	4,404	86.17
Octane	10,000	5,796	114.23
Nonane	8,000	6,493	128.25
Decane	8,000	7,190	142.28
Ethylene**	27,000	1,499	28.05
Propylene	20,000	2,182	42.08
Cyclohexane	13,000	4,180	84.16
Benzene**	14,000	3,475	78.11
Toluene**	11,000	4,274	92.14
Methyl Chloride (Chloromethane)**	82,500	705	50.49

Footnotes
* Greenhouse gas.
** Hazardous air pollutant.

Data Element	Default Value	Sources for Default Values used in the calculation . . .	If you used your own site-specific values, please enter the value used and the reference source . . .	Recommended data sources for site-specific information
Electricity Cost ($/kWh)	0.0641	Average annual electricity cost for industrial plants is based on 2016 price data compiled by the U.S. Energy Information Administration from data reported on Form EIA-861 and 861S, (https://www.eia.gov/electricity/annual/html/epa_02_04.html).		Plant's utility bill or use U.S. Energy Information Administration (EIA) data for most recent year. Available at http://www.eia.gov/electricity/data.cfm#sales.
Fuel Cost ($/Mscf)	3.51	Annual average price paid for natural gas by industrial facilities in 2016 from the U.S. Energy Information Administration. Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.		Check with fuel supplier or use U.S. Energy Information Administration (EIA) data for most recent year." Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.
Operator Labor ($/hour)	26.61	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for operators based on data for plant and System Operators – other (51-8099).		Use plant-specific labor rate.
Maintenance Labor ($/hour)	27.40	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for maintenance workers based on electrical and electronics commercial and industrial equipment repairers (49-2094).		Use plant-specific labor rate.

Design Parameters

The following design parameters for the oxidizer were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Composition of Inlet Gas Stream		
Pollutant Name	**Concentration in Waste Stream (ppmv) From Data Inputs Tab**	**Adjusted Concentration with Dilution Air (ppmv)**
Propane	3	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
Total	3	0

Constants used in calculations:

Temperature of auxiliary fuel (T_{af}) =	Reference Temperature (T_{ref}) =	77.0	°F
Density of auxiliary Fuel at 77 °F (ρ_{af}) =		0.0408	lb/ft^3
Heat Input of auxiliary fuel ($-\Delta h_{caf}$) =		21,502	Btu/lb
Density of waste gas at 77 °F (ρ_{wi}) =		0.0739	lb/ft^3
Mean Heat Capacity of Air (C_{pmair})	(For thermal oxidizers)	0.255	Btu/lb °F

Parameter	Equation	Calculated Value	Units	Value	Units
Sum of volume fraction of combustible components =	$= (\sum x_i) =$	3	ppmv		
Lower Explosive Limit of waste gas (LEL_{mix})	$= [\sum((x_j)/((\sum x_i) \times LEL_j))]^{-1} =$	21,000	ppmv		
	Where x_j is the volume fraction and LEL_j the lower explosive limit for each combustible component in the waste gas.				
% LEL_{mix}	= (Total Combustible Conc. In Mixture/LEL_{mix}) × 100 =	0.01	percent	* Note: Since the LEL of the waste gas stream is below 25%, no dilution air is needed.	
Dilution Factor	= (LEL_{mix} x 0.249)/($\sum x_i$) =	Not applicable			
Lower Explosive Limit (LEL) of waste gas after addition of dilution air	= (Total Adjusted Conc. With Dilution Air/LEL_{mix}) × 100 =	Not Applicable			
Inlet volumetric flow rate(Qwi) at 77°F and 1 atm.	(From Data Entry Tab) =	88,040	scfm		
Oxygen Content of gas stream	= 100 - ($\sum x_j \times 100/10^6$) =	20.90	percent		
Fan Power Consumption (FP)	$= [(1.17 \times 10^{-4}) \times Q_{wi} \times \Delta P]/\varepsilon$	326.2	kW		
Q_{wo}	$\approx Q_{wi} =$	88,040	scfm		
Operating temperature of oxidizer (T_{fi})	(From Data Entry Tab)	1,600	°F		
Temperature of waste gas at outlet to preheater (T_{wo})	= Heat Recovery × ($T_{fi} - T_{wi}$) + T_{wi} =	100	°F	Note: this temperature is relevant for incinerators, but not for the RTOs (both regenerative and recuperative).	
Temperature of flue gas exiting the regenerative oxidizer (T_{fo})	$= T_{fi} - 0.95(T_{fi} - T_{wi}) =$	175	°F		
Heat Input of waste gas ($-\Delta h_{cwi}$)	$= \sum (-\Delta h_{ci})\, x_i$ Where ($-\Delta h_{ci}$) is the heat of combustion and x_i the fraction of component "i" at 77 °F.	0.01	Btu/scf	0.1	Btu/lb
Estimated Auxiliary Fuel Flow (Q_{af}) at 77 °F and 1 atm.	(Calculated using Equation 2.45 in Appendix B)	143.25	scfm		
Auxiliary fuel Energy Input =		125,670	Btu/min		
Minimum Energy required for combustion stabilization =	= 5% × Total Energy Input = 0.05 × $\rho_{fi} \times Q_{fi} \times C_{pmfi} \times (T_{fi} - T_{ref})$ =	123,070	Btu/min		
Is the calculated auxiliary fuel sufficient to stabilize combustion? (Note: If the auxiliary fuel energy input > 5% of Total Energy Input, then the auxilary fuel is sufficient.)		Yes			
Auxiliary fuel flow (Qaf) at 77°F and 1 atm. =		143	scfm		
Total Volumetric Throughput (Q_{tot}) at 77 °F and 1 atm.	$= Q_{fi} = Q_{wo} + Q_a + Q_{af} = Q_{wi} + Q_{af} =$	88,183	scfm		

Capital Recovery Factor:

Parameter	Equation	Calculated Value
Capital Recovery Factor (CRF) =	$i\,(1+i)^n/(1+i)^n - 1 =$ Where n = Equipment Life and i= Interest Rate	0.0837

Cost Estimate

Direct Costs		
Total Purchased equipment costs (in 2025 dollars)		
Incinerator + auxiliary equipment[a] (A) =		
Equipment Costs (EC) for Regenerative Oxidizer	=(2.204 x 100,000 + 11.57 Qtot) x (2025 CEPI/1999 CEPCI) =	$2,317,838 in 2025 dollars
Instrumentation[b] =	0.10 × A =	$231,784
Sales taxes =	0.03 × A =	$69,535
Freight =	0.05 × A =	$115,892
	Total Purchased equipment costs (B) =	$2,735,048 in 2025 dollars

Footnotes
a - Auxiliary equipment includes equipment (e.g., duct work) normally not included with unit furnished by incinerator vendor.
b - Includes the instrumentation and controls furnished by the incinerator vendor.

Direct Installation Costs (in 2025 dollars)		
Foundations and Supports =	0.08 × B =	$218,804
Handling and Erection =	0.14 × B =	$382,907
Electrical =	0.04 × B =	$109,402
Piping =	0.02 × B =	$54,701
Insulation for Ductwork =	0.01 × B =	$27,350
Painting =	0.01 × B =	$27,350
Site Preparation (SP) =		$0
Buildings (Bldg) =		$0
	Total Direct Installaton Costs =	$820,514
Total Direct Costs (DC) =	B + C + SP + Bldg =	$3,555,563 in 2025 dollars

Total Indirect Installation Costs (in 2025 dollars)		
Engineering =	0.10 × B =	$273,505
Construction and field expenses =	0.05 × B =	$136,752
Contractor fees =	0.10 × B =	$273,505
Start-up =	0.02 × B =	$54,701
Performance test =	0.01 × B =	$27,350
	Total Indirect Costs (IC) =	$765,814
Continency Cost (C) =	CF(IC+DC)=	$432,138
Total Capital Investment =	**DC + IC +C =**	**$4,753,514 in 2025 dollars**

Direct Annual Costs		
Annual Electricity Cost	= Annual Electricity Usage × Operating Hours/year × Electricity Price =	$183,160
Annual Fuel Costs for Natural Gas	= $Cost_{fuel}$ × Fuel Usage Rate × 60 min/hr × Operating hours/year	$767,974
Operating Labor	Operator = 0.5hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$27,375
	Supervisor = 15% of Operator	$4,106
Maintenance Costs	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$32,850
	Materials = 100% of maintenance labor	$32,850
Direct Annual Costs (DC) =		**$1,048,315 in 2025 dollars**

Indirect Annual Costs		
Overhead	= 60% of sum of operating, supervisor, maintenance labor and maintenance materials	$58,309
Administrative Charges	= 2% of TCI	$95,070
Property Taxes	= 1% of TCI	$47,535
Insurance	= 1% of TCI	$47,535
Capital Recovery	= CRF[TCI-1.08(cat. Cost)]	$397,771
Indirect Annual Costs (IC) =		**$646,220 in 2025 dollars**
Total Annual Cost =	**DC + IC =**	**$1,694,535 in 2025 dollars**

Cost Effectiveness

Cost Effectiveness = (Total Annual Cost)/(Annual Quantity of VOC/HAP Pollutants Destroyed)

Total Annual Cost (TAC) =	$1,694,535 per year in 2025 dollars
VOC/HAP Pollutants Destroyed =	6.1 tons/year
Cost Effectiveness =	$276,686 per ton of pollutants removed in 2025 dollars

Appendix F
Cost Calculations for an Afterburner to Control EAF VOC Emissions (Partial Control - 50% Control Efficiency)

Data Inputs

Select the type of oxidizer

Enter the following information for your emission source:

Composition of Inlet Gas Stream				
Pollutant Name	Concentration (ppmv)	Lower Explosive Limit (LEL) (ppmv)*	Heat of Combustion (Btu/scf)	Molecular Weight
Propane	3	21,000	2,353	44.09

Note: The lower explosion limit (LEL), heat of combustion and molecular weight for some commonly used VOC/HAP are provided in the table below. In addition, the heat of combustion to be entered in column D is a lower heating value (LHV), not a higher heating value (HHV).

Enter the design data for the proposed oxidizer:

Number of operating hours/year	8,760	hours/year	
Inlet volumetric flow rate(Q_{wi}) at 77°F and 1 atm.	100,000	scfm	
Pressure drop (ΔP)	19	inches of water	* 19 inches of water is a default pressure drop for thermal oxidizers. User should enter actual value, if known.
Motor/Fan Efficiency (ε)	60	percent*	* 60% is a default fan efficiency. User should enter actual value, if known.
Inlet Waste Gas Temperature (T_{wi})	100	°F*	* 100°F is a default temperature. User should enter actual value, if known.
Operating Temperature (T_{fi})	500	°F	* Note: Default value for Tfi is 2000°F for thermal regenerative oxidizers. Use actual value if known. Tfi for regenerative oxidizers typically between 1800 and 2000°F.
Destruction and Removal Efficiency (DRE)	50	percent	
Estimated Equipment Life	20	Years*	* 20 years is the typical equipment life. User should enter actual value, if known.
Heat Loss (η)	1	percent*	* 1 percent is a default value for the heat loss. User should enter actual value, if known. Heat loss is typically between 0.2 and 1.5%.

Percent Energy Recovery (HR) =

0 p
35 p
50 p
70 p

Catalyst Data:

Estimated catalyst life (y)	0	years
Catalyst Unit Cost (CC)	0	$/ft³
Space velocity for catalyst (Φ)	0	/hour

Enter the cost data:

Desired dollar-year	2025			
CEPCI* for 2025	829.3	Enter the CEPCI value for 2025	536.4	2016 CEPCI
Annual Interest Rate (i)	5.50	%		
Electricity ($Cost_{elect}$)	0.0641	$/kWh		
Natural Gas Fuel Cost ($Cost_{fuel}$)	0.0102	$/scf		
Operator Labor Rate	$50.00	per hour		
Maintenance Labor rate	$60.00	per hour		
Contingency Factor (CF)	10.0	Percent		

*Enter dollar year first.

* The default rate of 5.50% is the current bank prime rate, which is a nominal (or market) G45interest rate.

* $0.0641/kWh is a default price for electicity. User should enter actual value, if known.

* 10 percent of the total capital investment F45is a default value for construction contingencies. User may enter values between 5 and 15 percent.

* CEPCI is the Chemical Engineering Plant Cost Escalation/De-escalation Index. The use of CEPCI in this spreadsheet is not an endorsement of the index for purposes of cost escalation or de-escalation, but is there merely to allow for availability of a well-known cost index to spreadsheet users. Use of other well-known cost indexes (e.g., M&S) is acceptable.

Data Sources for Default Values Used in Calculations:

Parameters for Common Compounds:

Compound	LEL (ppmv)	Heat of Combustion (Btu/scf)	Molecular Weight
Methane*	50,000	911	16.04
Ethane	30,000	1,631	30.07
Propane	21,000	2,353	44.09
Butane	19,000	3,101	58.12
Pentane	14,000	3,709	72.15
Hexane	11,000	4,404	86.17
Octane	10,000	5,796	114.23
Nonane	8,000	6,493	128.25
Decane	8,000	7,190	142.28
Ethylene**	27,000	1,499	28.05
Propylene	20,000	2,182	42.08
Cyclohexane	13,000	4,180	84.16
Benzene**	14,000	3,475	78.11
Toluene**	11,000	4,274	92.14
Methyl Chloride (Chloromethane)**	82,500	705	50.49

Footnotes
* Greenhouse gas.
** Hazardous air pollutant.

Data Element	Default Value	Sources for Default Values used in the calculation . . .	If you used your own site-specific values, please enter the value used and the reference source . . .	Recommended data sources for site-specific information
Electricity Cost ($/kWh)	0.0641	Average annual electricity cost for industrial plants is based on 2016 price data compiled by the U.S. Energy Information Administration from data reported on Form EIA-861 and 861S, (https://www.eia.gov/electricity/annual/html/epa_02_04.html).		Plant's utility bill or use U.S. Energy Information Administration (EIA) data for most recent year. Available at http://www.eia.gov/electricity/data.cfm#sales.
Fuel Cost ($/Mscf)	3.51	Annual average price paid for natural gas by industrial facilities in 2016 from the U.S. Energy Information Administration. Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.		Check with fuel supplier or use U.S. Energy Information Administration (EIA) data for most recent year." Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.
Operator Labor ($/hour)	26.61	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for operators based on data for plant and System Operators – other (51-8099).		Use plant-specific labor rate.
Maintenance Labor ($/hour)	27.40	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for maintenance workers based on electrical and electronics commercial and industrial equipment repairers (49-2094).		Use plant-specific labor rate.

Design Parameters

The following design parameters for the oxidizer were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Composition of Inlet Gas Stream		
Pollutant Name	Concentration in Waste Stream (ppmv) From Data Inputs Tab	Adjusted Concentration with Dilution Air (ppmv)
Propane	3	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
Total	3	0

Constants used in calculations:

Temperature of auxiliary fuel (T_{af}) =	Reference Temperature (T_{ref}) =	77.0 °F
Density of auxiliary Fuel at 77 °F (ρ_{af}) =		0.0408 lb/ft^3
Heat Input of auxiliary fuel ($-\Delta h_{caf}$) =		21,502 Btu/lb
Density of waste gas at 77 °F (ρ_{wi}) =		0.0739 lb/ft^3
Mean Heat Capacity of Air (C_{pmair})	(For thermal oxidizers)	0.255 Btu/lb °F

Parameter	Equation	Calculated Value	Units	Value	Units
Sum of volume fraction of combustible components =	= ($\sum x_i$) =	3	ppmv		
Lower Explosive Limit of waste gas (LEL_{mix})	= $[\sum((x_j)/((\sum x_i) \times LEL_j))]^{-1}$ =	21,000	ppmv		
	Where x_j is the volume fraction and LEL_j the lower explosive limit for each combustible component in the waste gas.				
% LEL_{mix}	= (Total Combustible Conc. In Mixture/LEL_{mix}) × 100 =	0.01	percent	* Note: Since the LEL of the waste gas stream is below 25%, no dilution air is needed.	
Dilution Factor	= (LEL_{mix} x 0.249)/($\sum x_i$) =	Not applicable			
Lower Explosive Limit (LEL) of waste gas after addition of dilution air	= (Total Adjusted Conc. With Dilution Air/LEL_{mix}) × 100 =	Not Applicable			
Inlet volumetric flow rate(Qwi) at 77°F and 1 atm.	(From Data Entry Tab) =	100,000	scfm		
Oxygen Content of gas stream	= 100 - ($\sum x_j \times 100/10^6$) =	20.90	percent		
Fan Power Consumption (FP)	= $[(1.17 \times 10^{-4}) \times Q_{wi} \times \Delta P]/\varepsilon$	370.5	kW		
Q_{wo}	≈ Q_{wi} =	100,000	scfm		
Operating temperature of oxidizer (T_{fi})	(From Data Entry Tab)	500	°F		
Temperature of waste gas at outlet to preheater (T_{wo})	= Heat Recovery × (T_{fi} - T_{wi}) + T_{wi} =	100	°F	Note: this temperature is relevant for incinerators, but not for the RTOs (both regenerative and recuperative).	
Temperature of flue gas exiting the regenerative oxidizer (T_{fo})	= T_{fi} - 0.95(T_{fi} - T_{wi}) =	120	°F		
Heat Input of waste gas ($-\Delta h_{cwi}$)	= $\sum (-\Delta h_{ci}) x_i$ Where ($-\Delta h_{ci}$) is the heat of combustion and x_i the fraction of component "i" at 77 °F.	0.01	Btu/scf	0.1	Btu/lb
Estimated Auxiliary Fuel Flow (Q_{af}) at 77 °F and 1 atm.	(Calculated using Equation 2.45 in Appendix B)	43.22	scfm		
Auxiliary fuel Energy Input =		37,912	Btu/min		
Minimum Energy required for combustion stabilization =	= 5% × Total Energy Input = 0.05 × $\rho_{fi} \times Q_{fi} \times C_{pmfi} \times (T_{fi} - T_{ref})$ =	38,779	Btu/min		
Is the calculated auxiliary fuel sufficient to stabilize combustion? (Note: If the auxiliary fuel energy input > 5% of Total Energy Input, then the auxilary fuel is sufficient.)		No		Note: Additional auxiliary fuel equivalent to 5% of total energy input is required to stabilize combustion.	
Auxiliary fuel flow (Qaf) (adjusted for fuel required for combustion stabilization)at 77°F and 1 atm. =		44	scfm		
Total Volumetric Throughput (Q_{tot}) at 77 °F and 1 atm.	= $Q_{fi} = Q_{wo} + Q_a + Q_{af} = Q_{wi} + Q_{af}$ =	100,044	scfm		

Capital Recovery Factor:

Parameter	Equation	Calculated Value
Capital Recovery Factor (CRF) =	$i(1+i)^n/(1+i)^n - 1$ = Where n = Equipment Life and i= Interest Rate	0.0837

Cost Estimate

Direct Costs		
Total Purchased equipment costs (in 2025 dollars)		
Incinerator + auxiliary equipment[a] (A) =		
Equipment Costs (EC) for Regenerative Oxidizer	=(2.204 x 100,000 + 11.57 Qtot) x (2025 CEPI/1999 CEPCI) =	$2,574,197 in 2025 dollars
Instrumentation[b] =	0.10 × A =	$257,420
Sales taxes =	0.03 × A =	$77,226
Freight =	0.05 × A =	$128,710
	Total Purchased equipment costs (B) =	$3,037,553 in 2025 dollars

Footnotes

a - Auxiliary equipment includes equipment (e.g., duct work) normally not included with unit furnished by incinerator vendor.

b - Includes the instrumentation and controls furnished by the incinerator vendor.

Direct Installation Costs (in 2025 dollars)		
Foundations and Supports =	0.08 × B =	$243,004
Handling and Erection =	0.14 × B =	$425,257
Electrical =	0.04 × B =	$121,502
Piping =	0.02 × B =	$60,751
Insulation for Ductwork =	0.01 × B =	$30,376
Painting =	0.01 × B =	$30,376
Site Preparation (SP) =		$0
Buildings (Bldg) =		$0
	Total Direct Installaton Costs =	$911,266
Total Direct Costs (DC) =	B + C + SP + Bldg =	$3,948,819 in 2025 dollars
Total Indirect Installation Costs (in 2025 dollars)		
Engineering =	0.10 × B =	$303,755
Construction and field expenses =	0.05 × B =	$151,878
Contractor fees =	0.10 × B =	$303,755
Start-up =	0.02 × B =	$60,751
Performance test =	0.01 × B =	$30,376
	Total Indirect Costs (IC) =	$850,515
Continency Cost (C) =	CF(IC+DC)=	$479,933
Total Capital Investment =	**DC + IC +C =**	**$5,279,267 in 2025 dollars**
Direct Annual Costs		
Annual Electricity Cost	= Annual Electricity Usage × Operating Hours/year × Electricity Price =	$208,042
Annual Fuel Costs for Natural Gas	= $Cost_{fuel}$ × Fuel Usage Rate × 60 min/hr × Operating hours/year	$236,979
Operating Labor	Operator = 0.5hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$27,375
	Supervisor = 15% of Operator	$4,106
Maintenance Costs	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$32,850
	Materials = 100% of maintenance labor	$32,850
Direct Annual Costs (DC) =		**$542,202 in 2025 dollars**
Indirect Annual Costs		
Overhead	= 60% of sum of operating, supervisor, maintenance labor and maintenance materials	$58,309
Administrative Charges	= 2% of TCI	$105,585
Property Taxes	= 1% of TCI	$52,793
Insurance	= 1% of TCI	$52,793
Capital Recovery	= CRF[TCI-1.08(cat. Cost)]	$441,765
Indirect Annual Costs (IC) =		**$711,245 in 2025 dollars**
Total Annual Cost =	**DC + IC =**	**$1,253,447 in 2025 dollars**

Cost Effectiveness

Cost Effectiveness = (Total Annual Cost)/(Annual Quantity of VOC/HAP Pollutants Destroyed)

Total Annual Cost (TAC) =	$1,253,447 per year in 2025 dollars
VOC/HAP Pollutants Destroyed =	3.9 tons/year
Cost Effectiveness =	$324,336 per ton of pollutants removed in 2025 dollars

Data Inputs

Select the type of oxidizer

Enter the following information for your emission source:

Composition of Inlet Gas Stream				
Pollutant Name	Concentration (ppmv)	Lower Explosive Limit (LEL) (ppmv)*	Heat of Combustion (Btu/scf)	Molecular Weight
Propane	3	21,000	2,353	44.09

Note: The lower explosion limit (LEL), heat of combustion and molecular weight for some commonly used VOC/HAP are provided in the table below. In addition, the heat of combustion to be entered in column D is a lower heating value (LHV), not a higher heating value (HHV).

Enter the design data for the proposed oxidizer:

Number of operating hours/year	8,760	hours/year	
Inlet volumetric flow rate(Q_{wi}) at 77°F and 1 atm.	88,040	scfm	
Pressure drop (ΔP)	19	inches of water	* 19 inches of water is a default pressure drop for thermal oxidizers. User should enter actual value, if known.
Motor/Fan Efficiency (ε)	60	percent*	* 60% is a default fan efficiency. User should enter actual value, if known.
Inlet Waste Gas Temperature (T_{wi})	100	°F*	* 100°F is a default temperature. User should enter actual value, if known.
Operating Temperature (T_{fi})	500	°F	* Note: Default value for Tfi is 2000°F for thermal regenerative oxidizers. Use actual value if known. Tfi for regenerative oxidizers typically between 1800 and 2000°F.
Destruction and Removal Efficiency (DRE)	50	percent	
Estimated Equipment Life	20	Years*	* 20 years is the typical equipment life. User should enter actual value, if known.
Heat Loss (η)	1	percent*	* 1 percent is a default value for the heat loss. User should enter actual value, if known. Heat loss is typically between 0.2 and 1.5%.

Percent Energy Recovery (HR) =

0 p
35 p
50 p
70 p

Catalyst Data:

Estimated catalyst life (y)	0	years
Catalyst Unit Cost (CC)	0	$/ft^3
Space velocity for catalyst (Φ)	0	/hour

Enter the cost data:

Desired dollar-year	2025				
CEPCI* for 2025	829.3	Enter the CEPCI value for 2025	536.4	2016 CEPCI	*Enter dollar year first.
Annual Interest Rate (i)	5.50	%			* The default rate of 5.50% is the current bank prime rate, which is a nominal (or market) G45interest rate.
Electricity ($Cost_{elect}$)	0.0641	$/kWh			* $0.0641/kWh is a default price for electicity. User should enter actual value, if known.
Natural Gas Fuel Cost ($Cost_{fuel}$)	0.0102	$/scf			
Operator Labor Rate	$50.00	per hour			
Maintenance Labor rate	$60.00	per hour			
Contingency Factor (CF)	10.0	Percent			* 10 percent of the total capital investment F45is a default value for construction contingencies. User may enter values between 5 and 15 percent.

* CEPCI is the Chemical Engineering Plant Cost Escalation/De-escalation Index. The use of CEPCI in this spreadsheet is not an endorsement of the index for purposes of cost escalation or de-escalation, but is there merely to allow for availability of a well-known cost index to spreadsheet users. Use of other well-known cost indexes (e.g., M&S) is acceptable.

Data Sources for Default Values Used in Calculations:

Parameters for Common Compounds:

Compound	LEL (ppmv)	Heat of Combustion (Btu/scf)	Molecular Weight
Methane*	50,000	911	16.04
Ethane	30,000	1,631	30.07
Propane	21,000	2,353	44.09
Butane	19,000	3,101	58.12
Pentane	14,000	3,709	72.15
Hexane	11,000	4,404	86.17
Octane	10,000	5,796	114.23
Nonane	8,000	6,493	128.25
Decane	8,000	7,190	142.28
Ethylene**	27,000	1,499	28.05
Propylene	20,000	2,182	42.08
Cyclohexane	13,000	4,180	84.16
Benzene**	14,000	3,475	78.11
Toluene**	11,000	4,274	92.14
Methyl Chloride (Chloromethane)**	82,500	705	50.49

Footnotes
* Greenhouse gas.
** Hazardous air pollutant.

Data Element	Default Value	Sources for Default Values used in the calculation . . .	If you used your own site-specific values, please enter the value used and the reference source . . .	Recommended data sources for site-specific information
Electricity Cost ($/kWh)	0.0641	Average annual electricity cost for industrial plants is based on 2016 price data compiled by the U.S. Energy Information Administration from data reported on Form EIA-861 and 861S, (https://www.eia.gov/electricity/annual/html/epa_02_04.html).		Plant's utility bill or use U.S. Energy Information Administration (EIA) data for most recent year. Available at http://www.eia.gov/electricity/data.cfm#sales.
Fuel Cost ($/Mscf)	3.51	Annual average price paid for natural gas by industrial facilities in 2016 from the U.S. Energy Information Administration. Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.		Check with fuel supplier or use U.S. Energy Information Administration (EIA) data for most recent year." Available at http://www.eia.gov/dnav/ng/hist/n3035us3A.htm.
Operator Labor ($/hour)	26.61	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for operators based on data for plant and System Operators – other (51-8099).		Use plant-specific labor rate.
Maintenance Labor ($/hour)	27.40	Bureau of Labor Statistics, May 2016 National Occupational Employment and Wage Estimates – United States, May 2016 (https://www.bls.gov/oes/current/oes_nat.htm). Hourly rates for maintenance workers based on electrical and electronics commercial and industrial equipment repairers (49-2094).		Use plant-specific labor rate.

Design Parameters

The following design parameters for the oxidizer were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Composition of Inlet Gas Stream		
Pollutant Name	Concentration in Waste Stream (ppmv) From Data Inputs Tab	Adjusted Concentration with Dilution Air (ppmv)
Propane	3	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
0	0	NA
Total	3	0

Constants used in calculations:

Temperature of auxiliary fuel (T_{af}) =	Reference Temperature (T_{ref}) =	77.0	°F
Density of auxiliary Fuel at 77 °F (ρ_{af}) =		0.0408	lb/ft^3
Heat Input of auxiliary fuel ($-\Delta h_{caf}$) =		21,502	Btu/lb
Density of waste gas at 77 °F (ρ_{wi}) =		0.0739	lb/ft^3
Mean Heat Capacity of Air (C_{pmair})	(For thermal oxidizers)	0.255	Btu/lb °F

Parameter	Equation	Calculated Value	Units	Value	Units
Sum of volume fraction of combustible components =	$= (\sum x_i) =$	3	ppmv		
Lower Explosive Limit of waste gas (LEL_{mix})	$= [\sum((x_j)/((\sum x_i) \times LEL_j))]^{-1} =$	21,000	ppmv		
	Where x_j is the volume fraction and LEL_j the lower explosive limit for each combustible component in the waste gas.				
% LEL_{mix}	= (Total Combustible Conc. In Mixture/LEL_{mix}) × 100 =	0.01	percent	* Note: Since the LEL of the waste gas stream is below 25%, no dilution air is needed.	
Dilution Factor	$= (LEL_{mix} \times 0.249)/(\sum x_i) =$	Not applicable			
Lower Explosive Limit (LEL) of waste gas after addition of dilution air	= (Total Adjusted Conc. With Dilution Air/LEL_{mix}) × 100 =	Not Applicable			
Inlet volumetric flow rate(Qwi) at 77°F and 1 atm.	(From Data Entry Tab) =	88,040	scfm		
Oxygen Content of gas stream	$= 100 - (\sum x_j \times 100/10^6) =$	20.90	percent		
Fan Power Consumption (FP)	$= [(1.17 \times 10^{-4}) \times Q_{wi} \times \Delta P]/\varepsilon$	326.2	kW		
Q_{wo}	$\approx Q_{wi} =$	88,040	scfm		
Operating temperature of oxidizer (T_{fi})	(From Data Entry Tab)	500	°F		
Temperature of waste gas at outlet to preheater (T_{wo})	= Heat Recovery × ($T_{fi} - T_{wi}$) + T_{wi} =	100	°F	Note: this temperature is relevant for incinerators, but not for the RTOs (both regenerative and recuperative).	
Temperature of flue gas exiting the regenerative oxidizer (T_{fo})	$= T_{fi} - 0.95(T_{fi} - T_{wi}) =$	120	°F		
Heat Input of waste gas ($-\Delta h_{cwi}$)	$= \sum (-\Delta h_{ci})\, x_i$ Where ($-\Delta h_{ci}$) is the heat of combustion and x_i the fraction of component "i" at 77 °F.	0.01	Btu/scf	0.1	Btu/lb
Estimated Auxiliary Fuel Flow (Q_{af}) at 77 °F and 1 atm.	(Calculated using Equation 2.45 in Appendix B)	38.05	scfm		
Auxiliary fuel Energy Input =		33,378	Btu/min		
Minimum Energy required for combustion stabilization =	= 5% × Total Energy Input = 0.05 × $\rho_{fi} \times Q_{fi} \times C_{pmfi} \times (T_{fi} - T_{ref})$ =	34,141	Btu/min		
Is the calculated auxiliary fuel sufficient to stabilize combustion? (Note: If the auxiliary fuel energy input > 5% of Total Energy Input, then the auxilary fuel is sufficient.)		No		Note: Additional auxiliary fuel equivalent to 5% of total energy input is required to stabilize combustion.	
Auxiliary fuel flow (Qaf) (adjusted for fuel required for combustion stabilization)at 77°F and 1 atm. =		39	scfm		
Total Volumetric Throughput (Q_{tot}) at 77 °F and 1 atm.	$= Q_{fi} = Q_{wo} + Q_a + Q_{af} = Q_{wi} + Q_{af} =$	88,079	scfm		

Capital Recovery Factor:

Parameter	Equation	Calculated Value
Capital Recovery Factor (CRF) =	$i\,(1+i)^n/(1+i)^n - 1 =$ Where n = Equipment Life and i= Interest Rate	0.0837

Cost Estimate

Direct Costs

Total Purchased equipment costs (in 2025 dollars)

Incinerator + auxiliary equipment[a] (A) =		
Equipment Costs (EC) for Regenerative Oxidizer	=(2.204 x 100,000 + 11.57 Qtot) x (2025 CEPI/1999 CEPCI) =	$2,315,583 in 2025 dollars
Instrumentation[b] =	0.10 × A =	$231,558
Sales taxes =	0.03 × A =	$69,467
Freight =	0.05 × A =	$115,779
	Total Purchased equipment costs (B) =	$2,732,387 in 2025 dollars

Footnotes

a - Auxiliary equipment includes equipment (e.g., duct work) normally not included with unit furnished by incinerator vendor.

b - Includes the instrumentation and controls furnished by the incinerator vendor.

Direct Installation Costs (in 2025 dollars)

Foundations and Supports =	0.08 × B =	$218,591
Handling and Erection =	0.14 × B =	$382,534
Electrical =	0.04 × B =	$109,295
Piping =	0.02 × B =	$54,648
Insulation for Ductwork =	0.01 × B =	$27,324
Painting =	0.01 × B =	$27,324
Site Preparation (SP) =		$0
Buildings (Bldg) =		$0
	Total Direct Installaton Costs =	$819,716
Total Direct Costs (DC) =	B + C + SP + Bldg =	$3,552,104 in 2025 dollars

Total Indirect Installation Costs (in 2025 dollars)

Engineering =	0.10 × B =	$273,239
Construction and field expenses =	0.05 × B =	$136,619
Contractor fees =	0.10 × B =	$273,239
Start-up =	0.02 × B =	$54,648
Performance test =	0.01 × B =	$27,324
	Total Indirect Costs (IC) =	$765,068
Continency Cost (C) =	CF(IC+DC)=	$431,717
Total Capital Investment =	**DC + IC +C =**	**$4,748,889 in 2025 dollars**

Direct Annual Costs

Annual Electricity Cost	= Annual Electricity Usage × Operating Hours/year × Electricity Price =	$183,160
Annual Fuel Costs for Natural Gas	= $Cost_{fuel}$ × Fuel Usage Rate × 60 min/hr × Operating hours/year	$208,637
Operating Labor	Operator = 0.5hours/shift × Labor Rate × (Operating hours/8 hours/shift)	$27,375
	Supervisor = 15% of Operator	$4,106
Maintenance Costs	Labor = 0.5 hours/shift × Labor Rate × (Operating Hours/8 hours/shift)	$32,850
	Materials = 100% of maintenance labor	$32,850
Direct Annual Costs (DC) =		**$488,978 in 2025 dollars**

Indirect Annual Costs

Overhead	= 60% of sum of operating, supervisor, maintenance labor and maintenance materials	$58,309
Administrative Charges	= 2% of TCI	$94,978
Property Taxes	= 1% of TCI	$47,489
Insurance	= 1% of TCI	$47,489
Capital Recovery	= CRF[TCI-1.08(cat. Cost)]	$397,384
Indirect Annual Costs (IC) =		**$645,648 in 2025 dollars**
Total Annual Cost =	**DC + IC =**	**$1,134,626 in 2025 dollars**

Cost Effectiveness

Cost Effectiveness = (Total Annual Cost)/(Annual Quantity of VOC/HAP Pollutants Destroyed)

Total Annual Cost (TAC) =	$1,134,626 per year in 2025 dollars
VOC/HAP Pollutants Destroyed =	3.4 tons/year
Cost Effectiveness =	$333,474 per ton of pollutants removed in 2025 dollars

Public Notice
Ohio Environmental Protection Agency
Draft State Implementation Plan
VOC Reasonably Available Control Technology (RACT)
for Charter Manufacturing Company, Inc. (Facility ID 1318171623)

Cuyahoga County

Notice is hereby given that the Director of the Ohio Environmental Protection Agency, (Ohio EPA) is submitting to the United States Environmental Protection Agency (U.S. EPA) Reasonably Available Control Technology (RACT) for Charter Manufacturing Company, Inc. (Facility ID 1318171623) for approval into Ohio's state implementation plan (SIP) for the 2015 ozone National Ambient Air Quality Standard (NAAQS).

On March 17, 2025, Ohio submitted a revision to Ohio's SIP to address RACT requirements for the 2015 8-hour ozone NAAQS. As noted in this submittal, Ohio Administrative Code (OAC) rule 3745-21-11(B) requires facilities that have the potential to emit of fifty tons per year or more, but less than one hundred tons per year of volatile organic compounds (VOC) and are located in nonattainment counties to submit a RACT study for sources not controlled by Ohio's Control Technique Guideline (CTG) regulations in OAC Chapter 3745-21 or by categorical non-CTG RACT in OAC rules 3745-21-12, 3745-21-14, 3745-21-16, 3745-21-21 and 3745-21-25.

Ohio is now submitting source-specific VOC RACT for Charter Manufacturing Company, Inc. (Facility ID 1318171623) for approval into Ohio's SIP. This facility is located in the Cleveland 2015 ozone maintenance area and has no prior existing source-specific RACT established in OAC rule 3745-21-09.

The updated RACT Study was submitted per OAC rule 3745-21-11(B). Ohio has determined that the updated RACT study, along with supplemental information submitted subsequently, is sufficient to justify the continued use of the existing scrap management plan and duct direct shell evacuation (DEC) system (with adjustable air gap and water-cooled elbow and duct) allowing for efficient post furnace VOC combustion pursuant to OAC rule 3745-31-05(D) proposed by the facility to act as RACT for the electric arc furnace under the 2015 ozone standard.

Ohio EPA is now requesting approval of the proposed RACT for Charter Manufacturing Company, Inc. into Ohio's SIP.

Ohio EPA is seeking public comment to satisfy U.S. EPA requirements for public involvement in SIP related activities in accordance with 40 CFR 51.102.

The public comment period will run until October 12, 2026. Written comments should be submitted at: https://ohioepa.commentinput.com - Search by entering the permit # (P0141210 for Charter Manufacturing Company, Inc.) in the "Search Projects" search box.

A public hearing on this action may be requested by contacting Kathryn Jobe at 614-728-0671 or kathryn.jobe@epa.ohio.gov no later than 30 days from the draft public notice. If a public hearing is requested, a new notification will be published to identify the time and location of the public hearing. The public hearing will be held at least 30 days after the date of the new notification.

All interested persons are entitled to comment on these changes. All comments submitted to the above address by the close of business 30 days from when the draft public notice is issued will be considered by Ohio EPA prior to final action on this action. Written statements submitted after this time period may be considered as time and circumstances permit but will not be part of the official record.

Questions or comments about this document should be directed to Kathryn Jobe at 614-728-0671 or kathryn.jobe@epa.ohio.gov.

DATE

Ms. Anne Vogel
Regional Administrator
U.S. EPA, Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604

Re: Revision to Ohio's Reasonably Available Control Technology (RACT) State Implementation Plan for the 2015 Ozone National Ambient Air Quality Standards – Source-Specific Volatile Organic Compound (VOC*)* RACT for Charter Manufacturing Company, Inc. (Facility ID 1318171623)

Dear Administrator Vogel:

On March 17, 2025, Ohio submitted a revision to Ohio's State Implementation Plan (SIP) to address Reasonably Available Control Technology (RACT) requirements for the 2015 8-hour ozone National Ambient Air Quality Standards (NAAQS) for areas classified as serious. As noted in this submittal, Ohio EPA adopted requirements in Ohio Administrative Code (OAC) rule 3745-21-11 for facilities in the nonattainment areas that emit fifty tons per year or more, but less than one hundred tons per year of volatile organic compounds (VOC) from sources not controlled by Ohio's CTG regulations in OAC Chapter 3745-21 or by categorical non-CTG RACT in OAC rules 3745-21-12, 3745-21-14, 3745-21-16, 3745-21-21 and 3745-21-25 to submit an updated RACT study within one year of the effective date of the rule. Upon review of the RACT study, Ohio EPA evaluated if the RACT proposed by the facility is appropriate to satisfy RACT requirements under the 2015 ozone standard.

Ohio is now submitting source-specific VOC RACT for Charter Manufacturing Company, Inc. (Facility ID 1318171623) for approval into Ohio's SIP. This facility is located in the Cleveland 2015 ozone maintenance area and has no prior existing source-specific RACT established in OAC rule 3745-21-09.

The updated VOC RACT Study was submitted per OAC rule 3745-21-11. Ohio has determined that the updated RACT study, along with supplemental information submitted subsequently, is sufficient to justify the continued use of the existing scrap management plan and duct direct shell evacuation (DEC) system (with adjustable air gap and water-cooled elbow and duct) allowing for efficient post furnace VOC combustion pursuant to OAC rule 3745-31-05(D) proposed by the facility to act as RACT for the electric arc furnace under the 2015 ozone standard. The RACT study is provided in Appendix A, and the permit that incorporated RACT is provided as Appendix B. Within the permit, we have highlighted the terms and conditions associated with RACT and request only those provisions are subject to this SIP revision request. Appendix C provides the permit strategy write-up for the permit.

Ohio held a public comment period on Ohio's RACT determination from September 10 to October 12, 2026. Appendix D contains the public notice. ***[Ohio's response to comments received during the public comment period is in Appendix E/No comments were received during the public comment period].***

This SIP does not include the relaxation of any existing requirements and therefore will not interfere with the attainment or maintenance of the NAAQS in accordance with section 110(l) of the CAA.

Ohio EPA is now requesting approval of the proposed RACT for Charter Manufacturing Company, Inc. into Ohio's SIP.

Ohio EPA is submitting this SIP via U.S. EPA's State Planning Electronic Collaboration System (SPeCS). If you have questions, please contact Jennifer Van Vlerah in our Division of Air Pollution Control at (614) 644-3696.

Sincerely,

John Logue
Director

Cc: Bob Hodanbosi, Chief, Division of Air Pollution Control, Ohio EPA

Enclosures