

CLASS I – SIGNIFICANT PERMIT REVISION AIR DISPERSION MODELING REPORT

Hermosa Mine

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1. INTRODUCTION

1.1 Background

South32 Hermosa Inc. (South32) is a mineral exploration and development company focused on the exploration and development of the Hermosa Mine (the Facility) near Patagonia, Arizona, in Santa Cruz County. The Arizona Department of Environmental Quality (ADEQ) issued Class I Air Quality Permit No. 96653 on August 26, 2024, (as Amended by Minor Permit Revision (MPR) No. 106420 and MPR 109292) to South32 for the construction and operation of the South32 Hermosa Mine. Pursuant to Arizona Administrative Code (A.A.C.) R18-2-320, South32 is submitting a Significant Permit Revision (SPR) application to revise Permit No. 96653. As part of the application, South32 is submitting this modeling report for the ambient air quality assessment associated with proposed changes to the Facility.

1.2 Purpose

As part of the minor New Source Review (mNSR) process under A.A.C. R18-2-334, an ambient air quality assessment was conducted via air dispersion modeling to demonstrate that potential impacts from the Hermosa Mine will not interfere with attainment or maintenance of the PM₁₀ and PM_{2.5} National Ambient Air Quality Standard (NAAQS). The NAAQS are protective of the general public and “at risk” populations.

1.3 Pollutants

The following pollutants with NAAQS standards were evaluated in the air dispersion modeling analysis as the Hermosa Mine has Potential-to-Emit (PTE) estimates above minor NSR thresholds for these pollutants based on the proposed Project:

- ▶ Particulate matter less than 10 microns (PM₁₀);
- ▶ Particulate matter less than 2.5 microns (PM_{2.5});

Corresponding averaging periods and standards are included in detail in Section 3.1.

1.4 Modeling Approach

The modeling approach submitted with the original permit application in December 2023 generally remains unchanged; therefore, no new modeling protocol has been submitted for this revision. Additional details on the modeling methodology and approach are included in Section 3. The process and configuration changes at the Facility outlined in the MPR application submitted on May 6, 2025 (MPR 109292), have been incorporated into this sitewide modeling. Furthermore, in addition to the air dispersion modeling demonstration assessing primary pollutant impacts, other assessments were conducted to evaluate the impacts of precursor emissions and secondary formation for particulate matter.

2. PROJECT AND SITE INFORMATION

South32 Hermosa is a mineral exploration and development company focused on the exploration and development of the Hermosa Mine near Patagonia, Arizona, in Santa Cruz County. South32 is constructing an underground mine that will lead to the production or above-ground beneficiation of mined ores (zinc, silver, manganese, and lead) into crushed ore or concentrates for further beneficiation off-site. The Hermosa Mine is located in an area of Santa Cruz County currently designated as attainment or unclassifiable for all NAAQS.¹

The current Class I permit authorizes the use of fifty-eight (58) 2,600 kW natural gas engines at operational loads of 75-100%. This modeling report incorporates the proposed changes to the Facility under the SPR application, as follows:

- ▶ Increase the operating load range of fourteen (14) of the 2.6-Megawatt (MW) Natural Gas Engines from the permitted 75-100% to 50-100% to account for fluctuation in load requirements during operation.
- ▶ Reduce the total number of permitted natural gas 2.6 MW engines from fifty-eight (58) to forty (40) to account for the updated power profile for the operation of the mine.
- ▶ Update the following natural gas engine parameters:
 - Update stack height to 28 feet
 - Update stack location to north side in selected engine enclosures
 - Update location of engines
- ▶ Reduce the Plan I and II natural gas delivery trips to account for the reduced number of engines.
- ▶ Updates to modeled emission rates based on representation changes to the six (6) Diesel CAT XQ1140 gensets (Model ID: HS1-HS6), the C200D2RE engine (Model ID: ENG5), and the moisture content for the tailings and associated sources.

In addition to the proposed changes to the Facility as a result of the SPR, this revised modeling analysis includes the following updates to the model based off changes from MPR No. 109292 submitted in May 2025:

- ▶ Updated emission rates based on changes outlined in the SPR application.
- ▶ Updated Plan II Boundary to align with the latest MPO.
- ▶ Added and revised emission sources associated with the following processes:
 - Coarse ore handling system and associated dust collectors
 - Wet ore beneficiation (after the primary mill)
 - Reagent Storage
 - Water Treatment Plant #1 (WTP1)
 - Trips associated with the East Ore Stockpile (EOS)
- ▶ Updated building structures and road configurations based on latest South32 Hermosa site layouts

This modeling analysis excludes the 4.4 MW natural gas engine option, which was removed as highlighted in the MPR 109292 application. All existing, unchanged emission sources have been previously identified in the original Class I air application and the subsequent MPR applications. As such, this report focuses on any revised or new source/model configuration.

¹ Per Arizona Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants, Green Book, Environmental Protection Agency (EPA).

2.1 Site Location & Description

The Hermosa Mine is located approximately 24 kilometers (~15 miles) east-northeast of Nogales, Arizona in Santa Cruz County. Figure 2-1 and Figure 2-2 provides the general location of the site with respect to southern Arizona as well as surrounding cities and highways. Regionally, the Hermosa Mine is located in the northern section of the Patagonia Mountains, a region with a long history of mining and which is characterized by forests and grasslands interspersed with areas of exposed rocks and jutting mountains. The Hermosa Mine lies at approximately 1,585 meters above sea level with higher elevations to the north, west, and south. For this modeling analysis, South32 used ambient air boundaries for both the current and proposed operations known as Plan I and Plan II, respectively. Figure 2-1 through Figure 2-1 include overall site plans during Plan I and Plan II, including property boundaries, as well as zoomed-in maps of the beneficiation areas for Taylor and Clark.

The current Public Access Restriction Plan (PARP) submitted on January 24, 2025, precludes access to South32 patented lands. The Plan I ambient air boundary (AAB) is modeled based on this current PARP. A portion of Harshaw Road, which cuts directly through South32 land, will be publicly accessible during operation of the Hermosa Mine. Public access is restricted solely to the road. The modeled ambient air boundary incorporates receptors in these publicly accessible areas, consistent with the previous modeling analysis.

South32 is awaiting approval from the United States Forest Service (USFS) for operation on Forest Service land as outlined in the MPO. This approval would coincide with updates to the PARP for the Plan II AAB. Conservatively, emissions were determined for the operating year with maximum emissions for the proposed Hermosa Mine. This is a very conservative approach since it is highly unlikely that all emitting activities will be performed in the same operating year during life of mine.

Figure 2-1: Hermosa Project - Location Map - Plan I

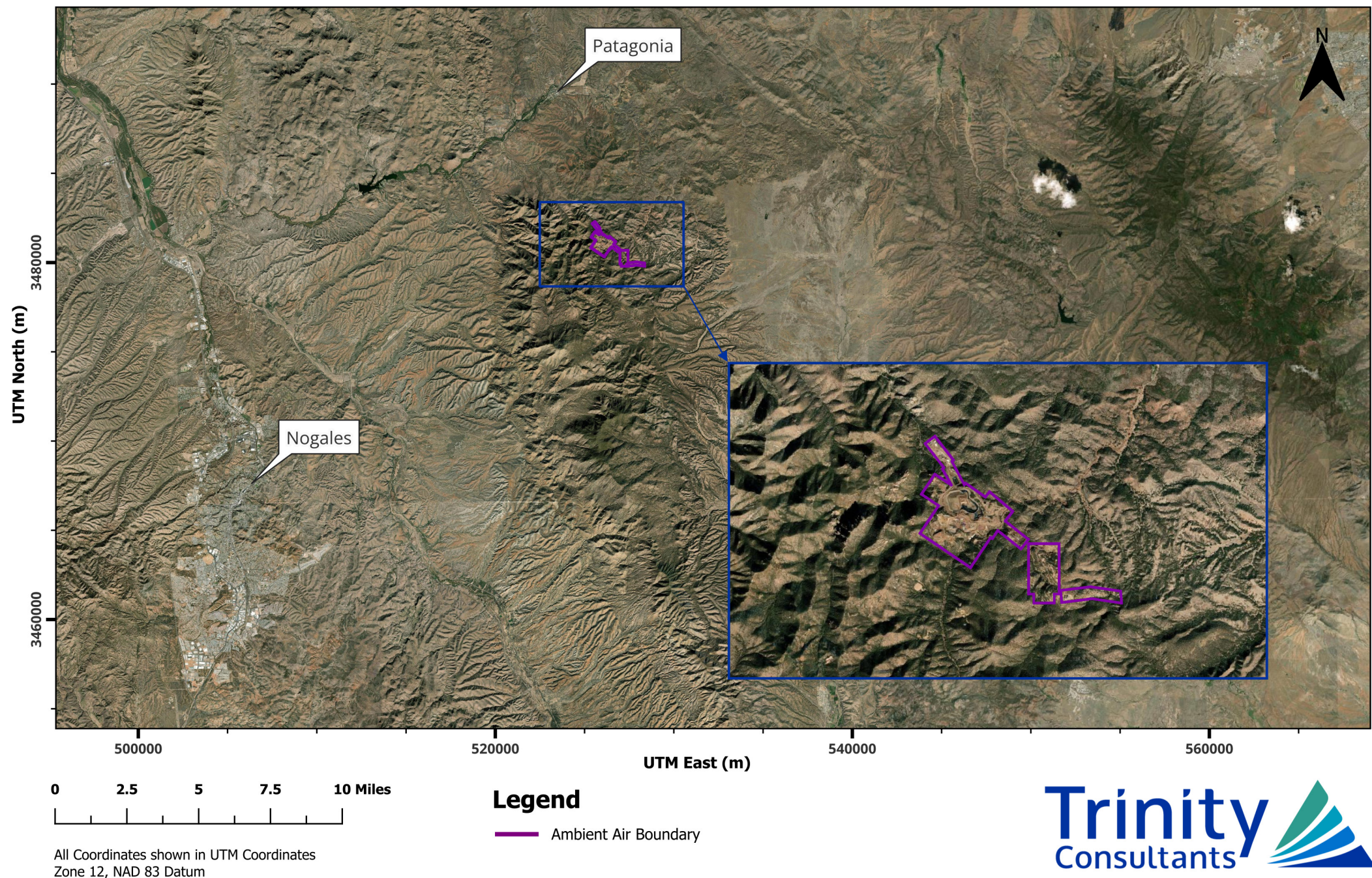


Figure 2-2: Hermosa Project - Location Map - Plan II

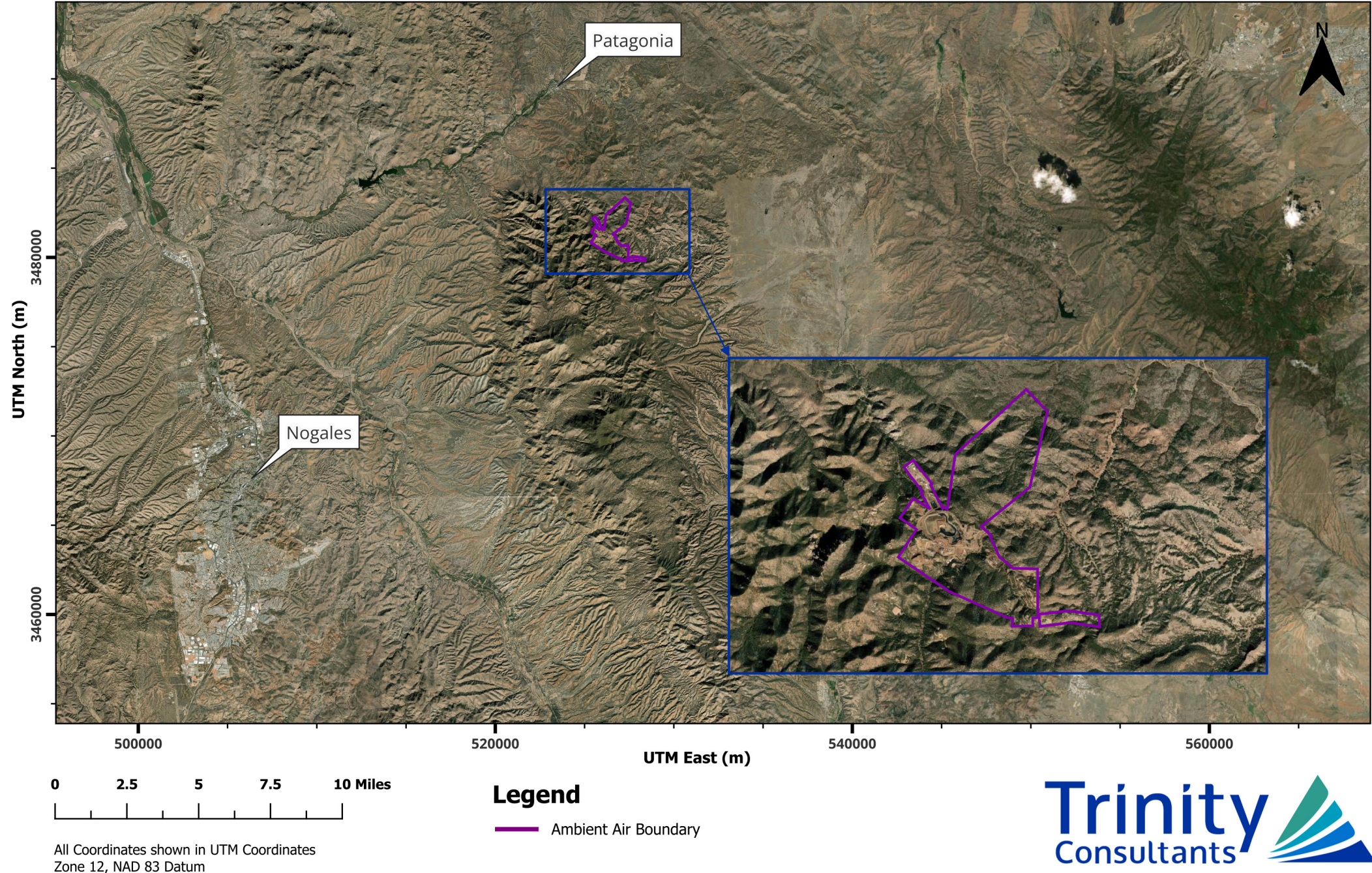


Figure 2-3: Hermosa Project - Zoom In Locations

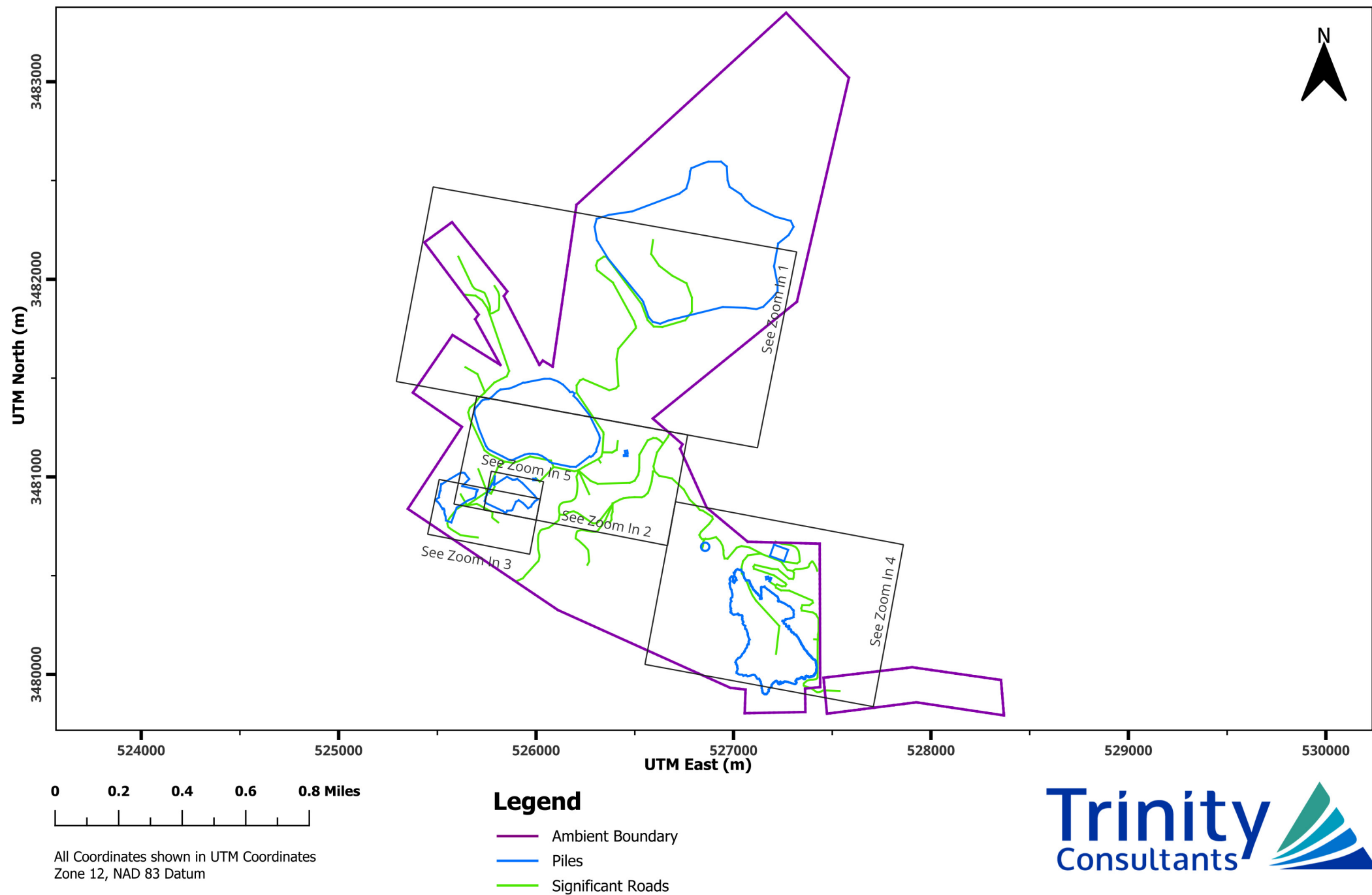


Figure 2-4: Hermosa Project - Piles and Roads - Plan I

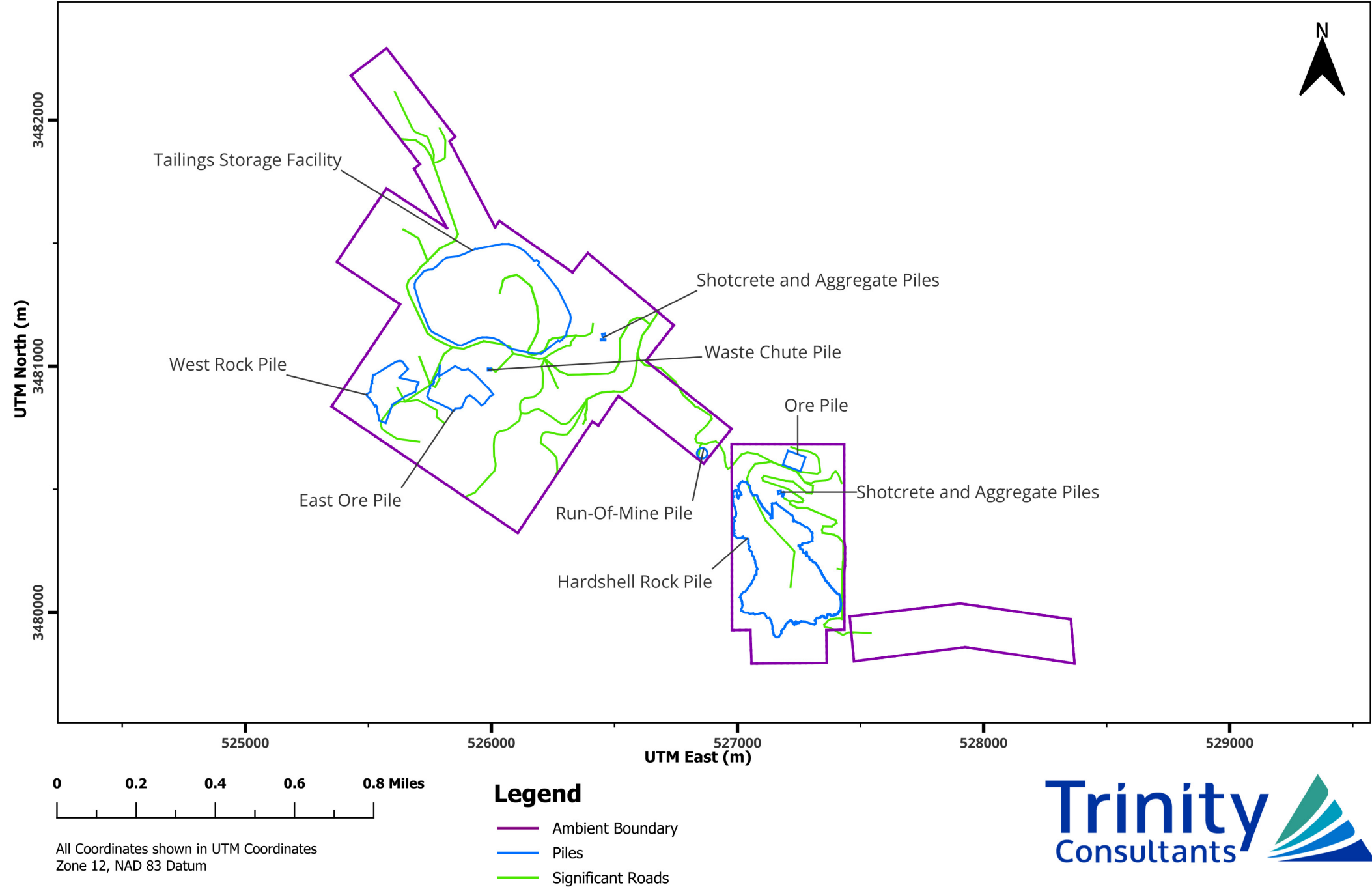


Figure 2-5: Hermosa Project - Piles and Roads - Plan II

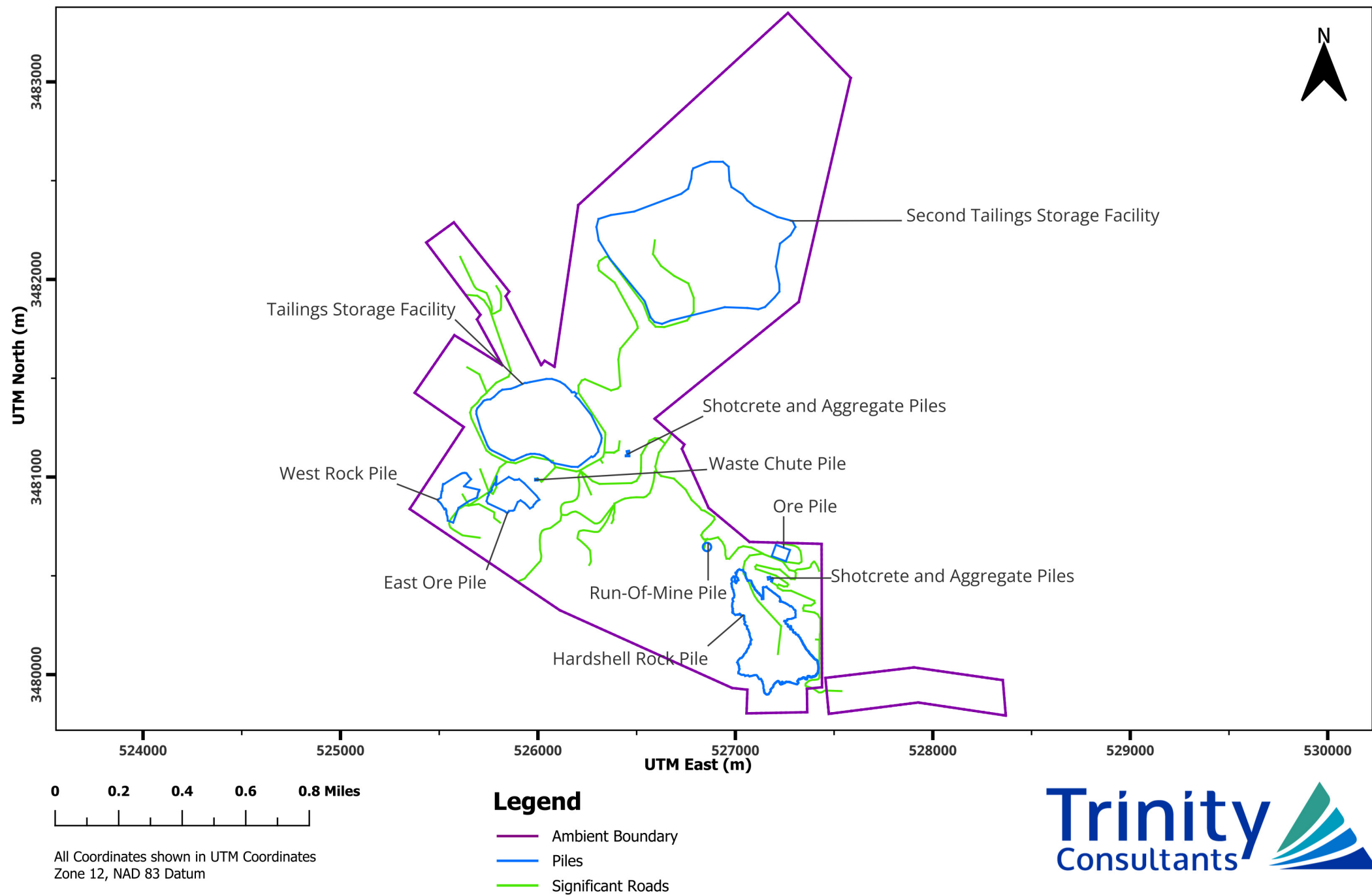


Figure 2-6: Hermosa Project - Building Zoom In 1

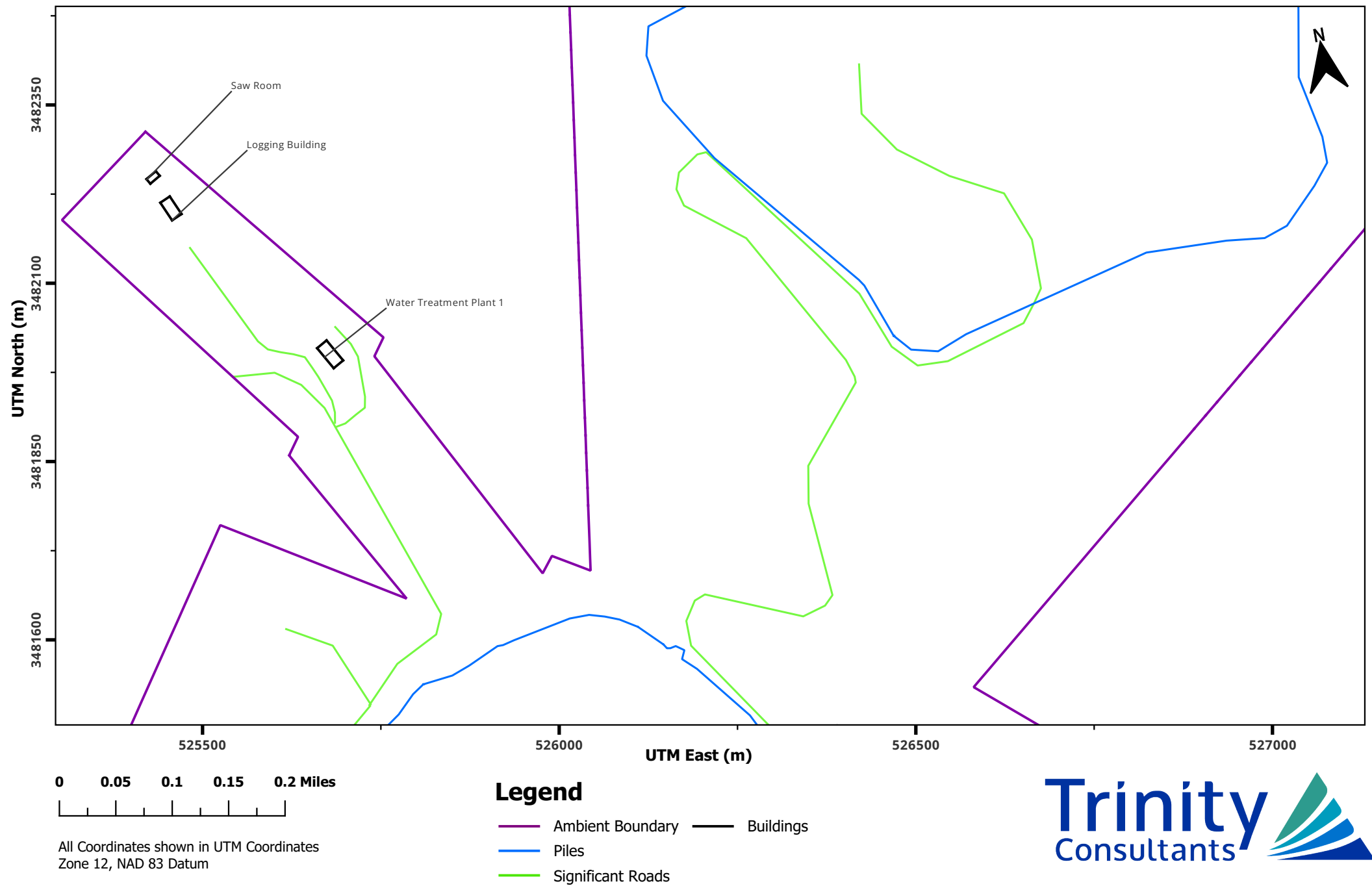


Figure 2-7: Hermosa Project - Building Zoom In 2

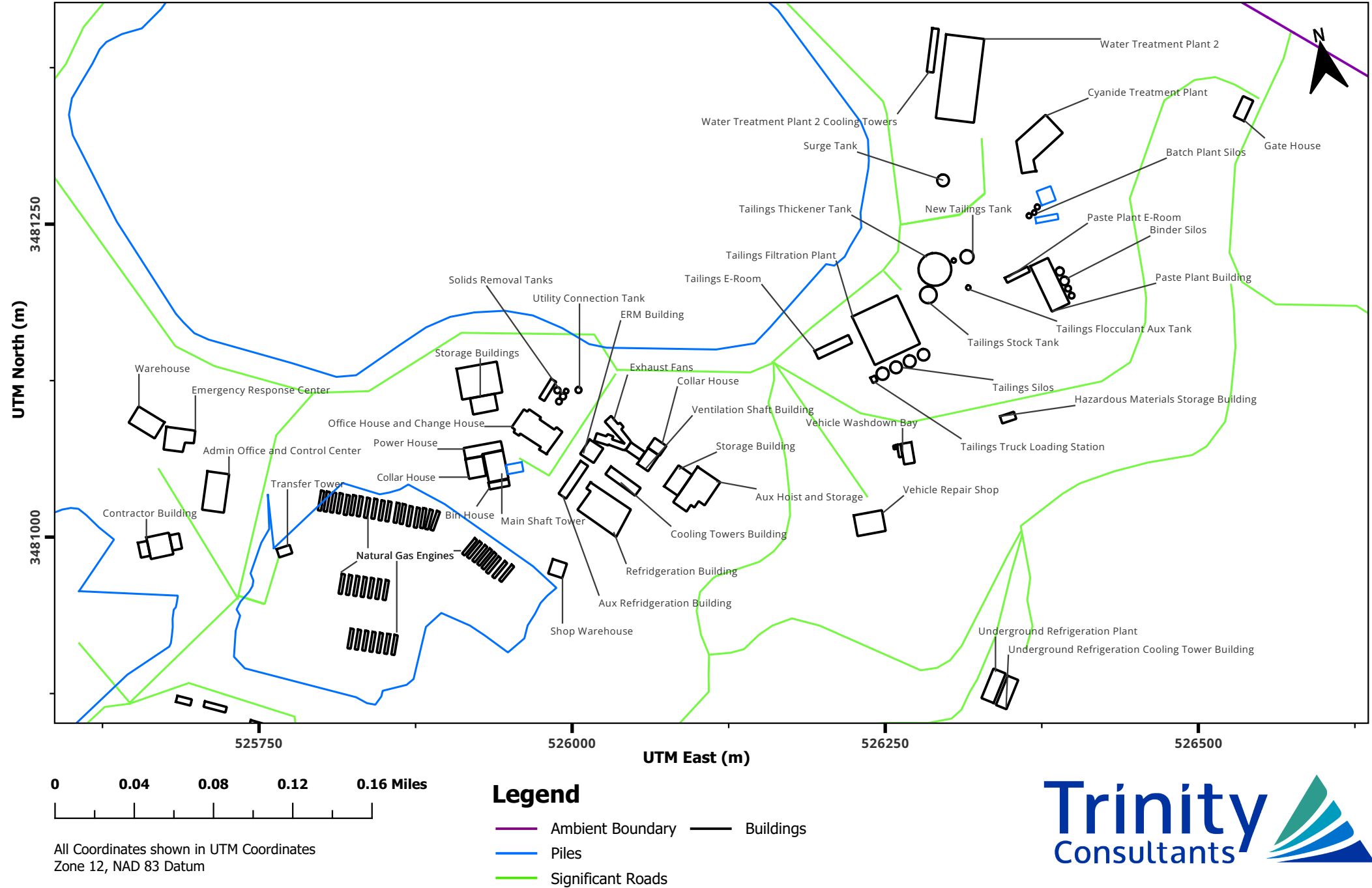


Figure 2-8: Hermosa Project - Building Zoom In 3

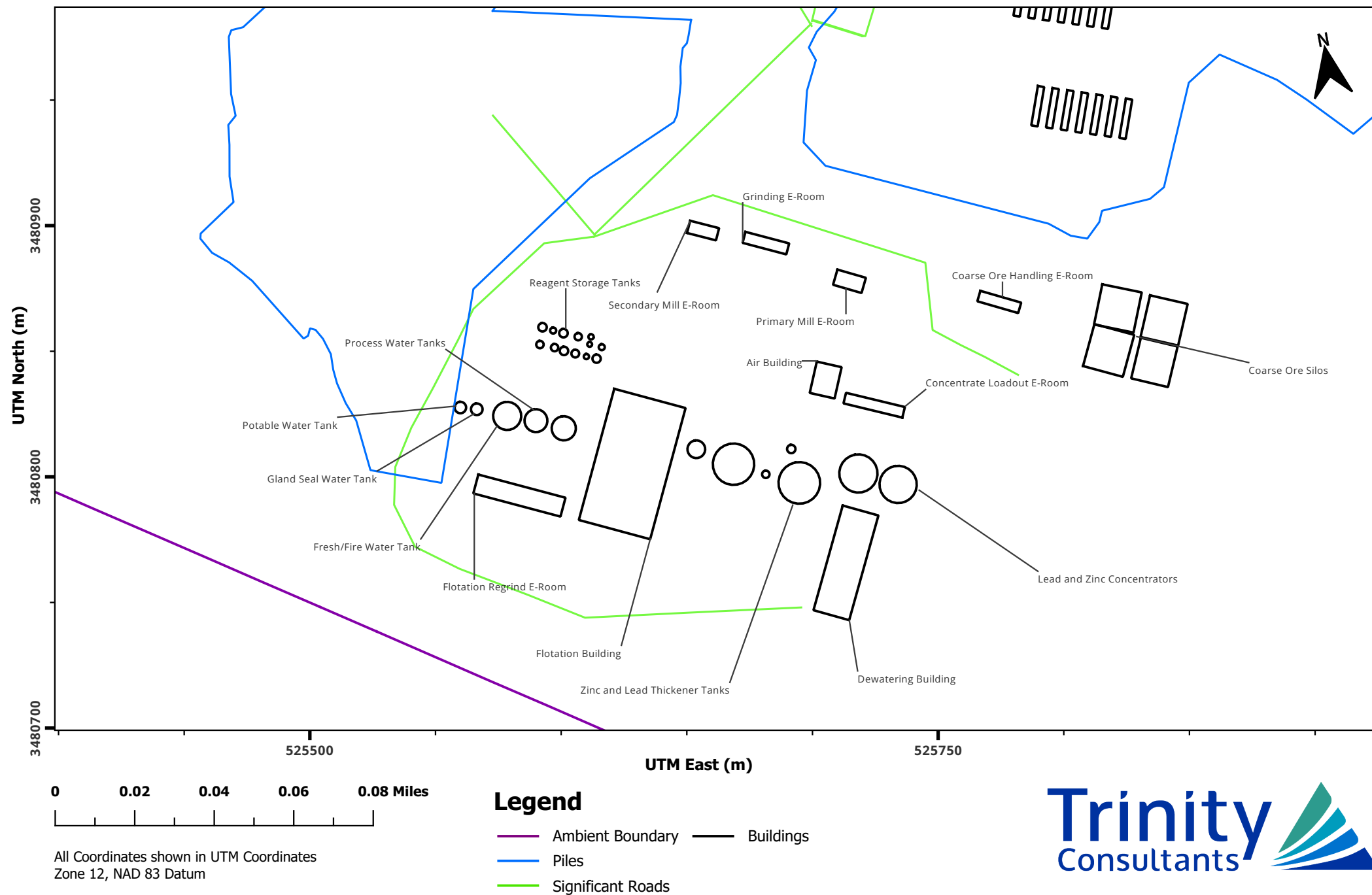


Figure 2-9: Hermosa Project - Building Zoom In 4

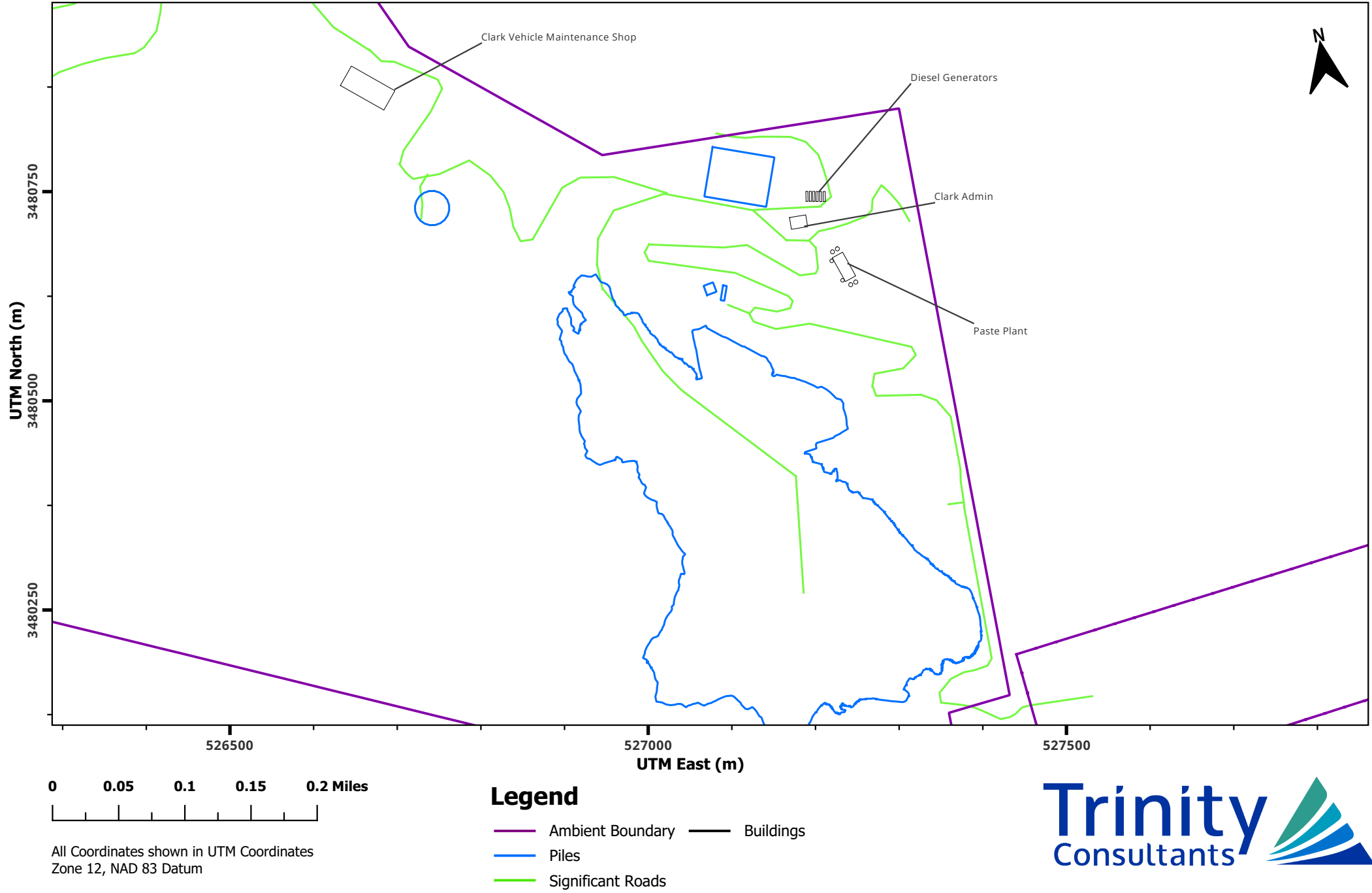


Figure 2-10: Hermosa Project - Building Zoom In 5

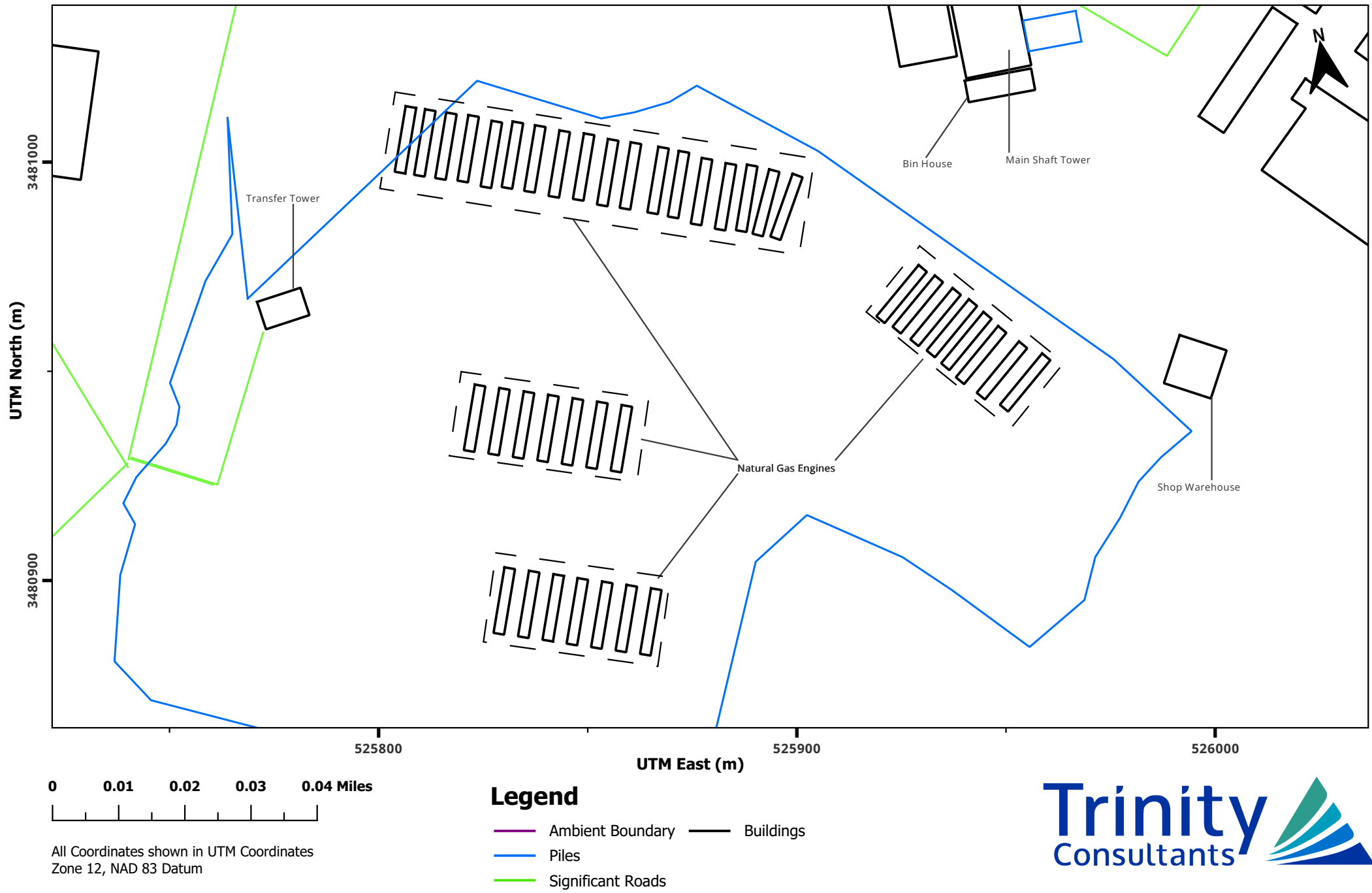


Figure 2-11: Hermosa Project - Emission Sources Zoom In 1

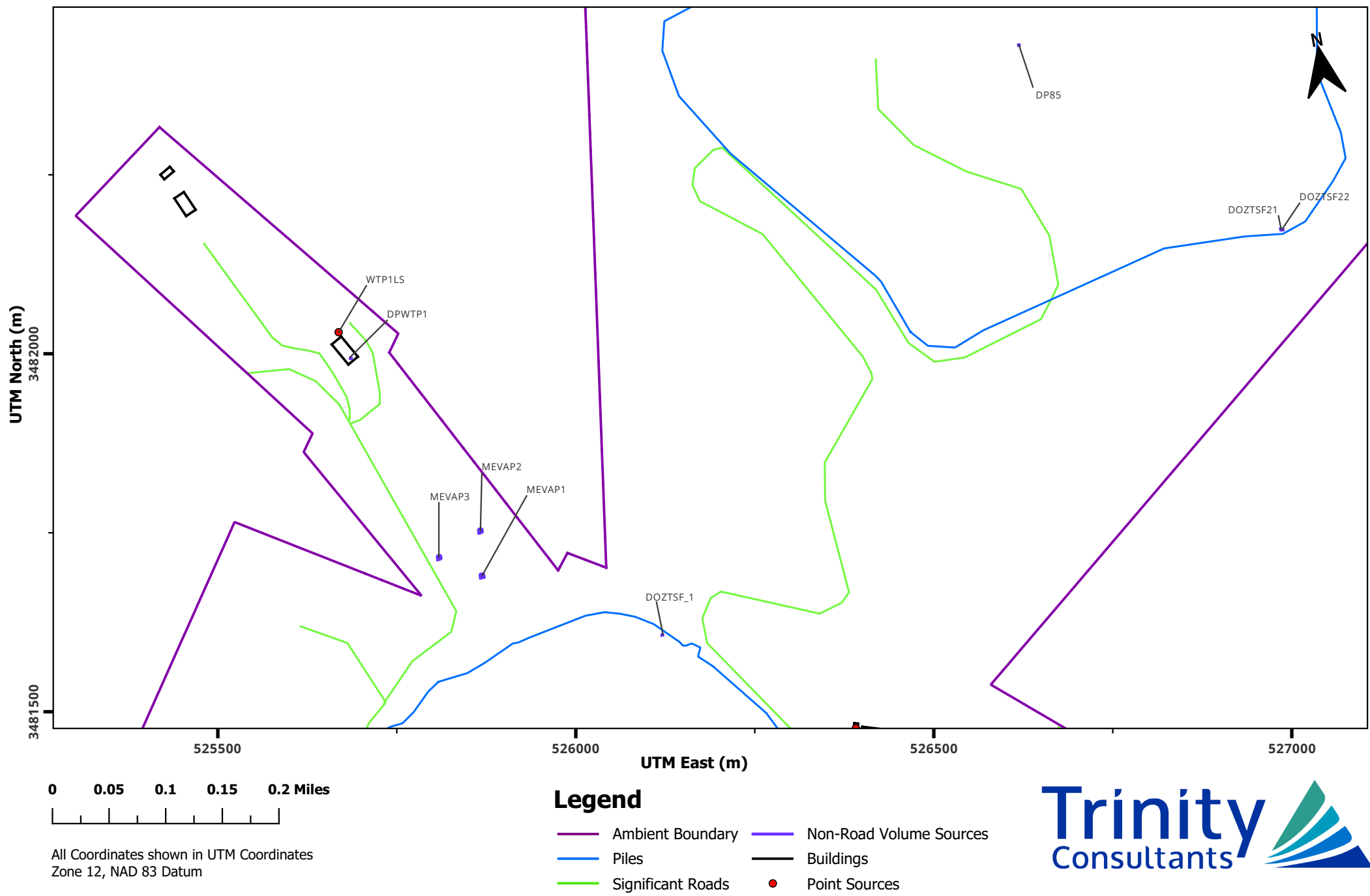


Figure 2-12: Hermosa Project - Emission Sources Zoom In 2

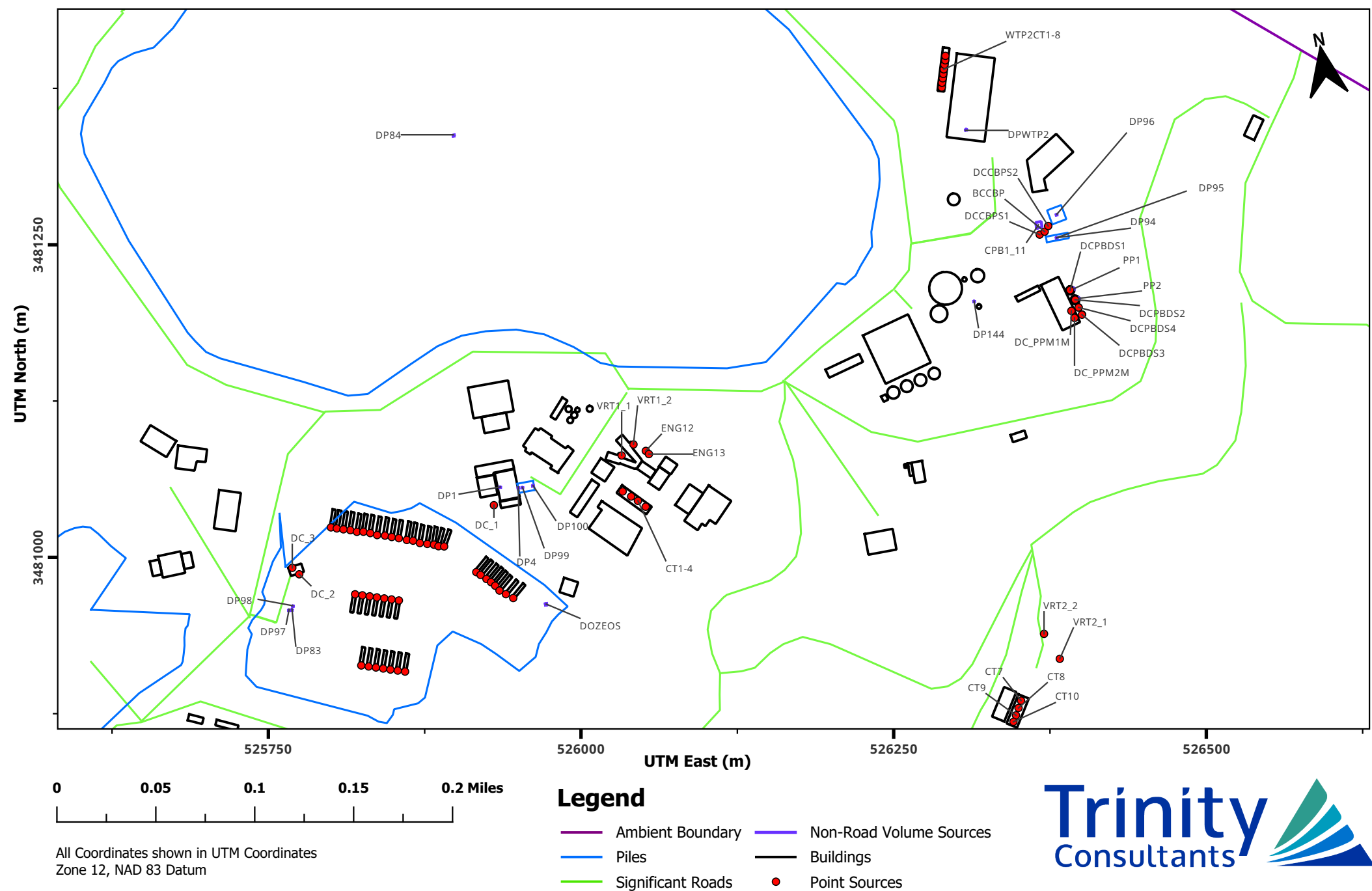


Figure 2-13: Hermosa Project - Emission Sources Zoom In 3

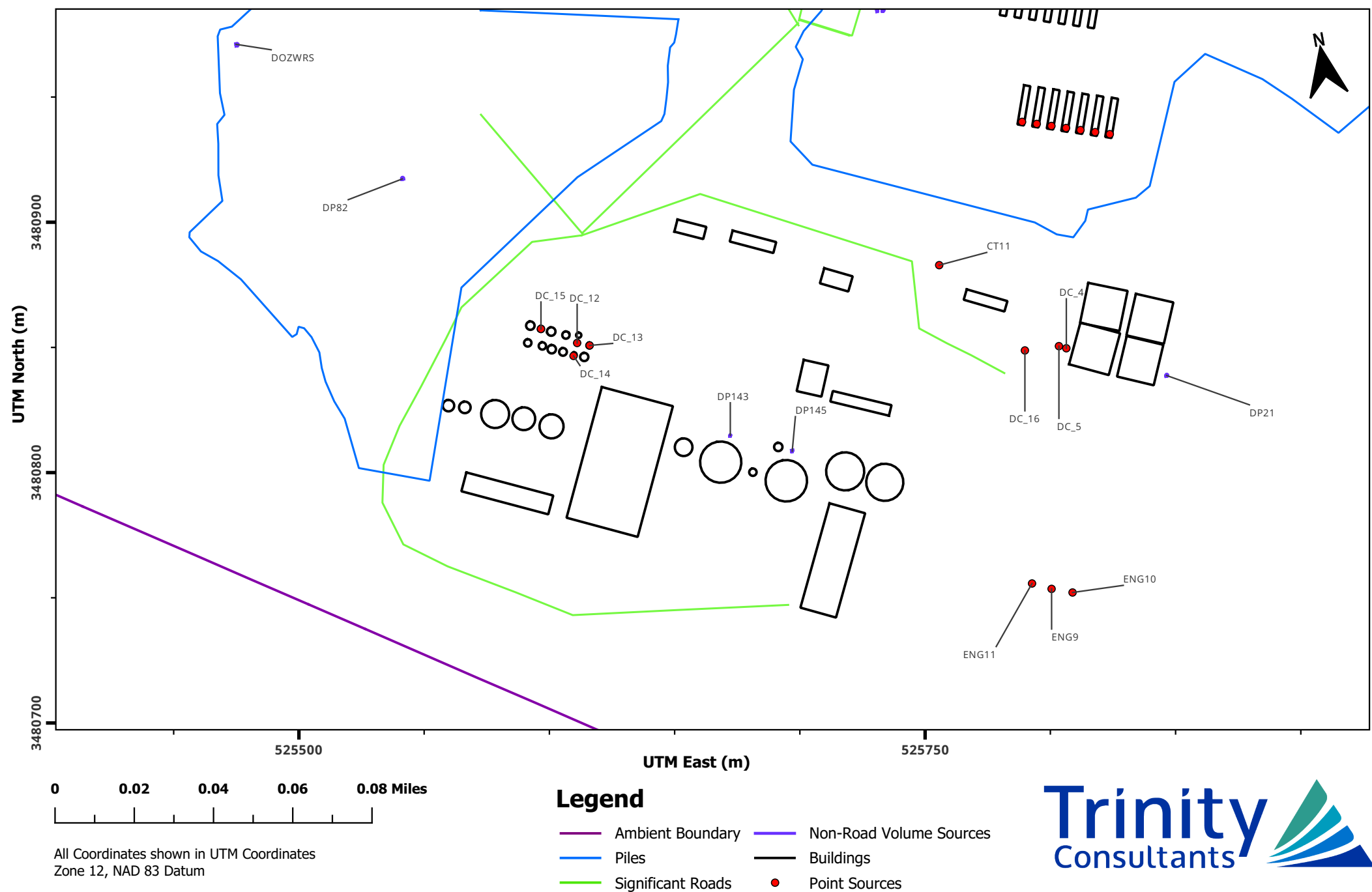


Figure 2-14: Hermosa Project - Emission Sources Zoom In 4 (Plan I)

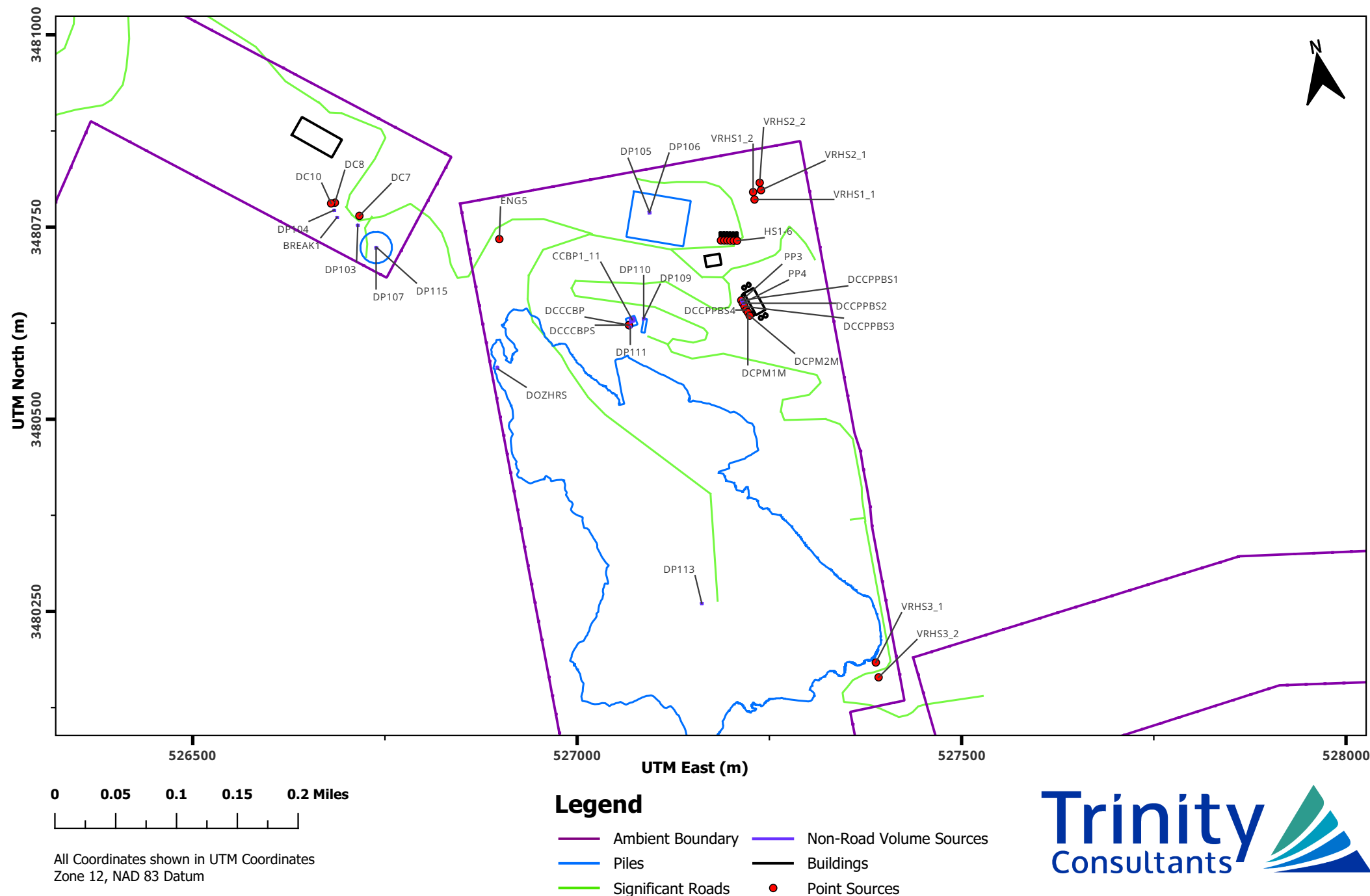
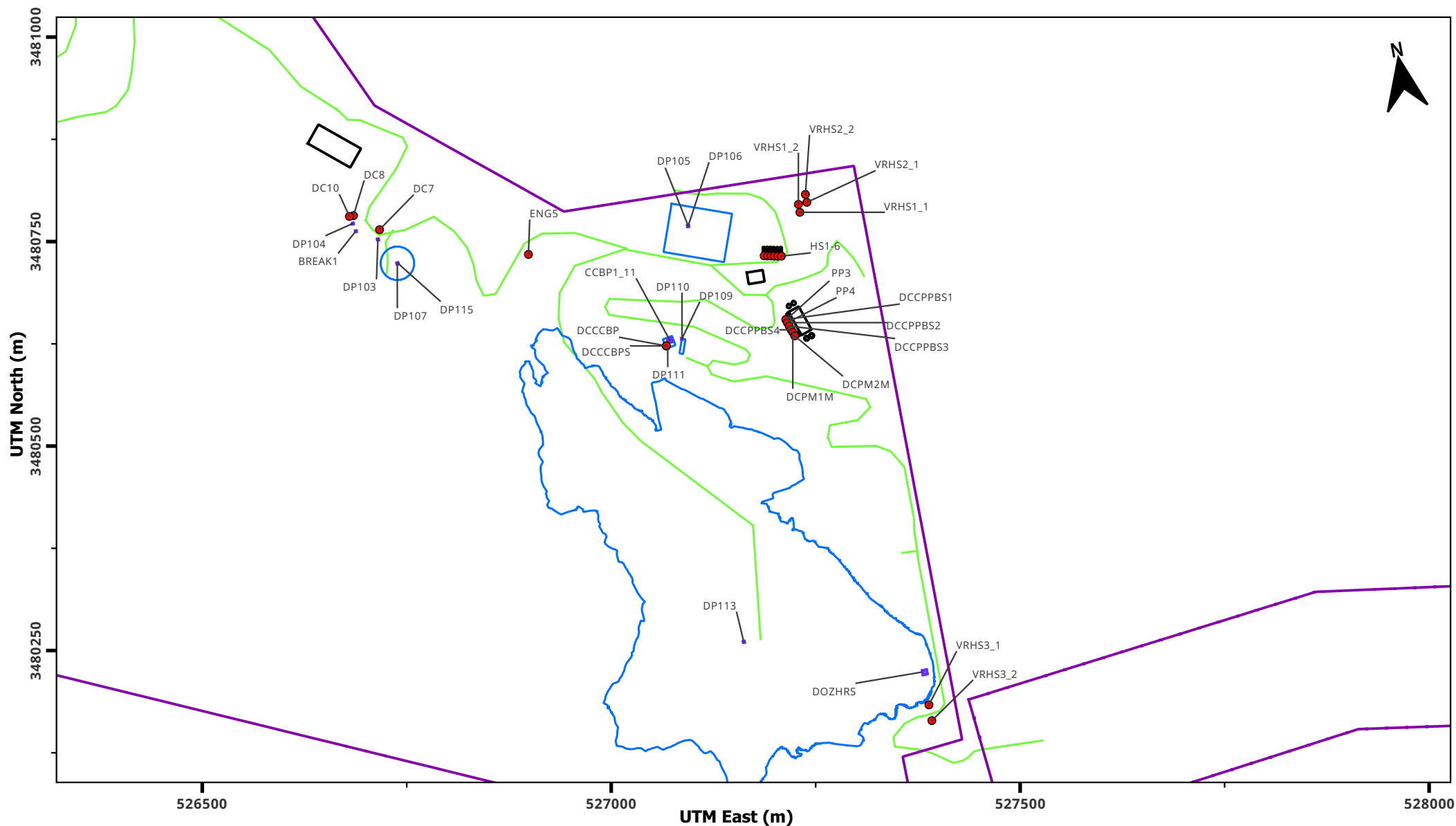


Figure 2-15: Hermosa Project - Emission Sources Zoom In 4 (Plan II)



0 0.05 0.1 0.15 0.2 Miles

All Coordinates shown in UTM Coordinates
Zone 12, NAD 83 Datum

Legend

- Ambient Boundary
- Piles
- Significant Roads
- Non-Road Volume Sources
- Buildings
- Point Sources

Figure 2-16: Hermosa Project - Emission Sources Zoom In 5

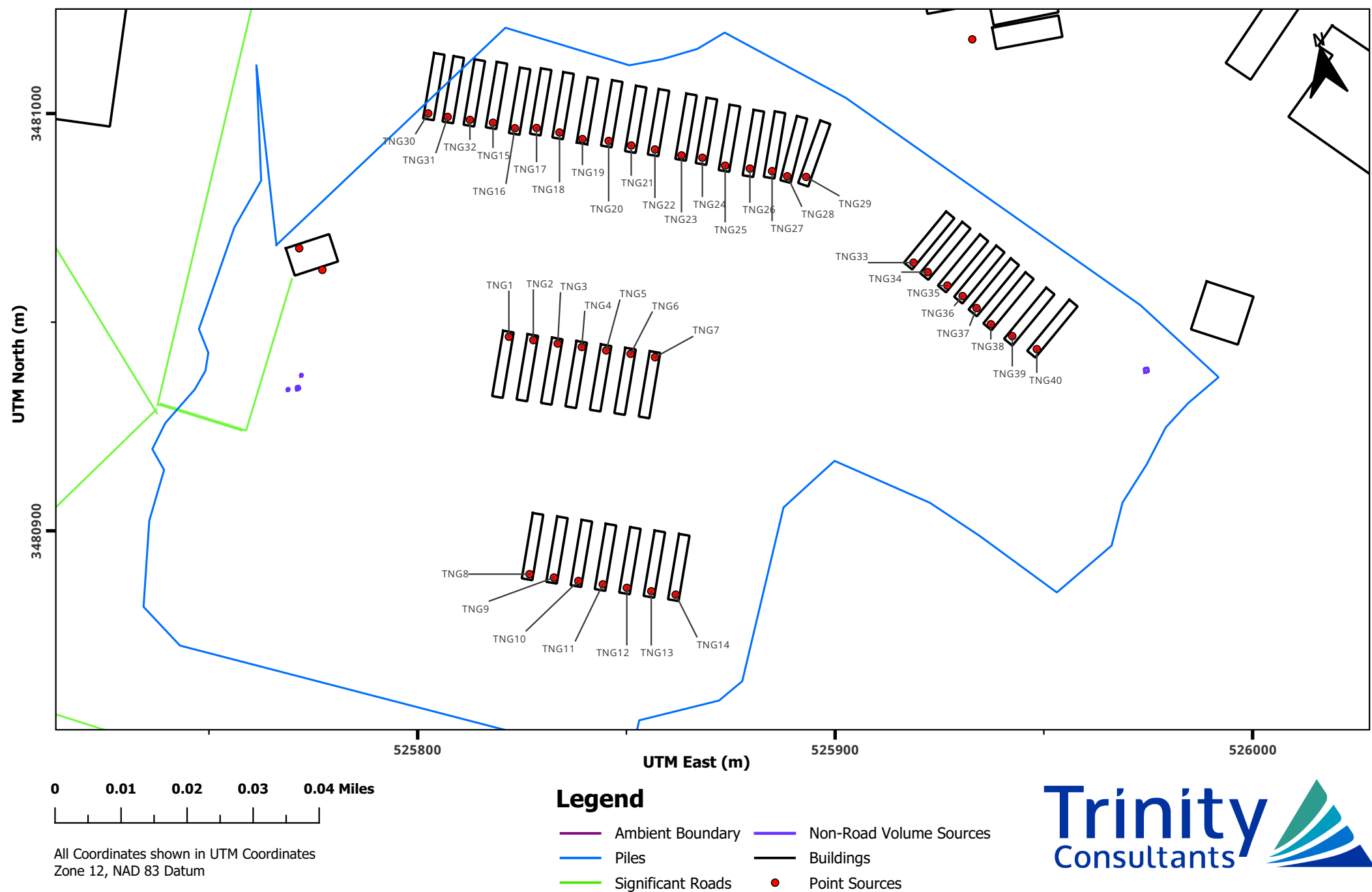


Figure 2-17: Hermosa Project - Roads Updates - Plan I

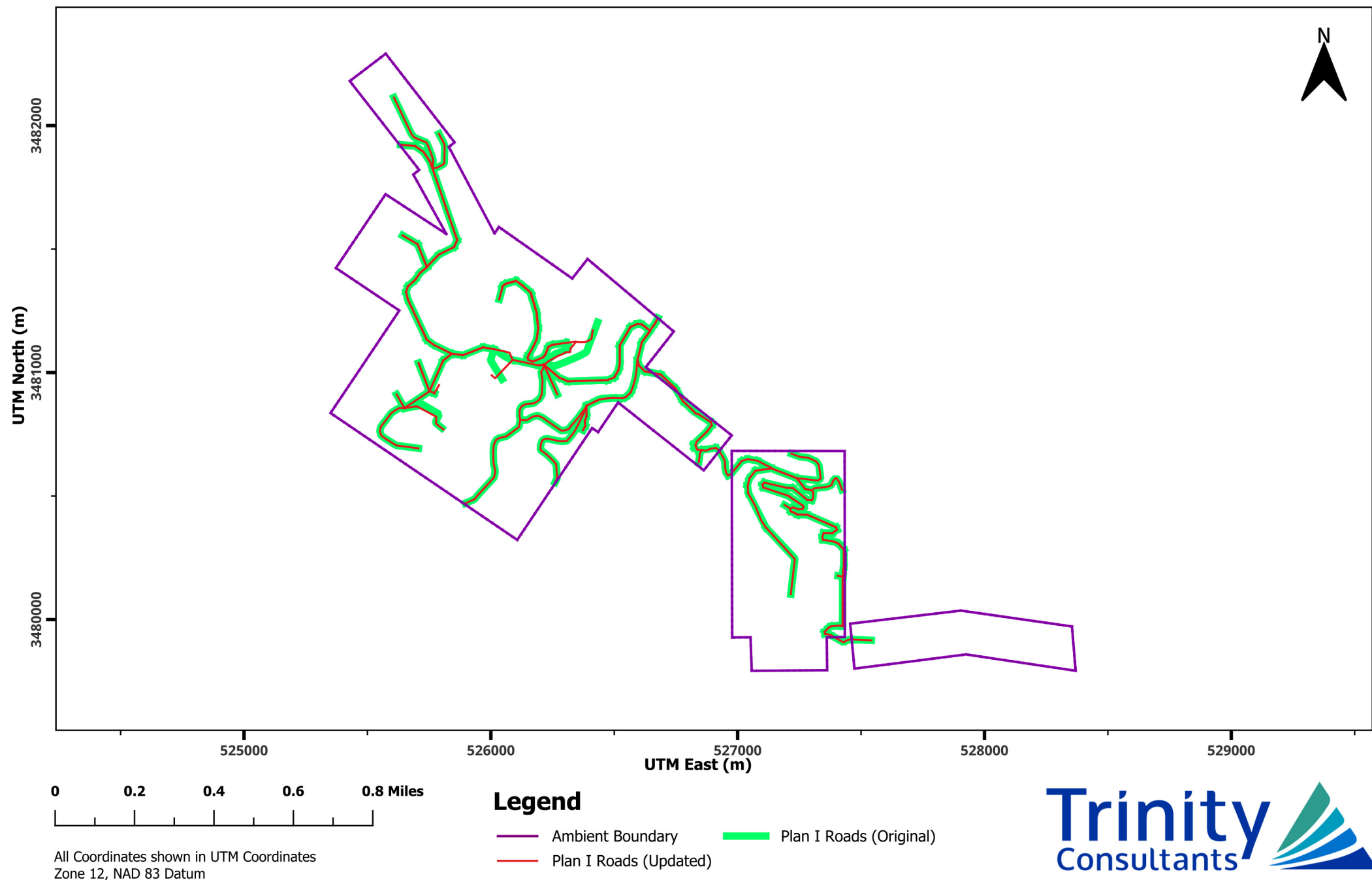
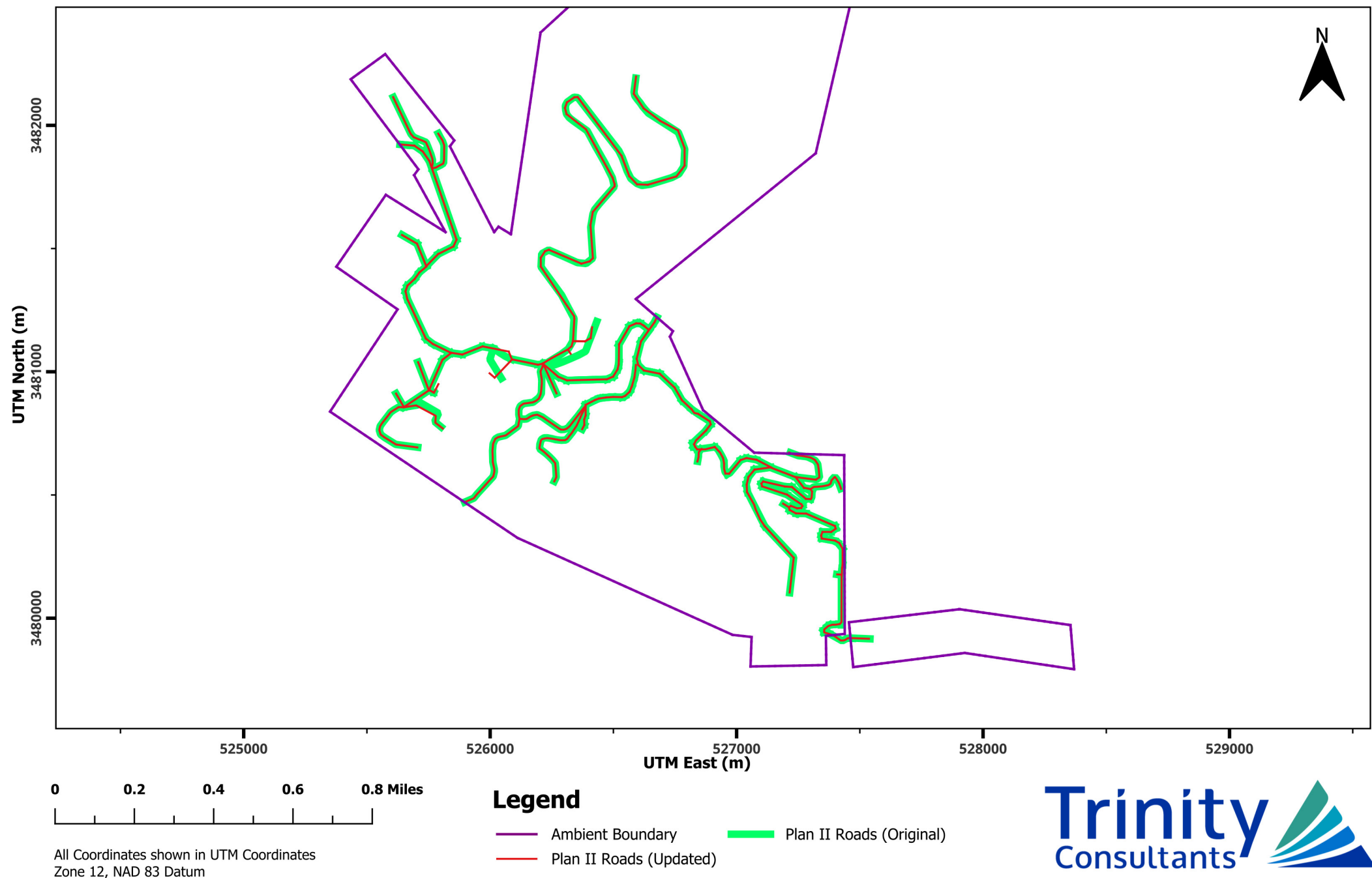


Figure 2-18: Hermosa Project - Roads Updates - Plan II



ID	Description
AGG	Clark Agg Stockpile
BCCBP	CBP Cement Silo
BREAK1	Clark Rock Breaker
CBP1_11	CBP Plant
CCBP1_11	Clark CBP Plant
CHUTE	Waste Chute Bin
CT1	Cooling Tower Cell 1
CT2	Cooling Tower Cell 2
CT3	Cooling Tower Cell 3
CT4	Cooling Tower Cell 4
CT7	UG Refridgeration CT Cell 1
CT8	UG Refridgeration CT Cell 2
CT9	UG Refridgeration CT Cell 3
CT10	UG Refridgeration CT Cell 4
CT11	Mill Cooling Tower
DC_PPM1M	Plant Plant Module 1 Mixer
DC_PPM2M	Plant Plant Module 2 Mixer
DC-1	21210-CX-00002 Main Shaft Ore Discharge Dust Collector 7
DC-2	21210-CX-00001 Coarse Ore Overland Dust Collector 7
DC-3	21210-CX-00003 Transfer Tower Silo Dust Collector 4
DC-4	21510-CX-00001 Coarse Ore Silo Dust Collector 4
DC-7	Coarse Ore Dust Collection System,23100-FAN-0001
DC-8	Coarse Ore Dust Collection System,23100-FAN-0002
DC-10	Coarse Ore Dust Collection System,23100-DCD-0005
DC-12	22620-CX-00001 Copper Sulphate Mix Tank Dust Collector
DC-13	22620-CX-00002 10% Zinc Sulphate Mix Tank Dust Collector
DC-14	22620-CX-00005 50% Zinc Sulphate Mix Tank Dust Collector
DC-15	22620-CX-00004 Caustic Mix Tank Dust Collector
DC-16	22210-CX-00001 Pebble Crusher Dust Collector 4
DCCBPS1	CBP Cement Supplement Silo 1
DCCBPS2	CBP Cement Supplement Silo 2
DCCCBP	CBP Cement Silo
DCCCBPS	CBP Cement Supplement Silo
DCCPPBS1	Paste Plant Binder Silo 1
DCCPPBS2	Paste Plant Binder Silo 2
DCCPPBS3	Paste Plant Binder Silo 3
DCCPPBS4	Paste Plant Binder Silo 4
DCPBDS1	Paste Plant Binder Storage Silo 1
DCPBDS2	Paste Plant Binder Storage Silo 2
DCPBDS3	Paste Plant Binder Dosage Silo 1
DCPBDS4	Paste Plant Binder Dosage Silo 2
DCPM1M	Plant Plant Module 1 Mixer
DCPM2M	Plant Plant Module 2 Mixer
DOZAREA	Dozer on Hardrock Storage
DOZEOS	Dozer on East Ore Stockpile
DOZHRS	Dozer on Hardshell Rock Stockpile
DOZTSF_1	Dozer on TSF_1
DOZTSF21	TSF2 dozer 1
DOZTSF22	TSF2 dozer 2
DOZWRS	Dozer on West Rock Stockpile
DP1	Drop of crushed ore from underground to 21210-BN-00001 Main Shaft Ore Surge Bin
DP4	Drop from Shaft to Waste Chute
DP21	Drop from Haul Truck to 21710-CV-00001 Primary Mill Feed Conveyor Hopper
DP82	Drop on West NAG Stockpile
DP83	Drop on East NAG Stockpile
DP84	TSF

ID	Description
DP85	Drops on TSF2
DP94	Transfer from Agg Stockpile to Loader
DP95	Transfer of Agg Material from Loader to Haul Truck
DP96	Transfer of Shotcrete Aggregate from Stockpile to Loader
DP97	Transfer of Ore from East Ore Stockpile to Loader
DP98	Transfer of Ore from Loader to Haul Truck
DP99	Transfer of Rock and Ore from Waste Chute to Loader
DP100	Transfer of Rock and Ore from Loader to Haul Truck
DP103	Haul Truck Dump into Primary Crusher Feed Hopper from ROM Stockpile (23100-HPR-0001)
DP104	Drop from silo to trucks
DP105	Transfer of Development Ore from Ore Stockpile to Loader
DP106	Transfer of Development Ore Mined from Loader to Haul Truck
DP107	Transfer from ROM Stockpile to Loader
DP109	Transfer from Agg Stockpile to Loader
DP110	Transfer of Agg Material from Loader to Haul Truck
DP111	Transfer of Shotcrete Aggregate from Stockpile to Loader
DP113	Hardshell NAG Wasterock Storage Drop
DP114	Ore Stockpile Drop
DP115	ROM Stockpile Drop
DP143	Drop of 50 lb bag of Lead Concentrate Flocculant to 22620-EP-00002 Concentrate Flocculant Preparation Module
DP144	Drop of 1 ton bag of Tailings Flocculant to 22620-EP-00001 Tailings Flocculant Preparation Module
DP145	Drop of 50 lb bag of Zinc Concentrate Flocculant to 22620-EP-00002 Concentrate Flocculant Preparation Module
DPWTP2	WTP2 Reagent Drops inside bldg
ENG5	CUMMINS Power Generation C200D2RE (ENGINE 0001)
ENG9	CAT C175 Substation 1 (ENGINE 0002)
ENG10	CAT C175 Substation 2 (ENGINE 0003)
ENG11	CAT C175 Substation 3 (ENGINE 0004)
ENG12	CAT C175 Shaft 1 (ENGINE 0005)
ENG13	CAT C175 Shaft 2 (ENGINE 0006)
EOS	East Ore Stockpile
HRS	Hardshell Rock Stockpile
HS1	Diesel Hardshell (ENGINE 0007)
HS2	Diesel Hardshell (ENGINE 0008)
HS3	Diesel Hardshell (ENGINE 0009)
HS4	Diesel Hardshell (ENGINE 0010)
HS5	Diesel Hardshell (ENGINE 0011)
HS6	Diesel Hardshell (ENGINE 0012)
MEVAP1	Mechanical Evaporator 1
MEVAP2	Mechanical Evaporator 2
MEVAP3	Mechanical Evaporator 3
ORE	Clark Ore Stockpile
PP1	Truck Pneumatic Loadout to Silo 1
PP2	Truck Pneumatic Loadout to Silo 2
PP3	Truck Pneumatic Loadout to Silo 1
PP4	Truck Pneumatic Loadout to Silo 2
ROM	Clark ROM Stockpile
SHOT	Clark Shotcrete Stockpile
TAGG	Taylor Agg Stockpile
TNG1	Natural Gas Engine 1 (ENGINE 0013)
TNG2	Natural Gas Engine 2 (ENGINE 0014)
TNG3	Natural Gas Engine 3 (ENGINE 0015)
TNG4	Natural Gas Engine 4 (ENGINE 0016)
TNG5	Natural Gas Engine 5 (ENGINE 0017)
TNG6	Natural Gas Engine 6 (ENGINE 0018)
TNG7	Natural Gas Engine 7 (ENGINE 0019)
TNG8	Natural Gas Engine 8 (ENGINE 0020)

ID	Description
TNG9	Natural Gas Engine 9 (ENGINE 0021)
TNG10	Natural Gas Engine 10 (ENGINE 0022)
TNG11	Natural Gas Engine 11 (ENGINE 0023)
TNG12	Natural Gas Engine 12 (ENGINE 0024)
TNG13	Natural Gas Engine 13 (ENGINE 0025)
TNG14	Natural Gas Engine 14 (ENGINE 0026)
TNG15	Natural Gas Engine 15 (ENGINE 0027)
TNG16	Natural Gas Engine 16 (ENGINE 0028)
TNG17	Natural Gas Engine 17 (ENGINE 0029)
TNG18	Natural Gas Engine 18 (ENGINE 0030)
TNG19	Natural Gas Engine 19 (ENGINE 0031)
TNG20	Natural Gas Engine 20 (ENGINE 0032)
TNG21	Natural Gas Engine 21 (ENGINE 0033)
TNG22	Natural Gas Engine 22 (ENGINE 0034)
TNG23	Natural Gas Engine 23 (ENGINE 0035)
TNG24	Natural Gas Engine 24 (ENGINE 0036)
TNG25	Natural Gas Engine 25 (ENGINE 0037)
TNG26	Natural Gas Engine 26 (ENGINE 0038)
TNG27	Natural Gas Engine 27 (ENGINE 0039)
TNG28	Natural Gas Engine 28 (ENGINE 0040)
TNG29	Natural Gas Engine 29 (ENGINE 0041)
TNG30	Natural Gas Engine 30 (ENGINE 0042)
TNG31	Natural Gas Engine 31 (ENGINE 0043)
TNG32	Natural Gas Engine 32 (ENGINE 0044)
TNG33	Natural Gas Engine 33 (ENGINE 0045)
TNG34	Natural Gas Engine 34 (ENGINE 0046)
TNG35	Natural Gas Engine 35 (ENGINE 0047)
TNG36	Natural Gas Engine 36 (ENGINE 0048)
TNG37	Natural Gas Engine 37 (ENGINE 0049)
TNG38	Natural Gas Engine 38 (ENGINE 0050)
TNG39	Natural Gas Engine 39 (ENGINE 0051)
TNG40	Natural Gas Engine 40 (ENGINE 0052)
TSF_1	Tailing Storage Facility
TSF2	USFS Tailings Storage Facility
TSHOT	Taylor Shotcrete Stockpile
VRHS1_1	Ventilation - Exhaust Raises NE Hardshell #1
VRHS1_2	Ventilation - Exhaust Raises NE Hardshell #1
VRHS2_1	Ventilation - Exhaust Raises NE Hardshell #2
VRHS2_2	Ventilation - Exhaust Raises NE Hardshell #2
VRHS3_1	Ventilation - Exhaust Raise SE Hardshell
VRHS3_2	Ventilation - Exhaust Raise SE Hardshell
VRT1_1	Ventilation Shaft - Taylor
VRT1_2	Ventilation Shaft - Taylor
VRT2_1	Vent Raise - Taylor
VRT2_2	Vent Raise - Taylor
WRS	West Rock Stockpile
WTP1LS	Waste Water Treatment Plant #1 Lime Silo
WTP2CT1	WTP2 CT Cell 1
WTP2CT2	WTP2 CT Cell 2
WTP2CT3	WTP2 CT Cell 3
WTP2CT4	WTP2 CT Cell 4
WTP2CT5	WTP2 CT Cell 5
WTP2CT6	WTP2 CT Cell 6
WTP2CT7	WTP2 CT Cell 7
WTP2CT8	WTP2 CT Cell 8

3. AIR DISPERSION MODELING APPROACH

As part of the mNSR process under A.A.C. R18-2-334, an ambient air quality assessment was conducted via air dispersion modeling to demonstrate that potential impacts from the Hermosa Mine will not interfere with attainment or maintenance of the PM₁₀ and PM_{2.5} NAAQS. The NAAQS are standards set by the U.S. Environmental Protection Agency (EPA) to protect public health and the environment. Primary standards protect public health, including the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards protect public welfare, including visibility and damage to animals, crops, vegetation, and buildings.

South32 is submitting this air dispersion modeling to support the Class I SPR application. The modeling follows the same approach as the original permit application. The results presented here reflect the proposed changes under the current SPR application, as well as the configuration changes outlined in the MPR 109292 application.

3.1 Full Impact Analysis

A full impact analysis was performed to demonstrate that ambient concentrations from the Hermosa Mine combined with representative background concentrations for that pollutant will not interfere with attainment or maintenance of the NAAQS. For this submittal, a grid of 10 km was used, consistent with the modeling completed as part of the original Class I application and modeling report.

The full impact NAAQS analysis accounts for ambient background concentration of pollutants determined from ambient monitoring data. Consistent with the original modeling submittal, an evaluation of off-site inventory sources was not conducted because the Hermosa Mine does not trigger the PSD program.² The results from direct modeling of Hermosa Mine emissions and ambient background concentration were compared to the NAAQS. The pollutants and averaging periods, the corresponding NAAQS used, and the form of the model result to be used for comparison are summarized in **Table 3-1** below based on a three-year meteorological dataset.

Table 3-1. NAAQS Thresholds

Pollutant	Averaging Period	Class II NAAQS (µg/m ³)	Modeling Result ^{1,2,3}
PM ₁₀	24-hour	150	H4H
PM _{2.5}	Annual	9	H1H
	24-hour	35	H8H

¹ Guideline on Air Quality Models; Final Rule, 40 CFR Part 51, Appendix W, January 17, 2017.

² EPA Memo, Modeling Procedures for Demonstrating Compliance with PM_{2.5} NAAQS, March 23, 2010.

3.2 Hazardous Air Pollutants Analysis

Per ADEQ’s “Learning Site Policy,” if a facility is within 2 miles or less of a learning site, the facility should submit a modeling analysis to demonstrate compliance with the NAAQS and Acute/Chronic Ambient Air

² Per Arizona Department of Environmental Quality, *Air Dispersion Modeling Guidelines for Arizona Air Quality Permits*, Section 5, November 1, 2019. There are no significant sources in the vicinity of the Hermosa Mine that would likely cause concentrations to diverge from the conservative background values chosen.

Concentrations (AAAC and CAAC) for listed air toxics.³ Because there are no learning sites within 2 miles of the Hermosa Mine, an analysis of AAAC and CAAC impacts was not required under ADEQ's Learning Sites Policy.

3.3 Voluntary Limits

Pursuant to A.A.C. R18-2-304.F.5, South32 Hermosa may elect to accept voluntary limits in accordance with R18-2-306.01. South32 Hermosa has elected to implement the following voluntary limits based on this modeling analysis:

- ▶ The natural gas engines will operate only between 50% and 100% load. Compliance will be demonstrated by programming interlocks. South32 is proposing to operate the engines in the following load split:
 - Fourteen (14) engines will operate between 50% and 100% load
 - The remaining twenty-six (26) engines will operate between 75% and 100% load

³ Per Arizona Department of Environmental Quality, *Air Dispersion Modeling Guidelines for Arizona Air Quality Permits*, Section 7.8, November 1, 2019. A "learning site" consists of all existing public schools, charter schools, and private schools at the K-12 level, and all planned sites for schools approved by the Arizona School Facilities Board.

4. MODEL OVERVIEW

This section contains a description of the model selection and the meteorological data, terrain data, building wake effects, and receptors that were used in the air dispersion modeling analysis. It also describes the model refinements that were used for addressing PM₁₀ impacts.

4.1 Dispersion Model Selection

On November 9, 2005, the U.S. EPA promulgated the American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD) for adoption into the Guideline on Air Quality Models (Guidelines).⁴ AERMOD includes a state-of-the-science downwash algorithm and utilizes AERMET, a meteorological data preprocessor that utilizes current planetary boundary layer (PBL) theory to calculate the dispersion coefficients (σ_y and σ_z).⁵ The most current version of the AERMOD model (version 24142) was used in conducting the Hermosa Mine modeling analysis. The modeling was performed using the regulatory default option, except as discussed in the sections below.

4.2 Meteorological Data

There have been no updates to the meteorological data since the original permit application. On-site meteorological data at South32 Hermosa has been collected from 2018 through 2022 at the Trench meteorological station, which is representative for modeling purposes due to close proximity to the emissions activities and similar terrain characteristics. The meteorological data collected from the South32 Hermosa on-site station was consistent with EPA recommendations for on-site meteorological data instruments and completeness. Version 22112 of the AERMET program was used in conducting the South32 Hermosa meteorological modeling analysis. A newer version of AERMET is available; however, changes to the program are minimal and not expected to cause differences in the AERMET output.

4.3 Terrain

There have been no updates on the methodology related to the terrain data since the original permit application. The terrain elevation for each modeled receptor, building and source, was determined using the USGS National Elevation Dataset (NED). Specifically, the 2021 USGS NED 1/3 arc second (approximately 10-meter resolution) file was used. Where site grading data was available, elevation was determined using that data. For instance, site grading data was used in conjunction with NED to properly locate the TSFs, hoists, and grinding circuits to assure representative elevations. The terrain height for each modeled receptor was calculated using the AERMOD terrain processor (AERMAP version 18081). A newer version of AERMAP is available; however, changes to the program are minimal and not expected to cause differences in the AERMAP output.

4.4 Building Wake Effects (Downwash)

The emission sources for South32 Hermosa considered in this analysis were evaluated in terms of their proximity to nearby structures. The purpose of this evaluation was to determine if stack discharge might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of

⁴ Code of Federal Regulations, Title 40-Protection of the Environment, Part 51, Appendix W.

⁵ U.S. EPA, User's Guide for the AMS/EPA Regulatory Model-AERMOD, September 2004.

turbulence that are greater than if the building was absent. Plumes entrained in the zones of turbulence experience enhanced plume growth and restricted plume rise. AERMOD incorporates the Plume Rise Model Enhancements (PRIME) algorithms using dimensions from the EPA's Building Profile Input Program (BPIP) for estimating for plumes affected by building wakes.

The effects of downwash were limited to stacks located within a distance defined as five times "L" of a structure, where "L" is the lesser of a structure's height or direction-specific projected width. Stacks located at a distance greater than 5L are not subject to the wake effects of the structure.

The South32 Hermosa site layout was reviewed to determine the buildings or structures that have stacks within 5L. Direction-specific building dimensions and the dominant downwash structure parameters were determined using the *BREEZE®* BPIP software, developed by Trinity Consultants, Inc. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with PRIME enhancement (BPIP-PRIME), version 04274.⁶

4.5 Receptor Grid

A receptor grid was developed for the air dispersion analyses to encompass a region extending up to 10 km beyond the South32 Hermosa ambient air boundary which would cover the town of Patagonia. The Plan II scenario receptor grid has been updated in this modeling revision to align with the new facility boundary, while maintaining an extent of 10 km. The receptor grid was developed to ensure that the maximum pollutant concentrations are captured by the model. Additional discrete receptors were placed at select locations based on previous feedback from ADEQ. Note that all receptor coordinates were established using the UTM NAD83 coordinate system. The primary receptor grids include the following⁷:

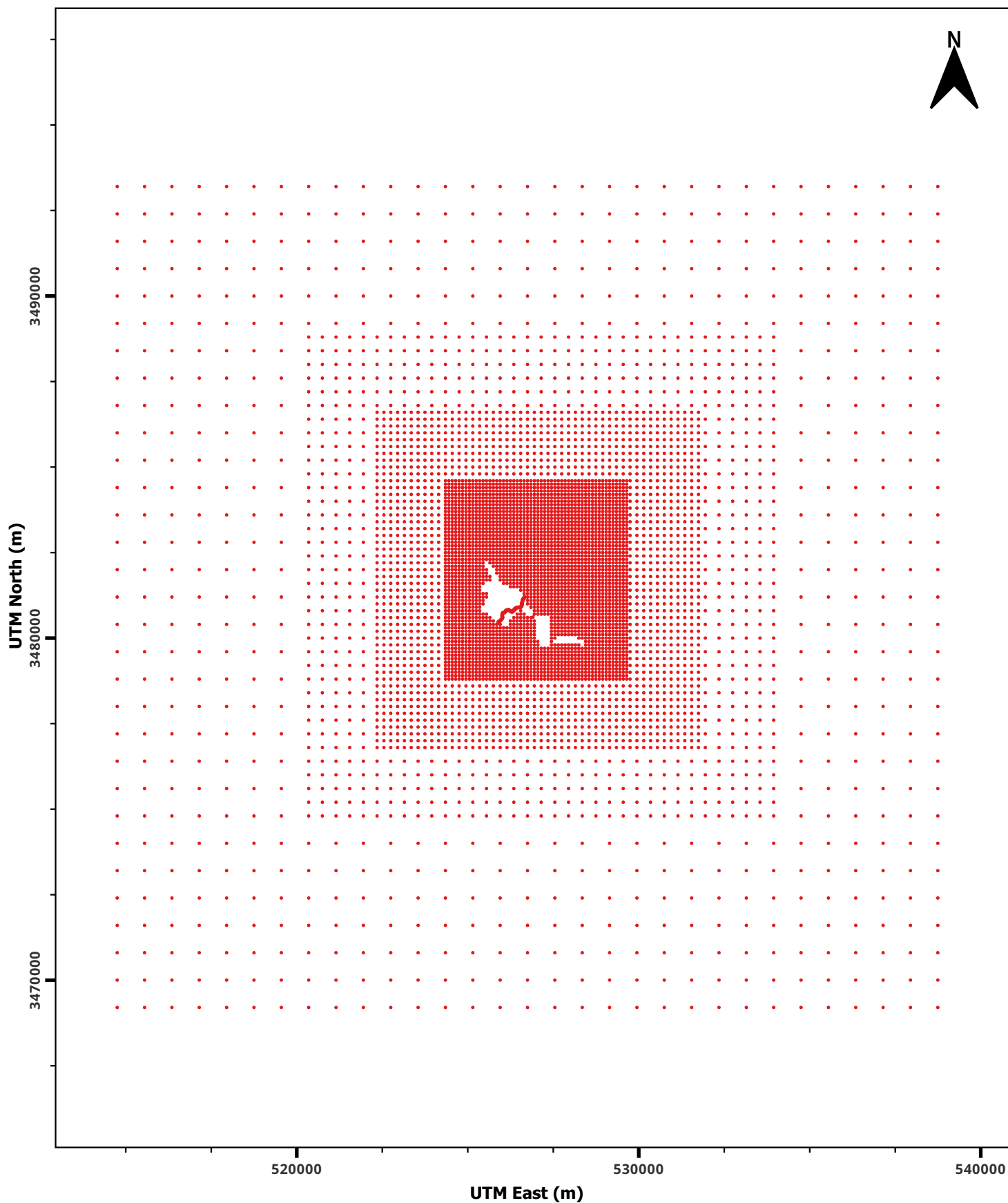
1. The "fenceline grid" is a discrete receptor grid with the receptors spaced at 25-meter intervals along the South32 Hermosa ambient air boundary and along Harshaw Road within the ambient air boundary.
2. The "fine grid" contains 100-meter spaced receptors extending approximately 1 kilometer from the ambient air boundary and 200-meter spaced receptors from 1 kilometer to approximately 3 kilometers from the ambient air boundary, excluding the receptors within the ambient air boundary.
3. The "medium grid" contains 400-meter spaced receptors extending approximately 5 kilometers from the ambient air boundary, excluding the receptors within the ambient air boundary and fine grids.
4. The "coarse grid" contains 800-meter spaced receptors extending up to 10 kilometers from the ambient air boundary, excluding the receptors within the ambient air boundary, fine, and medium grids.

All publicly accessible areas of the Hermosa Mine are, or will be, fenced and/or posted with no trespassing signs and will be monitored for site security. The current PARP describes the access restriction implementation currently in place at the mine, which aligns with the ambient air boundary of Plan I. South32 will amend the PARP to represent Plan II operations once implemented. South32 Hermosa has set forth an AAB in purple for Plan I and Plan II along with discrete receptors outlined in blue in **Figure 4-1** through **Figure 4-1**. These receptor grids align with the original modeling analysis, other than the aforementioned AAB changes to Plan II and the addition of select discrete receptors.

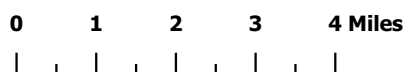
⁶ U.S. Environmental Protection Agency, *User's Guide to the Building Profile Input Program*, Research Triangle Park, NC, EPA-454/R-93-038.

⁷ Per Arizona Department of Environmental Quality, *Air Dispersion Modeling Guidelines for Arizona Air Quality Permits*, Section 3.6, September 23, 2013.

Figure 4-2: Hermosa Project - Plan I - Receptors



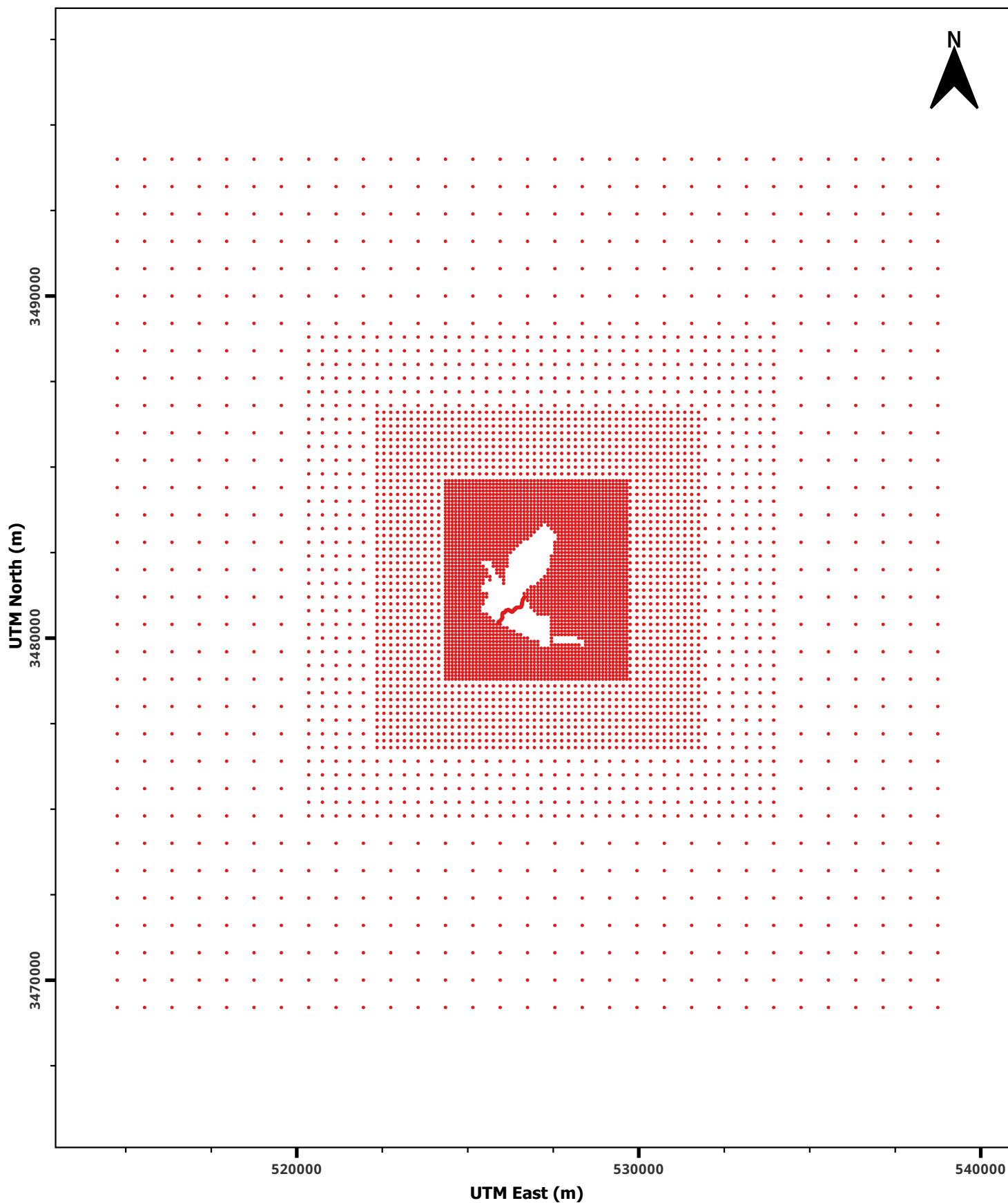
All Coordinates shown in UTM Coordinates
Zone 12, NAD 83 Datum



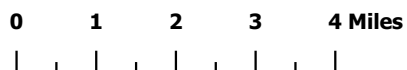
Legend

- Receptors

Figure 4-3: Hermosa Project - Plan II - Receptors



All Coordinates shown in UTM Coordinates
Zone 12, NAD 83 Datum



Legend

● Receptors

4.6 Particle Dry Deposition

There have been no updates to the particle dry deposition settings since the original permit application. The Dry Deposition option in AERMOD calculates the fraction of the particulate emissions in the plume that are removed from the plume due to interaction with the ground surface. This option was utilized for the PM₁₀ modeling analysis.

There are two EPA methods available as part of the AERMOD Dry Deposition option – Method 1 and Method 2⁸. Since Method 2 is a non-regulatory option and based on feedback from ADEQ⁹, South32 Hermosa used Method 1 for all sources.

The use of this option in AERMOD required particle size distribution data including the following:

- ▶ Mean particle diameter;
- ▶ Mass weighted particle size distribution; and
- ▶ Particle density.

For sources added from MPR 109292, calculation methods for determining the listed parameters above was performed consistently with the initial modeling analysis.

⁸ Per *AERMOD Deposition Algorithms – Science Document (Revised Draft)*, located at http://www.epa.gov/scram001/7thconf/aermod/aer_scid.pdf

⁹ Per comments on preliminary modeling protocol from ADEQ dated May 16th, 2022.

5. BACKGROUND CONCENTRATIONS

As part of the SPR application, the selected monitoring stations based on the original permitting were reassessed to incorporate more recent background concentration data, where applicable.

“Background concentrations” refer to the monitored existing concentrations of a regulated pollutant in an area. A “representative” background concentration is required for each modeled pollutant and averaging period to complete the Full Impact NAAQS modeling analysis. The background concentration accounts for sources of air pollution other than those explicitly modeled. These sources may include the following:

- ▶ Natural sources;
- ▶ Nearby, non-modeled sources; and
- ▶ Unidentified sources of air pollution (e.g., long-range transport).

Typically, background concentrations are accounted for by using air quality data measured at an appropriate monitoring station. For isolated sources such as the Hermosa Mine, there might be an absence of monitoring stations in the vicinity of the Hermosa Mine, or the closest monitor might not be representative of Hermosa Mine background concentrations. Under such occurrence, and per 40 CFR Part 51, Appendix W, South32 Hermosa can utilize a “regional site” to represent an equivalent background for each pollutant. A regional site is one that is not located near the Hermosa Mine, but is impacted by similar natural, industrial, and long-range transport sources of pollutant emissions. Section 8.3 of 40 CFR Part 51, Appendix W discusses the requirements for obtaining “representative” background concentrations.

Data from EPA’s AirData website was reviewed to identify the monitor station locations in areas surrounding South32 Hermosa. The evaluation area was expanded until a “representative” monitor station could be located.

Per ADEQ guidance for determining background concentrations, the quality and age of the data collected must be considered. Therefore, the analysis utilizes the most recent three years of data, in which the background data is more than 75% complete¹⁰, for each regional site.

5.1 Particulate Matter

The IMPROVE Saguaro East monitor was selected as the representative monitoring site for both PM₁₀ and PM_{2.5} in the December 2023 modeling report, with background concentrations originally based on data from 2018 to 2020. For the current analysis of PM₁₀, data from 2021 through 2024 were initially considered. However, the 2024 data did not satisfy the 75% completeness requirement. Therefore, the three-year period from 2021 to 2023 was selected.

The most representative PM₁₀ background concentration is as follows:

- ▶ 29 µg/m³ for the 24-hr PM₁₀ standard

¹⁰ Data completeness per 40 CFR Part 50, Appendix K, Sections 2.3(a) and (b); 40 CFR Part 50, Appendix N, Section 3.0(c); 40 CFR Part 50, Appendix R, Section 4(b) and 4(c)(i); and 40 CFR Part 50, Appendix S, Section 3.1(b) and Section 3.2(b).

For PM_{2.5}, both annual and 24-hour averaging periods were re-assessed for 2021-2024. Per 40 CFR Part 50 Appendix N, Quarters 3 and 4 do not meet the 75% completeness requirement. As such, South32 is proposing to use only Quarters 1 and 2 of 2024. As such, the 3 most recent complete years of data are Quarters 3 and 4 of 2021, all of 2022 and 2023, and Quarters 1 and 2 of 2024.

The most representative background concentrations were equal to the following:

- ▶ 7.3 µg/m³ for the 24-hr PM_{2.5} standard
- ▶ Since the IMPROVE monitor does not collect PM_{2.5} Annual¹¹ data, these values were calculated using the PM_{2.5} 24-hr data and the value is 3.65 µg/m³.

¹¹ The annual PM_{2.5} standard is met when the three-year average of the annual mean is less than or equal to 12 µg/m³

6. EMISSIONS MODELED & SOURCE CHARACTERIZATION

The following sections discuss the Hermosa Mine emission sources included in the modeling demonstration. The process and configuration changes at the Facility outlined in MPR 109292, have been incorporated into this sitewide modeling analysis.

6.1 Emissions Modeled

Emissions from the various operations noted in Section 6.2 were included in this analysis. A detailed description of these operations and the emission rates used in this modeling demonstration are contained in the previously submitted air permit applications and model report.

Emissions were determined for the operating year with maximum emissions for the Hermosa Mine. Note that this is a very conservative assumption since it is highly unlikely that all these activities will be performed in the same operating year during life of mine. Daily (24-hour) predicted model concentrations were based upon daily emission rates calculated using either the daily activity rates for the maximum emission or maximum equipment design rates.

Motor vehicle and mobile source emissions were excluded from the emissions modeled for stationary source permitting purposes, consistent with Arizona Revised Statutes (A.R.S.) §49-402(A)(7) and A.A.C. R18-2-101(146)(a)(i). Emissions caused by motor vehicles and mobile sources (e.g., entrained dust) were included in the emissions modeled.

6.2 Source Characterization

Details associated with characterizing the Hermosa Mine emission sources into various AERMOD model source representations are provided in the previous modelling report submission. Source characterizations remain unchanged, except as discussed below. Please note that model parameters were assumed when data was unavailable based on typical configurations for similar sources.

6.2.1 Point Sources

The updates to the model associated with the point sources are as follows:

- ▶ Natural Gas Engines:
 - The total number of natural gas 2.6 MW engines were reduced from fifty-eight (58) to forty (40) to account for updated load requirements for the operation of the mine.
 - Configuration of the natural gas engines was modified, and the stack locations on select engines were relocated to the north side of the engine enclosures.
 - The natural gas engine stacks were modeled at an increased height of 28 feet based on the stack height of currently installed units onsite.
 - A loading analysis was completed for the use of forty 2.6 MW natural gas engines at 50%, 75%, and 100% loads. The 50% load parameters were referenced from the stack testing report attached in 8.Appendix C.
- ▶ Dust Collectors
 - As outlined in the original modeling report, all additional dust collectors associated with MPR 109292 also release exhaust at ambient temperature and thus were modeled at 0 Kelvin (-459.67 °F), which flags the model to use the hourly ambient temperature from the meteorological data as the exit

temperature. Dust collector exhaust velocities were based on the volumetric flowrate of the dust collector and height were based on information provided by South32.

► **Mill Cooling Tower**

- Consistent with the original modeling analysis, stack parameters for the Mill cooling tower added in MPR 109292 was based on the characteristics of the cooling tower fan. Release height was based on the height of the cooling tower cell, diameter was based on the area cross section for the cooling tower exhaust fan, and the vertical velocity was determined by the fan flow rate. The mill cooling tower exhausts at ambient temperature and thus was modeled at 0 Kelvin (-459.67 °F).

6.2.1.1 Loading Analysis for Natural Gas Engines

South32 Hermosa may produce power onsite using multiple generators powered by natural gas engines. The generators are expected to operate at 100% load with a small fraction of the generators operating at 50% or 75% load for short periods. In order to capture the worst-case short-term impacts in the dispersion models, a load analysis on the generators was performed. Model runs with the generators operating at 50%, 75%, and 100% loads were performed. Each pollutant was run for both the Plan I and Plan II operating scenarios. Modeling parameters for each loading scenario were taken from design drawings and actual source testing results. **Table 6-1** provides the stack parameters and emission rates used in the load analysis.

Table 6-1. Load Analysis Stack Parameters – 2.6MW Engines

Load	Stack Height (m)	Stack Diameter (m)	Stack Temperature (K)	Stack Velocity (m/s)	Emission Rate (g/s)
					PM _{2.5}
50%	8.53	0.81	761.58	3.27	3.77E-02
75%	8.53	0.81	761.02	4.68	1.71E-02
100%	8.53	0.81	742.87	6.03	2.07E-03

As discussed previously, to provide greater operational flexibility, South32 is proposing to operate fourteen (14) 2.6 MW natural gas engines between 50-100% loads and twenty-six (26) 2.6 MW natural gas engines between 75-100% loads.

From the loading analysis it was determined PM impacts are greater at lower loads for the natural gas engines. Based on these results, 50% loading parameters are applied to 14 engines, and 75% loading parameters are applied to the remaining 26 engines in the PM₁₀ and PM_{2.5} models.

6.2.2 Volume Sources

6.2.2.1 Volume Sources – Road Segments

The updates to the model associated with the volume sources are as follows:

- The number of natural gas truck trips were updated to reflect the reduced number of engines onsite. Updates to road source parameters and emission rates was made consistent with the previous modeling analysis and ADEQ guidance.¹²

¹² Section 3.3.5 of the ADEQ Modeling Guidelines.

- ▶ Consistent with changes noted in MPR 109292, trips associated with the East Ore Stockpile (EOS) have been updated to reflect the reduced number of trips from the shaft area to the stockpile. An additional route from the EOS to the milling area has been added. Updates to road source parameters and emission rates were made consistent with the previous modeling analysis and ADEQ guidance.
- ▶ Road configurations have been updated based on the latest Site layouts, provided by South32 in MPR 109292.

6.2.2.2 Volume Sources – Loading and Unloading/Material Handling

Consistent with the previous modeling analysis, emissions for material loading, unloading, and transfers was modeled, including additional transfer points added in MPR 109292. The release height of these sources was determined by dividing the source vertical dimension by 2. For surface-based material handling operations, initial vertical dimension was calculated by dividing the height of the drop point by 2.15, and for elevated sources the difference between the height of the drop point and the height of the vessel where the material is dropped to, divide by 4.3. Additionally, the initial lateral dimension was determined to be the width of the source divided by 4.3.

6.2.2.3 Volume Sources – Dozers

Emissions from materials handling by dozers were modeled as volume source types. The release height was set to ½ the blade height and the width of the volume source was set to the blade width. The dozer source base elevations were set equal to the worst-case pile elevations found in the previous pile elevation sensitivity analysis.

An updated sensitivity study was performed to identify the worst-case dozer volume source location for the Hardshell dozer since changes to the pile layout and ambient air boundary surrounding this area have occurred as part of MPR 109292. Two models, for Plan I and Plan II, with six source locations around the perimeter of the pile, was used in the analysis. The source location with the highest impacts were used in the site wide modeling. **Table 6-2** shows the model results and the worst-case location for the Hardshell Waste Rock Storage (HRS) dozer.

Table 6-2. Dozer Sensitivity Analysis Results

Source	Concentrations						Worst Case Location	
	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	UTMx (m)	UTMy (m)
Plan I Results								
DOZHRS	587.00	70.87	598.057	462.78	1328.41	3054.72	526985.3	3480461.0
Plan II Results								
DOZHRS	439.08	73.68	108.98	69.45	25.39	39.19	527408.4	3480026.8

For modeling the PM_{2.5} annual standard, lateral dimensions were updated to be representative of the larger areas which will be operated on during the course of a month, and locations for dozers are slightly adjusted from 24-hr modeling to ensure all larger volume sources are inside the ambient air boundary. Dozers are still placed in the same general locations as 24-hr modeling for PM₁₀/PM_{2.5}. The dozer for the Hardshell stockpile was modeled as an area sources, as described below.

6.2.3 Area Sources

The Tailings Storage Facilities, Rock Stockpiles, and Other Stockpiles have been modeled as area sources. These piles grow to large areas, but only a small portion of the pile is active at one time. Once the inactive areas become stabilized, emissions from the stabilized inactive areas are negligible. However, consistent with the initial modeling analysis, South32 conservatively modeled the entire pile areas.

Based on updated layouts, the HRS stockpile has been revised in this modeling analysis. Pile parameters remain consistent with the previous models as the shape and location of the pile remains similar to the original design.

6.2.3.1 Area Sources – Road Segments Near Receptors

Road segments that were within the exclusion zone of a defined volume source were modeled as an area source.¹³ Additional road area sources (in lieu of volume sources) were added into the models based off changes to the Plan II Ambient Air Boundary.

Consistent with the previous modeling analysis, road area sources were included with the following considerations in mind:

- ▶ Sources were limited to a 10:1 length to width ratio so in some cases multiple area sources were defined to cover a road segment.
- ▶ Emissions for the area source segment were the sum of the volume source segment emissions within the area source.
- ▶ Receptors within 1 meter of an area source were relocated to a distance of 1 meter from the area source.

6.2.3.2 Area Sources – Dozer Sources Near Receptors

For modeling the PM_{2.5} annual averaging period, consistent with the previous modeling analysis, dozer sources were modeled over larger areas representative of the typical operation during the course of a month. Locations for dozers are slightly adjusted from 24-hr modeling to ensure all larger volume sources are inside the ambient air boundary. Due to the proximity to the ambient air boundary, the Hardshell dozer was modeled as an area source to avoid exclusion from any nearby receptors. The HRS Dozer was still placed in the same general locations as 24-hr modeling for PM₁₀/PM_{2.5}. The modeled area source was set to encompass the entirety of the original volume source. Release height, initial vertical dimension, and emission rates were set equal to that of the superseded volume source.

¹³ Volume source exclusion zone is $(2.15 \times \sigma_y) + 1$ meter).

7. MODELING RESULTS

A Full Impact Analysis was conducted for a 10 km receptor grid¹⁴. Results of the Full Impact Analysis are presented in **Table 7-1**. As shown, the Hermosa Mine will not interfere with attainment or maintenance of the NAAQS. Details of the secondary PM_{2.5} assessment is provided in Section 0.

Table 7-1. NAAQS Full Impact Analysis Results

Pollutant	Averaging Period	Modeled Concentration ¹ (µg/m ³)	Secondary Formation Concentration (µg/m ³)	Background Concentration ² (µg/m ³)	Total Concentration ³ (µg/m ³)	NAAQS (µg/m ³)	Exceeds NAAQS? (Yes/No)	Form of the Standard ^{5,6}
PM ₁₀	24-hour	105.60	-	29	134.60	150	No	Not to be exceeded more than once per year on average
PM _{2.5} ⁴	Annual	5.02	0.0002	3.65	8.67	9	No	Annual mean
	24-hour	16.54	0.017	7.3	23.86	35	No	98th percentile, averaged over 5 years

¹ Modeled concentration includes emission sources at the Hermosa Mine. The concentration is reported as the highest receptor in the form of the standard.

² Refer to Section 5 for a detailed analysis concerning the background concentration.

³ The total concentration for comparison to the NAAQS is the modeled plus the background concentration.

⁴ PM_{2.5} modeled concentration includes secondary PM_{2.5} impacts.

⁵ Guideline on Air Quality Models; Final Rule, 40 CFR Part 51, Appendix W, January 17, 2017.

⁶ EPA Memo, Modeling Procedures for Demonstrating Compliance with PM_{2.5} NAAQS, March 23, 2010.

¹⁴ Per email from Feng Mao, ADEQ, on 04/18/2023.

7.1 Secondary PM_{2.5} Assessment

Precursor pollutants for PM_{2.5} (i.e., NO_x and SO₂) can undergo photochemical reactions with gases in the atmosphere, resulting in the formation of secondary PM_{2.5} downwind of an emission source, which can add to concentrations resulting from direct (or primary) emissions of PM_{2.5}. Two of the largest constituents of secondary PM_{2.5} in the U.S. are sulphates (SO₄²⁻) and nitrates (NO₃⁻), both of which are formed from their respective precursor pollutants (i.e., SO₂ for SO₄²⁻, NO_x for NO₃⁻).

EPA has published hypothetical source modeled concentrations with relationship to location and source characterization in the April 2019 Modeled Emission Rates for Precursors (MERPs) Memo (MERPs guidance). These hypothetical sources use one year of meteorological data to determine modeled impacts.

Table 7-2. EPA MERP Facilities in Arizona

Source	County	Latitude	Longitude	Distance to South32 Hermosa (km)	Max Nearby Terrain (m)	Max Nearby Urban (%)
36	Coconino	35.428	-111.270	440	2,483	7.4
14	Gila	33.469	-110.789	220	1,592	4.3
17	La Paz	33.400	-113.408	330	757	0.9

Consistent with the original modeling analysis, Source 17 was chosen as the most representative hypothetical source and was used to find secondary PM_{2.5} impacts from the Hermosa Mine with the new MERP methodology found in EPA April 2024 guidance.¹⁵ The MERP guidance provides data for a variety of model combinations, including a source height of 10 m vs. 90 m, and emission rates of 500 tons, 1,000 tons, and 3,000 tons. All emissions at the Hermosa Mine are emitted from sources lower in height; therefore, a stack height of 10 m at Source 17 was representative. Emissions from NO_x and SO₂ are both well under 500 tpy; therefore, an emission rate of 500 tons was the most representative. Based on the above considerations, South32 Hermosa proposed Source 17 in La Paz County as the representative MERP source.

From the Hermosa Mine, a MERP value was obtained for each applicable pollutant for each PM_{2.5} averaging period from the EPA MERPs Qlik website.¹⁶ Specifically, a MERP value was needed for both NO_x and SO₂ on a 24-hour and annual basis. EPA provides this MERP data based on different combinations of emission rates and source heights from each hypothetical source. These values are summarized in **Table 7-3** below.

¹⁵ EPA Memo, Clarification on the Development of MERPs as a Tier 1 Demonstration for Ozone and PM_{2.5}, April 30, 2024

¹⁶ <https://www.epa.gov/scram/merps-view-qlik>. Last visited on July 1, 2025.

Table 7-3. Source 17 Worst-Case MERP Data

Precursor	Stack Height (m)	Emission Rate (tpy)	Daily PM _{2.5} Max Modeled Concentration (µg/m ³)	Annual PM _{2.5} Max Modeled Concentration (µg/m ³)
NO _x	10	500	0.0393	0.000411
SO ₂	10	500	0.313	0.00320

To estimate the total impact of PM_{2.5}, secondary PM_{2.5} impact have been added to PM_{2.5} model results (i.e., primary PM_{2.5} impacts) for comparison to the applicable standards. Results are included in Section 7 and demonstrate that the Hermosa Mine will not interfere with attainment or maintenance of the NAAQS.

The contributions of secondarily formed PM_{2.5} are calculated below using the equation described above and **Table 7-3** values. The secondary formation due to each precursor (i.e., NO_x and SO₂ for PM_{2.5}) are summed in the calculations below.

Daily:

$$0.017 \left(\frac{\mu g}{m^3} \right) = \left(\frac{154.74 \text{ tpy NO}_x \text{ Project} \times 0.0393 \left(\frac{\mu g}{m^3} \right)}{500 \text{ tpy of NO}_x} + \frac{7.92 \text{ tpy SO}_2 \text{ Project} \times 0.3128 \left(\frac{\mu g}{m^3} \right)}{500 \text{ tpy of SO}_2} \right)$$

Annual:

$$0.0002 \left(\frac{\mu g}{m^3} \right) = \left(\frac{154.74 \text{ tpy NO}_x \text{ Project} \times 0.000411 \left(\frac{\mu g}{m^3} \right)}{500 \text{ tpy of NO}_x} + \frac{7.92 \text{ tpy SO}_2 \text{ Project} \times 0.0032 \left(\frac{\mu g}{m^3} \right)}{500 \text{ tpy of SO}_2} \right)$$

The concentrations for daily and annual PM_{2.5} were added to the respective model results.

8. ELECTRONIC FILES

The electronic files provided as part of this submittal contain all of the air dispersion modeling analyses electronic input, output, and other files used to generate the results presented in this report. The following is a list of files provided:

- ▶ All AERMOD input, output, and plot files;
- ▶ AERMOD meteorological data files;
- ▶ AERMOD terrain data files; and
- ▶ All BPIP/BPIPP input and output files;

APPENDIX A. MODELED EMISSION RATES AND SOURCE PARAMETERS

**Mine Development
Plan I PTE**

**Mine Development
Point Sources**

Table A-1. South32 Hermosa Point Sources

Source ID	Description	From BREEZE Model						Short Term Emission Rate (g/s)					Long Term Emission Rate (g/s)		Stk Ht (m)	Stk Temp (K)	Stk Vel (m/s)	Stk Diam (m)
		UTMx	UTMy	Elev (m)				PM ₁₀	PM _{2.5}	Lead	NO _x	CO	PM _{2.5}	NO _x				
				1/8-hr	24-hr	Monthly	annual											
CT1	Cooling Tower Cell 1	526068.5	3480969.0	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
CT2	Cooling Tower Cell 2	526074.5	3480963.7	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
CT3	Cooling Tower Cell 3	526079.3	3480959.2	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
CT4	Cooling Tower Cell 4	526084.6	3480953.4	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
WTP2CT1	WTP2 CT Cell 1	526383.5	3481244.8	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT2	WTP2 CT Cell 2	526384.4	3481248.5	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT3	WTP2 CT Cell 3	526385.6	3481252.0	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT4	WTP2 CT Cell 4	526386.7	3481255.4	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT5	WTP2 CT Cell 5	526387.8	3481259.0	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT6	WTP2 CT Cell 6	526389.0	3481262.7	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT7	WTP2 CT Cell 7	526390.3	3481266.0	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT8	WTP2 CT Cell 8	526391.1	3481269.5	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
CT7	UG Refridgeration CT Cell 1	526356.0	3480742.7	1540.79	1540.79	1540.79	1540.79	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT8	UG Refridgeration CT Cell 2	526352.9	3480737.2	1541.08	1541.08	1541.08	1541.08	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT9	UG Refridgeration CT Cell 3	526349.8	3480731.7	1541.59	1541.59	1541.59	1541.59	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT10	UG Refridgeration CT Cell 4	526346.8	3480726.9	1542.00	1542.00	1542.00	1542.00	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT11	Mill Cooling Tower	525790.0	3480817.5	1603.25	1603.25	1603.25	1603.25	5.25E-05	1.83E-05				1.83E-05		15.00	0.00	93.69	5.00
VRT2_1	Vent Raise - Taylor	526393.2	3480770.4	1572.77	1572.77	1572.77	1572.77	9.61E-02	1.25E-02	1.52E-03	1.46E-01	7.89E+00	9.51E-03	4.31E-03	13.00	296.95	11.47	4.28
VRT2_2	Vent Raise - Taylor	526384.3	3480792.7	1572.77	1572.77	1572.77	1572.77	9.61E-02	1.25E-02	1.52E-03	1.46E-01	7.89E+00	9.51E-03	4.31E-03	13.00	296.95	11.47	4.28
VRT1_1	Ventilation Shaft - Taylor	526073.0	3480997.9	1573.32	1573.32	1573.32	1573.32	2.65E-01	3.45E-02	4.20E-03	4.02E-01	2.17E+01	2.62E-02	1.19E-02	13.00	293.85	21.37	5.21
VRT1_2	Ventilation Shaft - Taylor	526084.1	3481005.0	1570.59	1570.59	1570.59	1570.59	2.65E-01	3.45E-02	4.20E-03	4.02E-01	2.17E+01	2.62E-02	1.19E-02	13.00	293.85	21.37	5.21
DC-1	21210-CX-00002 Main Shaft Ore Discharge Dust Collector 7	525963.5	3480977.1	1572.77	1572.77	1572.77	1572.77	7.02E-03	7.02E-03	2.72E-04			7.02E-03		10.70	0.00	21.70	0.30
DC-2	21210-CX-00001 Coarse Ore Overland Conveyor Dust Collector 7	525797.6	3480950.7	1586.63	1586.63	1586.63	1586.63	1.08E-02	1.08E-02	5.11E-04			1.08E-02		27.46	0.00	33.38	0.30
DC-3	21210-CX-00003 Transfer Tower Silo Dust Collector 4	525793.0	3480956.9	1584.82	1584.82	1584.82	1584.82	6.48E-02	6.48E-02	2.51E-03			6.48E-02		27.46	0.00	200.30	0.30
DC-4	21510-CX-00001 Coarse Ore Silo Dust Collector 4	525834.6	3480774.9	1602.33	1602.33	1602.33	1602.33	2.38E-02	2.38E-02	1.12E-03			2.38E-02		10.70	0.00	73.44	0.30
DC-5	21710-CX-00002 Silo Discharge Dust Collector 5	525831.8	3480776.3	1602.33	1602.33	1602.33	1602.33	2.34E-02	2.34E-02	1.11E-03			2.34E-02		10.70	0.00	72.44	0.30
DC-12	22620-CX-00001 Copper Sulphate Mix Tank Dust Collector	525639.7	3480813.2	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-13	22620-CX-00002 10% Zinc Sulphate Mix Tank Dust Collector	525644.5	3480811.3	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-14	22620-CX-00005 50% Zinc Sulphate Mix Tank Dust Collector	525637.3	3480808.3	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-15	22620-CX-00004 Caustic Mix Tank Dust Collector	525626.3	3480821.5	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-16	22210-CX-00001 Pebble Crusher Dust Collector 4	525817.9	3480777.1	1603.25	1603.25	1603.25	1603.25	2.67E-02	2.67E-02	1.26E-03			2.67E-02		10.70	0.00	82.46	0.30
DC-7	Coarse Ore Dust Collection System,23100-FAN-0001	526842.0	3480691.4	1550.70	1550.70	1550.70	1550.70	3.46E-03	3.46E-03	6.08E-05			3.46E-03		5.49	0.00	13.21	0.58
DC-8	Coarse Ore Dust Collection System,23100-FAN-0002	526813.3	3480714.4	1552.40	1552.40	1552.40	1552.40	3.46E-03	3.46E-03	6.08E-05			3.46E-03		5.49	0.00	13.21	0.58
DC-10	Coarse Ore Dust Collection System,23100-DCD-0005	526808.2	3480714.4	1552.75	1552.75	1552.75	1552.75	3.46E-03	3.46E-03	6.08E-05			3.46E-03		5.49	0.00	13.21	0.58
VRHS1_1	Ventilation - Exhaust Raises NE Hardshell #1	527359.8	3480617.4	1604.25	1604.25	1604.25	1604.25	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS1_2	Ventilation - Exhaust Raises NE Hardshell #1	527359.8	3480627.4	1605.45	1605.45	1605.45	1605.45	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS2_1	Ventilation - Exhaust Raises NE Hardshell #2	527370.6	3480628.0	1603.13	1603.13	1603.13	1603.13	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS2_2	Ventilation - Exhaust Raises NE Hardshell #2	527370.6	3480638.0	1603.67	1603.67	1603.67	1603.67	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS3_1	Ventilation - Exhaust Raise SE Hardshell	527406.0	3479986.0	1661.92	1661.92	1661.92	1661.92	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS3_2	Ventilation - Exhaust Raise SE Hardshell	527406.0	3479986.0	1667.17	1667.17	1667.17	1667.17	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
ENG5	CUMMINS POWER GENERATION C200D2RE	527018.4	3480627.4	1560.52	1560.52	1560.52	1560.52	1.18E-03	1.18E-03	2.37E-02	2.07E-01	1.18E-03	2.37E-02		1.80	726.15	0.07	0.10
ENG9	CAT C175 Substation 1	525810.9	3480679.9	1603.25	1603.25	1603.25	1603.25	3.67E-02	3.67E-02	1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61	
ENG10	CAT C175 Substation 2	525819.0	3480676.9	1603.25	1603.25	1603.25	1603.25	3.67E-02	3.67E-02	1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61	
ENG11	CAT C175 Substation 3	525803.5	3480683.5	1603.25	1603.25	1603.25	1603.25	3.67E-02	3.67E-02	1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61	
ENG12	CAT C175 Shaft 1	526093.0	3480998.0	1572.77	1572.77	1572.77	1572.77	3.67E-02	3.67E-02	1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61	
ENG13	CAT C175 Shaft 2	526095.0	3480995.0	1572.77	1572.77	1572.77	1572.77	3.67E-02	3.67E-02	1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61	
50TNG1	NG Trench 50%	525839.3	3480926.4	1581.91	1581.91	1581.91	1581.91	3.77E-02	3.77E-02				1.67E-02	3.77E-02	8.53	761.58	3.27	0.81
50TNG2	NG Trench 50%	525845	3480924.5															

Mine Development
Point Sources

Source ID	Description	From BREEZE Model						Short Term Emission Rate (g/s)					Long Term Emission Rate (g/s)		Stk Ht (m)	Stk Temp (K)	Stk Vel (m/s)	Stk Diam (m)
		UTMx	UTMy	Elev (m)				PM ₁₀	PM _{2.5}	Lead	NO _x	CO	PM _{2.5}	NO _x				
				1/8-hr	24-hr	Monthly	annual											
75TNG32	NG Trench 75%	525839.6	3480980.1	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG33	NG Trench 75%	525939.5	3480926.2	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG34	NG Trench 75%	525942.5	3480923.3	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG35	NG Trench 75%	525946.6	3480919.2	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG36	NG Trench 75%	525949.8	3480916	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG37	NG Trench 75%	525952.6	3480912.5	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG38	NG Trench 75%	525955.3	3480908	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG39	NG Trench 75%	525959.9	3480904.2	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG40	NG Trench 75%	525965.2	3480900	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
HS1	Diesel Hardshell	527306.3	3480572.3	1581.32	1581.32	1581.32	1581.32	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS2	Diesel Hardshell	527310.6	3480571.4	1581.72	1581.72	1581.72	1581.72	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS3	Diesel Hardshell	527314.6	3480570.7	1582.33	1582.33	1582.33	1582.33	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS4	Diesel Hardshell	527318.5	3480569.7	1583.38	1583.38	1583.38	1583.38	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS5	Diesel Hardshell	527322.8	3480568.8	1584.52	1584.52	1584.52	1584.52	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS6	Diesel Hardshell	527327.2	3480568	1585.76	1585.76	1585.76	1585.76	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
100TNG1	NG Trench 100%	525839.3	3480926.4	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG2	NG Trench 100%	525845	3480924.5	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG3	NG Trench 100%	525850.7	3480922.6	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG4	NG Trench 100%	525856.3	3480920.7	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG5	NG Trench 100%	525862	3480918.8	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG6	NG Trench 100%	525867.7	3480916.9	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG7	NG Trench 100%	525873.4	3480915	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG8	NG Trench 100%	525833.7	3480868.6	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG9	NG Trench 100%	525839.4	3480866.7	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG10	NG Trench 100%	525845.1	3480864.8	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG11	NG Trench 100%	525850.8	3480862.9	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG12	NG Trench 100%	525856.4	3480861	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG13	NG Trench 100%	525862.1	3480859.1	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG14	NG Trench 100%	525867.8	3480857.2	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG15	NG Trench 100%	525845	3480978.4	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG16	NG Trench 100%	525850	3480976.1	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG17	NG Trench 100%	525855.2	3480975.2	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG18	NG Trench 100%	525860.5	3480973.1	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG19	NG Trench 100%	525865.7	3480970.5	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG20	NG Trench 100%	525871.9	3480968.9	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG21	NG Trench 100%	525877.1	3480966.8	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG22	NG Trench 100%	525882.6	3480964.8	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG23	NG Trench 100%	525888.7	3480962.2	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG24	NG Trench 100%	525893.6	3480960.7	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG25	NG Trench 100%	525898.7	3480957.8	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG26	NG Trench 100%	525904.5	3480956	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG27	NG Trench 100%	525909.7	3480954.4	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG28	NG Trench 100%	525913.1	3480952.5	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG29	NG Trench 100%	525917.6	3480951.5	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG30	NG Trench 100%	525829.9	3480983.5	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG31	NG Trench 100%	525834.4	3480981.8	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG32	NG Trench 100%	525839.6	3480980.1	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG33	NG Trench 100%	525939.5	3480926.2	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG34	NG Trench 100%	525942.5	3480923.3	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG35	NG Trench 100%	525946.6	3480919.2	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG36	NG Trench 100%	525949.8	3480916	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG37	NG Trench 100%	525952.6	3480912.5	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG38	NG Trench 100%	525955.3	3480908	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG39	NG Trench 100%	525959.9	3480904.2	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	
100TNG40	NG Trench 100%	525965.2	3480900	1581.91	1581.91	1581.91	1581.91			8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81	

Mine Development
Horz point

Table A-2. South32 Hermosa Horizontal Point Sources

Model ID	Source ID	Material	Description	From BREEZE Model			Short Term Emission Rate (g/s)					Long Term Emission Rate (g/s)		Stk Ht (m)	Stk Temp (K)	Stk Vel (m/s)	Stk Diam (m)
				UTMx	UTMy	Elev (m)	PM ₁₀	PM _{2.5}	Lead	NO _x	CO	PM _{2.5}	NO _x				
Taylor																	
DC-CBP	BCCBP	Cement	CBP Cement Silo	526444.4	3481114.2	1553.57	2.40E-05	2.40E-05	0.00E+00			2.40E-05		10.7	0.00	4.00	0.3
DCCBPS1	DCCBPS1	Cement	CBP Cement Supplement Silo 1	526440.0	3481112.6	1553.57	5.15E-05	5.15E-05	0.00E+00			5.15E-05		10.7	0.00	4.00	0.3
DCCBPS2	DCCBPS2	Cement	CBP Cement Supplement Silo 2	526448.1	3481118.2	1553.57	5.15E-05	5.15E-05	0.00E+00			5.15E-05		10.7	0.00	4.00	0.3
DC-PPBSS1	DCPBDS1	Binder	Paste Plant Binder Storage Silo 1	526456.1	3481063.7	1554.48	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DC-PPBSS2	DCPBDS2	Binder	Paste Plant Binder Storage Silo 2	526458.7	3481055.3	1554.48	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DC-PPBDS3	DCPBDS3	Binder	Paste Plant Binder Dosage Silo 1	526461.9	3481042.3	1554.48	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DC-PPBDS4	DCPBDS4	Binder	Paste Plant Binder Dosage Silo 2	526460.3	3481048.6	1554.48	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DC-PPM1M	DCPM1M	Binder	Plant Plant Module 1 Mixer	526454.0	3481046.9	1554.48	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3
DC-PPM2M	DCPM2M	Binder	Plant Plant Module 2 Mixer	526455.5	3481040.8	1554.48	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3
WTP1LS	WTP1LS	Lime	Waste Water Treatment Plant #1 Lime Silo	525771.3	3481956.3	1503.83	5.40E-03	5.40E-03	0.00E+00			5.40E-03		6.4	0.00	4.00	0.3
Clark																	
DC-CCBP	DCCCBP	Cement	CBP Cement Silo	527166.30	3480484.30	1620.27	1.18E-06	1.18E-06	0.00E+00			1.18E-06		10.7	0.00	4.00	0.3
DCCCBPS	DCCCBPS	Cement	CBP Cement Supplement Silo	527166.30	3480484.30	1620.27	1.71E-05	1.71E-05	0.00E+00			1.71E-05		10.7	0.00	4.00	0.3
DC-CPPBS1	DCCPPBS1	Binder	Paste Plant Binder Silo 1	527318.3	3480489.5	1606.44	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DC-CPPBS2	DCCPPBS2	Binder	Paste Plant Binder Silo 2	527319.5	3480485.3	1607.59	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DC-CPPBS3	DCCPPBS3	Binder	Paste Plant Binder Silo 3	527321	3480480.7	1608.98	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DC-CPPBS4	DCCPPBS4	Binder	Paste Plant Binder Silo 4	527322.5	3480475.7	1610.21	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DC-CPM1M	DC_PPM1M	Binder	Plant Plant Module 1 Mixer	527324	3480472.4	1611.26	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3
DC-CPM2M	DC_PPM2M	Binder	Plant Plant Module 2 Mixer	527325.5	3480467.5	1612.33	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3

**Mine Development
Area Sources**

Table A-3. South32 Hermosa Area Sources

Type of Pile	Source ID	Description	From BREEZE Model			Short Term Emission Rate (g/s/m2)			Long Term Emission Rate (g/s/m2)		Rel Ht (m)	Xlength (m)	Ylength (m)	Angle	Init vert dim	Area (sq. ft)	Area (m2)	
			UTMx	UTMy	Elev (m)			PM ₁₀	PM _{2.5}	Lead								PM _{2.5}
					24-hr	monthly	annual											
Polygon	TSF_1	Tailing Storage Facility	525625.8	3480953.2	1584.96	1584.96	1584.96	1.18E-06	1.77E-07	1.00E-08	1.77E-07	4.57	POLYGON			2.13	2,535,243.20	200,851.20
Polygon	WRS	West Rock Stockpile	525787.7	3480958.7	1595.12	1590.04	1590.04	3.73E-07	5.59E-08	2.64E-09	5.59E-08	4.57	POLYGON			2.13	278,224.70	25,847.92
Polygon	EOS	East Ore Stockpile	525820	3481442.1	1581.91	1581.91	1581.91	3.73E-07	5.59E-08	3.53E-08	5.59E-08	4.57	POLYGON			2.13	308,125.65	28,625.81
Polygon	HRS	Hardshell Rock Stockpile	526991.6	3480492.9	1623.06	1600.20	1600.20	3.73E-07	5.59E-08	4.23E-09	5.59E-08	4.57	POLYGON			2.13	1,641,033.49	152,457.00
Circular	ROM	Clark ROM Stockpile	526856.2	3480646.2	1559.60	1559.60	1559.60	3.73E-07	5.59E-08	1.31E-08	5.59E-08	3.05	RADIUS->	20.95	20.00	1.42	14,839.60	1,378.64
Rectangular	ORE	Clark Ore Stockpile	527205.0	3480657.0	1571.71	1571.71	1571.71	3.73E-07	5.59E-08	1.31E-08	5.59E-08	3.05	60.96	76.20	110.00	1.42	50,000.52	4,645.20
Rectangular	AGG	Clark Agg Stockpile	527186.9	3480489.4	1619.40	1619.40	1619.40	7.80E-08	1.17E-08		1.17E-08	3.05	18.29	4.57	110.00	1.42	899.86	83.60
Rectangular	SHOT	Clark Shotcrete Stockpile	527165.6	3480481.1	1620.82	1620.82	1620.82	7.80E-08	1.17E-08		1.17E-08	3.05	12.19	12.19	-10.00	1.42	1,599.52	148.60
Rectangular	TAGG	Taylor Agg Stockpile	526444.6	3481105.4	1546.14	1546.14	1546.14	7.80E-08	1.17E-08		1.17E-08	3.05	18.29	4.57	110.00	1.42	899.86	83.60
Rectangular	TSHOT	Taylor Shotcrete Stockpile	526451.6	3481118.9	1539.21	1539.21	1539.21	7.80E-08	1.17E-08		1.17E-08	3.05	12.19	12.19	-10.00	1.42	1,599.52	148.60
Rectangular	CHUTE	Waste Chute Bin	525998.4	3480990.8	1572.77	1572.77	1572.77	3.77E-07	5.66E-08	4.33E-09	5.66E-08	3.05	13.00	7.60	180.00	1.42	1,063.47	98.80
Rectangular	DOZAREA	Dozer on Hardrock Storage	527363.6	3480051.9	1623.06	1600.20	1600.20	-	-	1.08E-07	2.00E-06	1.75	40.00	41.00	90.00	0.94	17,652.81	1,640.00

**Mine Development
Volume Sources**

Table A-4. South32 Hermosa Volume Sources

Source ID	Description	From BREEZE Model					Short Term Emission Rate (g/s)			Long Term Emission Rate (g/s)	Source Vertical Dimension (m)	Source Width (m)	Rel Ht (m)	Init Lat Dim	Init Vert. Dim	
		UTMx	UTMy	Elev (m)	PM ₁₀	PM _{2.5}	Lead	PM _{2.5}								
									24-hr	monthly						annual
Taylor																
DP1	Drop of crushed ore from underground to 21210-BN-00001 Main Shaft Ore Surge Bin	525971.2	3480990.7	1572.77	1572.77	1572.77	3.36E-02	5.08E-03	2.74E-03	5.08E-03	-	2.00	24.92	0.47	3.06	
DP4	Drop from Shaft to Waste Chute	525985.6	3480987.5	1572.77	1572.77	1572.77	1.19E-02	1.80E-03	1.58E-04	1.98E-03	-	2.00	6.40	0.47	0.85	
DP21	Drop from Haul Truck to 21710-CV-00001 Primary Mill Feed Conveyor Hopper	525872.7	3480756.7	1602.33	1602.33	1602.33	1.44E-01	2.18E-02	4.93E-04	7.49E-04	3.75	3.43	3.92	0.80	0.46	
DP82	Drop on West NAG Stockpile	525582.2	3480891.9	1595.12	1590.04	1590.04	9.09E-03	1.38E-03	6.79E-05	1.38E-03	7.07	3.43	0.70	0.80	3.29	
DP83	Drop on East Ore Stockpile	525786.5	3480923.5	1581.91	1581.91	1581.91	2.02E-01	3.05E-02	4.93E-04	7.49E-04	7.07	3.43	0.70	0.80	3.29	
DP84	TSF	525986.2	3481278.7	1584.96	1584.96	1584.96	1.70E-02	2.58E-03	1.53E-04	2.58E-03	7.07	3.43	0.70	0.80	3.29	
DP94	Transfer from Agg Stockpile to Loader	526453.1	3481107.6	1542.65	1542.65	1542.65	9.02E-03	1.37E-03	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16	
DP95	Transfer of Agg Material from Loader to Haul Truck	526453.1	3481107.6	1542.65	1542.65	1542.65	9.02E-03	1.37E-03	0.00E+00	1.70E-04	3.75	2.04	0.89	0.47	0.87	
DP96	Transfer of Shotcrete Aggregate from Stockpile to Loader	526456.5	3481126.2	1535.67	1535.67	1535.67	6.31E-03	9.56E-04	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16	
DP97	Transfer of Ore from East Ore Stockpile to Loader	525784.1	3480923.6	1595.12	1590.04	1590.04	2.02E-01	3.05E-02	4.93E-04	7.49E-04	2.59	2.04	1.30	0.47	1.16	
DP98	Transfer of Ore from Loader to Haul Truck	525787.9	3480926.4	1595.12	1590.04	1590.04	2.02E-01	3.05E-02	4.93E-04	7.49E-04	3.75	2.04	1.87	0.47	0.87	
DP99	Transfer of Rock and Ore from Waste Chute to Loader	525988.9	3480987.1	1572.77	1572.77	1572.768	3.97E-02	6.01E-03	5.28E-04	6.61E-03	2.59	2.04	1.30	0.47	1.16	
DP100	Transfer of Rock and Ore from Loader to Haul Truck	525997.5	3480986.9	1572.77	1572.77	1572.768	3.97E-02	6.01E-03	5.28E-04	6.61E-03	3.75	2.04	1.87	0.47	0.87	
CBP1_11	CBP Plant	526440.8	3481120.6	1541.94	1541.94	1541.94	9.24E-03	9.24E-03	0.00E+00	9.24E-03	-	-	2.40	4.52	2.23	
DPWTP2	WTP2 Reagent Drops inside bldg	526396.80	3481207.50	1561.01	1561.01	1561.01	1.67E-04	1.66E-04	0.00E+00	1.66E-04	-	-	0.70	0.80	1.74	
DP143	Drop of Lead Concentrate Flocculant to 22620-EP-00002 Lead Concentrate Flocculant Preparation Module	525694.00	3480765.00	1603.25	1603.25	1603.25	1.14E-03	1.73E-04		2.05E-06	2.50	2.37	2.75	0.55	1.16	
DP144	Drop of Tailings Flocculant to 22620-EP-00001 Tailings Flocculant Preparation Module	526377.70	3481069.10	1562.42	1562.42	1562.42	5.03E-02	7.61E-03		4.66E-06	2.50	2.37	2.75	0.55	1.16	
DP145	Drop of Zinc Concentrate Flocculant to 22620-EP-00003 Zinc Concentrate Flocculant Preparation Module	525717.60	3480754.20	1603.25	1603.25	1603.25	7.60E-04	1.15E-04		2.24E-06	2.50	2.37	2.75	0.55	1.16	
DPWTP1	WTP1 Reagent Drops	525780.70	3481918.30	1502.88	1502.88	1502.88	8.03E-07	1.22E-07		4.86E-08			0.70	0.80	1.74	
DOZTSF_1	Dozer on TSF_1	526145.0	3481450.0	1584.96	1584.96	1584.96	5.44E-02	2.71E-02	1.10E-03	2.71E-02	-	-	1.75	0.96	0.94	
DOZWRS	Dozer on West Rock Stockpile	525526	3480957.5	1595.12	1590.04	1590.04	4.12E-03	3.28E-03	1.11E-04	3.28E-03	-	-	1.75	0.96	0.94	
DOZEOS	Dozer on East Ore Stockpile	525990.5	3480890.1	1581.91	1581.91	1581.91	4.12E-03	3.28E-03	1.48E-03	3.28E-03	-	-	1.75	0.96	0.94	
MEVAP1	Mechanical Evaporator 1	525908.5	3481579	1513.31	1513.31	1513.31	6.82E-03	1.02E-03	0.00E+00	1.71E-04	-	-	5.33	5.01	2.48	
MEVAP2	Mechanical Evaporator 2	525917.9	3481642.2	1512.68	1512.68	1512.68	6.82E-03	1.02E-03	0.00E+00	1.71E-04	-	-	5.33	5.01	2.48	
MEVAP3	Mechanical Evaporator 3	525853.4	3481615.7	1511.22	1511.22	1511.22	6.82E-03	1.02E-03	0.00E+00	1.71E-04	-	-	5.33	5.01	2.48	
PP1	Truck Pneumatic Loadout to Silo 1	526459.3	3481064.30	1554.48	1554.48	1554.48	4.19E-04	8.74E-05	0.00E+00	8.74E-05	-	-	2.00	1.16	4.98	
PP2	Truck Pneumatic Loadout to Silo 2	526461.9	3481055.80	1554.48	1554.48	1554.48	4.19E-04	8.74E-05	0.00E+00	8.74E-05	-	-	2.00	1.16	4.98	
Clark																
DP103	Haul Truck Dump into Primary Crusher Feed Hopper from ROM Stockpile (Z3100-HPR-0001)	526837.8	3480679.9	1554.48	1554.48	1554.48	6.06E-03	9.18E-04	1.51E-04	5.96E-04	3.75	3.43	3.92	0.80	1.74	
DP104	Drop from silo to trucks	526810.7	3480704.9	1554.48	1554.48	1554.48	1.41E-02	2.14E-03	5.02E-04	1.99E-03			4.957	0.593	0.496	
DP105	Transfer of Development Ore from Ore Stockpile to Loader	527220	3480626	1568.34	1568.34	1568.34	7.88E-03	1.19E-03	2.93E-04	1.19E-03	2.59	2.04	1.30	0.47	1.16	
DP106	Transfer of Development Ore Mined from Loader to Haul Truck	527220	3480626	1568.34	1568.34	1568.34	7.88E-03	1.19E-03	2.93E-04	1.19E-03	3.75	2.04	0.89	0.47	0.87	
DP107	Transfer from ROM Stockpile to Loader	526856.2	3480646.2	1559.6	1559.6	1559.6	2.16E-03	3.27E-04	8.03E-05	3.27E-04	2.59	2.04	1.30	0.47	1.16	
DP109	Transfer from Agg Stockpile to Loader	527187	3480489	1619.4	1619.4	1619.4	9.02E-03	1.37E-03	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16	
DP110	Transfer of Agg Material from Loader to Haul Truck	527187	3480489	1619.4	1619.4	1619.4	9.02E-03	1.37E-03	0.00E+00	1.70E-04	3.75	2.04	0.89	0.47	0.87	
DP111	Transfer of Shotcrete Aggregate from Stockpile to Loader	527168	3480482	1620.95	1620.95	1620.95	6.31E-03	9.56E-04	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16	
DP113	Hardshell NAG Wasterock Storage Drop	527194	3480105	1623.06	1600.2	1600.2	3.53E-02	5.35E-03	4.23E-04	5.35E-03	3.75	3.43	0.70	0.80	1.74	
DP114	Ore Stockpile Drop	527220	3480626	1568.34	1568.34	1568.34	7.88E-03	1.19E-03	2.93E-04	1.19E-03	3.75	3.43	0.70	0.80	1.74	
DP115	ROM Stockpile Drop	526856.2	3480646.2	1559.96	1559.96	1559.96	2.16E-03	3.27E-04	8.03E-05	3.27E-04	3.75	3.43	0.70	0.80	1.74	
CCBP1_11	Clark CBP Plant	527171.7	3480490.4	1619.37	1619.37	1619.37	4.70E-04	4.70E-04	0.00E+00	4.70E-04	-	-	2.40	4.52	2.23	
DOZHR5	Dozer on Hardshell Rock Stockpile	527385.0	3480030.7	1623.06	1600.2	1600.2	4.12E-03	3.28E-03	-	-	-	-	1.75	0.96	0.94	
BREAK1	Clark Rock Breaker	526812.60	3480694.90	1554.5	1554.5	1554.5	1.22E-04	1.85E-05	6.14E-05	8.21E-06	-	-	1.78	0.43	0.83	
PP3	Truck Pneumatic Loadout to Silo 1	527319.5	3480489.70	1606.44	1606.44	1606.44	2.10E-04	4.37E-05	0.00E+00	4.37E-05	-	-	2.00	1.16	4.98	
PP4	Truck Pneumatic Loadout to Silo 2	527320.7	3480485.80	1607.59	1607.59	1607.59	2.10E-04	4.37E-05	0.00E+00	4.37E-05	-	-	2.00	1.16	4.98	

Table A-5. South32 Hermosa Road Area Sources

Index	ID	Description	X	Y	Elevation	Total Daily PM ₁₀	Total Daily PM _{2.5}	Total Annual PM _{2.5}	Total Daily Pb	Area	Release height	X length	Y length	Angle	Init. Vert. dim.
						(g/s m ²)	(g/s m ²)	(g/s m ²)	(g/s m ²)						
										(m ²)	(m)	(m)	(m)		(m)
CRAREA1		526380.2	3480832	1538.7	3.81E-06	3.81E-07	3.08E-07	1.51E-09	240	3.06	12	20	1	2.84	
CRAREA2		526376.7	3480866	1524.89	8.90E-06	8.90E-07	5.50E-07	3.52E-09	1065	2.39	15	71	62	2.23	
CRAREA3		526446.8	3480899.4	1521.98	1.31E-05	1.31E-06	7.97E-07	5.18E-09	516	2.39	12	43	83	2.23	
CRAREA4		526493	3480903	1521.1	1.25E-05	1.25E-06	7.62E-07	4.95E-09	540	2.39	12	45	90	2.23	
CRAREA5		526539	3480903	1519.88	1.34E-05	1.34E-06	8.16E-07	5.31E-09	336	2.39	12	28	48.1	2.23	
CRAREA6		526562	3480922	1518.95	9.68E-06	9.68E-07	5.89E-07	3.83E-09	931.2	2.39	16	58.2	14.5	2.23	
CRAREA7		526628.30	3481008.50	1518.46	1.97E-05	1.97E-06	1.31E-06	7.78E-09	998.04	2.32	12.4	32.1	95.9	2.15	
CRAREA8		526671.9	3481003.3	1523.15	3.26E-05	3.26E-06	2.18E-06	1.29E-08	360	2.32	12	30	112	2.15	
CRAREA9		526700.5	3480985.9	1525.15	4.57E-05	4.57E-06	3.05E-06	1.81E-08	600	2.32	8	75	133	2.15	
CRAREA10		526747.8	3480924.2	1529.55	1.72E-05	1.72E-06	1.15E-06	6.81E-09	910	2.32	65	14	59	2.15	
CRAREA11		526786	3480867	1536.77	1.57E-05	1.57E-06	1.05E-06	6.19E-09	750	2.32	50	15	43	2.15	
CRAREA12		526806	3481131.5	1512.96	2.11E-05	2.11E-06	1.38E-06	8.33E-09	1363	2.18	94	14.5	103	2.03	
CRAREA13		526812.3	3481133.9	1512.95	1.89E-05	1.89E-06	1.24E-06	7.47E-09	759.9	2.18	17	44.7	32.1	2.03	
CRAREA14		526840.2	3480842.4	1544.55	1.78E-05	1.78E-06	1.19E-06	7.04E-09	1088	2.32	16	68	122	2.16	
CRAREA15		526911.3	3480690.7	1551.17	2.18E-05	2.18E-06	1.45E-06	8.63E-09	546	2.48	42	13	59.5	2.31	
CRAREA16		526953.3	3480585	1549.74	1.91E-05	1.91E-06	1.27E-06	7.55E-09	624	2.48	16	39	45	2.31	
CRAREA17		527423	3480286	1661.09	3.51E-06	3.51E-07	2.82E-07	1.39E-09	1320	3.10	110	12	90	2.89	
CRAREA18		527418.9	3480170.3	1674.33	3.46E-06	3.46E-07	2.78E-07	1.37E-09	1440	3.10	110	12	90	2.89	
CRAREA19		527420	3480049	1660.24	4.27E-06	4.27E-07	3.43E-07	1.69E-09	700	3.10	70	10	90	2.89	
CRAREA24		526304.8	3480773.8	1529.73	1.06E-06	1.06E-06	6.43E-07	4.17E-09	816.2	2.38	14	58.3	40.5	2.22	
CRAREA25		526279.1	3480771.3	1530.76	1.61E-05	1.61E-06	9.79E-07	6.35E-09	268	2.38	10	26.8	89.4	2.22	
CRAREA26		526192.4	3480836.3	1538.62	9.63E-06	9.63E-07	5.87E-07	3.81E-09	1565.55	2.38	14.7	106.5	124.6	2.22	
CRAREA29		526025.4	3480741.7	1550.06	3.08E-06	3.08E-07	2.56E-07	1.22E-09	629.06	3.11	14.2	44.3	78.9	2.89	
CRAREA31		526636.9	3481173.1	1513.21	2.60E-05	2.60E-06	1.80E-06	1.03E-08	1096.5	2.04	17	64.5	31.9	1.90	
CRAREA34		526893.6	3480798.8	1545.16	6.26E-06	6.26E-07	4.20E-07	2.47E-09	774.4922	2.32	18.8	18.19	122.3	2.16	
CRAREA35		526981.8	3480614.2	1600.42	5.12E-06	5.12E-07	3.40E-07	2.02E-09	775.4922	2.48	18.19	16.7	43.2	2.31	
CRAREA36		526981.8	3480614.2	1659.15	1.16E-06	1.16E-07	9.46E-08	4.58E-10	776.4922	3.05	15.7	18.19	121	2.84	
CRAREA37		527407.7	3480549.5	1670.79	2.10E-06	2.10E-07	1.72E-07	8.30E-10	777.4922	3.05	33.7	18.19	74.6	2.84	
CRAREA38		527417.6	3480297.2	1580.06	6.61E-07	6.61E-08	5.21E-08	2.61E-10	778.4922	3.10	11.5	12.1	71	2.89	
CRAREA39		527373.7	3479942.2	1521.97	1.28E-06	1.28E-07	1.03E-07	5.06E-10	779.4922	3.10	22.4	12.1	161.7	2.89	
CRAREA40		527211.1	3480686.5	1585.24	9.74E-07	9.74E-08	7.96E-08	3.85E-10	780.4922	3.05	18.19	21	126.2	2.84	
CRAREA41		526659.8	3481005.2	1521.97	5.01E-06	5.01E-07	3.35E-07	1.98E-09	781.4922	2.32	12.4	9.1	95.9	2.15	
TRAREA1		526261.2	3480584.7	1598.24	2.14E-06	2.14E-07	1.78E-07	8.47E-10	766.4922	3.11	34.1	18.19	114.2	2.89	
TRAREA2		525803.8	3481926.6	1507.48	1.17E-06	1.17E-07	8.91E-08	4.64E-10	767.4922	3.05	20.4	18.19	90	2.84	
TRAREA3		525631.7	3481926	1484.31	6.88E-07	6.88E-08	5.71E-08	2.72E-10	768.4922	3.06	12.1	12.8	90	2.85	
TRAREA6		526353.9	3480808.4	1535.38	2.13E-06	2.13E-07	1.77E-07	8.41E-10	771.4922	3.11	33	18.19	113.1	2.89	
TRAREA7		526381.1	3480829.8	1539.73	5.92E-07	5.92E-08	4.78E-08	2.34E-10	772.4922	3.06	10.6	12.1	94.9	2.84	
TRAREA8		526107.8	3480838.3	1544.01	3.35E-06	3.35E-07	2.04E-07	1.33E-09	773.4922	2.38	19.3	18.19	90	2.22	

ID	Description	X	Y	Elevation	Emission Rate				Area	Release Height	X length	Y length	Angle	Init. Vert. Dim.
					Total Daily PM ₁₀	Total Daily PM _{2.5}	Total Annual PM _{2.5}	Total Daily Pb						
					(g/s m ²)	(g/s m ²)	(g/s m ²)	(g/s m ²)						
CRAREA21		526597.6	3481020.6	1515.96	1.20E-05	1.20E-06	7.31E-07	4.75E-09	562.70	2.39	-	-	-	2.23
CRAREA22		526616.1	3481000.2	1517.16	1.77E-05	1.77E-06	1.18E-06	7.01E-09	441.62	2.32	-	-	-	2.15
CRAREA2Y		527371.7	3479931.9	1670.72	4.35E-06	4.35E-07	3.49E-07	1.72E-09	1144.63	3.10	-	-	-	2.89
CRAREA23		526374.4	3480853.7	1527.19	1.38E-05	1.38E-06	8.40E-07	5.45E-09	468.60	2.38	-	-	-	2.22
CRAREA27		526181.2	3480832.7	1538.35	1.35E-05	1.35E-06	8.22E-07	5.33E-09	798.73	2.38	-	-	-	2.22
CRAREA28		526121.2	3480800.8	1542.08	3.87E-06	3.87E-07	3.22E-07	1.53E-09	834.59	3.11	-	-	-	2.89
CRAREA30		526023.4	3480735.6	1548.96	3.53E-06	3.53E-07	2.93E-07	1.39E-09	1284.04	3.11	-	-	-	2.89
CRAREA31		526008.1	3480625	1553.09	3.28E-06	3.28E-07	2.73E-07	1.30E-09	1968.88	3.11	-	-	-	2.89
CRAREA32		525887.4	3480473.2	1553.94	3.38E-06	3.38E-07	2.81E-07	1.34E-09	765.49	3.11	-	-	-	2.89
TRAREA5		526370.6	3480837	1532.32	2.13E-06	2.13E-07	1.77E-07	8.42E-10	770.49	3.11	-	-	-	2.89
CRAREA43		526601.5	3481026.7	1516.12	4.57E-05	4.57E-06	3.00E-06	1.81E-08	104.67	2.18	-	-	-	2.03

Table A-6. South32 Hermosa Road Volume Sources

Segment Name	INDEX	ID	Description	UTM X Coordinate (m)	UTM Y Coordinate(m)	Elevation (m)	Emission Rate				Road Width (ft)	Road Width (m)	Adjusted Road Width (m)	Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)	Area Source (If Applicable)
							Total Daily PM ₁₀ (g/s)	Total Daily PM _{2.5} (g/s)	Total Annual PM _{2.5} (g/s)	Total Daily Lead (g/s)							
AR	1	TRAR_1	AR	526672.9	3481213.7	1511.02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.04	7.33	1.90	CRAREA33
AR	2	TRAR_2	AR	526665.4	3481199.6	1511.42	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.04	7.33	1.90	CRAREA33
AR	3	TRAR_3	AR	526656.2	3481186.5	1512.16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.04	7.33	1.90	CRAREA33
AR	4	TRAR_4	AR	526646.8	3481173.6	1512.84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.04	7.33	2.03	CRAREA33
RS	5	CRRS_1	RS	526640.6	3481161.6	1513.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA13
RS	6	CRRS_2	RS	526631	3481148.8	1512.96	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA13
RS	7	CRRS_3	RS	526621.4	3481136	1512.82	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA13
RS	8	CRRS_4	RS	526611.8	3481123.2	1512.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA12
RS	9	CRRS_5	RS	526607.9	3481107.7	1513.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA12
RS	10	CRRS_6	RS	526604	3481092.2	1513.99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA12
RS	11	CRRS_7	RS	526600.2	3481076.6	1514.46	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA12
RS	12	CRRS_8	RS	526596.3	3481061.1	1515.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA12
RS	13	CRRS_9	RS	526595.4	3481045.7	1515.62	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA12
RS	14	CRRS_10	RS	526599.4	3481031.3	1515.95	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.18	7.33	2.03	CRAREA43
ST	15	TRST_1	ST	526599.4	3481018.5	1515.58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA21
ST	16	TRST_2	ST	526589.7	3481002.6	1515.56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA21
ST	17	TRST_3	ST	526587.4	3480986.8	1516.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA21
ST	18	TRST_4	ST	526583.9	3480971.2	1516.83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA6
ST	19	TRST_5	ST	526579.8	3480955.7	1517.33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA6
ST	20	TRST_6	ST	526575.4	3480940.4	1517.97	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA6
ST	21	TRST_7	ST	526568.6	3480925.9	1518.59	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA6
ST	22	TRST_8	ST	526559.1	3480913.3	1519.16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA5
ST	23	TRST_9	ST	526547.6	3480902.2	1519.57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA5
ST	24	TRST_10	ST	526532.8	3480896.2	1519.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA4
ST	25	TRST_11	ST	526516.8	3480896.8	1520.27	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA4
ST	26	TRST_12	ST	526500.8	3480897.3	1520.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA4
ST	27	TRST_13	ST	526494.8	3480896.6	1521.22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA3
ST	28	TRST_14	ST	526489.9	3480895.2	1521.66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA3
ST	29	TRST_15	ST	526453	3480893.7	1522.37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA3
ST	30	TRST_16	ST	526437.6	3480889.7	1523.19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA2
ST	31	TRST_17	ST	526423.1	3480882.8	1525.89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA2
ST	32	TRST_18	ST	526408.7	3480876	1526.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA2
ST	33	TRST_19	ST	526394.2	3480869.2	1525.99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.39	7.33	2.23	CRAREA2
TU	34	TRTU_1	TU	526387.4	3480860	1527.69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.06	5.63	2.84	CRAREA2
TU	35	TRTU_2	TU	526387.3	3480848	1532.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.06	5.63	2.84	CRAREA1
TU	36	TRTU_3	TU	526387.2	3480836	1537.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.06	5.63	2.84	CRAREA1
TU	37	TRTU_4	TU	526387	3480824	1542.69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.06	5.63	2.84	TRAREA7
TU	38	TRTU_5	TU	526383.2	3480812.7	1546.45	4.58E-04	4.58E-05	3.70E-05	1.81E-07	20	6.10	12.10	3.06	5.63	2.84	
TU	39	TRTU_6	TU	526380.9	3480801.2	1549.4	4.58E-04	4.58E-05	3.70E-05	1.81E-07	20	6.10	12.10	3.06	5.63	2.84	
TU	40	TRTU_7	TU	526381.9	3480799.2	1551.52	4.58E-04	4.58E-05	3.70E-05	1.81E-07	20	6.10	12.10	3.06	5.63	2.84	
TU	41	TRTU_8	TU	526379.5	3480778	1550.99	4.58E-04	4.58E-05	3.70E-05	1.81E-07	20	6.10	12.10	3.06	5.63	2.84	
TU	42	TRTU_9	TU	526373.7	3480767.4	1548.04	4.58E-04	4.58E-05	3.70E-05	1.81E-07	20	6.10	12.10	3.06	5.63	2.84	
SV	43	CRSV1_1	SV	526606.6	3481021.7	1516.44	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA22
SV	44	CRSV1_2	SV	526619.3	3481009	1517.37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA22
SV	45	CRSV1_3	SV	526635.4	3481002.6	1518.66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA7
SV	46	CRSV1_4	SV	526653.1	3480999.3	1520.23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA7
SV	47	CRSV3_1	SV	526763.2	3480909.9	1531.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA10
SV	48	CRSV3_2	SV	526772.2	3480894.3	1533.43	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA10
SV	49	CRSV3_3	SV	526782.6	3480879.9	1535.47	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA10
SV	50	CRSV3_4	SV	526795.9	3480867.7	1537.51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA11
SV	51	CRSV3_5	SV	526809.2	3480855.6	1539.29	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA11
SV	52	CRSV3_6	SV	526823	3480844.1	1540.79	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.15	CRAREA11
VD	53	CRVD3_1	VD	526801.9	3480601.5	1552.83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.48	8.46	2.31	CRAREA16
VD	54	CRVD3_2	VD	526993.6	3480615.2	1554.22	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.48	8.46	2.31	CRAREA35
VD	55	CRVD3_3	VD	527005.3	3480628.8	1554.72	3.97E-03	3.97E-04	2.64E-04	1.57E-06	40	12.19	18.19	2.48	8.46	2.31	
VD	56	CRVD3_4	VD	527017.2	3480642.3	1555.88	3.97E-03	3.97E-04	2.64E-04	1.57E-06	40	12.19	18.19	2.48	8.46	2.31	
VD	57																

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LP	82	TRLP3_8	LP	525804.9	3481706.9	1506.19	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	83	TRLP3_9	LP	525810.8	3481689.9	1508.48	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	84	TRLP3_10	LP	525816.7	3481672.9	1510.55	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	85	TRLP4_1	LP	525820.3	3481662.2	1511.71	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	86	TRLP4_2	LP	525826.2	3481645.2	1512.35	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	87	TRLP4_3	LP	525832.1	3481628.2	1512.7	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	88	TRLP4_4	LP	525838	3481611.2	1513.09	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	89	TRLP4_5	LP	525843.9	3481594.2	1513.64	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	90	TRLP4_6	LP	525849.8	3481577.2	1514.85	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	91	TRLP4_7	LP	525855.7	3481560.2	1516.59	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	92	TRLP4_8	LP	525861.6	3481543.2	1518.43	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	93	TRLP4_9	LP	525867.3	3481526.7	1519.97	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	94	TRLP4_10	LP	525873.1	3481510.5	1522.14	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	95	TRLP5_1	LP	525878.8	3481503.3	1523.51	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	96	TRLP5_2	LP	525884.5	3481496.1	1524.88	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	97	TRLP5_3	LP	525890.2	3481488.9	1526.25	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	98	TRLP5_4	LP	525895.9	3481481.7	1527.62	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	99	TRLP5_5	LP	525901.6	3481474.5	1528.99	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	100	TRLP5_6	LP	525907.3	3481467.3	1530.36	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	101	TRLP5_7	LP	525913	3481460.1	1531.73	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
LP	102	TRLP5_8	LP	525918.7	3481452.9	1533.1	8.25E-04	8.25E-05	6.20E-05	3.26E-07	40	12.19	18.19	2.96	8.46	2.75	
PR	103	TRPR_1	PR	525924.4	3481445.7	1534.47	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	104	TRPR_2	PR	525930.1	3481438.5	1535.84	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	105	TRPR_3	PR	525935.8	3481431.3	1537.21	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	106	TRPR_4	PR	525941.5	3481424.1	1538.58	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	107	TRPR_5	PR	525947.2	3481416.9	1539.95	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	108	TRPR_6	PR	525952.9	3481409.7	1541.32	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	109	TRPR_7	PR	525958.6	3481402.5	1542.69	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	110	TRPR_8	PR	525964.3	3481395.3	1544.06	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	111	TRPR_9	PR	525970	3481388.1	1545.43	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	112	TRPR_10	PR	525975.7	3481380.9	1546.8	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	113	TRPR_11	PR	525981.4	3481373.7	1548.17	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	114	TRPR_12	PR	525987.1	3481366.5	1549.54	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	115	TRPR_13	PR	525992.8	3481359.3	1550.91	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	116	TRPR_14	PR	525998.5	3481352.1	1552.28	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	117	TRPR_15	PR	526004.2	3481344.9	1553.65	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	118	TRPR_16	PR	526009.9	3481337.7	1555.02	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	119	TRPR_17	PR	526015.6	3481330.5	1556.39	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	120	TRPR_18	PR	526021.3	3481323.3	1557.76	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	121	TRPR_19	PR	526027	3481316.1	1559.13	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	122	TRPR_20	PR	526032.7	3481308.9	1560.5	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	123	TRPR_21	PR	526038.4	3481301.7	1561.87	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	124	TRPR_22	PR	526044.1	3481294.5	1563.24	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	125	TRPR_23	PR	526049.8	3481287.3	1564.61	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	126	TRPR_24	PR	526055.5	3481280.1	1565.98	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	127	TRPR_25	PR	526061.2	3481272.9	1567.35	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
PR	128	TRPR_26	PR	526066.9	3481265.7	1568.72	9.95E-04	9.95E-05	6.67E-05	3.94E-07	40	12.19	18.19	2.94	8.46	2.73	
RH	129	TRRH_1	RH	526072.6	3481258.5	1570.09	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	130	TRRH_2	RH	526078.3	3481251.3	1571.46	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	131	TRRH_3	RH	526084	3481244.1	1572.83	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	132	TRRH_4	RH	526089.7	3481236.9	1574.2	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	133	TRRH_5	RH	526095.4	3481229.7	1575.57	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	134	TRRH_6	RH	526101.1	3481222.5	1576.94	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	135	TRRH_7	RH	526106.8	3481215.3	1578.31	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	136	TRRH_8	RH	526112.5	3481208.1	1579.68	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	137	TRRH_9	RH	526118.2	3481200.9	1581.05	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
RH	138	TRRH_10	RH	526123.9	3481193.7	1582.42	1.05E-02	1.05E-03	5.55E-04	4.15E-06	40	12.19	18.19	2.51	8.46	2.33	
FH	139	TRFH_1	FH	525715.5	3481029.8	1594.33	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
FH	140	TRFH_2	FH	525721.2	3481022.6	1595.7	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
FH	141	TRFH_3	FH	525726.9	3481015.4	1597.07	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
FH	142	TRFH_4	FH	525732.6	3481008.2	1598.44	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
FH	143	TRFH_5	FH	525738.3	3481001	1599.81	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
FH	144	TRFH_6	FH	525744	3480993.8	1601.18	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
FH	145	TRFH_7	FH	525749.7	3480986.6	1602.55	1.42E-03	1.42E-04	1.13E-04	5.60E-07	40	12.19	18.19	2.34	8.46	2.18	
HC	146	TRHC_1	HC	525755.4	3480979.4	1603.92	6.88E-03	6.88E-04	3.79E-04	2.72E-06	40	12.19	18.19	3.23	8.46	3.00	
HC	147	TRHC_2	HC	525761.1	3480972.2	1605.29	6.88E-03	6.88E-04	3.79E-04	2.72E-06	40	12.19	18.19	3.23	8.46	3.00	
HC	148	TRHC_3	HC	525766.8	3480965	1606.66	6.88E-03	6.88E-04	3.79E-04	2.72E-06	40	12.19	18.19	3.23	8.46	3.00	
RD	149	TRRD_1	RD	525772.5	34												

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BQ	180	TRBQ_2	BQ	526226.2	3481007.4	1562.45	8.63E-04	8.63E-05	6.48E-05	3.41E-07	40	12.19	18.19	2.88	8.46	2.68	
BQ	181	TRBQ_3	BQ	526233.5	3480991	1561.72	8.63E-04	8.63E-05	6.48E-05	3.41E-07	40	12.19	18.19	2.88	8.46	2.68	
BQ	182	TRBQ_4	BQ	526240.9	3480974.5	1555.44	8.63E-04	8.63E-05	6.48E-05	3.41E-07	40	12.19	18.19	2.88	8.46	2.68	
BQ	183	TRBQ_5	BQ	526248.3	3480958.1	1550.18	8.63E-04	8.63E-05	6.48E-05	3.41E-07	40	12.19	18.19	2.88	8.46	2.68	
BQ	184	TRBQ_6	BQ	526255.7	3480941.7	1546.49	8.63E-04	8.63E-05	6.48E-05	3.41E-07	40	12.19	18.19	2.88	8.46	2.68	
BQ	185	TRBQ_7	BQ	526263.1	3480925.3	1547.83	8.63E-04	8.63E-05	6.48E-05	3.41E-07	40	12.19	18.19	2.88	8.46	2.68	
RB	186	TRRB_1	RB	526270.2	3481026	1562.36	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	187	TRRB_2	RB	526275.9	3481014.4	1562.3	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	188	TRRB_3	RB	526279.6	3481002.7	1561.89	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	199	TRRB_4	RB	526283.4	3480991.1	1561.12	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	200	TRRB_5	RB	526277.1	3480979.5	1559.53	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	201	TRRB_6	RB	526293.7	3480972.5	1557.73	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	202	TRRB_7	RB	526310.3	3480965.6	1555.24	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	203	TRRB_8	RB	526328.2	3480965.3	1553.7	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	204	TRRB_9	RB	526346.2	3480965.8	1552.13	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	205	TRRB_10	RB	526364.2	3480966.3	1549.81	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	206	TRRB_11	RB	526382.2	3480966.8	1548.47	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	207	TRRB_12	RB	526400.1	3480967.4	1546.28	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	208	TRRB_13	RB	526418.1	3480967.9	1544.39	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	209	TRRB_14	RB	526436.1	3480968.4	1542.45	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	210	TRRB_15	RB	526454.1	3480968.9	1540.69	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	211	TRRB_16	RB	526472.1	3480969.5	1538.56	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	212	TRRB_17	RB	526488.5	3480976.6	1538.32	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	213	TRRB_18	RB	526503	3480986.3	1538.58	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	214	TRRB_19	RB	526512.3	3481001.7	1536.02	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	215	TRRB_20	RB	526518.8	3481018.2	1532.96	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	216	TRRB_21	RB	526521.7	3481035.9	1532.16	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	217	TRRB_22	RB	526521.8	3481053.9	1530.94	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	218	TRRB_23	RB	526521.9	3481071.9	1530.25	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	219	TRRB_24	RB	526522	3481089.9	1529.65	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	220	TRRB_25	RB	526522.1	3481107.9	1527.46	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	221	TRRB_26	RB	526530.1	3481123.7	1522.39	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	222	TRRB_27	RB	526539.2	3481130.3	1522.16	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	223	TRRB_28	RB	526548.2	3481154.9	1522.61	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	224	TRRB_29	RB	526557.2	3481170.5	1520.82	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	225	TRRB_30	RB	526567.1	3481185	1518.73	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	226	TRRB_31	RB	526583.5	3481192.6	1517	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	227	TRRB_32	RB	526600.5	3481196.8	1515.14	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	228	TRRB_33	RB	526616.8	3481191.4	1513.4	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
RB	229	TRRB_34	RB	526631.1	3481180.4	1512.99	7.18E-03	7.18E-04	4.67E-04	2.84E-06	40	12.19	18.19	2.28	8.46	2.12	
ZY	230	CRZY1_1	ZY	527425	3480164.6	1673.53	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	231	CRZY1_2	ZY	527425	3480152.6	1672.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	232	CRZY1_3	ZY	527425	3480140.6	1671.66	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	233	CRZY1_4	ZY	527425	3480128.6	1670.94	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	234	CRZY1_5	ZY	527425	3480116.6	1669.33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	235	CRZY1_6	ZY	527425	3480104.6	1666.62	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	236	CRZY1_7	ZY	527425	3480092.6	1664.79	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	237	CRZY1_8	ZY	527425	3480080.6	1663.32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	238	CRZY1_9	ZY	527425	3480068.6	1662.54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	239	CRZY1_10	ZY	527425	3480056.6	1662.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA18
ZY	240	CRZY1_11	ZY	527425	3480044.6	1661.74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA19
ZY	241	CRZY1_12	ZY	527425	3480032.6	1661.99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA19
ZY	242	CRZY1_13	ZY	527425	3480020.6	1663	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA19
ZY	243	CRZY1_14	ZY	527425	3480008.6	1664.56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA19
ZY	244	CRZY1_15	ZY	527425	3479996.6	1665.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA19
ZY	245	CRZY1_16	ZY	527425	3479984.6	1667.04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA19
ZY	246	CRZY1_17	ZY	527425	3479972.6	1671.18	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	247	CRZY1_18	ZY	527425	3479960.6	1670.75	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	248	CRZY1_19	ZY	527425	3479948.6	1670.18	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	249	CRZY1_20	ZY	527425	3479936.6	1669.06	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	250	CRZY1_21	ZY	527425	3479924.6	1668.73	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	251	CRZY1_22	ZY	527425	3479912.6	1668.6	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	252	CRZY1_23	ZY	527425	3479900.6	1668.51	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	253	CRZY1_24	ZY	527425	3479888.6	1668.4	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	254	CRZY1_25	ZY	527425	3479876.6	1668.3	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	255	CRZY1_26	ZY	527425	3479864.6	1668.2	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	
ZY	256	CRZY1_27	ZY	527425	3479852.6	1668.1	4.98E-04	4.98E-05	4.00E-05	1.97E-07	20	6.10	12.10	3.10	5.63	2.89	

Mine Development
Mod - Vol Road Params

GB	281	TRGB1_7	GB	526104	3481369.7	1552.01	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	282	TRGB1_8	GB	526119.1	3481359.9	1552.67	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	283	TRGB1_9	GB	526132.9	3481348.5	1552.3	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	284	TRGB1_10	GB	526146.7	3481336.9	1551.95	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	285	TRGB1_11	GB	526159.3	3481324.2	1550.96	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	286	TRGB1_12	GB	526165	3481307.5	1549.11	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	287	TRGB1_13	GB	526170.5	3481290.4	1548.33	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	288	TRGB1_14	GB	526176.3	3481273.4	1542.59	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	289	TRGB1_15	GB	526180.7	3481256	1540.2	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	290	TRGB1_16	GB	526185.3	3481238.8	1539.6	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	291	TRGB1_17	GB	526186.5	3481220.8	1539.4	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	292	TRGB1_18	GB	526188.6	3481202.9	1542.53	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	293	TRGB1_19	GB	526191.2	3481185.1	1547.76	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	294	TRGB1_20	GB	526189.9	3481167.3	1551.35	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	295	TRGB1_21	GB	526187.6	3481149.5	1549.84	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	296	TRGB1_22	GB	526184	3481131.9	1548.43	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	297	TRGB1_23	GB	526176.4	3481115.6	1548.89	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	298	TRGB1_24	GB	526168.3	3481099.5	1549.36	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	299	TRGB1_25	GB	526159.6	3481083.7	1549.47	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	300	TRGB1_26	GB	526149.4	3481063.6	1550.44	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	301	TRGB1_27	GB	526156.4	3481049.6	1551.64	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	302	TRGB1_28	GB	526173.5	3481047	1553.59	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	303	TRGB1_29	GB	526190.4	3481052.7	1552.53	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	304	TRGB1_30	GB	526206.9	3481060	1552.49	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	305	TRGB1_31	GB	526219.4	3481072.3	1552.82	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	306	TRGB1_32	GB	526226.6	3481088.7	1553.22	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	307	TRGB1_33	GB	526235	3481104.3	1552.67	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	308	TRGB1_34	GB	526250.9	3481112.1	1552.69	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	309	TRGB1_35	GB	526268.6	3481115	1551.98	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	310	TRGB1_36	GB	526286.3	3481118.3	1553.13	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	311	TRGB1_37	GB	526304	3481121.4	1558.03	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
GB	312	TRGB1_38	GB	526315.8	3481113.6	1561.7	9.06E-03	9.06E-04	5.08E-04	3.58E-06	17	5.03	11.03	3.24	5.13	3.01	
LC	313	TRLC_1	LC	525607.9	3482112.8	1492.18	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	314	TRLC_2	LC	525615.8	3482096.4	1492.97	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	315	TRLC_3	LC	525623.6	3482080	1492.82	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	316	TRLC_4	LC	525631.5	3482063.6	1492.6	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	317	TRLC_5	LC	525639.4	3482047.2	1492.41	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	318	TRLC_6	LC	525647.2	3482030.8	1492.2	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	319	TRLC_7	LC	525655.1	3482014.4	1492.05	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	320	TRLC_8	LC	525662.9	3481998	1492	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	321	TRLC_9	LC	525670.8	3481981.6	1492.89	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	322	TRLC_10	LC	525678.7	3481965.2	1497.7	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	323	TRLC_11	LC	525690.3	3481952.6	1498.4	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	324	TRLC_12	LC	525706.9	3481945.2	1498.25	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	325	TRLC_13	LC	525723.5	3481937.7	1499.05	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	326	TRLC_14	LC	525740.1	3481930.2	1499.9	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	327	TRLC_15	LC	525747.4	3481914	1499.72	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	328	TRLC_16	LC	525753.7	3481897	1499.06	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	329	TRLC_17	LC	525760	3481879.9	1498.02	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	330	TRLC_18	LC	525766.4	3481862.9	1496.83	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	331	TRLC_19	LC	525766.3	3481844.8	1495.77	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LC	332	TRLC_20	LC	525765.8	3481826.6	1495.31	8.07E-04	8.07E-05	6.61E-05	3.19E-07	40	12.19	18.19	2.92	8.46	2.72	
LA	333	TRLA_1	LA	525778.3	3481828.2	1495.64	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	334	TRLA_2	LA	525794.4	3481836.7	1496.75	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	335	TRLA_3	LA	525810.5	3481845.2	1498.79	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	336	TRLA_4	LA	525811.8	3481862.8	1499	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	337	TRLA_5	LA	525812.1	3481881	1500.78	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	338	TRLA_6	LA	525812.3	3481899.1	1502.19	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	339	TRLA_7	LA	525812.6	3481917.3	1504.89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.05	8.46	2.84	
LA	340	TRLA_8	LA	525807.5	3481934.1	1509.07	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	341	TRLA_9	LA	525798.5	3481949.9	1515.28	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
LA	342	TRLA_10	LA	525789.5	3481965.8	1517.71	9.00E-04	9.00E-05	6.84E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
HI	343	TRHI_1	HI	525743.4	3480918.6	1594.94	8.13E-03	8.13E-04	3.13E-04	3.21E-06	40	12.19	18.19	2.12	8.46	1.97	
HI	344	TRHI_2	HI	525728.6	3480908	1597.57	8.13E-03	8.13E-04	3.13E-04	3.21E-06	40	12.19	18.19	2.12	8.46	1.97	
HI	345	TRHI_3	HI	525713.8	3480897.4	1599.59	8.13E-03	8.13E-04	3.13E-04	3.21E-06	40	12.19	18.19	2.12	8.46	1.97	
HI	346	TRHI_4	HI	525699	3480886.9	1600.19	8.13E-03	8.13E-04	3.13E-04	3.21E-06	40	12.19	18.19	2.12	8.46	1.97	
HI	347	TRHI_5	HI	525684.2	3480876.3	1606.61	8.13E-03	8.13E-04	3.13E-04	3.21E-06	40	12.19	18.19	2.12	8.46	1.97	
HI	348	TRHI_6	HI	525669.4	3480865.7												

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IL	372	TRIL_1	IL	525663.5	3480857.4	1610.57	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	373	TRIL_2	IL	525681.5	3480860	1610.65	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	374	TRIL_3	IL	525699.5	3480862.6	1604.74	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	375	TRIL_4	IL	525715.9	3480857	1603.42	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	376	TRIL_5	IL	525731.6	3480847.9	1603.8	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	377	TRIL_6	IL	525747.4	3480838.7	1603.17	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	378	TRIL_7	IL	525763.1	3480829.6	1603.98	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	379	TRIL_8	IL	525778.8	3480820.4	1605.23	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	380	TRIL_9	IL	525778.7	3480806.9	1607.96	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	381	TRIL_10	IL	525779.1	3480792.8	1607.57	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	382	TRIL_11	IL	525793.1	3480781.2	1608.87	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
IL	383	TRIL_12	IL	525807.1	3480769.6	1610.31	4.45E-03	4.45E-04	1.52E-04	1.76E-06	40	12.19	18.19	2.83	8.46	2.63	
BP	393	TRBP_1	BP	526213	3481018.5	1562.57	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	394	TRBP_2	BP	526204	3481003.9	1562.81	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	395	TRBP_3	BP	526207.5	3480986.9	1562.35	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	396	TRBP_4	BP	526209.8	3480969.7	1561.38	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	397	TRBP_5	BP	526208.9	3480951.6	1559.58	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	398	TRBP_6	BP	526208	3480933.4	1558.11	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	399	TRBP_7	BP	526207	3480915.3	1556.56	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	400	TRBP_8	BP	526200.7	3480898.2	1554.9	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	401	TRBP_9	BP	526189.4	3480884.3	1553.15	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	402	TRBP_10	BP	526174.2	3480876.5	1552.15	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	403	TRBP_11	BP	526156.1	3480875	1551.23	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	404	TRBP_12	BP	526138.4	3480871.7	1549.76	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	405	TRBP_13	BP	526123.1	3480862.8	1546.36	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	406	TRBP_14	BP	526115.1	3480847.4	1543.85	2.59E-03	2.59E-04	1.58E-04	1.03E-06	40	12.19	18.19	2.38	8.46	2.22	
BP	407	TRBP_15	BP	526117	3480829.3	1542.96	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.38	8.46	2.22	TRAREA8
XA	408	CRXA_1	XA	527310.1	3480531.7	1594.48	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	409	CRXA_2	XA	527327.9	3480534.1	1596	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	410	CRXA_3	XA	527346	3480535.3	1598.2	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	411	CRXA_4	XA	527363.9	3480538.3	1600.15	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	412	CRXA_5	XA	527379.5	3480546.5	1601.59	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	413	CRXA_6	XA	527385.9	3480563.4	1600.48	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	414	CRXA_7	XA	527398.2	3480573.6	1600.09	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	415	CRXA_8	XA	527409.8	3480560.2	1599.26	8.16E-04	8.16E-05	6.67E-05	3.23E-07	40	12.19	18.19	3.05	8.46	2.84	
XA	416	CRXA_9	XA	527416	3480543.1	1598.74	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.05	8.46	2.84	CRAREA37
XA	417	CRXA_10	XA	527422.1	3480526	1598.19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.05	8.46	2.84	CRAREA37
VX	418	CRVX_1	VX	527118.3	3480610.7	1574.99	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	419	CRVX_2	VX	527100.2	3480608.8	1579.38	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	420	CRVX_3	VX	527082.9	3480604.3	1583.35	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	421	CRVX_4	VX	527067.7	3480594.6	1586.71	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	422	CRVX_5	VX	527055.6	3480581	1586.98	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	423	CRVX_6	VX	527046.9	3480565.9	1594.46	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	424	CRVX_7	VX	527042.3	3480548.4	1581.22	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	425	CRVX_8	VX	527042.3	3480530.2	1577.94	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	426	CRVX_9	VX	527042.3	3480512	1573.49	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	427	CRVX_10	VX	527050.2	3480496.2	1573.29	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	428	CRVX_11	VX	527060.1	3480480.9	1575.17	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	429	CRVX_12	VX	527069.2	3480465.3	1577.46	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	430	CRVX_13	VX	527075.3	3480448.1	1577.66	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	431	CRVX_14	VX	527081.5	3480431	1578.53	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	432	CRVX_15	VX	527088.6	3480414.3	1581.05	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	433	CRVX_16	VX	527096.4	3480397.9	1583.95	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	434	CRVX_17	VX	527106.9	3480383.1	1587.86	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	435	CRVX_18	VX	527117.8	3480368.5	1591.36	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	436	CRVX_19	VX	527128.7	3480354.7	1596.73	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	437	CRVX_20	VX	527141.5	3480340.9	1602.22	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	438	CRVX_21	VX	527153.5	3480327.2	1604.25	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	439	CRVX_22	VX	527166.1	3480314.1	1603.43	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	440	CRVX_23	VX	527178.7	3480301	1602.54	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	441	CRVX_24	VX	527191.4	3480288	1602.14	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	442	CRVX_25	VX	527204	3480274.9	1601.99	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	443	CRVX_26	VX	527216.7	3480261.8	1604.14	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	444	CRVX_27	VX	527229.3	3480248.7	1610.85	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	445	CRVX_28	VX	527231	3480232	1611.73	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	446	CRVX_29	VX	527228.6	3480214	1609.9	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	447	CRVX_30	VX	527226.3	3480195.9	1605.36	3.98E-03	3.98E-04	2.67E-04	1.57E-06	40	12.19	18.19	2.41	8.46	2.24	
VX	448	CRVX															

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XB	472	CRXB_3	XB	527303.7	3480489.5	1602.64	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	473	CRXB_4	XB	527293.6	3480484.5	1600.29	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	474	CRXB_5	XB	527281.9	3480483.6	1602.14	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	475	CRXB_6	XB	527273.3	3480492.2	1601.42	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	476	CRXB_7	XB	527264.8	3480500.7	1600.44	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	477	CRXB_8	XB	527256.2	3480509.3	1599.77	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	478	CRXB_9	XB	527247.1	3480517.2	1599.36	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	479	CRXB_10	XB	527237.2	3480524	1599.95	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	480	CRXB_11	XB	527227	3480530.5	1600.69	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	481	CRXB_12	XB	527215	3480531.6	1603.61	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	482	CRXB_13	XB	527202.9	3480532.6	1604.37	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	483	CRXB_14	XB	527191.2	3480535.3	1603.64	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	484	CRXB_15	XB	527179.4	3480538.3	1603.29	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	485	CRXB_16	XB	527167.7	3480541.2	1603.22	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	486	CRXB_17	XB	527156	3480544.2	1602.26	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	487	CRXB_18	XB	527144.2	3480547.2	1601.36	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	488	CRXB_19	XB	527132.5	3480550.1	1600.77	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	489	CRXB_20	XB	527120.8	3480553.1	1600.14	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	490	CRXB_21	XB	527108.7	3480553.4	1600.23	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	491	CRXB_22	XB	527102.1	3480547.2	1601.36	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	492	CRXB_23	XB	527105.1	3480537.3	1603.21	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	493	CRXB_24	XB	527115.1	3480530.4	1605.59	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	494	CRXB_25	XB	527126.3	3480526.1	1607.4	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	495	CRXB_26	XB	527137.7	3480522	1609.15	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	496	CRXB_27	XB	527149.4	3480519	1609.92	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	497	CRXB_28	XB	527161.3	3480517	1610.25	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	498	CRXB_29	XB	527173.2	3480514.9	1610.77	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	499	CRXB_30	XB	527184.6	3480511.1	1611.76	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	500	CRXB_31	XB	527195.3	3480505.5	1612.95	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	501	CRXB_32	XB	527205.9	3480499.7	1614.03	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	502	CRXB_33	XB	527215.7	3480492.6	1615.19	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	503	CRXB_34	XB	527225.5	3480485.5	1616.01	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	504	CRXB_35	XB	527235.8	3480479.1	1616.1	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	505	CRXB_36	XB	527246.4	3480473.4	1615.46	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	506	CRXB_37	XB	527257.1	3480467.7	1614.88	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	507	CRXB_38	XB	527262.3	3480457.5	1617.65	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	508	CRXB_39	XB	527260.1	3480448.5	1621.37	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	509	CRXB_40	XB	527248.4	3480447.2	1624.01	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	510	CRXB_41	XB	527236.5	3480448.9	1625.79	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	511	CRXB_42	XB	527225.4	3480452.1	1626.93	6.00E-04	6.00E-05	4.58E-05	2.37E-07	20	6.10	12.10	2.99	5.63	2.78	
BC	512	CRBC_1	BC	527210.9	3480451.1	1628.79	5.14E-04	5.14E-05	3.93E-05	2.03E-07	20	6.10	12.10	3.03	5.63	2.82	
BC	513	CRBC_2	BC	527200.6	3480457.4	1627.55	5.14E-04	5.14E-05	3.93E-05	2.03E-07	20	6.10	12.10	3.03	5.63	2.82	
BC	514	CRBC_3	BC	527190.2	3480463.7	1626.77	5.14E-04	5.14E-05	3.93E-05	2.03E-07	20	6.10	12.10	3.03	5.63	2.82	
BZ	515	CRBZ_1	BZ	527218.4	3480441.3	1631.12	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	516	CRBZ_2	BZ	527227.5	3480433.6	1632.65	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	517	CRBZ_3	BZ	527237.5	3480427.5	1633.22	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	518	CRBZ_4	BZ	527249.6	3480427.2	1632.06	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	519	CRBZ_5	BZ	527261.7	3480427	1630.42	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	520	CRBZ_6	BZ	527273.8	3480426.7	1628.7	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	521	CRBZ_7	BZ	527285	3480422.3	1629.25	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	522	CRBZ_8	BZ	527296.1	3480417.5	1631.03	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	523	CRBZ_9	BZ	527307.2	3480412.7	1632.33	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	524	CRBZ_10	BZ	527318.3	3480407.9	1633.77	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	525	CRBZ_11	BZ	527329.4	3480403.1	1634.32	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	526	CRBZ_12	BZ	527340.5	3480398.3	1635.03	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	527	CRBZ_13	BZ	527351.6	3480393.5	1635.29	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	528	CRBZ_14	BZ	527362.8	3480389.8	1635.83	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	529	CRBZ_15	BZ	527373.9	3480384	1636.6	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	530	CRBZ_16	BZ	527385	3480379.2	1638.9	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	531	CRBZ_17	BZ	527395.3	3480373.5	1641.35	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	532	CRBZ_18	BZ	527400.7	3480363.4	1642.94	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	533	CRBZ_19	BZ	527392.2	3480354.9	1644.85	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	534	CRBZ_20	BZ	527381.2	3480351.7	1646.52	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	535	CRBZ_21	BZ	527369.1	3480351	1647.9	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	536	CRBZ_22	BZ	527357.1	3480350.3	1649.83	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	537	CRBZ_23	BZ	527347	3480345.5	1653.02	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	538	CRBZ_24	BZ	527344.2	3480335.1	1656.11	5.15E-04	5.15E-05	4.13E-05	2.04E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	539	CRBZ_25	BZ	527350.8	3480326.5	1658.04	5.										

Mine Development
Mod - Vol Road Params

TV	563	TRTV_5	TV	526343	3480766.9	1532.47	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	564	TRTV_6	TV	526331.8	3480752.5	1530.29	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	565	TRTV_7	TV	526320.6	3480738.2	1533.21	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	566	TRTV_8	TV	526309.4	3480723.8	1541.83	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	567	TRTV_9	TV	526293.3	3480721.3	1548.89	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	568	TRTV_10	TV	526275.3	3480723.5	1547	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	569	TRTV_11	TV	526257.4	3480726.6	1550.75	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	570	TRTV_12	TV	526239.6	3480730.5	1554.16	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	571	TRTV_13	TV	526221.4	3480731.8	1557.84	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	572	TRTV_14	TV	526206.9	3480724	1564.46	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	573	TRTV_15	TV	526202.1	3480706.4	1567.08	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	574	TRTV_16	TV	526200.2	3480688.6	1570.13	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	575	TRTV_17	TV	526213.4	3480679.4	1574.88	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	576	TRTV_18	TV	526227.8	3480668.9	1578.9	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	577	TRTV_19	TV	526240.8	3480656.1	1581.77	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	578	TRTV_20	TV	526253.7	3480643.4	1584.03	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	579	TRTV_21	TV	526262.8	3480628.6	1588.69	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	580	TRTV_22	TV	526265.9	3480610.6	1594.1	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	581	TRTV_23	TV	526266.8	3480592.5	1598.76	8.21E-04	8.21E-05	6.81E-05	3.25E-07	40	12.19	18.19	3.11	8.46	2.89	
TV	582	TRTV_24	TV	526267.3	3480574.3	1602.51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.11	8.46	2.89	TRAREA1
TV	583	TRTV_25	TV	526265.5	3480557.8	1602.12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.11	8.46	2.89	TRAREA1
VA	584	CRVA_1	VA	526845.8	3480673.9	1553.4	8.99E-04	8.99E-05	7.35E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
VA	585	CRVA_2	VA	526845.8	3480655.7	1555.59	8.99E-04	8.99E-05	7.35E-05	3.56E-07	40	12.19	18.19	3.05	8.46	2.84	
VA	586	CRVA_3	VA	526842.4	3480638.2	1559.23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.05	8.46	2.84	CRAREA36
VB	587	CRVB_1	VB	526841.6	3480831.7	1542.25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.16	CRAREA14
VB	588	CRVB_2	VB	526857.1	3480822.1	1543.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.16	CRAREA14
VB	589	CRVB_3	VB	526872.5	3480812.5	1544.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.16	CRAREA14
VB	590	CRVB_4	VB	526888	3480802.9	1544.92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.16	CRAREA14
VB	591	CRVB_5	VB	526893.7	3480787.9	1545.17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.32	8.46	2.16	CRAREA14
VB	592	CRVB_6	VB	526886.4	3480772.7	1545.75	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VB	593	CRVB_7	VB	526873.4	3480759.9	1546.43	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VB	594	CRVB_8	VB	526860.5	3480747.1	1548.09	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VB	595	CRVB_9	VB	526847.6	3480734.6	1548.07	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VB	596	CRVB_10	VB	526834.7	3480721.5	1550.05	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VB	597	CRVB_11	VB	526830.1	3480705.1	1551.92	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VB	598	CRVB_12	VB	526836.4	3480689.6	1551.31	4.84E-03	4.84E-04	3.25E-04	1.92E-06	40	12.19	18.19	2.32	8.46	2.16	
VD	599	CRVD1_1	VD	526854.9	3480683	1553.86	3.97E-03	3.97E-04	2.64E-04	1.57E-06	40	12.19	18.19	2.48	8.46	2.31	
VD	600	CRVD1_2	VD	526873	3480684.4	1553.87	3.97E-03	3.97E-04	2.64E-04	1.57E-06	40	12.19	18.19	2.48	8.46	2.31	
VD	601	CRVD1_3	VD	526889.7	3480691	1551.88	3.97E-03	3.97E-04	2.64E-04	1.57E-06	40	12.19	18.19	2.48	8.46	2.31	
VD	602	CRVD1_4	VD	526907.6	3480694.2	1550.92	3.97E-03	3.97E-04	2.64E-04	1.57E-06	40	12.19	18.19	2.48	8.46	2.31	
VD	603	CRVD1_5	VD	526922.7	3480685.8	1550.08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	2.48	8.46	2.31	CRAREA15
VD	604	CRVD2_1	VD	526931.2	3480673	1548.87	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	2.48	5.63	2.31	CRAREA15
VD	605	CRVD2_2	VD	526937	3480662.4	1547.54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	2.48	5.63	2.31	CRAREA15
VD	606	CRVD2_3	VD	526942.8	3480651.7	1544.98	3.97E-03	3.97E-04	2.64E-04	1.57E-06	20	6.10	12.10	2.48	5.63	2.31	
VD	607	CRVD2_4	VD	526946.2	3480641	1546.18	3.97E-03	3.97E-04	2.64E-04	1.57E-06	20	6.10	12.10	2.48	5.63	2.31	
VD	608	CRVD2_5	VD	526948.2	3480628.9	1550.3	3.97E-03	3.97E-04	2.64E-04	1.57E-06	20	6.10	12.10	2.48	5.63	2.31	
VD	609	CRVD2_6	VD	526948.2	3480616.8	1551.81	3.97E-03	3.97E-04	2.64E-04	1.57E-06	20	6.10	12.10	2.48	5.63	2.31	
VD	610	CRVD2_7	VD	526951	3480605.5	1550.1	3.97E-03	3.97E-04	2.64E-04	1.57E-06	20	6.10	12.10	2.48	5.63	2.31	
VD	611	CRVD2_8	VD	526953.4	3480593.7	1549.35	3.97E-03	3.97E-04	2.64E-04	1.57E-06	20	6.10	12.10	2.48	5.63	2.31	
VD	612	CRVD2_9	VD	526960.7	3480585.3	1549.06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	2.48	5.63	2.31	CRAREA16
VD	613	CRVD2_10	VD	526971.5	3480588.9	1550.45	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	2.48	5.63	2.31	CRAREA16
ZY	614	CRZY2_1	ZY	527400.5	3479925.7	1672.39	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	615	CRZY2_2	ZY	527408.2	3479919.9	1672.43	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	616	CRZY2_3	ZY	527416	3479914.2	1672.33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	617	CRZY2_4	ZY	527424.3	3479909.6	1672.09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	618	CRZY2_5	ZY	527433.9	3479908.9	1672	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	619	CRZY2_6	ZY	527442	3479914.1	1671.83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	620	CRZY2_7	ZY	527450.3	3479918.6	1671.75	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
ZY	621	CRZY2_8	ZY	527459.9	3479919.5	1671.57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.10	4.49	2.89	CRAREA21
TP	622	TRTP_1	TP	526374.8	3480845.3	1530.49	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA23
TP	623	TRTP_2	TP	526364.7	3480833.2	1530.52	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA23
TP	624	TRTP_3	TP	526354.6	3480821.1	1530.44	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA23
TP	625	TRTP_4	TP	526344.4	3480809.1	1530.57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA24
TP	626	TRTP_5	TP	526334.3	3480797	1529.99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA24
TP	627	TRTP_6	TP	526324.2	3480785	1528.67	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA24
TP	628	TRTP_7	TP	526314.1	3480772.9	1529.41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.38	7.33	2.22	CRAREA24
TP	629	TRTP_8	TP	526300.3	3480766.2	1530.18	0.00E+00	0.00E+00	0.00E+00	0.00E+00							

Mine Development
Mod - Vol Road Params

DP	654	TRDP_12	DP	526011.3	3480682.3	1548.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA30
DP	655	TRDP_13	DP	526011	3480666.6	1548.93	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA30
DP	656	TRDP_14	DP	526010.8	3480650.8	1549.93	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA30
DP	657	TRDP_15	DP	526010.5	3480635.1	1551.02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA30
DP	658	TRDP_16	DP	526014	3480619.7	1551.51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	659	TRDP_17	DP	526018.2	3480604.6	1551.34	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	660	TRDP_18	DP	526017.4	3480588.8	1550.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	661	TRDP_19	DP	526010.9	3480574.6	1549.68	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	662	TRDP_20	DP	526000.3	3480563	1551.23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	663	TRDP_21	DP	525989.6	3480551.3	1552.73	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	664	TRDP_22	DP	525999	3480539.7	1553.32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	665	TRDP_23	DP	525968.4	3480528.1	1554.67	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	666	TRDP_24	DP	525957.2	3480516.5	1554.57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	667	TRDP_25	DP	525947.1	3480504.8	1554.08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA31
DP	668	TRDP_26	DP	525939.7	3480491.3	1557.13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA32
DP	669	TRDP_27	DP	525925.4	3480484.8	1556	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA32
DP	670	TRDP_28	DP	525911.1	3480478.2	1555.31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA32
DP	671	TRDP_29	DP	525896.7	3480471.7	1554.28	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.11	7.33	2.89	CRAREA32
OP	672	TROP_1	OP	525737.6	3481435.4	1535.55	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	673	TROP_2	OP	525733.3	3481446.7	1535.15	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	674	TROP_3	OP	525728.9	3481458	1536.32	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	675	TROP_4	OP	525724.6	3481469.3	1536.83	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	676	TROP_5	OP	525720.2	3481480.6	1537.15	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	677	TROP_6	OP	525715.9	3481491.9	1537.27	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	678	TROP_7	OP	525711.5	3481503.2	1537.25	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	679	TROP_8	OP	525707.2	3481514.5	1537.3	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	680	TROP_9	OP	525699.3	3481522.7	1537.57	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	681	TROP_10	OP	525688.6	3481528.3	1538.12	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	682	TROP_11	OP	525677.9	3481534	1539.57	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	683	TROP_12	OP	525667.2	3481539.6	1540.54	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	684	TROP_13	OP	525656.5	3481545.3	1540.99	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
OP	685	TROP_14	OP	525645.8	3481550.9	1541.43	6.29E-04	6.29E-05	4.57E-05	2.49E-07	20	6.10	12.10	3.04	5.63	2.83	
LB	686	TRLB_1	LB	525637.5	3481020.5	1484.68	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.06	5.63	2.85	TRAREA3
LB	687	TRLB_2	LB	525649.6	3481030	1485.16	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	688	TRLB_3	LB	525661.7	3481919.4	1485.47	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	689	TRLB_4	LB	525673.8	3481918.8	1486	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	690	TRLB_5	LB	525685.8	3481917.5	1486.12	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	691	TRLB_6	LB	525697.7	3481915.6	1486.52	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	692	TRLB_7	LB	525707.3	3481908.4	1486.55	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	693	TRLB_8	LB	525717	3481901.1	1487.4	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	694	TRLB_9	LB	525725.9	3481893.1	1489.42	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	695	TRLB_10	LB	525733.1	3481883.3	1491.7	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	696	TRLB_11	LB	525740.3	3481873.6	1494.34	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	697	TRLB_12	LB	525747.4	3481863.8	1495.54	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	698	TRLB_13	LB	525754.4	3481854	1495.38	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	699	TRLB_14	LB	525758.2	3481842.5	1494.27	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
LB	700	TRLB_15	LB	525762	3481831	1494.72	5.28E-04	5.28E-05	4.39E-05	2.09E-07	20	6.10	12.10	3.06	5.63	2.85	
MT	638	TRMT_1	MT	526344.7	3481124.3	1559.34	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
MT	639	TRMT_2	MT	526361.7	3481124.1	1556.15	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
MT	640	TRMT_3	MT	526378.6	3481124	1553.1	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
MT	641	TRMT_4	MT	526394.3	3481129	1549.86	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
MT	642	TRMT_5	MT	526408	3481138	1546.23	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
MT	643	TRMT_6	MT	526410.2	3481154.8	1547.44	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
MT	644	TRMT_7	MT	526412.3	3481171.7	1549.91	8.65E-04	8.65E-05	6.86E-05	3.42E-07	20	6.10	12.10	2.99	5.63	2.78	
BAA	645	TRBAA_1	BAA	526222.8	3481039.2	1561.9	8.05E-03	8.05E-04	4.47E-04	3.18E-06	40	12.19	18.19	3.22	8.46	2.99	
BAA	646	TRBAA_2	BAA	526238.3	3481048.6	1562.14	8.05E-03	8.05E-04	4.47E-04	3.18E-06	40	12.19	18.19	3.22	8.46	2.99	
BAA	647	TRBAA_3	BAA	526254.1	3481057.8	1562.18	8.05E-03	8.05E-04	4.47E-04	3.18E-06	40	12.19	18.19	3.22	8.46	2.99	
BAA	648	TRBAA_4	BAA	526270.1	3481066.4	1562.14	8.05E-03	8.05E-04	4.47E-04	3.18E-06	40	12.19	18.19	3.22	8.46	2.99	
BAA	649	TRBAA_5	BAA	526286.1	3481075	1562.11	8.05E-03	8.05E-04	4.47E-04	3.18E-06	40	12.19	18.19	3.22	8.46	2.99	
BAA	650	TRBAA_6	BAA	526302.2	3481083.6	1562.18	8.05E-03	8.05E-04	4.47E-04	3.18E-06	40	12.19	18.19	3.22	8.46	2.99	
DE	651	TRDE_1	DE	526079.8	3481040.4	1575.23	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
DE	652	TRDE_2	DE	526067.2	3481027.3	1577.07	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
DE	653	TRDE_3	DE	526054.7	3481014.1	1577.31	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
DE	654	TRDE_4	DE	526042.1	3481001	1577.75	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
DE	655	TRDE_5	DE	526029.5	3480987.8	1575.25	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
DE	656	TRDE_6	DE	526016.8	3480977.2	1573.14	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
DE	657	TRDE_7	DE	526003.1	3480969.1	1575.28	1.97E-03	1.97E-04	1.45E-04	7.77E-07	40	12.19	18.19	2.56	8.46	2.38	
AAAB	658	TRAAAB_1	AAAB														

Table A-7. South32 Hermosa Rectangular Buildings

ID	Description	X Coordinate	Y- Coordinate	Elevation	Height	X Length	Y Length	Angle
CPBLDG	Clark Paste Plant Building	527323.5	3480498	1606.06	15.00	32.90	14.30	71.5
CONTBLD1	Contractor building - existing	525680	3480983.1	1592.58	6.10	12.30	7.60	88.7
CONTBLD2	Contractor building - existing	525687.5	3480986.1	1592.58	6.10	17.90	18.60	88.3
CONTBLD3	Contractor building - existing	525706.3	3480984.4	1592.58	6.10	12.50	7.80	88.8
GENBLG1	Genset Enclosure	525838.2	3480928.1	1581.9	4.11	16.15	2.59	110
GENBLG2	Genset Enclosure	525843.9	3480926.2	1581.9	4.11	16.15	2.59	110
GENBLG3	Genset Enclosure	525849.6	3480924.3	1581.9	4.11	16.15	2.59	110
GENBLG4	Genset Enclosure	525855.3	3480922.4	1581.9	4.11	16.15	2.59	110
GENBLG5	Genset Enclosure	525861	3480920.5	1581.9	4.11	16.15	2.59	110
GENBLG6	Genset Enclosure	525866.7	3480918.6	1581.9	4.11	16.15	2.59	110
GENBLG7	Genset Enclosure	525872.4	3480916.7	1581.9	4.11	16.15	2.59	110
GENBLG8	Genset Enclosure	525837.2	3480883.1	1581.9	4.11	16.15	2.59	110
GENBLG9	Genset Enclosure	525842.9	3480881.2	1581.9	4.11	16.15	2.59	110
GENBLG10	Genset Enclosure	525848.6	3480879.3	1581.9	4.11	16.15	2.59	110
GENBLG11	Genset Enclosure	525854.2	3480877.3	1581.9	4.11	16.15	2.59	110
GENBLG12	Genset Enclosure	525859.9	3480875.4	1581.9	4.11	16.15	2.59	110
GENBLG13	Genset Enclosure	525865.6	3480873.5	1581.9	4.11	16.15	2.59	110
GENBLG14	Genset Enclosure	525871.3	3480871.6	1581.9	4.11	16.15	2.59	110
GENBLG15	Genset Enclosure	525848.6	3480992.8	1581.9	4.11	16.15	2.59	110
GENBLG16	Genset Enclosure	525853.9	3480990.4	1581.9	4.11	16.15	2.59	110
GENBLG17	Genset Enclosure	525858.9	3480989.3	1581.9	4.11	16.15	2.59	110
GENBLG18	Genset Enclosure	525864.1	3480987.4	1581.9	4.11	16.15	2.59	110
GENBLG19	Genset Enclosure	525869.7	3480985.1	1581.9	4.11	16.15	2.59	110
GENBLG20	Genset Enclosure	525875.4	3480983.3	1581.9	4.11	16.15	2.59	110
GENBLG21	Genset Enclosure	525880.9	3480980.9	1581.9	4.11	16.15	2.59	110
GENBLG22	Genset Enclosure	525886.2	3480979.1	1581.9	4.11	16.15	2.59	110
GENBLG23	Genset Enclosure	525892.6	3480976.8	1581.9	4.11	16.15	2.59	110
GENBLG24	Genset Enclosure	525897.3	3480974.9	1581.9	4.11	16.15	2.59	110
GENBLG25	Genset Enclosure	525902.5	3480972.2	1581.9	4.11	16.15	2.59	110
GENBLG26	Genset Enclosure	525908	3480969.9	1581.9	4.11	16.15	2.59	110
GENBLG27	Genset Enclosure	525913	3480968.6	1581.9	4.11	16.15	2.59	110
GENBLG28	Genset Enclosure	525918.1	3480966.5	1581.9	4.11	16.15	2.59	115
GENBLG29	Genset Enclosure	525923.5	3480964.4	1581.9	4.11	16.15	2.59	120
GENBLG30	Genset Enclosure	525834	3480997.7	1581.9	4.11	16.15	2.59	110
GENBLG31	Genset Enclosure	525838.5	3480996.1	1581.9	4.11	16.15	2.59	110
GENBLG32	Genset Enclosure	525843.4	3480994.4	1581.9	4.11	16.15	2.59	110
GENBLG33	Genset Enclosure	525949.6	3480937	1581.9	4.11	16.15	2.59	140
GENBLG34	Genset Enclosure	525953	3480933.8	1581.9	4.11	16.15	2.59	140
GENBLG35	Genset Enclosure	525956.7	3480930	1581.9	4.11	16.15	2.59	140
GENBLG36	Genset Enclosure	525960.1	3480926.6	1581.9	4.11	16.15	2.59	140
GENBLG37	Genset Enclosure	525963	3480922.9	1581.9	4.11	16.15	2.59	140
GENBLG38	Genset Enclosure	525965.9	3480918.9	1581.9	4.11	16.15	2.59	140
GENBLG39	Genset Enclosure	525970.2	3480914.3	1581.9	4.11	16.15	2.59	140
GENBLG40	Genset Enclosure	525975.2	3480910.4	1581.9	4.11	16.15	2.59	140
WTP2	WTP2 Building	526400.6	3481269.7	1559.1	16.76	68.50	31.10	107.5
WTP1	WTP #1	525758.5	3481941	1502.85	7.62	37.10	17.50	60.9
UTCGBLDG		526354.8	3480748.2	1538.55	15.00	25.60	9.20	122.5
UGFRPLNT	Underground Refridgeration Plant	526339.5	3480728.5	1538.68	15.00	25.90	10.70	-57.3
PRIMERM	Secondary Mill E-Room	525743.9	3480824.8	1603.248	6.00	6.40	12.00	116.6
CVMS	Clark Vehicle Maintenance Shop	526773.7	3480813	1543.89	15.00	60.75	27.10	40
CADMIN	Clark Admin	527281.3	3480555.7	1582.77	6.00	14.50	20.00	91.3
HS1_GEN	Gen Enclosure	527304.7	3480571.3	1581.41	2.90	2.44	12.19	8.9
HS2_GEN	Gen Enclosure	527308.9	3480570.6	1581.78	2.90	2.44	12.19	8.9
HS3_GEN	Gen Enclosure	527312.9	3480569.8	1582.15	2.90	2.44	12.19	8.9
HS4_GEN	Gen Enclosure	527316.8	3480568.9	1583.13	2.90	2.44	12.19	8.9
HS5_GEN	Gen Enclosure	527321.1	3480568	1584.21	2.90	2.44	12.19	8.9
HS6_GEN	Gen Enclosure	527325.5	3480567.3	1585.36	2.90	2.44	12.19	8.9
COS2	Coarse Ore Silo 2	525848.2	3480799.4	1602.334	23.01	16.60	16.30	112.1
COS1	Coarse Ore Silo 1	525834.5	3480768.3	1602.334	23.01	16.70	17.60	25.7
COS4	Coarse Ore Silo 4	525866.4	3480791.5	1602.334	23.01	17.30	15.60	113.4
COS3	Coarse Ore Silo 3	525859.6	3480775.3	1602.334	23.01	16.90	15.30	113.9
TT1	Transfer Tower	525789.8	3480957.5	1581.91	16.76	7.00	11.10	82.4
COLHOU	Collar House	525953.9	3481001.3	1572.768	13.11	16.10	14.10	90
MNTWR	Main Shaft Tower	525968.9	3481002.7	1572.768	79.25	23.20	16.10	89.1
BINHOU	Bin House	525968.8	3480979	1572.768	24.69	5.30	16.40	90
STGBLDG1	Storage Building (Fmr. Sinking Hoist BLDG)	525960.2	3481074.9	1572.768	14.02	25.40	33.10	90.2
STGBLDG2	Storage Building 2	525966.6	3481049.3	1572.768	14.02	13.30	20.30	89.6
STGBLDG3	Storage Building 3	526108.5	3480950.4	1572.768	10.06	13.50	20.60	45
COLHOU2	Collar House 2	526101.3	3480983.7	1572.768	10.36	11.60	9.60	45

VENTBLDG	Ventilation Shaft and Sinking Headframe	526090.4	3480972.3	1572.768	49.99	10.60	15.50	45
PASTBLDG	Paste Plant Building	526433.5	3481072	1554.48	18.75	40.80	15.80	75.1
HAZMATB	Hazardous Materials Storage Building	526387	3480956.6	1545.77	0.61	6.10	11.90	82.2
ADMOFF	Admin Office and Control Center	525746.1	3481030	1592.58	3.66	31.50	17.80	108.4
GRNERM	Grinding E-room and Transformers Annex	525710.1	3480846.6	1603.248	6.40	4.60	18.30	115.3
PPERM	Paste Plant E-Room	526411.4	3481066.5	1554.48	6.40	4.50	20.50	74.1
CONCERM	Concentrate Loadout E Room	525758.8	3480761.1	1603.248	6.40	4.40	24.50	-65.9
FLOERM	Flotation Re grind Electrical Room	525585.9	3480769.7	1603.248	6.71	7.90	36.50	115.4
COAERM	Coarse Ore Handling E Room	525799.2	3480805.8	1603.248	6.40	4.40	17.20	116.6
HVRPR	Light Vehicle Repair Shop	526255.6	3480899.1	1550.09	7.92	17.10	23.20	90
WHOUSE	Warehouse	525719.1	3481075.5	1592.58	9.14	24.70	15.40	-138.1
TTRKLS	Tailings Truck Loading Station	526289.2	3481006.6	1562.1	25.91	4.80	4.10	74.4
SOLBLDG	Solids Removal Building	526034.2	3481053.1	1572.768	9.14	18.30	4.90	132.3
LOGBLDG	Logging Building	525576.5	3482185.7	1493.45	9.14	30.20	16.20	66.8
SAWRM	Saw Room	525563.2	3482222.4	1492.00	3.66	8.60	17.50	60.3
DEWATER	Dewatering Building	525728.6	3480730.5	1603.248	26.82	44.00	15.00	116.1
AIRRM	Air Building	525728.9	3480789.7	1603.248	3.05	13.00	10.30	113.2
FLTBLDG	Flotation Building	525646.3	3480793.8	1603.248	28.04	55.00	29.90	115.6
TFPLNT	Tailings Filtration plant	526283.7	3481058.1	1562.12	25.30	43.40	40.50	75.3
TERM	Tailings E-Room	526248.7	3481036.3	1562.05	6.40	7.20	30.30	75.3
SHOPWH	Shop warehouse, 11412	526008.9	3480908.7	1559.69	7.62	12.30	12.00	118.6
CTBLDG	Cooling Tower Structure	526069	3480974.1	1572.768	9.45	7.70	29.80	136.5
ERMBLDG	VFD E-House	526056	3480998.8	1572.768	6.40	14.10	13.20	133.9
AUXBLDG	Auxillary Refridge. plant building	526045.6	3480983	1572.768	6.40	32.00	7.30	134.5
EXHOUT	Exhaust Outlet to exhaust fans	526088.5	3480990.4	1572.768	6.40	7.50	13.80	135
GTHOUS	Gate House Building	526625.5	3481156.4	1513.26	3.66	18.10	9.10	-54.7
VW1	Vehicle Downwash Bay 1	526312.4	3480949.1	1549.908	9.14	8.70	16.90	-179.1
VW2	Vehicle Downwash Bay 2	526300.6	3480949.1	1549.908	9.14	10.30	2.90	91.2
VW3	Vehicle Downwash Bay 3	526300.7	3480949	1549.908	9.14	1.70	3.10	180
VW4	Vehicle Downwash Bay 4	526299	3480948.9	1549.908	9.14	1.60	3.00	-180
SECERM	Secondary Mill EROOM	525688.9	3480855.1	1603.248	6.00	5.10	12.10	114.9

Table A-8. South32 Hermosa Circular Buildings

ID	Description	X-Coordinate	Y-Coordinate	Elevation	Height	Radius	Corners
CPPTNK4	Paste Bldg Tank	527330.8	3480468.9	1616.44	7.92	2.18	24
CPPSILO2	Binder Silo 2	527339.6	3480461.9	1619.69	19.50	2.47	24
CPPSILO1	Binder Silo 1	527346.2	3480463.9	1620.89	19.50	2.56	24
CPPTNK2	Paste Plant Tank 4	527322.1	3480494.6	1607.98	11.00	2.18	24
CPBTNK1	Paste Bldg Tank	527325.1	3480505.2	1604.29	12.00	2.44	24
CPBTNK2	Paste Bldg Tank	527331.6	3480507.7	1604.57	12.00	2.47	24
PRCTK1	Process Water Tank	525612.8	3480786.9	1603.25	15.85	4.64	24
PRCTK2	Process Water Tank 2	525623.3	3480781.8	1603.25	15.85	4.90	24
GLNTK	Gland Seal Water Tank	525590.1	3480795.8	1603.25	7.32	2.35	24
PORTTK	Portable Water Tank	525583.7	3480797.7	1603.25	7.32	2.33	24
FRTK	Fresh/Fire Water Tank	525601.7	3480790.9	1603.25	13.11	5.69	24
LEADCT	Lead Concentrate Thickener	525688.2	3480755	1603.25	7.32	8.39	24
ZINCCCT	Zinc Concentrate Thickener	525713	3480742.7	1603.25	7.32	8.44	24
ZINCCTK	Zinc Concentrator Tank	525737.2	3480742.1	1603.25	15.70	7.75	24
LEADCTK	Lead Concentrator Tank	525752.2	3480734.8	1603.25	17.37	7.55	24
ZINCCDTK	Zinc Conditioning Tank	525674.5	3480763.7	1603.25	9.75	3.59	24
TSILO1	Tailings Silo 1	526299.6	3481008	1562.10	22.22	4.97	24
TSILO2	Tailings Silo 2	526311.3	3481011.1	1562.10	22.22	4.80	24
TSILO3	Tailings Silo 3	526323.1	3481013.9	1562.10	22.22	4.86	24
TSILO4	Tailings Silo 4	526335.1	3481017.1	1562.10	22.22	4.70	24
BNSILO1	Binder Silo 1	526456.2	3481063.5	1554.48	22.86	3.27	24
BNSILO2	Bin Silo 2	526458.6	3481055.2	1554.48	22.86	3.50	24
TTTNK	Tailings Thickener Tank	526356.8	3481083.6	1562.10	12.00	13.36	24
TSTNK	Tailings Stock Tank	526347.8	3481064.2	1562.10	17.37	6.82	24
BPSILO1	Batch Plant Silo 1	526439.9	3481112.5	1553.57	10.70	1.95	24
BPSILO2	Batch Plant Silo 2	526444.5	3481114.2	1553.57	10.70	1.80	24
BPSILO3	Batch Plant Silo 3	526447.8	3481118.3	1553.57	10.70	2.03	24
SRGTNK	Surge Tank	526376.5	3481153.5	1556.21	7.35	4.79	24
OVTNK	Tailings thickener overflow tank	526373.2	3481087.9	1562.10	8.53	1.72	24
TAILTNK1	Tailings flocculant auxillary tank	526380.8	3481064.1	1562.10	5.79	1.81	24
NTTNK	New tailings tank	526384.3	3481088.9	1562.10	13.11	5.36	24
UTLTNK	Utility connection tank	526054.4	3481040	1572.77	6.71	2.43	24
SLDRE1	Solids removal tank 1	526037.5	3481042.9	1572.77	3.96	2.49	24
SOLRE2	Solids removal tank 2	526037.1	3481033.7	1572.77	3.96	2.34	24
SOLRE3	Solids removal tank 3	526041.1	3481037.2	1572.77	3.96	2.48	24
SOLRE4	Solids removal tank 4	526044.4	3481040.9	1572.77	3.96	1.79	24
AUXTHCK	Auxillary thickener tank	525700.3	3480748.6	1603.25	5.94	1.50	24
AUXTHCK2	Auxillary Thickener tank 2	525712.3	3480756.8	1603.25	5.79	1.70	24
REAGTNK1	Reagents storage tank 1	525641.5	3480807.1	1603.25	5.03	1.67	24
REAGTNK2	Reagents storage tank 2	525637.6	3480808.7	1603.25	5.33	1.06	24
REAGTNK3	Reagents storage tank 3	525633.4	3480810.7	1603.25	5.33	1.57	24
REAGTNK4	Reagents storage tank 4	525629.1	3480812.6	1603.25	5.33	1.71	24
REAGTNK5	Reagents storage tank 5	525625.6	3480814.6	1603.25	4.72	1.49	24
REAGTNK6	Reagents storage tank 6	525620	3480816.9	1603.25	4.72	1.50	24
REAGTNK7	Reagents storage tank 7	525622.3	3480823.6	1603.25	4.72	1.72	24
REAGTNK9	Reagents storage tank 9	525630.2	3480819.7	1603.25	7.32	1.73	24
REGTNK10	Reagents Storage Tank 10	525635.8	3480817.2	1603.25	7.32	1.48	24
REGTNK11	Reagents Storage Tank 11	525640.9	3480816.2	1603.25	4.72	1.06	24
REGTNK12	Reagents Storage Tank 11	525639.8	3480813.3	1603.25	7.32	0.97	24
REGTNK13	Reagents Storage Tank 13	525644.4	3480811.3	1603.25	5.79	1.22	24
REAGTNK8	Reagents storage tank 8	525626.3	3480821.5	1603.25	4.72	1.22	24
BNSILO3	Binder Silo 3	526460.3	3481048.6	1554.48	14.33	2.38	24
BNSILO4	Binder Silo 4	526462.1	3481042.4	1554.48	14.33	2.32	24

Table A-9. South32 Hermosa Multi-sided Buildings

ID	Description	X-Coordinate	Y-Coordinate	Elevation	Height
WTP2CT	WTP2 CT Building	526390.4	3481276.6	1565.57	6.26
OFFHOU	Office House & Change House	526019.3	3480993.7	1572.768	8.5344
PWRHOU	Power House	525954.1	3481001.7	1572.768	13.1064
AUXHOS	AUX Hoist and Storage	526138.1	3480961	1572.768	14.6304
EXFAN	Exhaust Fans 16611	526083.1	3480985.2	1572.768	15.24
EMRC	Emergency Response Center	525719.9	3481071.6	1592.58	4.572
RFGPLNT	Refridgeration Plant Building	526050.3	3480964.4	1572.768	9.7536
CNPLNT	Cyanide Treatment Plant	526452	3481147.2	1539.39	12.8016

**Mine Development
Plan II Modeling**

**Mine Development
Point Sources**

Table A-1. South32 Hermosa Point Sources

Source ID	Description	From BREEZE Model						Short Term Emission Rate (g/s)					Long Term Emission Rate (g/s)		Stk Ht (m)	Stk Temp (K)	Stk Vel (m/s)	Stk Diam (m)
		UTMx	UTMy	Elev (m)				PM ₁₀	PM _{2.5}	Lead	NO _x	CO	PM _{2.5}	NO _x				
				1/8-hr	24-hr	Monthly	annual											
CT1	Cooling Tower Cell 1	526068.5	3480969.0	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
CT2	Cooling Tower Cell 2	526074.5	3480963.7	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
CT3	Cooling Tower Cell 3	526079.3	3480959.2	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
CT4	Cooling Tower Cell 4	526084.6	3480953.4	1572.77	1572.77	1572.77	1572.77	1.93E-04	6.73E-05				6.73E-05		15.00	0.00	93.69	5.00
WTP2CT1	WTP2 CT Cell 1	526383.5	3481244.8	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT2	WTP2 CT Cell 2	526384.4	3481248.5	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT3	WTP2 CT Cell 3	526385.6	3481252.0	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT4	WTP2 CT Cell 4	526386.7	3481255.4	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT5	WTP2 CT Cell 5	526387.8	3481259.0	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT6	WTP2 CT Cell 6	526389.0	3481262.7	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT7	WTP2 CT Cell 7	526390.3	3481266.0	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
WTP2CT8	WTP2 CT Cell 8	526391.1	3481269.5	1559.05	1559.05	1559.05	1559.05	7.34E-05	1.46E-06				1.46E-06		6.41	0.00	93.69	2.74
CT7	UG Refrigeration CT Cell 1	526356.0	3480742.7	1540.79	1540.79	1540.79	1540.79	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT8	UG Refrigeration CT Cell 2	526352.9	3480737.2	1541.08	1541.08	1541.08	1541.08	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT9	UG Refrigeration CT Cell 3	526349.8	3480731.7	1541.59	1541.59	1541.59	1541.59	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT10	UG Refrigeration CT Cell 4	526346.8	3480726.9	1542.00	1542.00	1542.00	1542.00	2.85E-04	9.92E-05				9.92E-05		15.00	0.00	93.69	5.00
CT11	Mill Cooling Tower	525790.0	3480817.5	1603.25	1603.25	1603.25	1603.25	5.25E-05	1.83E-05				1.83E-05		15.00	0.00	93.69	5.00
VRT2_1	Vent Raise - Taylor	526393.2	3480770.4	1572.77	1572.77	1572.77	1572.77	9.61E-02	1.25E-02	1.52E-03	1.46E-01	7.89E+00	9.51E-03	4.31E-03	13.00	296.95	11.47	4.28
VRT2_2	Vent Raise - Taylor	526384.3	3480792.7	1572.77	1572.77	1572.77	1572.77	9.61E-02	1.25E-02	1.52E-03	1.46E-01	7.89E+00	9.51E-03	4.31E-03	13.00	296.95	11.47	4.28
VRT1_1	Ventilation Shaft - Taylor	526073.0	3480997.9	1573.32	1573.32	1573.32	1573.32	2.65E-01	3.45E-02	4.20E-03	4.02E-01	2.17E+01	2.62E-02	1.19E-02	13.00	293.85	21.37	5.21
VRT1_2	Ventilation Shaft - Taylor	526084.1	3481005.0	1570.59	1570.59	1570.59	1570.59	2.65E-01	3.45E-02	4.20E-03	4.02E-01	2.17E+01	2.62E-02	1.19E-02	13.00	293.85	21.37	5.21
DC-1	21210-CX-00002 Main Shaft Ore Discharge Dust Collector 7	525963.5	3480977.1	1572.77	1572.77	1572.77	1572.77	7.02E-03	7.02E-03	2.72E-04			7.02E-03		10.70	0.00	21.70	0.30
DC-2	21210-CX-00001 Coarse Ore Overland Dust Collector 7	525797.6	3480950.7	1586.63	1586.63	1586.63	1586.63	1.08E-02	1.08E-02	5.11E-04			1.08E-02		27.46	0.00	33.38	0.30
DC-3	21210-CX-00003 Transfer Tower Silo Dust Collector 4	525793.0	3480956.9	1584.82	1584.82	1584.82	1584.82	6.48E-02	6.48E-02	2.51E-03			6.48E-02		27.46	0.00	200.30	0.30
DC-4	21510-CX-00001 Coarse Ore Silo Dust Collector 4	525834.6	3480774.9	1602.33	1602.33	1602.33	1602.33	2.38E-02	2.38E-02	1.12E-03			2.38E-02		10.70	0.00	73.44	0.30
DC-5	21710-CX-00002 Silo Discharge Dust Collector 5	525831.8	3480776.3	1602.33	1602.33	1602.33	1602.33	2.34E-02	2.34E-02	1.11E-03			2.34E-02		10.70	0.00	72.44	0.30
DC-12	22620-CX-00001 Copper Sulphate Mix Tank Dust Collector	525639.7	3480813.2	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-13	22620-CX-00002 10% Zinc Sulphate Mix Tank Dust Collector	525644.5	3480811.3	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-14	22620-CX-00005 50% Zinc Sulphate Mix Tank Dust Collector	525637.3	3480808.3	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-15	22620-CX-00004 Caustic Mix Tank Dust Collector	525626.3	3480821.5	1603.25	1603.25	1603.25	1603.25	8.64E-03	8.64E-03	0.00E+00			8.64E-03		10.70	0.00	6.68	0.30
DC-16	22210-CX-00001 Pebble Crusher Dust Collector 4	525817.9	3480777.1	1603.25	1603.25	1603.25	1603.25	2.67E-02	2.67E-02	1.26E-03			2.67E-02		10.70	0.00	82.46	0.30
DC-7	Coarse Ore Dust Collection System,23100-FAN-0001	526842.0	3480691.4	1550.70	1550.70	1550.70	1550.70	3.46E-03	3.46E-03	6.08E-05			3.46E-03		5.49	0.00	13.21	0.58
DC-8	Coarse Ore Dust Collection System,23100-FAN-0002	526813.3	3480714.4	1552.40	1552.40	1552.40	1552.40	3.46E-03	3.46E-03	6.08E-05			3.46E-03		5.49	0.00	13.21	0.58
DC-10	Coarse Ore Dust Collection System,23100-DCD-0005	526808.2	3480714.4	1552.75	1552.75	1552.75	1552.75	3.46E-03	3.46E-03	6.08E-05			3.46E-03		5.49	0.00	13.21	0.58
VRHS1_1	Ventilation - Exhaust Raises NE Hardshell #1	527359.8	3480617.4	1604.25	1604.25	1604.25	1604.25	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS1_2	Ventilation - Exhaust Raises NE Hardshell #1	527359.8	3480627.4	1605.45	1605.45	1605.45	1605.45	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS2_1	Ventilation - Exhaust Raises NE Hardshell #2	527370.6	3480628.0	1603.13	1603.13	1603.13	1603.13	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS2_2	Ventilation - Exhaust Raises NE Hardshell #2	527370.6	3480638.0	1603.67	1603.67	1603.67	1603.67	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS3_1	Ventilation - Exhaust Raise SE Hardshell	527406.0	3479986.0	1661.92	1661.92	1661.92	1661.92	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
VRHS3_2	Ventilation - Exhaust Raise SE Hardshell	527406.0	3479966.0	1667.17	1667.17	1667.17	1667.17	1.22E-01	1.24E-02	2.69E-03	4.83E-02	2.61E+00	1.03E-02	6.74E-04	13.00	307.59	15.88	2.75
ENG5	CUMMINS POWER GENERATION C200D2RE	527018.4	3480627.4	1560.52	1560.52	1560.52	1560.52	1.18E-03	1.18E-03		2.37E-02	2.07E-01	1.18E-03	2.37E-02	1.80	726.15	0.07	0.10
ENG9	CAT C175 Substation 1	525810.9	3480679.9	1603.25	1603.25	1603.25	1603.25	3.67E-02	3.67E-02		1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61
ENG10	CAT C175 Substation 2	525819.0	3480676.9	1603.25	1603.25	1603.25	1603.25	3.67E-02	3.67E-02		1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61
ENG11	CAT C175 Substation 3	525803.5	3480683.5	1603.25	1603.25	1603.25	1603.25	3.67E-02	3.67E-02		1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61
ENG12	CAT C175 Shaft 1	526093.0	3480998.0	1572.77	1572.77	1572.77	1572.77	3.67E-02	3.67E-02		1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61
ENG13	CAT C175 Shaft 2	526095.0	3480995.0	1572.77	1572.77	1572.77	1572.77	3.67E-02	3.67E-02		1.83E-01	3.21E+00	2.09E-03	1.83E-01	2.23	745.45	12.09	0.61
50TNG1	NG Trench 50%	525839.3	3480926.4	1581.91	1581.91	1581.91	1581.91	3.77E-02	3.77E-02				1.67E-02	3.77E-02	8.53	761.58	3.27	0.81
50TNG2	NG Trench 50%	525845	3480924.5	1581.91	1581.91	1581.91	1581											

Mine Development
Point Sources

Source ID	Description	From BREEZE Model						Short Term Emission Rate (g/s)					Long Term Emission Rate (g/s)		Stk Ht (m)	Stk Temp (K)	Stk Vel (m/s)	Stk Diam (m)
		UTMx	UTMy	Elev (m)				PM ₁₀	PM _{2.5}	Lead	NO _x	CO	PM _{2.5}	NO _x				
				1/8-hr	24-hr	Monthly	annual											
75TNG30	NG Trench 75%	525829.9	3480983.5	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG31	NG Trench 75%	525834.4	3480981.8	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG32	NG Trench 75%	525839.6	3480980.1	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG33	NG Trench 75%	525939.5	3480926.2	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG34	NG Trench 75%	525942.5	3480923.3	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG35	NG Trench 75%	525946.6	3480919.2	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG36	NG Trench 75%	525949.8	3480916	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG37	NG Trench 75%	525952.6	3480912.5	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG38	NG Trench 75%	525955.3	3480908	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG39	NG Trench 75%	525959.9	3480904.2	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
75TNG40	NG Trench 75%	525965.2	3480900	1581.91	1581.91	1581.91	1581.91	1.71E-02	1.71E-02			1.46E-02	1.71E-02	8.53	761.02	4.68	0.81	
HS1	Diesel Hardshell	527306.3	3480572.3	1581.32	1581.32	1581.32	1581.32	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS2	Diesel Hardshell	527310.6	3480571.4	1581.72	1581.72	1581.72	1581.72	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS3	Diesel Hardshell	527314.6	3480570.7	1582.33	1582.33	1582.33	1582.33	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS4	Diesel Hardshell	527318.5	3480569.7	1583.38	1583.38	1583.38	1583.38	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS5	Diesel Hardshell	527322.8	3480568.8	1584.52	1584.52	1584.52	1584.52	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
HS6	Diesel Hardshell	527327.2	3480568	1585.76	1585.76	1585.76	1585.76	3.27E-03	3.27E-03		3.74E-02	1.92E-01	3.27E-03	3.74E-02	2.90	745.15	5.75	0.80
100TNG1	NG Trench 100%	525839.3	3480926.4	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG2	NG Trench 100%	525845	3480924.5	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG3	NG Trench 100%	525850.7	3480922.6	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG4	NG Trench 100%	525856.3	3480920.7	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG5	NG Trench 100%	525862	3480918.8	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG6	NG Trench 100%	525867.7	3480916.9	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG7	NG Trench 100%	525873.4	3480915	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG8	NG Trench 100%	525833.7	3480868.6	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG9	NG Trench 100%	525839.4	3480866.7	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG10	NG Trench 100%	525845.1	3480864.8	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG11	NG Trench 100%	525850.8	3480862.9	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG12	NG Trench 100%	525856.4	3480861	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG13	NG Trench 100%	525862.1	3480859.1	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG14	NG Trench 100%	525867.8	3480857.2	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG15	NG Trench 100%	525845	3480978.4	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG16	NG Trench 100%	525850	3480976.1	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG17	NG Trench 100%	525855.2	3480975.2	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG18	NG Trench 100%	525860.5	3480973.1	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG19	NG Trench 100%	525865.7	3480970.5	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG20	NG Trench 100%	525871.9	3480968.9	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG21	NG Trench 100%	525877.1	3480966.8	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG22	NG Trench 100%	525882.6	3480964.8	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG23	NG Trench 100%	525888.7	3480962.2	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG24	NG Trench 100%	525893.6	3480960.7	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG25	NG Trench 100%	525898.7	3480957.8	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG26	NG Trench 100%	525904.5	3480956	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG27	NG Trench 100%	525909.7	3480954.4	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG28	NG Trench 100%	525913.1	3480952.5	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG29	NG Trench 100%	525917.6	3480951.5	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG30	NG Trench 100%	525829.9	3480983.5	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG31	NG Trench 100%	525834.4	3480981.8	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG32	NG Trench 100%	525839.6	3480980.1	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG33	NG Trench 100%	525939.5	3480926.2	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG34	NG Trench 100%	525942.5	3480923.3	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG35	NG Trench 100%	525946.6	3480919.2	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG36	NG Trench 100%	525949.8	3480916	1581.91	1581.91	1581.91	1581.91				8.13E-02		2.07E-03	8.13E-02	8.53	742.87	6.03	0.81
100TNG37	NG Trench 100%	525952.6	3480912.5	1581.9														

**Mine Development
Horz point**

Table A-2. South32 Hermosa Horizontal Point Sources

Source ID	Material	Description	From BREEZE Model			Short Term Emission Rate (g/s)					Long Term Emission Rate (g/s)		Stk Ht (m)	Stk Temp (K)	Stk Vel (m/s)	Stk Diam (m)
			UTMx	UTMy	Elev (m)	PM ₁₀	PM _{2.5}	Lead	NO _x	CO	PM _{2.5}	NO _x				
Taylor																
BCCBP	Cement	CBP Cement Silo	526444.4	3481114.2	1553.57	2.40E-05	2.40E-05	0.00E+00			2.40E-05		10.7	0.00	4.00	0.3
DCCBPS1	Cement	CBP Cement Supplement Silo 1	526440.0	3481112.6	1553.57	5.15E-05	5.15E-05	0.00E+00			5.15E-05		10.7	0.00	4.00	0.3
DCCBPS2	Cement	CBP Cement Supplement Silo 2	526448.1	3481118.2	1553.57	5.15E-05	5.15E-05	0.00E+00			5.15E-05		10.7	0.00	4.00	0.3
DCPBDS1	Binder	Paste Plant Binder Storage Silo 1	526456.1	3481063.7	1554.48	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DCPBDS2	Binder	Paste Plant Binder Storage Silo 2	526458.7	3481055.3	1554.48	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DCPBDS3	Binder	Paste Plant Binder Dosage Silo 1	526461.9	3481042.3	1554.48	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DCPBDS4	Binder	Paste Plant Binder Dosage Silo 2	526460.3	3481048.6	1554.48	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DC_PPM1M	Binder	Plant Plant Module 1 Mixer	526454.0	3481046.9	1554.48	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3
DC_PPM2M	Binder	Plant Plant Module 2 Mixer	526455.5	3481040.8	1554.48	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3
WTP1LS	Lime	Waste Water Treatment Plant #1 Lime Silo	525771.3	3481956.3	1503.83	5.40E-03	5.40E-03	0.00E+00			5.40E-03		6.4	0.00	4.00	0.3
Clark																
DCCCBP	Cement	CBP Cement Silo	527166.30	3480484.30	1620.27	1.18E-06	1.18E-06	0.00E+00			1.18E-06		10.7	0.00	4.00	0.3
DCCCBPS	Cement	CBP Cement Supplement Silo	527166.30	3480484.30	1620.27	1.71E-05	1.71E-05	0.00E+00			1.71E-05		10.7	0.00	4.00	0.3
DCCPPBS1	Binder	Paste Plant Binder Silo 1	527318.3	3480489.5	1606.44	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DCCPPBS2	Binder	Paste Plant Binder Silo 2	527319.5	3480485.3	1607.59	4.05E-03	4.05E-03	0.00E+00			4.05E-03		10.7	0.00	4.00	0.3
DCCPPBS3	Binder	Paste Plant Binder Silo 3	527321	3480480.7	1608.98	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DCCPPBS4	Binder	Paste Plant Binder Silo 4	527322.5	3480475.7	1610.21	8.10E-03	8.10E-03	0.00E+00			8.10E-03		10.7	0.00	4.00	0.3
DCPM1M	Binder	Plant Plant Module 1 Mixer	527324	3480472.4	1611.26	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3
DCPM2M	Binder	Plant Plant Module 2 Mixer	527325.5	3480467.5	1612.33	1.62E-02	1.62E-02	0.00E+00			1.62E-02		10.7	0.00	4.00	0.3

**Mine Development
Area Sources**

Table A-3. South32 Hermosa Area Sources

Type of Pile	Source ID	Description	From BREEZE Model					Short Term Emission Rate (g/s/m2)			Long Term Emission Rate (g/s/m2)	Rel Ht (m)	Xlength (m)	Ylength (m)	Angle	Init vert dim	Area (sq. ft)	Area (m2)
			UTMx	UTMy	Elev (m)			PM ₁₀	PM _{2.5}	Lead	PM _{2.5}							
					24-hr	monthly	annual											
Polygon	TSF2	USFS Tailings Storage Facility	526570	3481808.6	1534.16	1534.16	1534.16	1.18E-06	1.77E-07	1.00E-08	1.77E-07	4.57	POLYGON			2.13	5,317,757.09	494,035.80
Polygon	TSF_1	Tailing Storage Facility	525625.8	3480953.2	1584.96	1584.96	1584.96	1.18E-06	1.77E-07	1.00E-08	1.77E-07	4.57	POLYGON			2.13	2,161,944.32	200,851.20
Polygon	WRS	West Rock Stockpile	525787.7	3480958.7	1595.12	1590.04	1590.04	3.73E-07	5.59E-08	2.64E-09	5.59E-08	4.57	POLYGON			2.13	278,224.70	25,847.92
Polygon	EOS	East Ore Stockpile	525820	3481442.1	1581.91	1581.91	1581.91	3.73E-07	5.59E-08	3.53E-08	5.59E-08	4.57	POLYGON			2.13	308,125.65	28,625.81
Polygon	HRS	Hardshell Rock Stockpile	526991.6	3480492.9	1623.06	1600.20	1600.20	3.73E-07	5.59E-08	4.23E-09	5.59E-08	4.57	POLYGON			2.13	1,641,033.49	152,457.00
Circular	ROM	Clark ROM Stockpile	526856.2	3480646.2	1559.60	1559.60	1559.60	3.73E-07	5.59E-08	1.31E-08	5.59E-08	3.05	RADIUS->	20.95	20.00	1.42	14,839.60	1,378.64
Rectangular	ORE	Clark Ore Stockpile	527205.0	3480657.0	1571.71	1571.71	1571.71	3.73E-07	5.59E-08	1.31E-08	5.59E-08	3.05	60.96	76.20	110.00	1.42	50,000.52	4,645.20
Rectangular	AGG	Clark Agg Stockpile	527186.9	3480489.4	1619.40	1619.40	1619.40	7.80E-08	1.17E-08		1.17E-08	3.05	18.29	4.57	110.00	1.42	899.86	83.60
Rectangular	SHOT	Clark Shotcrete Stockpile	527165.6	3480481.1	1620.82	1620.82	1620.82	7.80E-08	1.17E-08		1.17E-08	3.05	12.19	12.19	-10.00	1.42	1,599.52	148.60
Rectangular	TAGG	Taylor Agg Stockpile	526444.6	3481105.4	1546.14	1546.14	1546.14	7.80E-08	1.17E-08		1.17E-08	3.05	18.29	4.57	0.00	1.42	899.86	83.60
Rectangular	TSHOT	Taylor Shotcrete Stockpile	526451.6	3481118.9	1539.21	1539.21	1539.21	7.80E-08	1.17E-08		1.17E-08	3.05	12.19	12.19	-10.00	1.42	1,599.52	148.60
Rectangular	CHUTE	Waste Chute Bin	525998.4	3480990.8	1572.77	1572.77	1572.77	3.77E-07	5.66E-08	4.33E-09	5.66E-08	3.05	13.00	7.60	180.00	1.42	1,063.47	98.80
Rectangular	DOZAREA	Dozer on Hardrock Storage	527363.6	3480051.9	1623.06	1600.20	1600.20	-	-	1.08E-07	2.00E-06	1.75	40.00	41.00	90.00	0.94	17,652.81	1,640.00

**Mine Development
Volume Sources**

Table A-4. South32 Hermosa Volume Sources

Source ID	Description	From BREEZE Model					Short Term Emission Rate (g/s)			Long Term Emission Rate (g/s)	Source Vertical Dimension (m)	Source Width (m)	Rel Ht (m)	Init Lat Dim	Init Vert. Dim
		UTMx	UTMy	Elev (m)			PM ₁₀	PM _{2.5}	Lead	PM _{2.5}					
				24-hr	monthly	annual									
Taylor															
DP1	Drop of crushed ore from underground to 21210-BN-00001 Main Shaft Ore Surge Bin	525971.2	3480990.7	1572.77	1572.77	1572.77	3.36E-02	5.08E-03	2.74E-03	5.08E-03	-	2.00	24.92	0.47	3.06
DP4	Drop from Shaft to Waste Chute	525985.6	3480987.5	1572.77	1572.77	1572.77	1.19E-02	1.80E-03	1.58E-04	1.98E-03	-	2.00	6.40	0.47	0.85
DP21	Drop from Haul Truck to 21710-CV-00001 Primary Mill Feed Conveyor Hopper	525872.7	3480756.7	1602.33	1602.33	1602.33	1.44E-01	2.18E-02	4.93E-04	7.49E-04	3.75	3.43	3.92	0.80	0.46
DP82	Drop on West NAG Stockpile	525582.2	3480891.9	1595.12	1590.04	1590.04	4.33E-03	6.56E-04	3.24E-05	6.56E-04	7.07	3.43	0.70	0.80	3.29
DP83	Drop on East Ore Stockpile	525786.5	3480923.5	1581.91	1581.91	1581.91	2.02E-01	3.05E-02	4.93E-04	7.49E-04	7.07	3.43	0.70	0.80	3.29
DP84	TSF	525986.2	3481278.7	1584.96	1584.96	1584.96	8.12E-03	1.23E-03	7.29E-05	1.23E-03	7.07	3.43	0.70	0.80	3.29
DP85	Drops on TSF2	526795.7	3482181.6	1534.16	1534.16	1534.16	1.70E-02	2.58E-03	1.53E-04	2.58E-03	7.07	3.43	0.70	0.80	3.29
DP94	Transfer from Agg Stockpile to Loader	526453.1	3481107.6	1542.65	1542.65	1542.65	9.02E-03	1.37E-03	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16
DP95	Transfer of Agg Material from Loader to Haul Truck	526453.1	3481107.6	1542.65	1542.65	1542.65	9.02E-03	1.37E-03	0.00E+00	1.70E-04	3.75	2.04	0.89	0.47	0.87
DP96	Transfer of Shotcrete Aggregate from Stockpile to Loader	526456.5	3481126.2	1535.67	1535.67	1535.67	6.31E-03	9.56E-04	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16
DP97	Transfer of Ore from East Ore Stockpile to Loader	525784.1	3480923.6	1581.91	1581.91	1581.912	2.02E-01	3.05E-02	4.93E-04	7.49E-04	2.59	2.04	1.30	0.47	1.16
DP98	Transfer of Ore from Loader to Haul Truck	525787.9	3480926.4	1581.91	1581.91	1581.91	2.02E-01	3.05E-02	4.93E-04	7.49E-04	3.75	2.04	1.87	0.47	0.87
DP99	Transfer of Rock and Ore from Waste Chute to Loader	525988.9	3480987.1	1572.77	1572.77	1572.768	3.97E-02	6.01E-03	5.28E-04	6.61E-03	2.59	2.04	1.30	0.47	1.16
DP100	Transfer of Rock and Ore from Loader to Haul Truck	525997.5	3480986.9	1572.77	1572.77	1572.768	3.97E-02	6.01E-03	5.28E-04	6.61E-03	3.75	2.04	1.87	0.47	0.87
CBP1_11	CBP Plant	526440.8	3481120.6	1541.94	1541.94	1541.94	9.24E-03	9.24E-03	0.00E+00	9.24E-03	-	-	2.40	4.52	2.23
DPWTP2	WTP2 Reagent Drops inside bldg	526396.80	3481207.50	1561.01	1561.01	1561.01	1.67E-04	1.66E-04	0.00E+00	1.66E-04	-	-	0.70	0.80	1.74
DP143	Drop of Lead Concentrate Flocculant to 22620-EP-00002 Lead Concentrate Flocculant Preparation Module	525694.00	3480765.00	1603.25	1603.25	1603.25	1.14E-03	1.73E-04		2.05E-06	2.50	2.37	2.75	0.55	1.16
DP144	Drop of Tailings Flocculant to 22620-EP-00001 Tailings Flocculant Preparation Module	526377.70	3481069.10	1562.42	1562.42	1562.42	5.03E-02	7.61E-03		4.66E-06	2.50	2.37	2.75	0.55	1.16
DP145	Drop of Zinc Concentrate Flocculant to 22620-EP-00003 Zinc Concentrate Flocculant Preparation Module	525717.60	3480754.20	1603.25	1603.25	1603.25	7.60E-04	1.15E-04		2.24E-06	2.50	2.37	2.75	0.55	1.16
DPWTP1	WTP1 Reagent Drops	525780.70	3481918.30	1502.88	1502.88	1502.88	8.03E-07	1.22E-07		4.86E-08	-	-	0.70	0.80	1.74
DOZTSF21	TSF2 dozer 1	527114.2	3481856.3	1534.16	1534.16	1534.16	5.44E-02	2.71E-02	1.10E-03	2.71E-02	-	-	1.75	0.96	0.94
DOZTSF22	TSF2 dozer 2	527116.3	3481855.4	1534.16	1534.16	1534.16	5.44E-02	2.71E-02	1.10E-03	2.71E-02	-	-	1.75	0.96	0.94
DOZTSF_1	Dozer on TSF_1	526145.0	3481450.0	1584.96	1584.96	1584.96	5.44E-02	2.71E-02	1.10E-03	2.71E-02	-	-	1.75	0.96	0.94
DOZWRS	Dozer on West Rock Stockpile	525526	3480957.5	1595.12	1590.04	1590.04	4.12E-03	3.28E-03	1.11E-04	3.28E-03	-	-	1.75	0.96	0.94
DOZEOS	Dozer on East Ore Stockpile	525990.5	3480890.1	1581.91	1581.91	1581.91	4.12E-03	3.28E-03	1.48E-03	3.28E-03	-	-	1.75	0.96	0.94
MEVAP1	Mechanical Evaporator 1	525908.5	3481579	1513.31	1513.31	1513.31	6.82E-03	1.02E-03	0.00E+00	1.71E-04	-	-	5.33	5.01	2.48
MEVAP2	Mechanical Evaporator 2	525917.9	3481642.2	1512.68	1512.68	1512.68	6.82E-03	1.02E-03	0.00E+00	1.71E-04	-	-	5.33	5.01	2.48
MEVAP3	Mechanical Evaporator 3	525853.4	3481615.7	1511.22	1511.22	1511.22	6.82E-03	1.02E-03	0.00E+00	1.71E-04	-	-	5.33	5.01	2.48
PP1	Truck Pneumatic Loadout to Silo 1	526459.3	3481064.30	1554.48	1554.48	1554.48	4.19E-04	8.74E-05	0.00E+00	8.74E-05	-	-	2.00	1.16	4.98
PP2	Truck Pneumatic Loadout to Silo 2	526461.9	3481055.80	1554.48	1554.48	1554.48	4.19E-04	8.74E-05	0.00E+00	8.74E-05	-	-	2.00	1.16	4.98
Clark															
DP103	Haul Truck Dump into Primary Crusher Feed Hopper from ROM Stockpile (23100-HPR-0001)	526837.8	3480679.9	1554.48	1554.48	1554.48	6.06E-03	9.18E-04	1.51E-04	5.96E-04	3.75	3.43	3.92	0.80	1.74
DP104	Drop from silo to trucks	526810.7	3480704.9	1554.48	1554.48	1554.48	1.41E-02	2.14E-03	5.02E-04	1.99E-03			4.957	0.593	0.496
DP105	Transfer of Development Ore from Ore Stockpile to Loader	527220	3480626	1568.34	1568.34	1568.34	7.88E-03	1.19E-03	2.93E-04	1.19E-03	2.59	2.04	1.30	0.47	1.16
DP106	Transfer of Development Ore Mined from Loader to Haul Truck	527220	3480626	1568.34	1568.34	1568.34	7.88E-03	1.19E-03	2.93E-04	1.19E-03	3.75	2.04	0.89	0.47	0.87
DP107	Transfer from ROM Stockpile to Loader	526856.2	3480646.2	1559.6	1559.6	1559.6	2.16E-03	3.27E-04	8.03E-05	3.27E-04	2.59	2.04	1.30	0.47	1.16
DP109	Transfer from Agg Stockpile to Loader	527187	3480489	1619.4	1619.4	1619.4	9.02E-03	1.37E-03	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16
DP110	Transfer of Agg Material from Loader to Haul Truck	527187	3480489	1619.4	1619.4	1619.4	9.02E-03	1.37E-03	0.00E+00	1.70E-04	3.75	2.04	0.89	0.47	0.87
DP111	Transfer of Shotcrete Aggregate from Stockpile to Loader	527168	3480482	1620.95	1620.95	1620.95	6.31E-03	9.56E-04	0.00E+00	1.70E-04	2.59	2.04	1.30	0.47	1.16
DP113	Hardshell NAG Wasterock Storage Drop	527194	3480105	1623.06	1600.2	1600.2	3.53E-02	5.35E-03	4.23E-04	5.35E-03	3.75	3.43	0.70	0.80	1.74
DP114	Ore Stockpile Drop	527220	3480626	1568.34	1568.34	1568.34	7.88E-03	1.19E-03	2.93E-04	1.19E-03	3.75	3.43	0.70	0.80	1.74
DP115	ROM Stockpile Drop	526856.2	3480646.2	1559.96	1559.96	1559.96	2.16E-03	3.27E-04	8.03E-05	3.27E-04	3.75	3.43	0.70	0.80	1.74
CCBP1_11	Clark CBP Plant	527171.7	3480490.4	1619.37	1619.37	1619.37	4.70E-04	4.70E-04	0.00E+00	4.70E-04	-	-	2.40	4.52	2.23
DOZHRs	Dozer on Hardshell Rock Stockpile	527408.4	3480026.8	1623.06	1600.2	1600.2	4.12E-03	3.28E-03	-	-	-	-	1.75	0.96	0.94
BREAK1	Clark Rock Breaker	526812.60	3480694.90	1554.5	1554.5	1554.5	1.21E-04	1.84E-05	6.14E-05	8.21E-06	-	-	1.78	0.43	0.83
PP3	Truck Pneumatic Loadout to Silo 1	527319.5	3480489.70	1606.44	1606.44	1606.44	2.10E-04	4.37E-05	0.00E+00	4.37E-05	-	-	2.00	1.16	4.98
PP4	Truck Pneumatic Loadout to Silo 2	527320.7	3480485.80	1607.59	1607.59	1607.59	2.10E-04	4.37E-05	0.00E+00	4.37E-05	-	-	2.00	1.16	4.98

Table A-5. South32 Hermosa Road Area Sources

Index	ID	Description	X	Y	Elevation	Total Daily PM _{2.5}	Total Daily PM _{2.5}	Total Annual PM _{2.5}	Total Daily Pb	Area	Release height	X length	Y length	Angle	Init. Vert. dim.
						(g/s m ⁻²)	(g/s m ⁻²)	(g/s m ⁻²)	(g/s m ⁻²)	(m ²)	(m)	(m)	(m)		(m)
	CRAREA1		526380.2	3480832	1538.7	3.69E-06	3.69E-07	2.92E-07	1.46E-09	240	3.13	12	30	1	2.91
	CRAREA2		526376.7	3480866	1534.89	7.97E-06	7.97E-07	5.61E-07	3.15E-09	1065	2.52	15	71	62	2.35
	CRAREA3		526446.8	3480899.4	1521.98	1.17E-05	1.17E-06	8.17E-07	4.63E-09	516	2.52	12	43	83	2.35
	CRAREA4		526493	3480903	1521.1	1.12E-05	1.12E-06	7.81E-07	4.42E-09	540	2.52	12	45	90	2.35
	CRAREA5		526539	3480903	1519.88	1.20E-05	1.20E-06	8.37E-07	4.74E-09	336	2.52	12	28	48.1	2.35
	CRAREA6		526562	3480922	1518.95	8.64E-06	8.64E-07	6.04E-07	3.42E-09	931.2	2.52	16	58.2	14.5	2.35
	CRAREA7		526628.30	3481008.50	1518.46	2.92E-05	2.92E-06	2.09E-06	1.15E-08	398.04	2.27	12.4	32.1	95.9	2.11
	CRAREA8		526671.9	3481003.3	1523.15	4.84E-05	4.84E-06	3.46E-06	1.91E-08	360	2.27	12	30	112	2.11
	CRAREA9		526700.5	3480985.9	1525.15	6.78E-05	6.78E-06	4.85E-06	2.68E-08	600	2.27	8	75	133	2.11
	CRAREA10		526747.8	3480924.2	1529.55	2.55E-05	2.55E-06	1.83E-06	1.01E-08	910	2.27	65	14	59	2.11
	CRAREA11		526786	3480867	1536.77	2.32E-05	2.32E-06	1.66E-06	9.19E-09	750	2.27	50	15	43	2.11
	CRAREA12		526606	3481131.5	1512.96	2.17E-05	2.17E-06	1.58E-06	8.57E-09	1363	2.29	94	14.5	103	2.13
	CRAREA13		526612.3	3481133.9	1512.95	1.94E-05	1.94E-06	1.41E-06	7.69E-09	759.9	2.29	17	44.7	32.1	2.13
	CRAREA14		526840.2	3480842.4	1544.55	2.63E-05	2.63E-06	1.90E-06	1.04E-08	1088	2.27	16	68	122	2.11
	CRAREA17		527423	3480286	1661.09	3.62E-06	3.62E-07	2.82E-07	1.43E-09	1320	3.10	110	12	90	2.89
	CRAREA18		527418.9	3480170.3	1674.33	3.69E-06	3.69E-07	2.83E-07	1.46E-09	1440	3.08	120	12	90	2.86
	CRAREA19		527420	3480049	1660.24	4.55E-06	4.55E-07	3.49E-07	1.80E-09	700	3.08	70	10	90	2.86
	CRAREA24		526304.8	3480773.8	1529.73	9.43E-06	9.43E-07	6.59E-07	3.73E-09	816.2	2.51	14	58.3	40.5	2.34
	CRAREA25		526279.1	3480771.3	1530.76	1.44E-05	1.44E-06	1.00E-06	5.68E-09	268	2.51	10	26.8	89.4	2.34
	CRAREA26		526192.4	3480836.3	1538.62	8.60E-06	8.60E-07	6.01E-07	3.40E-09	1565.55	2.51	14.7	106.5	124.6	2.34
	CRAREA29		526025.4	3480741.7	1550.06	3.19E-06	3.19E-07	2.61E-07	1.26E-09	629.06	3.08	14.2	44.3	78.9	2.87
	CRAREA33		526636.3	3481172.7	1513.21	2.62E-06	2.62E-07	1.99E-07	1.03E-09	1020	2.93	17	60	31.9	2.73
	CRAREA34		526893.6	3480798.8	1545.16	2.10E-05	2.10E-06	1.51E-06	8.29E-09	342	2.27	18.8	18.19	122.3	2.11
	CRAREA37		527407.7	3480549.5	1600.42	2.58E-06	2.58E-07	2.14E-07	1.02E-09	613	3.11	33.7	18.19	74.6	2.89
	CRAREA38		527417.6	3480297.2	1659.15	3.81E-06	3.81E-07	2.97E-07	1.51E-09	139.2	3.10	11.5	12.1	71	2.89
	CRAREA39		527373.7	3479942.2	1670.79	3.92E-06	3.92E-07	3.00E-07	1.55E-09	271	3.08	22.4	12.1	-161.7	2.86
	CRAREA40		527227.6	3480673.7	1580.06	2.45E-06	2.45E-07	2.03E-07	9.68E-10	330.9	3.11	18.19	18.19	122.9	2.89
	CRAREA41		526659.8	3481005.2	1521.97	5.15E-05	5.15E-06	3.68E-06	2.04E-08	112.8	2.27	12.4	9.1	95.9	2.11
	CRAREA42		527243.3	3480666.7	1585.24	2.81E-06	2.81E-07	2.34E-07	1.11E-09	864	3.11	18.19	47.5	97.3	2.89
	TRAREA2		525802.8	3481926.6	1507.48	2.24E-06	2.24E-07	1.75E-07	8.87E-10	371.1	3.13	20.4	18.19	90	2.91
	TRAREA3		525640	3481926.0	1484.31	3.48E-05	3.48E-06	2.66E-06	1.38E-08	154.9	2.11	12.1	12.8	90	1.96
	TRAREA6		526353.9	3480808.4	1535.58	2.83E-06	2.83E-07	2.31E-07	1.12E-09	600.3	3.08	33	18.19	113.1	2.87
	TRAREA7		526381.1	3480829.8	1539.73	3.45E-06	3.45E-07	2.73E-07	1.36E-09	128.3	3.13	10.6	12.1	94.9	2.91
	TRAREA8		526107.8	3480838.3	1544.01	6.60E-06	6.60E-07	4.61E-07	2.61E-09	351.1	2.51	19.3	18.19	90	2.34

ID	Description	X	Y	Elevation	Emission Rate				Area	Release Height	X length	Y length	Angle	Init. Vert. Dim.
					Total Daily PM _{2.5}	Total Daily PM _{2.5}	Total Annual PM _{2.5}	Total Daily Pb						
					(g/s m ⁻²)	(g/s m ⁻²)	(g/s m ⁻²)	(g/s m ⁻²)						
CRAREA21		526597.6	3481020.6	1515.96	1.07E-05	1.07E-06	7.50E-07	4.24E-09	562.70	2.52	-	-	-	2.35
CRAREA22		526616.1	3481000.2	1517.16	2.63E-05	2.63E-06	1.88E-06	1.04E-08	441.62	2.27	-	-	-	2.11
CRAREA2Y		527371.7	3479931.9	1670.72	4.64E-06	4.64E-07	3.56E-07	1.83E-09	1144.63	3.08	-	-	-	2.86
CRAREA23		526374.4	3480853.7	1527.19	1.23E-05	1.23E-06	8.61E-07	4.87E-09	468.60	2.51	-	-	-	2.34
CRAREA27		526181.2	3480832.7	1538.35	1.20E-05	1.20E-06	8.42E-07	4.76E-09	798.73	2.51	-	-	-	2.34
CRAREA28		526121.2	3480800.8	1542.08	4.01E-06	4.01E-07	3.27E-07	1.59E-09	834.59	3.08	-	-	-	2.87
CRAREA30		526023.4	3480735.6	1548.96	3.65E-06	3.65E-07	2.98E-07	1.44E-09	1284.04	3.08	-	-	-	2.87
CRAREA31		526008.1	3480625	1553.09	3.40E-06	3.40E-07	2.78E-07	1.34E-09	1968.88	3.08	-	-	-	2.87
CRAREA32		525887.4	3480473.2	1553.94	3.50E-06	3.50E-07	2.85E-07	1.38E-09	765.49	3.08	-	-	-	2.87
TRAREA5		526370.6	3480837	1532.32	5.29E-06	5.29E-07	4.32E-07	2.09E-09	321.33	3.08	-	-	-	2.87
CRAREA43		526601.5	3481026.7	1516.12	4.70E-05	4.70E-06	3.42E-06	1.86E-08	104.67	2.29	-	-	-	2.13

Mine Development
Mod - Vol Road Params

Table A-6. South32 Hermosa Road Volume Sources

Segment Name	INDEX	ID	Description	UTM X Coordinate (m)	UTM Y Coordinate(m)	Elevation (m)	Emission Rate				Emission Rate				Road Width (ft)	Road Width (m)	Adjusted Road Width (m)	Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)	Area Source (if Applicable)
							PM ₁₀ (g/s)	PM _{2.5} (g/s)	PM _{2.5} (g/s)	Lead (g/s)	Total Daily PM ₁₀ (g/s)	Total Daily PM _{2.5} (g/s)	Total Annual PM _{2.5} (g/s)	Total Daily Lead (g/s)							
AR	3	TRAR_1	AR	526672.9	3481213.7	1511.02	6.67E-04	6.67E-05	5.08E-05	2.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.93	7.33	2.73	CRAREA33
AR	4	TRAR_2	AR	526665.4	3481199.6	1511.42	6.67E-04	6.67E-05	5.08E-05	2.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.93	7.33	2.73	CRAREA33
AR	5	TRAR_3	AR	526656.2	3481186.5	1512.16	6.67E-04	6.67E-05	5.08E-05	2.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.93	7.33	2.73	CRAREA33
AR	6	TRAR_4	AR	526646.8	3481173.6	1512.84	6.67E-04	6.67E-05	5.08E-05	2.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.93	7.33	2.73	CRAREA33
RS	7	CRRS_1	RS	526640.6	3481161.6	1513.04	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA13
RS	8	CRRS_2	RS	526631	3481148.9	1512.86	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA13
RS	9	CRRS_3	RS	526621.4	3481136	1512.82	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA13
RS	10	CRRS_4	RS	526611.8	3481123.2	1512.9	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA12
RS	11	CRRS_5	RS	526607.9	3481107.7	1513.1	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA12
RS	12	CRRS_6	RS	526604	3481092.2	1513.99	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA12
RS	13	CRRS_7	RS	526600.2	3481076.6	1514.46	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA12
RS	14	CRRS_8	RS	526596.3	3481061.1	1515.04	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA12
RS	15	CRRS_9	RS	526595.4	3481045.7	1515.62	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA12
RS	16	CRRS_10	RS	526599.2	3481031.3	1515.95	4.92E-03	4.92E-04	3.58E-04	1.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.29	7.33	2.13	CRAREA43
ST	17	TRST_1	ST	526591.4	3481018.5	1515.58	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA21
ST	18	TRST_2	ST	526589.7	3481002.6	1515.56	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA21
ST	19	TRST_3	ST	526587.4	3480986.8	1516.1	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA21
ST	20	TRST_4	ST	526583.9	3480971.2	1516.83	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA6
ST	21	TRST_5	ST	526579.8	3480955.7	1517.33	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA6
ST	22	TRST_6	ST	526575.4	3480940.4	1517.97	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA6
ST	23	TRST_7	ST	526568.6	3480925.9	1518.59	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA6
ST	24	TRST_8	ST	526559.1	3480913.3	1519.16	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA5
ST	25	TRST_9	ST	526547.6	3480902.2	1519.57	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA5
ST	26	TRST_10	ST	526532.8	3480896.2	1519.9	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA4
ST	27	TRST_11	ST	526516.8	3480896.8	1520.27	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA4
ST	28	TRST_12	ST	526500.8	3480897.3	1520.6	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA4
ST	29	TRST_13	ST	526484.8	3480896.6	1521.22	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA3
ST	30	TRST_14	ST	526468.9	3480895.2	1521.66	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA3
ST	31	TRST_15	ST	526453	3480893.7	1522.37	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA3
ST	32	TRST_16	ST	526437.6	3480889.7	1523.19	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA2
ST	33	TRST_17	ST	526423.1	3480882.8	1525.89	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA2
ST	34	TRST_18	ST	526408.7	3480876	1526.04	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA2
ST	35	TRST_19	ST	526394.2	3480869.2	1525.99	2.01E-03	2.01E-04	1.41E-04	7.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.52	7.33	2.35	CRAREA2
TU	36	TRTU_1	TU	526387.4	3480860	1527.69	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA2
TU	37	TRTU_2	TU	526387.3	3480848	1532.8	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1
TU	38	TRTU_3	TU	526387.2	3480836	1537.8	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1
TU	39	TRTU_4	TU	526387	3480824	1542.69	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	TRAREA7
TU	40	TRTU_5	TU	526383.2	3480812.7	1546.45	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1
TU	41	TRTU_6	TU	526380.9	3480801.2	1549.4	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1
TU	42	TRTU_7	TU	526381.9	3480789.2	1551.52	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1
TU	43	TRTU_8	TU	526379.5	3480778	1550.99	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1
TU	44	TRTU_9	TU	526373.7	3480767.4	1548.04	4.43E-04	4.43E-05	3.50E-05	1.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.13	5.63	2.91	CRAREA1

Mine Development
Mod - Vol Road Params

LP	86	TRLP3_10	LP	525816.7	3481672.9	1510.55	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	87	TRLP4_1	LP	525820.3	3481662.2	1511.71	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	88	TRLP4_2	LP	525826.2	3481645.2	1512.35	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	89	TRLP4_3	LP	525832.1	3481628.2	1512.7	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	90	TRLP4_4	LP	525838	3481611.2	1513.09	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	91	TRLP4_5	LP	525843.9	3481594.2	1513.64	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	92	TRLP4_6	LP	525849.8	3481577.2	1514.85	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	93	TRLP4_7	LP	525855.7	3481560.2	1516.59	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	94	TRLP4_8	LP	525861.6	3481543.2	1518.43	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	95	TRLP4_9	LP	525869.3	3481526.7	1519.97	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	96	TRLP4_10	LP	525851.4	3481510.5	1522.14	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	97	TRLP5_1	LP	525840.8	3481503.3	1523.51	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	98	TRLP5_2	LP	525824.7	3481495.3	1525.91	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	99	TRLP5_3	LP	525808.6	3481487.3	1528.23	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	100	TRLP5_4	LP	525792.5	3481479.3	1529.68	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	101	TRLP5_5	LP	525779.4	3481467.1	1531.56	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	102	TRLP5_6	LP	525766.8	3481454.3	1533.15	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	103	TRLP5_7	LP	525754.2	3481441.4	1534.64	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
LP	104	TRLP5_8	LP	525741.6	3481428.6	1536.23	6.83E-03	6.83E-04	5.24E-04	2.70E-06	6.83E-03	6.83E-04	5.24E-04	2.70E-06	40	12.19	18.19	2.11	8.46	1.96
PR	105	TRPR_1	PR	525733.6	3481421.1	1536.96	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	106	TRPR_2	PR	525719.8	3481409.5	1538.32	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	107	TRPR_3	PR	525707.8	3481396.4	1540.23	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	108	TRPR_4	PR	525697.6	3481381.5	1542.27	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	109	TRPR_5	PR	525685.5	3481368.4	1543.91	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	110	TRPR_6	PR	525672	3481356.5	1545.18	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	111	TRPR_7	PR	525661.5	3481342.6	1545.95	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	112	TRPR_8	PR	525656.1	3481325.5	1546.26	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	113	TRPR_9	PR	525660.9	3481308.2	1546.44	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	114	TRPR_10	PR	525666.2	3481291	1546.42	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	115	TRPR_11	PR	525673.9	3481274.8	1546.32	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	116	TRPR_12	PR	525681.6	3481258.5	1547.32	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	117	TRPR_13	PR	525689.3	3481242.2	1550.29	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	118	TRPR_14	PR	525697	3481225.9	1559.94	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	119	TRPR_15	PR	525704.7	3481209.7	1565.32	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	120	TRPR_16	PR	525712.4	3481193.4	1568.8	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	121	TRPR_17	PR	525720.1	3481177.1	1571.66	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	122	TRPR_18	PR	525727.8	3481160.8	1574.96	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	123	TRPR_19	PR	525735.5	3481144.6	1578.16	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	124	TRPR_20	PR	525745.1	3481129.9	1579.49	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	125	TRPR_21	PR	525759.6	3481119.2	1580.71	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	126	TRPR_22	PR	525774.6	3481109.3	1583.24	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	127	TRPR_23	PR	525790.7	3481101.3	1583.23	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	128	TRPR_24	PR	525806.8	3481093.3	1582.33	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	129	TRPR_25	PR	525822.9	3481085.3	1582.09	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
PR	130	TRPR_26	PR	525839	3481077.3	1582.31	7.12E-03	7.12E-04	5.46E-04	2.81E-06	7.12E-03	7.12E-04	5.46E-04	2.81E-06	40	12.19	18.19	2.11	8.46	1.96
RH	131	TRRH_1	RH	525833.1	3481069.6	1582.65	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	132	TRRH_2	RH	525818.9	3481058.5	1582.59	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	133	TRRH_3	RH	525806	3481046.4	1580.23	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	134	TRRH_4	RH	525798.6	3481030	1577.67	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	135	TRRH_5	RH	525791.2	3481013.6	1578.36	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	136	TRRH_6	RH	525783.8	3480997.2	1579.2	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	137	TRRH_7	RH	525776.4	3480980.8	1584.52	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	138	TRRH_8	RH	525769.1	3480964.3	1589.9	6.38E-03	6.38E-04	4.39E-04	2.52E-06	6.38E-03	6.38E-04	4.39E-04	2.52E-06	40	12.19	18.19	2.39	8.46	2.22
RH	139	TRRH_9	RH	525761.7	3480947.9	1														

Mine Development
Mod - Vol Road Params

BQ	174	TRBQ_3	BQ	526233.5	3480991	1561.72	7.72E-04	7.72E-05	6.05E-05	3.05E-07	7.72E-04	7.72E-05	6.05E-05	3.05E-07	40	12.19	18.19	3.07	8.46	2.86	
BQ	175	TRBQ_4	BQ	526240.9	3480974.5	1555.44	7.72E-04	7.72E-05	6.05E-05	3.05E-07	7.72E-04	7.72E-05	6.05E-05	3.05E-07	40	12.19	18.19	3.07	8.46	2.86	
BQ	176	TRBQ_5	BQ	526248.3	3480958.1	1550.18	7.72E-04	7.72E-05	6.05E-05	3.05E-07	7.72E-04	7.72E-05	6.05E-05	3.05E-07	40	12.19	18.19	3.07	8.46	2.86	
BQ	177	TRBQ_6	BQ	526255.7	3480941.7	1546.49	7.72E-04	7.72E-05	6.05E-05	3.05E-07	7.72E-04	7.72E-05	6.05E-05	3.05E-07	40	12.19	18.19	3.07	8.46	2.86	
BQ	178	TRBQ_7	BQ	526263.1	3480925.3	1547.83	7.72E-04	7.72E-05	6.05E-05	3.05E-07	7.72E-04	7.72E-05	6.05E-05	3.05E-07	40	12.19	18.19	3.07	8.46	2.86	
RB	179	TRRB_1	RB	526222.2	3481026	1562.36	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	180	TRRB_2	RB	526235.9	3481014.4	1562.3	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	181	TRRB_3	RB	526249.6	3481002.7	1561.89	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	182	TRRB_4	RB	526263.4	3480991.1	1561.12	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	183	TRRB_5	RB	526277.1	3480979.5	1559.53	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	184	TRRB_6	RB	526293.7	3480972.5	1557.73	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	185	TRRB_7	RB	526310.3	3480965.6	1555.24	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	186	TRRB_8	RB	526328.2	3480965.3	1553.7	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	187	TRRB_9	RB	526346.2	3480965.8	1552.13	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	188	TRRB_10	RB	526364.2	3480966.3	1549.81	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	189	TRRB_11	RB	526382.2	3480966.8	1548.47	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	190	TRRB_12	RB	526400.1	3480967.4	1546.28	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	191	TRRB_13	RB	526418.1	3480967.9	1544.39	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	192	TRRB_14	RB	526436.1	3480968.4	1542.45	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	193	TRRB_15	RB	526454.1	3480968.9	1540.69	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	194	TRRB_16	RB	526472.1	3480969.5	1538.56	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	195	TRRB_17	RB	526488.5	3480976.6	1538.32	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	196	TRRB_18	RB	526503	3480986.3	1538.58	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	197	TRRB_19	RB	526512.3	3481001.7	1536.02	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	198	TRRB_20	RB	526518.8	3481018.2	1532.96	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	199	TRRB_21	RB	526521.7	3481035.9	1532.16	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	200	TRRB_22	RB	526521.8	3481053.9	1530.94	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	201	TRRB_23	RB	526521.9	3481071.9	1530.25	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	202	TRRB_24	RB	526522	3481089.9	1529.65	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	203	TRRB_25	RB	526522.1	3481107.9	1527.46	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	204	TRRB_26	RB	526530.1	3481123.7	1522.39	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	205	TRRB_27	RB	526539.2	3481139.3	1522.16	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	206	TRRB_28	RB	526548.2	3481154.2	1522.61	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	207	TRRB_29	RB	526557.2	3481170.5	1520.82	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	208	TRRB_30	RB	526567.1	3481185	1518.73	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	209	TRRB_31	RB	526583.5	3481192.6	1517	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	210	TRRB_32	RB	526600.5	3481196.8	1515.14	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	211	TRRB_33	RB	526616.8	3481191.4	1513.4	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
RB	212	TRRB_34	RB	526631.1	3481180.4	1512.99	5.81E-03	5.81E-04	4.26E-04	2.30E-06	5.81E-03	5.81E-04	4.26E-04	2.30E-06	40	12.19	18.19	2.29	8.46	2.13	
ZY	213	CRZY1_1	ZY	527425	3480164.6	1673.53	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	214	CRZY2_1	ZY	527425	3480152.6	1672.9	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	215	CRZY1_3	ZY	527425	3480140.6	1671.66	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	216	CRZY1_4	ZY	527425	3480128.6	1670.04	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	217	CRZY1_5	ZY	527425	3480116.6	1668.33	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	218	CRZY1_6	ZY	527425	3480104.6	1666.62	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	219	CRZY1_7	ZY	527425	3480092.6	1664.79	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	220	CRZY1_8	ZY	527425	3480080.6	1663.32	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	221	CRZY1_9	ZY	527425	3480068.6	1662.54	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	222	CRZY1_10	ZY	527425	3480056.6	1662.04	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA18
ZY	223	CRZY1_11	ZY	527425	3480044.6	1661.74	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA19
ZY	224	CRZY1_12	ZY	527425	3480032.6	1661.99	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA19
ZY	225	CRZY1_13	ZY	527425	3480020.6	1663	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.08	5.63	2.86	CRAREA19
ZY	226	CRZY1_14	ZY	52																	

Mine Development
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LC	265	TRLC_8	LC	525662.9	3481998	1492	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	266	TRLC_9	LC	525670.8	3481981.6	1492.89	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	267	TRLC_10	LC	525678.7	3481965.2	1497.7	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	268	TRLC_11	LC	525690.3	3481952.6	1498.4	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	269	TRLC_12	LC	525706.9	3481945.2	1498.25	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	270	TRLC_13	LC	525723.5	3481937.7	1499.05	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	271	TRLC_14	LC	525740.2	3481930.2	1499.9	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	272	TRLC_15	LC	525747.4	3481914	1499.72	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	273	TRLC_16	LC	525753.7	3481897	1499.06	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	274	TRLC_17	LC	525760	3481879.9	1498.02	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	275	TRLC_18	LC	525766.4	3481862.9	1496.83	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	276	TRLC_19	LC	525766.3	3481944.8	1495.77	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LC	277	TRLC_20	LC	525765.8	3481826.6	1495.31	7.58E-04	7.58E-05	6.15E-05	3.00E-07	7.58E-04	7.58E-05	6.15E-05	3.00E-07	40	12.19	18.19	3.10	8.46	2.88	
LA	278	TRLA_1	LA	525778.3	3481828.2	1495.64	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	279	TRLA_2	LA	525794.4	3481836.7	1496.75	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	280	TRLA_3	LA	525810.5	3481845.2	1498.79	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	281	TRLA_4	LA	525811.8	3481862.8	1499	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	282	TRLA_5	LA	525812.1	3481881	1500.78	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	283	TRLA_6	LA	525812.3	3481899.1	1502.19	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	284	TRLA_7	LA	525812.6	3481917.3	1504.89	8.33E-04	8.33E-05	6.48E-05	3.29E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.13	8.46	2.91	TRAREA2
LA	285	TRLA_8	LA	525807.5	3481934.1	1509.07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	286	TRLA_9	LA	525798.5	3481949.9	1515.28	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
LA	287	TRLA_10	LA	525789.5	3481965.8	1517.71	8.33E-04	8.33E-05	6.48E-05	3.29E-07	8.33E-04	8.33E-05	6.48E-05	3.29E-07	40	12.19	18.19	3.13	8.46	2.91	
HI	288	TRHI_1	HI	525743.4	3480918.6	1594.94	5.88E-03	5.88E-04	3.76E-04	2.23E-06	5.88E-03	5.88E-04	3.76E-04	2.23E-06	40	12.19	18.19	2.33	8.46	2.17	
HI	289	TRHI_2	HI	525728.6	3480908	1597.57	5.88E-03	5.88E-04	3.76E-04	2.23E-06	5.88E-03	5.88E-04	3.76E-04	2.23E-06	40	12.19	18.19	2.33	8.46	2.17	
HI	290	TRHI_3	HI	525713.8	3480897.4	1599.59	5.88E-03	5.88E-04	3.76E-04	2.23E-06	5.88E-03	5.88E-04	3.76E-04	2.23E-06	40	12.19	18.19	2.33	8.46	2.17	
HI	291	TRHI_4	HI	525699	3480886.9	1600.19	5.88E-03	5.88E-04	3.76E-04	2.23E-06	5.88E-03	5.88E-04	3.76E-04	2.23E-06	40	12.19	18.19	2.33	8.46	2.17	
HI	292	TRHI_5	HI	525684.2	3480876.3	1606.61	5.88E-03	5.88E-04	3.76E-04	2.23E-06	5.88E-03	5.88E-04	3.76E-04	2.23E-06	40	12.19	18.19	2.33	8.46	2.17	
HI	293	TRHI_6	HI	525669.4	3480865.7	1610.1	5.88E-03	5.88E-04	3.76E-04	2.23E-06	5.88E-03	5.88E-04	3.76E-04	2.23E-06	40	12.19	18.19	2.33	8.46	2.17	
JI	294	TRJI_1	JI	525649.3	3480863.1	1604.38	2.17E-03	2.17E-04	2.29E-05	8.60E-07	2.17E-03	2.17E-04	2.29E-05	8.60E-07	40	12.19	18.19	3.15	8.46	2.93	
JI	295	TRJI_2	JI	525639.3	3480878.3	1592.35	2.17E-03	2.17E-04	2.29E-05	8.60E-07	2.17E-03	2.17E-04	2.29E-05	8.60E-07	40	12.19	18.19	3.15	8.46	2.93	
JI	296	TRJI_3	JI	525629.3	3480893.5	1587.76	2.17E-03	2.17E-04	2.29E-05	8.60E-07	2.17E-03	2.17E-04	2.29E-05	8.60E-07	40	12.19	18.19	3.15	8.46	2.93	
JI	297	TRJI_4	JI	525619.4	3480908.8	1584.88	2.17E-03	2.17E-04	2.29E-05	8.60E-07	2.17E-03	2.17E-04	2.29E-05	8.60E-07	40	12.19	18.19	3.15	8.46	2.93	
IK	298	TRIK_1	IK	525648.2	3480855.9	1608.13	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	299	TRIK_2	IK	525630	3480855.5	1599.09	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	300	TRIK_3	IK	525614	3480846.9	1600.08	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	301	TRIK_4	IK	525598.1	3480838.2	1603.9	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	302	TRIK_5	IK	525587	3480823.8	1607.28	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	303	TRIK_6	IK	525576.1	3480809.2	1607.25	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	304	TRIK_7	IK	525565.1	3480794.7	1607.97	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	305	TRIK_8	IK	525554.2	3480780.2	1607.64	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	306	TRIK_9	IK	525550.8	3480764.2	1604.83	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	307	TRIK_10	IK	525555.9	3480746.8	1604.23	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	308	TRIK_11	IK	525569.4	3480735.4	1603.53	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	309	TRIK_12	IK	525584.4	3480725	1603.59	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	310	TRIK_13	IK	525599.3	3480714.7	1603.28	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	311	TRIK_14	IK	525615	3480706.3	1601.53	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	312	TRIK_15	IK	525633	3480703.8	1600.41	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	313	TRIK_16	IK	525651.1	3480701.3	1602.65	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	314	TRIK_17	IK	525669.1	3480698.8	1602.85	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	315	TRIK_18	IK	525687.1	3480696.3	1603.16	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IK	316	TRIK_19	IK	525705.1	3480693.7	1601.87	3.14E-03	3.14E-04	2.58E-04	1.24E-06	3.14E-03	3.14E-04	2.58E-04	1.24E-06	40	12.19	18.19	2.10	8.46	1.96	
IL	317	TRIL_1	IL	525663.5	3480857.4	1610.57	1.59E-03	1.59E-04	1.2												

**Mine Development
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VX	357	CRVX_3	VX	527082.9	3480604.3	1583.35	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	358	CRVX_4	VX	527067.7	3480594.6	1586.71	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	359	CRVX_5	VX	527055.6	3480581	1586.98	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	360	CRVX_6	VX	527046	3480565.9	1584.46	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	361	CRVX_7	VX	527042.3	3480548.4	1581.22	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	362	CRVX_8	VX	527042.3	3480530.2	1577.94	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	363	CRVX_9	VX	527042.3	3480512	1573.49	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	364	CRVX_10	VX	527050.2	3480496.2	1573.29	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	365	CRVX_11	VX	527060.1	3480480.9	1575.17	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	366	CRVX_12	VX	527069.2	3480465.3	1577.46	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	367	CRVX_13	VX	527075.3	3480448.1	1577.66	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	368	CRVX_14	VX	527081.5	3480431	1578.53	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	369	CRVX_15	VX	527088.6	3480414.3	1581.05	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	370	CRVX_16	VX	527096.4	3480397.9	1583.95	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	371	CRVX_17	VX	527106.9	3480383.1	1587.86	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	372	CRVX_18	VX	527117.8	3480368.5	1591.36	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	373	CRVX_19	VX	527129.7	3480354.7	1596.73	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	374	CRVX_20	VX	527141.5	3480340.9	1602.22	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	375	CRVX_21	VX	527153.5	3480327.2	1604.25	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	376	CRVX_22	VX	527166.1	3480314.1	1603.43	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	377	CRVX_23	VX	527178.7	3480301	1602.54	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	378	CRVX_24	VX	527191.4	3480288	1602.14	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	379	CRVX_25	VX	527204	3480274.9	1601.99	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	380	CRVX_26	VX	527216.7	3480261.8	1604.14	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	381	CRVX_27	VX	527229.3	3480248.7	1610.85	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	382	CRVX_28	VX	527231	3480232	1611.73	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	383	CRVX_29	VX	527228.6	3480214	1609.9	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	384	CRVX_30	VX	527226.3	3480195.9	1605.36	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	385	CRVX_31	VX	527224	3480177.9	1599.88	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	386	CRVX_32	VX	527221.6	3480159.9	1593.59	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	387	CRVX_33	VX	527219.3	3480141.8	1588.46	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	388	CRVX_34	VX	527216.9	3480123.8	1590.74	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
VX	389	CRVX_35	VX	527214.6	3480105.7	1594.31	1.36E-03	1.36E-04	6.54E-05	5.39E-07	1.36E-03	1.36E-04	6.54E-05	5.39E-07	40	12.19	18.19	3.14	8.46	2.92	
YA	390	CRYA_1	YA	527335.1	3480572.9	1588.85	8.10E-04	8.10E-05	6.73E-05	3.20E-07	8.10E-04	8.10E-05	6.73E-05	3.20E-07	40	12.19	18.19	3.11	8.46	2.89	
YA	391	CRYA_2	YA	527334.3	3480591	1592.44	8.10E-04	8.10E-05	6.73E-05	3.20E-07	8.10E-04	8.10E-05	6.73E-05	3.20E-07	40	12.19	18.19	3.11	8.46	2.89	
YA	392	CRYA_3	YA	527332.6	3480609.1	1597.14	8.10E-04	8.10E-05	6.73E-05	3.20E-07	8.10E-04	8.10E-05	6.73E-05	3.20E-07	40	12.19	18.19	3.11	8.46	2.89	
YA	393	CRYA_4	YA	527328.9	3480626.4	1601.14	8.10E-04	8.10E-05	6.73E-05	3.20E-07	8.10E-04	8.10E-05	6.73E-05	3.20E-07	40	12.19	18.19	3.11	8.46	2.89	
YA	394	CRYA_5	YA	527317.1	3480640.2	1601.19	8.10E-04	8.10E-05	6.73E-05	3.20E-07	8.10E-04	8.10E-05	6.73E-05	3.20E-07	40	12.19	18.19	3.11	8.46	2.89	
YA	395	CRYA_6	YA	527301.2	3480648.5	1598.78	8.10E-04	8.10E-05	6.73E-05	3.20E-07	8.10E-04	8.10E-05	6.73E-05	3.20E-07	40	12.19	18.19	3.11	8.46	2.89	
YA	396	CRYA_7	YA	527284.1	3480654.3	1594.96	8.10E-04	8.10E-05	6.73E-05	3.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.11	8.46	2.89	CRAREA42
YA	397	CRYA_8	YA	527266.1	3480657.2	1589.52	8.10E-04	8.10E-05	6.73E-05	3.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.11	8.46	2.89	CRAREA42
YA	398	CRYA_9	YA	527248.1	3480659.2	1583.96	8.10E-04	8.10E-05	6.73E-05	3.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.11	8.46	2.89	CRAREA42
YA	399	CRYA_10	YA	527230.8	3480663.7	1583.12	8.10E-04	8.10E-05	6.73E-05	3.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.11	8.46	2.89	CRAREA40
WX	400	CRWX_1	WX	527254	3480558.1	1584.96	1.33E-03	1.33E-04	9.98E-05	5.26E-07	1.33E-03	1.33E-04	9.98E-05	5.26E-07	20	6.10	12.10	3.04	5.63	2.83	
WX	402	CRWX_2	WX	527258.9	3480547.1	1586.91	1.33E-03	1.33E-04	9.98E-05	5.26E-07	1.33E-03	1.33E-04	9.98E-05	5.26E-07	20	6.10	12.10	3.04	5.63	2.83	
WX	403	CRWX_3	WX	527265.4	3480537	1588.25	1.33E-03	1.33E-04	9.98E-05	5.26E-07	1.33E-03	1.33E-04	9.98E-05	5.26E-07	20	6.10	12.10	3.04	5.63	2.83	
WX	404	CRWX_4	WX	527276.1	3480531.4	1589.08	1.33E-03	1.33E-04	9.98E-05	5.26E-07	1.33E-03	1.33E-04	9.98E-05	5.26E-07	20	6.10	12.10	3.04	5.63	2.83	
WX	405	CRWX_5	WX	527287.2	3480527	1591.22	1.33E-03	1.33E-04	9.98E-05	5.26E-07	1.33E-03	1.33E-04	9.98E-05	5.26E-07	20	6.10	12.10	3.04	5.63	2.83	
WX	406	CRWX_6	WX	527299.1	3480524.5	1594.28	1.33E-03	1.33E-04	9.98E-05	5.26E-07	1.33E-03	1.33E-04	9.98E-05	5.26E-07	20	6.10	12.10	3.04	5.63	2.83	
XB	407	CRXB_1	XB	527305.5	3480513.2	1598.7	6.33E-04	6.33E-05	4.58E-05	2.50E-07	6.33E-04	6.33E-05	4.58E-05	2.50E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	408	CRXB_2	XB	527305.5	3480501.1	1601.29	6.33E-04	6.33E-05	4.58E-05	2.50E-07	6.33E-04	6.33E-05	4.58E-05	2.50E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	409	CRXB_3	XB	527303.7	3480489.5	1602.64	6.33E-04	6.33E-05	4.58E-05	2.50E-07	6.33E-04	6.33E-05	4.58E-05	2.50E-07	20	6.10	12.10	2.99	5.63	2.78	
XB	410	CRXB_4	XB	527293.6																	

Mine Development
Mod - Vol Road Params

XB	448	CRXB_42	XB	527225.4	3480452.1	1626.93	6.33E-04	6.33E-05	4.58E-05	2.50E-07	6.33E-04	6.33E-05	4.58E-05	2.50E-07	20	6.10	12.10	2.99	5.63	2.78	
BC	449	CRBC_1	BC	527210.9	3480451.1	1628.79	5.30E-04	5.30E-05	3.93E-05	2.09E-07	5.30E-04	5.30E-05	3.93E-05	2.09E-07	20	6.10	12.10	3.03	5.63	2.82	
BC	450	CRBC_2	BC	527200.6	3480457.4	1627.55	5.30E-04	5.30E-05	3.93E-05	2.09E-07	5.30E-04	5.30E-05	3.93E-05	2.09E-07	20	6.10	12.10	3.03	5.63	2.82	
BC	451	CRBC_3	BC	527190.2	3480463.7	1626.77	5.30E-04	5.30E-05	3.93E-05	2.09E-07	5.30E-04	5.30E-05	3.93E-05	2.09E-07	20	6.10	12.10	3.03	5.63	2.82	
BZ	452	CRBZ_1	BZ	527218.4	3480441.3	1631.12	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	453	CRBZ_2	BZ	527227.5	3480433.6	1632.65	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	454	CRBZ_3	BZ	527237.5	3480427.5	1633.22	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	455	CRBZ_4	BZ	527249.6	3480422.2	1632.06	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	456	CRBZ_5	BZ	527261.7	3480427	1630.42	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	457	CRBZ_6	BZ	527273.8	3480426.7	1628.7	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	458	CRBZ_7	BZ	527285	3480422.3	1629.25	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	459	CRBZ_8	BZ	527296.1	3480417.5	1631.03	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	460	CRBZ_9	BZ	527307.2	3480412.7	1632.33	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	461	CRBZ_10	BZ	527318.3	3480407.9	1633.77	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	462	CRBZ_11	BZ	527329.4	3480403.1	1634.32	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	463	CRBZ_12	BZ	527340.5	3480398.3	1635.03	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	464	CRBZ_13	BZ	527351.6	3480393.5	1635.29	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	465	CRBZ_14	BZ	527362.8	3480388.8	1635.53	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	466	CRBZ_15	BZ	527373.9	3480384	1636.6	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	467	CRBZ_16	BZ	527385	3480379.2	1638.9	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	468	CRBZ_17	BZ	527395.3	3480373.5	1641.35	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	469	CRBZ_18	BZ	527400.7	3480363.4	1642.94	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	470	CRBZ_19	BZ	527392.2	3480354.9	1644.85	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	471	CRBZ_20	BZ	527381.2	3480351.7	1646.52	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	472	CRBZ_21	BZ	527369.1	3480351	1647.9	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	473	CRBZ_22	BZ	527357.1	3480350.3	1649.83	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	474	CRBZ_23	BZ	527347	3480345.5	1653.02	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	475	CRBZ_24	BZ	527344.2	3480335.1	1656.11	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	476	CRBZ_25	BZ	527350.8	3480326.5	1658.04	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	477	CRBZ_26	BZ	527362	3480321.9	1658.16	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	478	CRBZ_27	BZ	527373.5	3480318.4	1657.99	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	479	CRBZ_28	BZ	527385.4	3480316.8	1657.06	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	480	CRBZ_29	BZ	527397.4	3480315.4	1659.13	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	481	CRBZ_30	BZ	527408.5	3480311.5	1656.14	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	482	CRBZ_31	BZ	527417.6	3480303.6	1657.51	5.31E-04	5.31E-05	4.13E-05	2.10E-07	5.31E-04	5.31E-05	4.13E-05	2.10E-07	20	6.10	12.10	3.10	5.63	2.89	
BZ	483	CRBZ_32	BZ	527424.3	3480294	1659.22	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA38
BZ	484	CRBZ_33	BZ	527427.5	3480282.4	1661.17	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	485	CRBZ_34	BZ	527427.4	3480270.3	1663.36	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	486	CRBZ_35	BZ	527427.3	3480258.2	1665.36	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	487	CRBZ_36	BZ	527427.2	3480246.1	1667.27	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	488	CRBZ_37	BZ	527427.1	3480234	1669.17	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	489	CRBZ_38	BZ	527427	3480221.9	1670.62	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	490	CRBZ_39	BZ	527427	3480209.8	1671.78	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	491	CRBZ_40	BZ	527426.9	3480197.7	1672.72	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
BZ	492	CRBZ_41	BZ	527426.8	3480185.6	1673.28	5.31E-04	5.31E-05	4.13E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20	6.10	12.10	3.10	5.63	2.89	CRAREA17
ZA	493	CRZA_1	ZA	527419.8	3480177.2	1674.31	6.55E-04	6.55E-05	5.17E-05	2.59E-07	6.55E-04	6.55E-05	5.17E-05	2.59E-07	20	6.10	12.10	3.13	5.63	2.91	
ZA	494	CRZA_2	ZA	527407.7	3480177.2	1675.46	6.55E-04	6.55E-05	5.17E-05	2.59E-07	6.55E-04	6.55E-05	5.17E-05	2.59E-07	20	6.10	12.10	3.13	5.63	2.91	
VC	495	CRVC_1	VC	526826.1	3480827.6	1542.04	8.50E-04	8.50E-05	6.93E-05	3.36E-07	8.50E-04	8.50E-05	6.93E-05	3.36E-07	20	12.19	18.19	3.15	8.46	2.93	
TV	496	TRTV_1	TV	526374.8	3480832.1	1536.54	8.50E-04	8.50E-05	6.93E-05	3.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.08	8.46	2.87	TRAREAS
TV	497	TRTV_2	TV	526366.9	3480815.7	1539.59	8.50E-04	8.50E-05	6.93E-05	3.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.08	8.46	2.87	TRAREAS
TV	498	TRTV_3	TV	526359.1	3480799.3	1540.93	8.50E-04	8.50E-05	6.93E-05	3.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.08	8.46	2.87	TRAREAS
TV	499	TRTV_4	TV	526351.7	3480782.6	1539.45	8.50E-04	8.50E-05	6.93E-05	3.36E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	40	12.19	18.19	3.08	8.46	2.87	TRAREAS
TV	500																				

**Mine Development
Mod - Vol Road Params**

VD	539	CRVD1_4	VD	526907.6	3480694.2	1550.92	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	40	12.19	18.19	2.37	8.46	2.21	
VD	540	CRVD1_5	VD	526922.7	3480685.8	1550.08	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	40	12.19	18.19	2.37	8.46	2.21	
VD	541	CRVD2_1	VD	526931.2	3480673.2	1548.87	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	40	6.10	12.10	2.37	5.63	2.21	
VD	542	CRVD2_2	VD	526937	3480662.4	1547.54	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	543	CRVD2_3	VD	526942.8	3480651.7	1544.98	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	544	CRVD2_4	VD	526948.2	3480641	1546.18	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	545	CRVD2_5	VD	526948.2	3480638.9	1550.3	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	546	CRVD2_6	VD	526948.2	3480616.8	1551.81	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	547	CRVD2_7	VD	526951	3480605.5	1550.1	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	548	CRVD2_8	VD	526953.4	3480593.7	1549.35	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	549	CRVD2_9	VD	526960.7	3480585.3	1549.06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
VD	550	CRVD2_10	VD	526971.5	3480588.9	1550.45	5.92E-03	5.92E-04	4.28E-04	2.34E-06	5.92E-03	5.92E-04	4.28E-04	2.34E-06	20	6.10	12.10	2.37	5.63	2.21	
ZY	551	CRZY2_1	ZY	527400.5	3479925.7	1672.39	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	552	CRZY2_2	ZY	527408.2	3479919.9	1672.43	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	553	CRZY2_3	ZY	527416	3479914.2	1672.33	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	554	CRZY2_4	ZY	527424.3	3479909.6	1672.09	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	555	CRZY2_5	ZY	527433.9	3479908.9	1672	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	556	CRZY2_6	ZY	527442	3479914.1	1671.93	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	557	CRZY2_7	ZY	527450.3	3479918.6	1671.75	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
ZY	558	CRZY2_8	ZY	527459.9	3479919.5	1671.57	5.31E-04	5.31E-05	4.07E-05	2.10E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	12	3.66	9.66	3.08	4.49	2.86	CRAREAZY
TP	559	TRTP_1	TP	526374.8	3480845.3	1530.49	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ3
TP	560	TRTP_2	TP	526364.7	3480833.2	1530.52	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ3
TP	561	TRTP_3	TP	526354.6	3480821.1	1530.44	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ3
TP	562	TRTP_4	TP	526344.4	3480809.1	1530.57	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ4
TP	563	TRTP_5	TP	526334.3	3480797	1529.99	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ4
TP	564	TRTP_6	TP	526324.2	3480785	1528.67	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ4
TP	565	TRTP_7	TP	526314.1	3480772.9	1529.41	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ4
TP	566	TRTP_8	TP	526300.3	3480766.2	1530.18	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ5
TP	567	TRTP_9	TP	526284.6	3480766.2	1530.61	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ5
TP	568	TRTP_10	TP	526271.2	3480774.1	1531.05	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	569	TRTP_11	TP	526258.1	3480782.8	1531.82	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	570	TRTP_12	TP	526245.3	3480792.1	1532.43	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	571	TRTP_13	TP	526232.5	3480801.3	1532.89	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	572	TRTP_14	TP	526219.8	3480810.5	1533.53	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	573	TRTP_15	TP	526207	3480819.7	1534.57	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	574	TRTP_16	TP	526192.5	3480825.4	1535.53	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ6
TP	575	TRTP_17	TP	526177	3480823.9	1536.33	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ7
TP	576	TRTP_18	TP	526162.5	3480818.5	1537.11	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ7
TP	577	TRTP_19	TP	526149.2	3480810.1	1537.66	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ7
TP	578	TRTP_20	TP	526134.4	3480807.3	1540.11	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ7
TP	579	TRTP_21	TP	526119.2	3480810.6	1542.51	1.92E-03	1.92E-04	1.35E-04	7.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	2.51	7.33	2.34	CRAREAZ7
DP	580	TRDP_1	DP	526117.1	3480795.9	1542.72	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ8
DP	581	TRDP_2	DP	526113.9	3480781.6	1541.79	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ8
DP	582	TRDP_3	DP	526102.5	3480770.9	1542.68	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ8
DP	583	TRDP_4	DP	526090.2	3480761	1543.95	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ8
DP	584	TRDP_5	DP	526077.9	3480751.1	1546.32	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ8
DP	585	TRDP_6	DP	526064.5	3480743.4	1549.84	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ9
DP	586	TRDP_7	DP	526049.3	3480739.2	1549.07	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ9
DP	587	TRDP_8	DP	526033.9	3480735.9	1547.76	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ9
DP	588	TRDP_9	DP	526021.2	3480727.4	1547.87	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ9
DP	589	TRDP_10	DP	526014.8	3480713.5	1548.3	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32	9.75	15.75	3.08	7.33	2.87	CRAREAZ9
DP	590	TRDP_11	DP	526012.2	3480698	1548.74	6.70E-04	6.70E-05	5.46E-05	2.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	32						

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LB	630	TRLB_8	LB	525717	3481901.1	1487.4	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	631	TRLB_9	LB	525725.9	3481893.1	1489.42	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	632	TRLB_10	LB	525733.1	3481883.3	1491.7	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	633	TRLB_11	LB	525740.3	3481873.6	1494.34	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	634	TRLB_12	LB	525747.4	3481863.8	1495.54	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	635	TRLB_13	LB	525754.4	3481854	1495.38	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	636	TRLB_14	LB	525758.2	3481842.5	1494.27	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
LB	637	TRLB_15	LB	525762	3481831	1494.72	5.39E-03	5.39E-04	4.12E-04	2.13E-06	5.39E-03	5.39E-04	4.12E-04	2.13E-06	20	6.10	12.10	2.11	5.63	1.96	
MT	638	TRMT_1	MT	526344.7	3481124.3	1559.34	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
MT	639	TRMT_2	MT	526361.7	3481124.1	1556.15	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
MT	640	TRMT_3	MT	526378.6	3481124	1553.1	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
MT	641	TRMT_4	MT	526394.3	3481129	1549.86	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
MT	642	TRMT_5	MT	526408	3481138	1546.23	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
MT	643	TRMT_6	MT	526410.2	3481154.8	1547.44	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
MT	644	TRMT_7	MT	526412.3	3481171.7	1549.91	8.57E-04	8.57E-05	6.73E-05	3.39E-07	8.57E-04	8.57E-05	6.73E-05	3.39E-07	20	6.10	12.10	3.07	5.63	2.85	
BAA	645	TRBAA_1	BAA	526222.8	3481039.2	1561.9	9.22E-03	9.22E-04	5.85E-04	3.65E-06	9.22E-03	9.22E-04	5.85E-04	3.65E-06	40	12.19	18.19	2.95	8.46	2.74	
BAA	646	TRBAA_2	BAA	526238.3	3481048.6	1562.14	9.22E-03	9.22E-04	5.85E-04	3.65E-06	9.22E-03	9.22E-04	5.85E-04	3.65E-06	40	12.19	18.19	2.95	8.46	2.74	
BAA	647	TRBAA_3	BAA	526254.1	3481057.8	1562.18	9.22E-03	9.22E-04	5.85E-04	3.65E-06	9.22E-03	9.22E-04	5.85E-04	3.65E-06	40	12.19	18.19	2.95	8.46	2.74	
BAA	648	TRBAA_4	BAA	526270.1	3481066.4	1562.14	9.22E-03	9.22E-04	5.85E-04	3.65E-06	9.22E-03	9.22E-04	5.85E-04	3.65E-06	40	12.19	18.19	2.95	8.46	2.74	
BAA	649	TRBAA_5	BAA	526286.1	3481075	1562.11	9.22E-03	9.22E-04	5.85E-04	3.65E-06	9.22E-03	9.22E-04	5.85E-04	3.65E-06	40	12.19	18.19	2.95	8.46	2.74	
BAA	650	TRBAA_6	BAA	526302.2	3481083.6	1562.18	9.22E-03	9.22E-04	5.85E-04	3.65E-06	9.22E-03	9.22E-04	5.85E-04	3.65E-06	40	12.19	18.19	2.95	8.46	2.74	
DE	651	TRDE_1	DE	526079.8	3481040.4	1575.23	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
DE	652	TRDE_2	DE	526087.2	3481027.3	1577.07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
DE	653	TRDE_3	DE	526094.7	3481014.1	1577.31	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
DE	654	TRDE_4	DE	526042.1	3481001	1577.75	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
DE	655	TRDE_5	DE	526029.5	3480987.8	1575.25	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
DE	656	TRDE_6	DE	526016.8	3480977.2	1573.14	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
DE	657	TRDE_7	DE	526003.1	3480989.1	1575.28	1.42E-03	1.42E-04	1.15E-04	5.63E-07	1.42E-03	1.42E-04	1.15E-04	5.63E-07	40	12.19	18.19	2.93	8.46	2.73	
AAAB	658	TRAAB_1	AAAB	526321.2	3481081.2	1562.29	6.74E-03	6.74E-04	4.17E-04	2.66E-06	6.74E-03	6.74E-04	4.17E-04	2.66E-06	40	12.19	18.19	3.29	8.46	3.06	
AAM	659	TRAAM_1	AAM	526322.2	3481096.6	1562.16	7.29E-03	7.29E-04	5.10E-04	2.88E-06	7.29E-03	7.29E-04	5.10E-04	2.88E-06	40	12.19	18.19	2.39	8.46	2.22	
AAM	660	TRAAM_2	AAM	526332.1	3481110.9	1562.06	7.29E-03	7.29E-04	5.10E-04	2.88E-06	7.29E-03	7.29E-04	5.10E-04	2.88E-06	40	12.19	18.19	2.39	8.46	2.22	
MN	661	TRMN_1	MN	526336.7	3481134.4	1560.43	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	662	TRMN_2	MN	526337.8	3481152.5	1560.93	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	663	TRMN_3	MN	526338.8	3481170.7	1561.75	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	664	TRMN_4	MN	526339.9	3481188.9	1562.87	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	665	TRMN_5	MN	526340.9	3481207	1565.39	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	666	TRMN_6	MN	526340.3	3481225.1	1567.6	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	667	TRMN_7	MN	526330.4	3481240.3	1568.3	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	668	TRMN_8	MN	526320.3	3481255.4	1568.88	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	669	TRMN_9	MN	526310.1	3481270.5	1572.41	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	670	TRMN_10	MN	526300.9	3481285.6	1574.19	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	671	TRMN_11	MN	526289.9	3481300.8	1574.95	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	672	TRMN_12	MN	526279.8	3481315.9	1574.67	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	673	TRMN_13	MN	526269.6	3481331	1574.71	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	674	TRMN_14	MN	526259.5	3481346.1	1574.94	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	675	TRMN_15	MN	526249.4	3481361.2	1575.17	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	676	TRMN_16	MN	526239.3	3481376.3	1575.05	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	677	TRMN_17	MN	526229.1	3481391.4	1575.42	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	678	TRMN_18	MN	526219	3481406.5	1575.51	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	679	TRMN_19	MN	526208.9	3481421.7	1575.23	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	680	TRMN_20	MN	526205.4	3481438.8	1573.75	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	681	TRMN_21	MN	526205.2	3481457	1574.83	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	682	TRMN_22	MN	526212	3481473.2	1573.31	1.09E-02	1.09E-03	6.81E-04	4.3											

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MN	719	TRMN_59	MN	526458.3	3481857	1581.09	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	720	TRMN_60	MN	526449.6	3481872.9	1581.38	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	721	TRMN_61	MN	526440.8	3481888.9	1580.58	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	722	TRMN_62	MN	526432.1	3481904.8	1578.63	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	723	TRMN_63	MN	526423.3	3481920.7	1575.93	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	724	TRMN_64	MN	526414.5	3481936.7	1573.15	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	725	TRMN_65	MN	526405.8	3481952.6	1572.03	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	726	TRMN_66	MN	526397	3481968.6	1571.35	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	727	TRMN_67	MN	526388	3481984.3	1570.72	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	728	TRMN_68	MN	526373.7	3481995.5	1569.78	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	729	TRMN_69	MN	526359.4	3482006.7	1570.28	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	730	TRMN_70	MN	526345.1	3482018	1573.28	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	731	TRMN_71	MN	526330.8	3482029.2	1574.91	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	732	TRMN_72	MN	526316.5	3482040.5	1577.36	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	733	TRMN_73	MN	526307.4	3482055.1	1579.05	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	734	TRMN_74	MN	526304.3	3482072.7	1577.99	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	735	TRMN_75	MN	526310.2	3482089.9	1576.9	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	736	TRMN_76	MN	526323.5	3482101.5	1576.76	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	737	TRMN_77	MN	526338.5	3482111.7	1572.93	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	738	TRMN_78	MN	526355.6	3482113.8	1568.27	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	739	TRMN_79	MN	526366.5	3482099.2	1571.65	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	740	TRMN_80	MN	526377.4	3482084.7	1576.98	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	741	TRMN_81	MN	526388.2	3482070.1	1577.47	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	742	TRMN_82	MN	526399.1	3482055.5	1574.74	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	743	TRMN_83	MN	526410	3482041	1573.6	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	744	TRMN_84	MN	526420.9	3482026.4	1569.05	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	745	TRMN_85	MN	526431.8	3482011.8	1569.16	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	746	TRMN_86	MN	526442.7	3481997.2	1569.84	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	747	TRMN_87	MN	526453.6	3481982.7	1571.16	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	748	TRMN_88	MN	526464.5	3481968.1	1571.15	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	749	TRMN_89	MN	526475.4	3481953.5	1572.56	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	750	TRMN_90	MN	526486.3	3481939	1574.06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	751	TRMN_91	MN	526497.1	3481924.4	1575.61	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	752	TRMN_92	MN	526508	3481909.8	1577.49	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	753	TRMN_93	MN	526518.9	3481895.3	1578.21	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	754	TRMN_94	MN	526529.8	3481880.7	1577.75	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	755	TRMN_95	MN	526537.5	3481864.4	1577.6	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	756	TRMN_96	MN	526544	3481847.4	1576.98	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	757	TRMN_97	MN	526550.5	3481830.4	1577.35	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	758	TRMN_98	MN	526556.9	3481813.4	1579.53	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	759	TRMN_99	MN	526563.4	3481796.4	1580.83	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	760	TRMN_100	MN	526575	3481782.6	1581.36	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	761	TRMN_101	MN	526587.6	3481769.1	1580.91	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	762	TRMN_102	MN	526602	3481760.4	1578.65	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	763	TRMN_103	MN	526620.2	3481759.7	1575.24	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	764	TRMN_104	MN	526638.4	3481758.9	1571.92	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	765	TRMN_105	MN	526655.9	3481763.7	1568.36	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	766	TRMN_106	MN	526673.3	3481768.8	1565.17	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	767	TRMN_107	MN	526690.8	3481773.8	1564.12	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	768	TRMN_108	MN	526708.3	3481778.9	1565.13	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	769	TRMN_109	MN	526725.8	3481784	1567.33	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	770	TRMN_110	MN	526743.2	3481789.1	1569.24	1.09E-02	1.09E-03	6.81E-04	4.30E-06	1.09E-02	1.09E-03	6.81E-04	4.30E-06	40	12.19	18.19	2.92	8.46	2.72	
MN	771	TRMN_111	MN	526758.8	348179																

Table A-7. South32 Hermosa Rectangular Buildings

ID	Description	X Coordinate	Y- Coordinate	Elevation	Height	X Length	Y Length	Angle
CPBLDG	Clark Paste Plant Building	527323.5	3480498	1606.06	15.00	32.90	14.30	71.5
CONTBLD1	Contractor building - existing	525680	3480983.1	1592.58	6.10	12.30	7.60	88.7
CONTBLD2	Contractor building - existing	525687.5	3480986.1	1592.58	6.10	17.90	18.60	88.3
CONTBLD3	Contractor building - existing	525706.3	3480984.4	1592.58	6.10	12.50	7.80	88.8
GENBLG1	Genset Enclosure	525838.2	3480928.1	1581.9	4.11	16.15	2.59	110
GENBLG2	Genset Enclosure	525843.9	3480926.2	1581.9	4.11	16.15	2.59	110
GENBLG3	Genset Enclosure	525849.6	3480924.3	1581.9	4.11	16.15	2.59	110
GENBLG4	Genset Enclosure	525855.3	3480922.4	1581.9	4.11	16.15	2.59	110
GENBLG5	Genset Enclosure	525861	3480920.5	1581.9	4.11	16.15	2.59	110
GENBLG6	Genset Enclosure	525866.7	3480918.6	1581.9	4.11	16.15	2.59	110
GENBLG7	Genset Enclosure	525872.4	3480916.7	1581.9	4.11	16.15	2.59	110
GENBLG8	Genset Enclosure	525837.2	3480883.1	1581.9	4.11	16.15	2.59	110
GENBLG9	Genset Enclosure	525842.9	3480881.2	1581.9	4.11	16.15	2.59	110
GENBLG10	Genset Enclosure	525848.6	3480879.3	1581.9	4.11	16.15	2.59	110
GENBLG11	Genset Enclosure	525854.2	3480877.3	1581.9	4.11	16.15	2.59	110
GENBLG12	Genset Enclosure	525859.9	3480875.4	1581.9	4.11	16.15	2.59	110
GENBLG13	Genset Enclosure	525865.6	3480873.5	1581.9	4.11	16.15	2.59	110
GENBLG14	Genset Enclosure	525871.3	3480871.6	1581.9	4.11	16.15	2.59	110
GENBLG15	Genset Enclosure	525848.6	3480992.8	1581.9	4.11	16.15	2.59	110
GENBLG16	Genset Enclosure	525853.9	3480990.4	1581.9	4.11	16.15	2.59	110
GENBLG17	Genset Enclosure	525858.9	3480989.3	1581.9	4.11	16.15	2.59	110
GENBLG18	Genset Enclosure	525864.1	3480987.4	1581.9	4.11	16.15	2.59	110
GENBLG19	Genset Enclosure	525869.7	3480985.1	1581.9	4.11	16.15	2.59	110
GENBLG20	Genset Enclosure	525875.4	3480983.3	1581.9	4.11	16.15	2.59	110
GENBLG21	Genset Enclosure	525880.9	3480980.9	1581.9	4.11	16.15	2.59	110
GENBLG22	Genset Enclosure	525886.2	3480979.1	1581.9	4.11	16.15	2.59	110
GENBLG23	Genset Enclosure	525892.6	3480976.8	1581.9	4.11	16.15	2.59	110
GENBLG24	Genset Enclosure	525897.3	3480974.9	1581.9	4.11	16.15	2.59	110
GENBLG25	Genset Enclosure	525902.5	3480972.2	1581.9	4.11	16.15	2.59	110
GENBLG26	Genset Enclosure	525908	3480969.9	1581.9	4.11	16.15	2.59	110
GENBLG27	Genset Enclosure	525913	3480968.6	1581.9	4.11	16.15	2.59	110
GENBLG28	Genset Enclosure	525918.1	3480966.5	1581.9	4.11	16.15	2.59	115
GENBLG29	Genset Enclosure	525923.5	3480964.4	1581.9	4.11	16.15	2.59	120
GENBLG30	Genset Enclosure	525834	3480997.7	1581.9	4.11	16.15	2.59	110
GENBLG31	Genset Enclosure	525838.5	3480996.1	1581.9	4.11	16.15	2.59	110
GENBLG32	Genset Enclosure	525843.4	3480994.4	1581.9	4.11	16.15	2.59	110
GENBLG33	Genset Enclosure	525949.6	3480937	1581.9	4.11	16.15	2.59	140
GENBLG34	Genset Enclosure	525953	3480933.8	1581.9	4.11	16.15	2.59	140
GENBLG35	Genset Enclosure	525956.7	3480930	1581.9	4.11	16.15	2.59	140
GENBLG36	Genset Enclosure	525960.1	3480926.6	1581.9	4.11	16.15	2.59	140
GENBLG37	Genset Enclosure	525963	3480922.9	1581.9	4.11	16.15	2.59	140
GENBLG38	Genset Enclosure	525965.9	3480918.9	1581.9	4.11	16.15	2.59	140
GENBLG39	Genset Enclosure	525970.2	3480914.3	1581.9	4.11	16.15	2.59	140
GENBLG40	Genset Enclosure	525975.2	3480910.4	1581.9	4.11	16.15	2.59	140
WTP2	WTP2 Building	526400.6	3481269.7	1559.1	16.76	68.50	31.10	107.5
WTP1	WTP #1	525758.5	3481941	1502.85	7.62	37.10	17.50	60.9
UTCGBLDG		526354.8	3480748.2	1538.55	15.00	25.60	9.20	122.5
UGFRPLNT	Underground Refridgeration Plant	526339.5	3480728.5	1538.68	15.00	25.90	10.70	-57.3
PRIMERM	Secondary Mill E-Room	525743.9	3480824.8	1603.248	6.00	6.40	12.00	116.6
CVMS	Clark Vehicle Maintenance Shop	526773.7	3480813	1543.89	15.00	60.75	27.10	40
CADMIN	Clark Admin	527281.3	3480555.7	1582.77	6.00	14.50	20.00	91.3
HS1_GEN	Gen Enclosure	527304.7	3480571.3	1581.41	2.90	2.44	12.19	8.9
HS2_GEN	Gen Enclosure	527308.9	3480570.6	1581.78	2.90	2.44	12.19	8.9
HS3_GEN	Gen Enclosure	527312.9	3480569.8	1582.15	2.90	2.44	12.19	8.9
HS4_GEN	Gen Enclosure	527316.8	3480568.9	1583.13	2.90	2.44	12.19	8.9
HS5_GEN	Gen Enclosure	527321.1	3480568	1584.21	2.90	2.44	12.19	8.9
HS6_GEN	Gen Enclosure	527325.5	3480567.3	1585.36	2.90	2.44	12.19	8.9
COS2	Coarse Ore Silo 2	525848.2	3480799.4	1602.334	23.01	16.60	16.30	112.1
COS1	Coarse Ore Silo 1	525834.5	3480768.3	1602.334	23.01	16.70	17.60	25.7
COS4	Coarse Ore Silo 4	525866.4	3480791.5	1602.334	23.01	17.30	15.60	113.4
COS3	Coarse Ore Silo 3	525859.6	3480775.3	1602.334	23.01	16.90	15.30	113.9
TT1	Transfer Tower	525789.8	3480957.5	1581.91	16.76	7.00	11.10	82.4
COLHOU	Collar House	525953.9	3481001.3	1572.768	13.11	16.10	14.10	90
MNTWR	Main Shaft Tower	525968.9	3481002.7	1572.768	79.25	23.20	16.10	89.1
BINHOU	Bin House	525968.8	3480979	1572.768	24.69	5.30	16.40	90
STGBLDG1	Storage Building (Fmr. Sinking Hoist BLDG)	525960.2	3481074.9	1572.768	14.02	25.40	33.10	90.2
STGBLDG2	Storage Building 2	525966.6	3481049.3	1572.768	14.02	13.30	20.30	89.6
STGBLDG3	Storage Building 3	526108.5	3480950.4	1572.768	10.06	13.50	20.60	45
COLHOU2	Collar House 2	526101.3	3480983.7	1572.768	10.36	11.60	9.60	45

VENTBLDG	Ventilation Shaft and Sinking Headframe	526090.4	3480972.3	1572.768	49.99	10.60	15.50	45
PASTBLDG	Paste Plant Building	526433.5	3481072	1554.48	18.75	40.80	15.80	75.1
HAZMATB	Hazardous Materials Storage Building	526387	3480956.6	1545.77	0.61	6.10	11.90	82.2
ADMOFF	Admin Office and Control Center	525746.1	3481030	1592.58	3.66	31.50	17.80	108.4
GRNERM	Grinding E-room and Transformers Annex	525710.1	3480846.6	1603.248	6.40	4.60	18.30	115.3
PPERM	Paste Plant E-Room	526411.4	3481066.5	1554.48	6.40	4.50	20.50	74.1
CONCERM	Concentrate Loadout E Room	525758.8	3480761.1	1603.248	6.40	4.40	24.50	-65.9
FLOERM	Flotation Regrind Electrical Room	525585.9	3480769.7	1603.248	6.71	7.90	36.50	115.4
COAERM	Coarse Ore Handling E Room	525799.2	3480805.8	1603.248	6.40	4.40	17.20	116.6
HVRPR	Light Vehicle Repair Shop	526255.6	3480899.1	1550.09	7.92	17.10	23.20	90
WHOUSE	Warehouse	525719.1	3481075.5	1592.58	9.14	24.70	15.40	-138.1
TTRKLS	Tailings Truck Loading Station	526289.2	3481006.6	1562.1	25.91	4.80	4.10	74.4
SOLBLDG	Solids Removal Building	526034.2	3481053.1	1572.768	9.14	18.30	4.90	132.3
LOGBLDG	Logging Building	525576.5	3482185.7	1493.45	9.14	30.20	16.20	66.8
SAWRM	Saw Room	525563.2	3482222.4	1492.00	3.66	8.60	17.50	60.3
DEWATER	Dewatering Building	525728.6	3480730.5	1603.248	26.82	44.00	15.00	116.1
AIRRM	Air Building	525728.9	3480789.7	1603.248	3.05	13.00	10.30	113.2
FLTBLDG	Flotation Building	525646.3	3480793.8	1603.248	28.04	55.00	29.90	115.6
TFPLNT	Tailings Filtration plant	526283.7	3481058.1	1562.12	25.30	43.40	40.50	75.3
TERM	Tailings E-Room	526248.7	3481036.3	1562.05	6.40	7.20	30.30	75.3
SHOPWH	Shop warehouse, 11412	526008.9	3480908.7	1559.69	7.62	12.30	12.00	118.6
CTBLDG	Cooling Tower Structure	526069	3480974.1	1572.768	9.45	7.70	29.80	136.5
ERMBLDG	VFD E-House	526056	3480998.8	1572.768	6.40	14.10	13.20	133.9
AUXBLDG	Auxillary Refridge. plant building	526045.6	3480983	1572.768	6.40	32.00	7.30	134.5
EXHOUT	Exhaust Outlet to exhaust fans	526088.5	3480990.4	1572.768	6.40	7.50	13.80	135
GTHOUS	Gate House Building	526625.5	3481156.4	1513.26	3.66	18.10	9.10	-54.7
VW1	Vehicle Downwash Bay 1	526312.4	3480949.1	1549.908	9.14	8.70	16.90	-179.1
VW2	Vehicle Downwash Bay 2	526300.6	3480949.1	1549.908	9.14	10.30	2.90	91.2
VW3	Vehicle Downwash Bay 3	526300.7	3480949	1549.908	9.14	1.70	3.10	180
VW4	Vehicle Downwash Bay 4	526299	3480948.9	1549.908	9.14	1.60	3.00	-180
SECERM	Secondary Mill EROOM	525688.9	3480855.1	1603.248	6.00	5.10	12.10	114.9

Table A-8. South32 Hermosa Circular Buildings

ID	Description	X-Coordinate	Y-Coordinate	Elevation	Height	Radius	Corners
CPPTNK4	Paste Bldg Tank	527330.8	3480468.9	1616.44	7.92	2.18	24
CPPSILO2	Binder Silo 2	527339.6	3480461.9	1619.69	19.50	2.47	24
CPPSILO1	Binder Silo 1	527346.2	3480463.9	1620.89	19.50	2.56	24
CPPTNK2	Paste Plant Tank 4	527322.1	3480494.6	1607.98	11.00	2.18	24
CPBTNK1	Paste Bldg Tank	527325.1	3480505.2	1604.29	12.00	2.44	24
CPBTNK2	Paste Bldg Tank	527331.6	3480507.7	1604.57	12.00	2.47	24
PRCTK1	Process Water Tank	525612.8	3480786.9	1603.25	15.85	4.64	24
PRCTK2	Process Water Tank 2	525623.3	3480781.8	1603.25	15.85	4.90	24
GLNTK	Gland Seal Water Tank	525590.1	3480795.8	1603.25	7.32	2.35	24
PORTTK	Portable Water Tank	525583.7	3480797.7	1603.25	7.32	2.33	24
FRTK	Fresh/Fire Water Tank	525601.7	3480790.9	1603.25	13.11	5.69	24
LEADCT	Lead Concentrate Thickener	525688.2	3480755	1603.25	7.32	8.39	24
ZINCCCT	Zinc Concentrate Thickener	525713	3480742.7	1603.25	7.32	8.44	24
ZINCCTK	Zinc Concentrator Tank	525737.2	3480742.1	1603.25	15.70	7.75	24
LEADCTK	Lead Concentrator Tank	525752.2	3480734.8	1603.25	17.37	7.55	24
ZINCCDTK	Zinc Conditioning Tank	525674.5	3480763.7	1603.25	9.75	3.59	24
TSILO1	Tailings Silo 1	526299.6	3481008	1562.10	22.22	4.97	24
TSILO2	Tailings Silo 2	526311.3	3481011.1	1562.10	22.22	4.80	24
TSILO3	Tailings Silo 3	526323.1	3481013.9	1562.10	22.22	4.86	24
TSILO4	Tailings Silo 4	526335.1	3481017.1	1562.10	22.22	4.70	24
BNSILO1	Binder Silo 1	526456.2	3481063.5	1554.48	22.86	3.27	24
BNSILO2	Bin Silo 2	526458.6	3481055.2	1554.48	22.86	3.50	24
TTTNK	Tailings Thickener Tank	526356.8	3481083.6	1562.10	12.00	13.36	24
TSTNK	Tailings Stock Tank	526347.8	3481064.2	1562.10	17.37	6.82	24
BPSILO1	Batch Plant Silo 1	526439.9	3481112.5	1553.57	10.70	1.95	24
BPSILO2	Batch Plant Silo 2	526444.5	3481114.2	1553.57	10.70	1.80	24
BPSILO3	Batch Plant Silo 3	526447.8	3481118.3	1553.57	10.70	2.03	24
SRGTNK	Surge Tank	526376.5	3481153.5	1556.21	7.35	4.79	24
OVTNK	Tailings thickener overflow tank	526373.2	3481087.9	1562.10	8.53	1.72	24
TAILTNK1	Tailings flocculant auxillary tank	526380.8	3481064.1	1562.10	5.79	1.81	24
NTTNK	New tailings tank	526384.3	3481088.9	1562.10	13.11	5.36	24
UTLTNK	Utility connection tank	526054.4	3481040	1572.77	6.71	2.43	24
SLDRE1	Solids removal tank 1	526037.5	3481042.9	1572.77	3.96	2.49	24
SOLRE2	Solids removal tank 2	526037.1	3481033.7	1572.77	3.96	2.34	24
SOLRE3	Solids removal tank 3	526041.1	3481037.2	1572.77	3.96	2.48	24
SOLRE4	Solids removal tank 4	526044.4	3481040.9	1572.77	3.96	1.79	24
AUXTHCK	Auxillary thickener tank	525700.3	3480748.6	1603.25	5.94	1.50	24
AUXTHCK2	Auxillary Thickener tank 2	525712.3	3480756.8	1603.25	5.79	1.70	24
REAGTNK1	Reagents storage tank 1	525641.5	3480807.1	1603.25	5.03	1.67	24
REAGTNK2	Reagents storage tank 2	525637.6	3480808.7	1603.25	5.33	1.06	24
REAGTNK3	Reagents storage tank 3	525633.4	3480810.7	1603.25	5.33	1.57	24
REAGTNK4	Reagents storage tank 4	525629.1	3480812.6	1603.25	5.33	1.71	24
REAGTNK5	Reagents storage tank 5	525625.6	3480814.6	1603.25	4.72	1.49	24
REAGTNK6	Reagents storage tank 6	525620	3480816.9	1603.25	4.72	1.50	24
REAGTNK7	Reagents storage tank 7	525622.3	3480823.6	1603.25	4.72	1.72	24
REAGTNK9	Reagents storage tank 9	525630.2	3480819.7	1603.25	7.32	1.73	24
REGTNK10	Reagents Storage Tank 10	525635.8	3480817.2	1603.25	7.32	1.48	24
REGTNK11	Reagents Storage Tank 11	525640.9	3480816.2	1603.25	4.72	1.06	24
REGTNK12	Reagents Storage Tank 11	525639.8	3480813.3	1603.25	7.32	0.97	24
REGTNK13	Reagents Storage Tank 13	525644.4	3480811.3	1603.25	5.79	1.22	24
REAGTNK8	Reagents storage tank 8	525626.3	3480821.5	1603.25	4.72	1.22	24
BNSILO3	Binder Silo 3	526460.3	3481048.6	1554.48	14.33	2.38	24
BNSILO4	Binder Silo 4	526462.1	3481042.4	1554.48	14.33	2.32	24

Table A-9. South32 Hermosa Multi-sided Buildings

ID	Description	X-Coordinate	Y-Coordinate	Elevation	Height
WTP2CT	WTP2 CT Building	526390.4	3481276.6	1565.57	6.26
OFFHOU	Office House & Change House	526019.3	3480993.7	1572.768	8.5344
PWRHOU	Power House	525954.1	3481001.7	1572.768	13.1064
AUXHOS	AUX Hoist and Storage	526138.1	3480961	1572.768	14.6304
EXFAN	Exhaust Fans 16611	526083.1	3480985.2	1572.768	15.24
EMRC	Emergency Response Center	525719.9	3481071.6	1592.58	4.572
RFGPLNT	Refridgeration Plant Building	526050.3	3480964.4	1572.768	9.7536
CNPLNT	Cyanide Treatment Plant	526452	3481147.2	1539.39	12.8016

APPENDIX B. PARTICLE SIZE DISTRIBUTION

**Mine Development
Particle Size Distribution**

Table B-1a. South32 Hermosa Particle Sizes

Particle Size (µm)		Mean Particle Diameter (µm)
Lower	Upper	
0	3.5	2.20
3.5	5	4.29
5	7	6.06
7	8.5	7.77
8.5	10	9.27

Taken From Rosemont Copper Project, AERMOD Modeling
Analysis. Appendix A. December 2012

Table B-1b. South32 Hermosa Densities

Density of Ore Rock		Density of Tailings	
(t/m ³)	(g/cm ³)	(t/m ³)	(g/cm ³)
3.01	3.01	2.82	2.82

Note: Particle Density based on PFD received from South32 on 5/22/2022

Table B-1c. South32 Taylor Drilling Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	6.57E-03	<2.5	2.20	0.47321409	1.00	1
10	6.57E-03	10-2.5	9.27	-2.41E-04	0.00	N/A
30	1.39E-02	30-10	--	5.27E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
1.33E-05	-1.67E-04	6.91E-03

lb/hr	Mean Particle Size	% of Emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.01	2.20	48%	102%	102%
0.01	4.29	46%	99%	-3%
0.01	6.06	46%	98%	-1%
0.01	7.77	46%	99%	0%
0.01	9.27	47%	100%	1%

Table B-1d. South32 Taylor Blasting Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	2.96E-01	<2.5	2.20	1.98E-01	0.38	1
10	7.77E-01	10-2.5	9.27	0.3217858	0.62	N/A
30	1.49E+00	30-10	--	4.80E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
-1.03E-03	7.70E-02	1.10E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.27	2.20	18%	37%	37%
0.42	4.29	28%	57%	20%
0.54	6.06	36%	73%	16%
0.65	7.77	43%	88%	15%
0.74	9.27	49%	100%	12%

Table B-1e. South32 Taylor Underground Crushing Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.27E-01	<2.5	2.20	5.51E-01	1.22	1
10	1.04E-01	10-2.5	9.27	-1.01E-01	N/A	N/A
30	2.32E-01	30-10	--	5.50E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
3.44E-04	-7.41E-03	1.44E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.13	2.20	56%	123%	123%
0.12	4.29	51%	113%	-10%
0.11	6.06	48%	107%	-6%
0.11	7.77	46%	102%	-4%
0.10	9.27	45%	100%	-2%

Table B-1f. South32 Taylor Underground Drop Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	2.95E-02	<2.5	2.20	0.47321409	1.00050978	1
10	2.95E-02	10-2.5	9.27	-2.41E-04	-0.0005098	N/A
30	6.23E-02	30-10	--	5.27E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	y
5.98E-05	-7.49E-04	3.10E-02

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.0296	2.20	48%	102%	102%
0.0289	4.29	46%	99%	-3%
0.0286	6.06	46%	98%	-1%
0.0288	7.77	46%	99%	0%
0.0292	9.27	47%	100%	1%

* Included the sum of DP-22 to DP-33 to account for the weight of underground drop emissions in the total vent particle size distribution.

**Mine Development
Particle Size Distribution**

Table B-1g. South32 Taylor Underground Unpaved Roads Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	5.47E-01	<2.5	2.20	2.58E-02	0.1	1
10	5.47E+00	10-2.5	9.27	2.32E-01	0.9	N/A
30	2.12E+01	30-10	--	7.42E-01	N/A	N/A

* The particle size multiplier for all Taylor underground roads is the same, total emissions were used in the table above to represent the weight of road sources in the total vent particle size distribution.

Linear Regression (2nd degree)		
a	b	c
4.73E-03	5.97E-01	-9.75E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.36	2.20	2%	7%	7%
1.67	4.29	8%	34%	26%
2.81	6.06	13%	57%	23%
3.95	7.77	19%	80%	23%
4.96	9.27	23%	100%	20%

Table B-1h. South32 Taylor Underground Emissions - ALL

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.01E+00	<2.5	2.20	4.38E-02	0.15764822	1
10	6.38E+00	10-2.5	9.27	2.34E-01	0.84235178	N/A
30	2.30E+01	30-10	--	7.22E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
4.12E-03	6.65E-01	-6.83E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.8042	2.20	3%	14%	14%
2.2501	4.29	10%	39%	25%
3.4973	6.06	15%	60%	21%
4.7393	7.77	21%	81%	21%
5.8400	9.27	25%	100%	19%

Table B-1i. South32 Clark Drilling Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.30E-03	<2.5	2.20	0.29675161	0.63	1
10	2.08E-03	10-2.5	9.27	1.76E-01	0.37	N/A
30	4.39E-03	30-10	--	5.27E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
4.56E-07	9.75E-05	1.06E-03

lb/hr	Mean Particle Size	% of Emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.0013	2.20	29%	64%	64%
0.0015	4.29	34%	74%	10%
0.0017	6.06	38%	83%	9%
0.0018	7.77	42%	92%	9%
0.0020	9.27	46%	100%	8%

Table B-1j. South32 Clark Blasting Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.05E-01	<2.5	2.20	0.12429973	0.23903794	1
10	4.37E-01	10-2.5	9.27	3.96E-01	0.76096206	N/A
30	8.41E-01	30-10	--	4.80E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
-8.79E-04	5.54E-02	-2.84E-02

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.09	2.20	11%	22%	22%
0.19	4.29	23%	47%	25%
0.27	6.06	33%	67%	20%
0.35	7.77	41%	85%	18%
0.41	9.27	49%	100%	15%

Table B-1k. South32 Clark Underground Drop Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	2.20E-03	<2.5	2.20	0.29675161	0.62741768	1
10	3.51E-03	10-2.5	9.27	1.76E-01	0.37258232	N/A
30	7.43E-03	30-10	--	5.27E-01	N/A	N/A

* Included the sum of DP-124 to DP-137 to account for the weight of underground drop emissions in the total vent particle size distribution.

Linear Regression (2nd degree)		
a	b	c
7.71E-07	1.65E-04	1.79E-03

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.0022	2.20	29%	64%	64%
0.0025	4.29	34%	74%	10%
0.0028	6.06	38%	83%	9%
0.0031	7.77	42%	92%	9%
0.0034	9.27	46%	100%	8%

Table B-1l. South32 Clark Underground Unpaved Roads Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	5.77E-01	<2.5	2.20	2.58E-02	0.1	1
10	5.77E+00	10-2.5	9.27	2.32E-01	0.9	N/A
30	2.24E+01	30-10	--	7.42E-01	N/A	N/A

* The particle size multiplier for all Clark underground roads is the same, total emissions were used in the table above to represent the weight of road sources in the total vent particle size distribution.

Linear Regression (2nd degree)		
a	b	c
5.00E-03	6.30E-01	-1.03E+00

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.38	2.20	2%	7%	7%
1.77	4.29	8%	34%	26%
2.97	6.06	13%	57%	23%
4.17	7.77	19%	80%	23%
5.24	9.27	23%	100%	20%

**Mine Development
Particle Size Distribution**

Table B-1m. South32 Clark Underground Emissions - ALL

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	6.85E-01	<2.5	2.20	2.95E-02	0.11025133	1
10	6.22E+00	10-2.5	9.27	2.38E-01	0.88974867	N/A
30	2.32E+01	30-10	--	7.32E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
4.12E-03	6.86E-01	-1.06E+00

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.4773	2.20	2%	8%	8%
1.9663	4.29	8%	35%	26%
3.2499	6.06	14%	57%	23%
4.5273	7.77	19%	80%	23%
5.6589	9.27	24%	100%	20%

Table B-1n. South32 Clark Rock Breaker Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.46E-04	<2.5	2.20	7.16E-02	0.15	1
10	9.64E-04	10-2.5	9.27	4.01E-01	N/A	N/A
30	2.04E-03	30-10	--	5.27E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
-2.01E-06	1.34E-04	-1.77E-04

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.0001	2.20	5%	12%	12%
0.0004	4.29	18%	41%	28%
0.0006	6.06	28%	63%	22%
0.0007	7.77	37%	83%	20%
0.0009	9.27	44%	100%	17%

Table B-1o. South32 Hermosa Dust Collectors Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	5.57E-02	<2.5	2.20	1	1	1
10	5.57E-02	10-2.5	9.27	0.00E+00	0	N/A
30	5.57E-02	30-10	--	0.00E+00	N/A	N/A

* The particle size multiplier for all the dust collectors is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
0.00E+00	0.00E+00	5.57E-02

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.06	2.20	100%	100%	100%
0.06	4.29	100%	100%	0%
0.06	6.06	100%	100%	0%
0.06	7.77	100%	100%	0%
0.06	9.27	100%	100%	0%

Table B-1p. South32 Hermosa Wind Erosion Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	6.93E-01	<2.5	2.20	0.075	0.15	1
10	4.62E+00	10-2.5	9.27	4.25E-01	0.85	N/A
30	9.24E+00	30-10	--	5.00E-01	N/A	N/A

* The particle size multiplier for wind erosion across all stockpiles is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
-1.06E-02	6.57E-01	-8.82E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.51	2.20	6%	12%	12%
1.74	4.29	19%	41%	29%
2.70	6.06	29%	63%	22%
3.58	7.77	39%	83%	20%
4.29	9.27	46%	100%	17%

Table B-1q. South32 Hermosa Generator Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	5.43	<2.5	2.20	1.00	1.00	1
10	5.43	10-2.5	9.27	0.00	0.00	N/A
30	5.43	30-10	--	0.00	N/A	N/A

* PM10 = PM2.5 emissions, thus all PM10 emissions are conservatively assumed to be PM2.5.

** The particle size multiplier for all natural gas generators is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
0.00E+00	0.00E+00	5.43E+00

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
5.43	2.20	100%	100%	100%
5.43	4.29	100%	100%	0%
5.43	6.06	100%	100%	0%
5.43	7.77	100%	100%	0%
5.43	9.27	100%	100%	0%

**Mine Development
Particle Size Distribution**

Table B-1r. South32 Hermosa WTP2 Cooling Towers Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	9.29E-05	<2.5	2.20	0.02	0.02	1
10	4.66E-03	10-2.5	9.27	0.90	0.98	N/A
30	5.07E-03	30-10	--	0.08	N/A	N/A

Linear Regression (1st degree)		
a	b	c
6.09E-04	-1.43E-03	

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
-0.0001	2.20	-2%	-2%	-2%
0.0012	4.29	23%	28%	30%
0.0023	6.06	45%	54%	25%
0.0033	7.77	65%	78%	25%
0.0042	9.27	83%	100%	22%

Table B-1s. South32 Hermosa CBP Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	7.33E-02	<2.5	2.20	0.40640681	1	1
10	7.33E-02	10-2.5	9.27	0.00E+00	0	N/A
30	1.80E-01	30-10	--	5.94E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
1.95E-04	-2.43E-03	7.82E-02

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.07	2.20	41%	102%	102%
0.07	4.29	40%	99%	-3%
0.07	6.06	39%	98%	-1%
0.07	7.77	39%	98%	1%
0.07	9.27	40%	100%	2%

* PM10 = PM2.5 emissions, thus all PM10 emissions are conservatively assumed to be PM2.5.

** The particle size multiplier for all concrete batch plant activities is the same, therefore one emission source is used in the table above as a representative sample.

*PM10 = PM2.5 emissions, thus all PM10 emissions are conservatively assumed to be PM2.5.

Table B-1t. South32 Hermosa Refrigeration Cooling Tower Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	2.14E-03	<2.5	2.20	0.18141169	0.34868017	1
10	6.13E-03	10-2.5	9.27	3.39E-01	0.65131983	N/A
30	1.18E-02	30-10	--	4.80E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
-9.08E-06	6.46E-04	5.80E-04

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.00	2.20	17%	34%	34%
0.00	4.29	27%	55%	21%
0.00	6.06	35%	72%	17%
0.01	7.77	43%	87%	15%
0.01	9.27	49%	100%	13%

** The particle size multiplier for both refrigeration sources is the same, therefore one emission source is used in the table above as a

Table B-1u. South32 Hermosa Dozer - TSF and TSF2

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	4.30E-01	<2.5	2.20	0.105	0.49747732	1
10	8.64E-01	10-2.5	9.27	1.06E-01	0.50252268	N/A
30	4.09E+00	30-10	--	7.89E-01	N/A	N/A

Linear Regression (2nd degree)		
a	b	c
3.77E-03	1.08E-02	3.79E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.42	2.20	10%	52%	52%
0.50	4.29	12%	62%	9%
0.58	6.06	14%	73%	11%
0.69	7.77	17%	86%	13%
0.80	9.27	20%	100%	14%

* The particle size multiplier for all TSF and TSF2 dozer emissions is the same, therefore one emission source is used in the table above as a representative sample.

Table B-1v. South32 Hermosa Dozer - Rock

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	5.21E-02	<2.5	2.20	1.05E-01	0.79610966	1
10	6.54E-02	10-2.5	9.27	2.69E-02	0.20389034	N/A
30	4.96E-01	30-10	--	8.68E-01	N/A	N/A

Linear Regression (1st degree)		
a	b	
1.78E-03	4.76E-02	

**Due to difference in PM10 and PM2.5 emissions, 1st degree linear regression was used for this emission source.

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.0515	2.20	10%	80%	80%
0.0552	4.29	11%	86%	6%
0.0584	6.06	12%	91%	5%
0.0614	7.77	12%	96%	5%
0.0641	9.27	13%	100%	4%

* The particle size multiplier for all rock dozer emissions is the same, therefore one emission source is used in the table above as a representative sample.

**Mine Development
Particle Size Distribution**

Table B-1w. South32 Hermosa Mechanical Evaporation Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.36E-02	<2.5	2.20	0.14888337	0.14888337	1
10	9.11E-02	10-2.5	9.27	8.51E-01	0.85111663	N/A
30	9.11E-02	30-10	--	0.00E+00	N/A	N/A

* The particle size multiplier for all evaporators is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
-3.76E-04	1.50E-02	-2.17E-02

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.01	2.20	11%	11%	11%
0.04	4.29	39%	42%	31%
0.06	6.06	61%	65%	23%
0.07	7.77	80%	85%	20%
0.09	9.27	94%	100%	15%

Table B-1x. South32 Hermosa Aboveground Unpaved Roads Emissions

Particle Size	Particle Size Multiplier	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	1.50E-01	<2.5	2.20	3.06E-02	0.1	1
10	1.50E+00	10-2.5	9.27	2.76E-01	0.9	N/A
30	4.90E+00	30-10	--	6.94E-01	N/A	N/A

* Particle Size Multiplier referenced from AP-42 Table 13.2.2-2.

** The particle size multiplier for all aboveground roads is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
-3.64E-04	1.85E-01	-3.09E-01

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.10	2.20	2%	7%	7%
0.48	4.29	10%	35%	28%
0.80	6.06	16%	58%	23%
1.10	7.77	23%	81%	23%
1.37	9.27	28%	100%	19%

Table B-1y. South32 Hermosa Paste Plant Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	6.94E-04	<2.5	2.20	7.16E-02	0.20854531	1
10	3.33E-03	10-2.5	9.27	2.72E-01	0.79145469	N/A
30	9.69E-03	30-10	--	6.57E-01	N/A	N/A

* The particle size multiplier for all paste plant operations is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
-1.20E-06	3.66E-04	-2.14E-04

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.0006	2.20	6%	19%	19%
0.0013	4.29	14%	43%	24%
0.0020	6.06	20%	64%	20%
0.0026	7.77	26%	83%	20%
0.0031	9.27	32%	100%	17%

Table B-1z. South32 Hermosa Surface Activity Drops Emissions

Particle Size	Emissions (lb/hr)	Size Range	Particle Diameter (mean)	PM Modeling Mass Fraction	PM ₁₀ Modeling Mass Fraction	PM _{2.5} Modeling Mass Fraction
2.5	7.29E-03	<2.5	2.20	0.07162162	0.15142857	1
10	4.81E-02	10-2.5	9.27	4.01E-01	0.84857143	N/A
30	1.02E-01	30-10	--	5.27E-01	N/A	N/A

* The particle size multiplier for all the surface activity drops is the same, therefore one emission source is used in the table above as a representative sample.

Linear Regression (2nd degree)		
a	b	c
-1.00E-04	6.70E-03	-8.84E-03

lb/hr	Mean Particle Size	% of emissions	Cumulative Distribution of Particle Sizes (%)	Particle Size Distribution
0.01	2.20	5%	12%	12%
0.02	4.29	18%	41%	28%
0.03	6.06	28%	63%	22%
0.04	7.77	37%	83%	20%
0.04	9.27	44%	100%	17%

APPENDIX C. ENGINE STACK TESTING REPORT



AIR HYGIENE, INC.

Testing Solutions for a Better World

STACK EMISSIONS STUDY
FOR THE
CATERPILLAR, G3520 TALE
PREPARED FOR
CATALYTIC COMBUSTION CORPORATION
AT THE
STEWART & STEVENSON INTEGRATION CENTER
HOUSTON, TEXAS
JULY 29-30 AND SEPTEMBER 1, 2021

Report Date: September 22, 2021



Corporate Headquarters

1600 W Tacoma Street
Broken Arrow, Oklahoma 74012



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Pittsburgh, PA 15205

**STACK EMISSIONS STUDY
FOR THE
CATERPILLAR, G3520 TALE
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JULY 29-30 AND SEPTEMBER 1, 2021**

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I, Patrick K. McGovern, Jr., QSTI
Sr. Regional Manager-Shreveport, LA
certify that this testing was conducted and
this report was created in conformance
with the requirements of ASTM D7036

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APPENDICES

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**Stack Emissions Study
Caterpillar, G3520 TALE
Catalytic Combustion Corporation
Stewart & Stevenson Integration Center
Houston, Texas
July 29-30 and September 1, 2021**

1.0 INTRODUCTION

Air Hygiene International, Inc. (Air Hygiene) has completed the Stack Emissions Study for nitrogen oxides (NO_x), carbon monoxide (CO), total hydrocarbons/volatile organic compounds (THC/VOC), ammonia (NH₃), particulate matter (PM), acetaldehyde (C₂H₄O), formaldehyde (HCHO), methane (CH₄), ethane (C₂H₆), nitrous oxide (N₂O), and carbon dioxide (CO₂) from the exhaust of the Caterpillar, G3520 TALE for Catalytic Combustion Corporation at the Stewart & Stevenson Integration Center in Houston, Texas. This report details the background, results, process description, and the sampling/analysis methodology of the stack sampling survey conducted on July 29-30 and September 1, 2021.

1.1 TEST PURPOSE AND OBJECTIVES

The purpose of the test was to conduct an emission test to document levels of selected pollutants at three test loads (50, 75, and 100 percent). The information will be used to confirm the emissions controls meet certain emission levels. The specific objective was to determine the emission concentration of NO_x, CO, THC/VOC, NH₃, PM, C₂H₄O, HCHO, CH₄, C₂H₆, N₂O, and CO₂ from the exhaust of Catalytic Combustion Corporation's Caterpillar, G3520 TALE.

1.2 SUMMARY OF TEST PROGRAM

The following list details pertinent information related to this specific project:

- 1.2.1 Participating Organizations
 - Catalytic Combustion Corporation
 - Air Hygiene
- 1.2.2 Industry
 - Catalyst Manufacturing
- 1.2.3 Plant Location
 - Stewart & Stevenson Integration Center in Houston, Texas
 - GPS Coordinates [Latitude 29.93248, Longitude -95.64816]
 - Physical Address: 10750 Telge Road, Houston, Texas
- 1.2.4 Equipment Tested
 - Caterpillar, G3520 TALE
- 1.2.5 Emission Points
 - Exhaust from the Caterpillar, G3520 TALE
 - For all gases, three sample points in the exhaust stack from the Caterpillar, G3520 TALE, at 16.7, 50.0, and 83.3 percent of the diameter
 - For all PM testing, 24 sampling points in the exhaust stack from the Caterpillar, G3520 TALE

1.2.6 Emission Parameters Measured

- NO_x
- CO
- THC/VOC
- NH₃
- PM
- C₂H₄O
- HCHO
- CH₄
- C₂H₆
- N₂O
- Flow
- H₂O
- CO₂
- O₂

1.2.7 Dates of Emission Test

- July 29-30 and September 1, 2021

1.2.8 Federal and State Certifications

- Stack Testing Accreditation Council AETB Certificate No. 3796.02
- International Standard ISO/IEC 17025:2005 Certificate No. 3796.01
- Texas NELAP Accreditation No. T104704523; Mobile Lab No. 1M104704523

1.3 KEY PERSONNEL

Catalytic Combustion Corporation:	Randy Sadler (rsadler@catalyticcombustion.com)	678-691-7214
Catalytic Combustion Corporation:	Kati Sedlacek (ksedlacek@catalyticcombustion.com)	678-691-7214
Air Hygiene:	Pat McGovern, Jr. (pmcgovern@airhygiene.com)	918-307-8865
Air Hygiene:	Matt McBride (mmcbride@airhygiene.com)	918-307-8865
Air Hygiene:	Chandler King	918-307-8865
Air Hygiene:	Pat McGovern, Sr.	918-307-8865
Air Hygiene:	Wade Nesom	918-307-8865
Air Hygiene:	Jeff Wollrab	918-307-8865

2.0 SUMMARY OF TEST RESULTS

Results from the sampling conducted on Catalytic Combustion Corporation's Caterpillar, G3520 TALE located at the Stewart & Stevenson Integration Center on July 29-30 and September 1, 2021 are summarized in the following table and relate only to the items tested.

All testing was performed without any real or apparent errors. All testing was conducted according to the approved testing protocol with the exception of a second mobilization to conduct the 100 percent load testing.

TABLE 2.1
SUMMARY OF CATERPILLAR, G3520 TALE RESULTS

Parameter	50% Load	75% Load	100% Load
Date (mm/dd/yy)	07/29/21	07/30/21	09/01/21
Engine Fuel Flow (SCFH)	14,559	20,455	26,278
Power Output (horsepower)	1,811.2	2,668.6	3,598.0
NOx (as NO ₂) (ppmvd)	7.24	6.26	9.81
NOx (as NO ₂) (ppm@15%O ₂)	3.51	3.09	4.86
NOx (as NO ₂) (g/kW*hr)	0.0627	0.0526	0.0787
NO (ppmvd)	7.24	6.23	8.87
NO (ppm@15%O ₂)	3.51	3.08	4.19
NO (g/kW*hr)	0.0408	0.0341	0.0465
NO (as NO ₂) (g/kW*hr)	0.0626	0.0523	0.0713
NO ₂ (ppmvd)	0.00	0.03	0.94
NO ₂ (ppm@15%O ₂)	0.00	0.02	0.68
NO ₂ (g/kW*hr)	0.0000	0.0003	0.0075
CO (ppmvd)	6.14	3.68	2.71
CO (ppm@15%O ₂)	2.98	1.81	1.33
CO (g/kW*hr)	0.0323	0.0188	0.0131
THC (as C ₃ H ₈) (ppmvd)	190.48	188.10	110.21
THC (as C ₃ H ₈) (ppm@15%O ₂)	79.07	80.06	47.36
THC (as C ₃ H ₈) (g/kW*hr)	1.35	1.30	0.73
VOC (as C ₃ H ₈) (ppmvd)	5.38	4.11	0.00
VOC (as C ₃ H ₈) (ppm@15%O ₂)	2.23	1.75	0.00
VOC (as C ₃ H ₈) (g/kW*hr)	0.0381	0.0285	0.0000
CH ₄ (as C ₃ H ₈) (ppmvd)	184.80	183.55	167.60
CH ₄ (as C ₃ H ₈) (ppm@15%O ₂)	89.63	90.62	82.95
CH ₄ (as C ₃ H ₈) (g/kW*hr)	1.5320	1.4779	1.2884
C ₂ H ₆ (as C ₃ H ₈) (ppmvd)	0.31	0.43	0.24
C ₂ H ₆ (as C ₃ H ₈) (ppm@15%O ₂)	0.15	0.21	0.12
C ₂ H ₆ (as C ₃ H ₈) (g/kW*hr)	0.0025	0.0035	0.0019
Total PM (mg)	14.10	6.27	3.48
Total PM (gr/dscf)	6.18E-03	1.91E-03	9.15E-04
Total PM (lb/hr)	0.22	0.10	0.06
Total PM (g/kW*hr)	0.0730	0.0221	0.0020
N ₂ O (ppmvd)	1.87	1.75	1.45
N ₂ O (ppm@15%O ₂)	0.91	0.86	0.71
N ₂ O (g/kW*hr)	0.0155	0.0140	0.0110
C ₂ H ₄ O (ppmvd)	1.74	3.16	0.94
C ₂ H ₄ O (ppm@15%O ₂)	0.85	1.56	0.46
C ₂ H ₄ O (g/kW*hr)	0.0145	0.0255	0.0071
HCHO (ppmvd)	0.07	0.00	0.91
HCHO (ppm@15%O ₂)	0.04	0.00	0.45
HCHO (g/kW*hr)	0.0004	0.0000	0.0047
NH ₃ (ppmvd)	0.47	16.79	5.56
NH ₃ (ppm@15%O ₂)	0.23	8.29	2.80
NH ₃ (g/kW*hr)	0.0015	0.0522	0.0168
CO ₂ (%)	6.72	6.59	6.64
CO ₂ (g/kW*hr)	556	530	509

3.0 SOURCE OPERATION

3.1 PROCESS DESCRIPTION

Catalytic Combustion Corporation is a provider of catalyst, air correction devices, and exhausts with products used to reduce the output of volatile organic compounds (VOCs). The interest of this test report is one caterpillar natural gas fired internal combustion engine located at the Stewart & Stevenson Integration Center in Houston, Texas.

3.2 SAMPLING LOCATION

The engine exhausts to the atmosphere through an independent stack. A stack extension was fabricated on-site and added prior to the test, the extension and installed test ports met the required EPA Method 1 criteria of at least 0.5 duct diameters (dd) upstream and 2.0 dd downstream from the nearest disturbances. The sampling ports are approximately 27 feet above ground level. A fuel flow meter is located on the unit. Catalytic Combustion Corporation provided an aerial lift to access the stack ports.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

The emission test on the Caterpillar, G3520 TALE at the Stewart & Stevenson Integration Center was performed following United States Environmental Protection Agency (EPA) methods described by the Code of Federal Regulations (CFR). Table 4.1 outlines the specific methods performed on July 29-30 and September 1, 2021.

**TABLE 4.1
SUMMARY OF SAMPLING METHODS**

Pollutant or Parameter	Sampling Method	Analysis Method
Sample Point Location	EPA Method 1	Equal Area Method
Stack Flow Rate	EPA Method 2	S-Type Pitot Tube
Oxygen	EPA Method 3A	Paramagnetic Cell
Stack Moisture Content	EPA Method 4	Gravimetric Analysis
Particulate Matter	EPA Method 5	Front Half Filterables
Stack Flow Rate	EPA Method 19	Dry Oxygen F Factor
Total Hydrocarbons	EPA Method 25A	Flame Ionization Detector
Particulate Matter	EPA Method 202	Back Half Condensables

Pollutant or Parameter	Sampling Method	Analysis Method
Nitrogen Oxides, Carbon Monoxide, Ammonia, Acetaldehyde, Formaldehyde, Methane, Ethane, Nitrous Oxide, Carbon Dioxide, and Moisture	EPA Method 320	Fourier Transform Infrared

4.2 INSTRUMENT CONFIGURATION AND OPERATIONS FOR GAS ANALYSIS

The sampling and analysis procedures used during these tests conform with the methods outlined in the Code of Federal Regulations (CFR), Title 40, Part 60, Appendix A, Methods 1, 2, 3A, 4, 5, 19, 25A; 40 CFR 51, Appendix M, Method 202; and 40 CFR 63, Appendix A, Method 320.

Figure 4.1 depicts the sample system used for the real-time gas analyzer tests. The gas sample was continuously pulled through the probe and transported, via heat-traced Teflon® tubing, to a heated head pump and into the FTIR then to a stainless-steel minimum-contact condenser designed to dry the sample. Transportation of the sample, through Teflon® tubing, continued into the sample manifold within the mobile laboratory via a stainless steel/Teflon® diaphragm pump. From the manifold, the sample was partitioned to the real-time analyzers through rotameters that controlled the flow rate of the sample. Exhaust samples were routed to the wet based analyzer prior to gas conditioning.

Figure 4.1 shows that the sample system was also equipped with a separate path through which a calibration gas could be delivered to the probe and back through the entire sampling system. This allowed for convenient performance of system bias checks as required by the testing methods.

All instruments were housed in a climate controlled, trailer-mounted mobile laboratory. Gaseous calibration standards were provided in aluminum cylinders with the concentrations certified by the vendor. EPA Protocol No. 1 was used to determine the cylinder concentrations where applicable (i.e., C₃H₈ calibration gases).

Table 4.2 provides a description of the analyzers used for the instrument portion of the tests. All data from the continuous monitoring instruments were recorded on a Logic Beach Portable Data Logging System which retrieves calibrated electronic data from each instrument every one second and reports an average of the collected data every 30 seconds. For target compounds measured with the Fourier transform infrared (FTIR) spectrometer, interferograms consisting of 30 co-added scans were recorded continuously during the test periods, and provided approximately 30-second average concentrations. Spectral data was analyzed by the MKS MG2000 software.

Figure 4.2 represents the sample system used for the PM tests. A heated stainless-steel probe with a glass liner and stainless-steel nozzle was inserted into the sample ports of the stack to extract gas measurements from the emission stream through a filter and glass impinger train. Flow rates are monitored with oil filled manometers and total sample volumes are measured with a dry gas meter. Glassware that is used to collect and analyze Method 202 condensable particulate samples is cleaned prior to the test with soap and water, and rinsed using tap water, deionized water, acetone, and finally, hexane. After cleaning, Air Hygiene incorporates a glassware bake at 300°C for six hours rather than the alternative of collecting a field train proof blank.

The stack gas analysis for O₂ concentrations was performed in accordance with procedures set forth in EPA Method 3A. The O₂ analyzer uses a paramagnetic cell detector.

THC emission concentrations were quantified in accordance with procedures set forth in EPA Method 25A. A continuous flame ionization (FID) analyzer was used for this purpose. VOC emission concentrations were quantified in conjunction with procedures outlined in EPA Method 320 for FTIR sampling and analysis of methane and ethane content. These results were then subtracted from the THC concentrations to determine VOC concentrations.

An MKS Instruments - MultiGas™ Fourier Transform Infrared (FTIR) spectrometer was used for NO_x, CO, NH₃, C₂H₄O, HCHO, CH₄, C₂H₆, N₂O, CO₂ and H₂O analysis per EPA Method 320. The FTIR spectrometer spectral resolution was 0.5 cm⁻¹. The system employed a silicon carbide infrared source at 1200°C, a helium neon reference laser, beam splitters, potassium bromide (KBr) cell window, front-surface optical transfer mirrors, and multi-pass absorption cells. MCT detectors were used and cooled with liquid nitrogen in order to maintain a constant temperature of 77 Kelvin. The approximately 5.11-meter multi-pass path cells incorporated aspheric, aberration-correcting mirrors to increase the optical throughput and the detection sensitivity. Transducers and thermocouples were connected directly to the insulated sample cells that provide the pressure and temperatures of the sample streams. During testing, the temperature of the absorption cells was set at 191°C. Elevated temperature prevented gas condensation within the cell and minimized compound adhesion to the cell walls and mirrors. The volume of the absorption cell was 0.5 liters, so at a sample gas flow rate of 4.0 liters per minute, the sample gas in the cell is refreshed approximately four times each minute. Interferograms consisting of 30 co-added scans were recorded continuously during the test periods, and provided approximately 30-second average concentrations.

TABLE 4.2
ANALYTICAL INSTRUMENTATION

Parameter	Manufacturer and Model	Range	Sensitivity	Detection Principle
NO _x , CO, NH ₃ , C ₂ H ₄ O, HCHO, CH ₄ , C ₂ H ₆ , N ₂ O, CO ₂ , H ₂ O	MKS 2030	User may select from multiple ranges	0.1 ppm	Fourier Transform Infrared – FTIR
THC	VIG 210	User may select up to 10,000 ppm	0.1 ppm	Flame Ionization Detector
O ₂	SERVOMEX 1440	0-25%	0.1%	Paramagnetic cell, inherently linear.

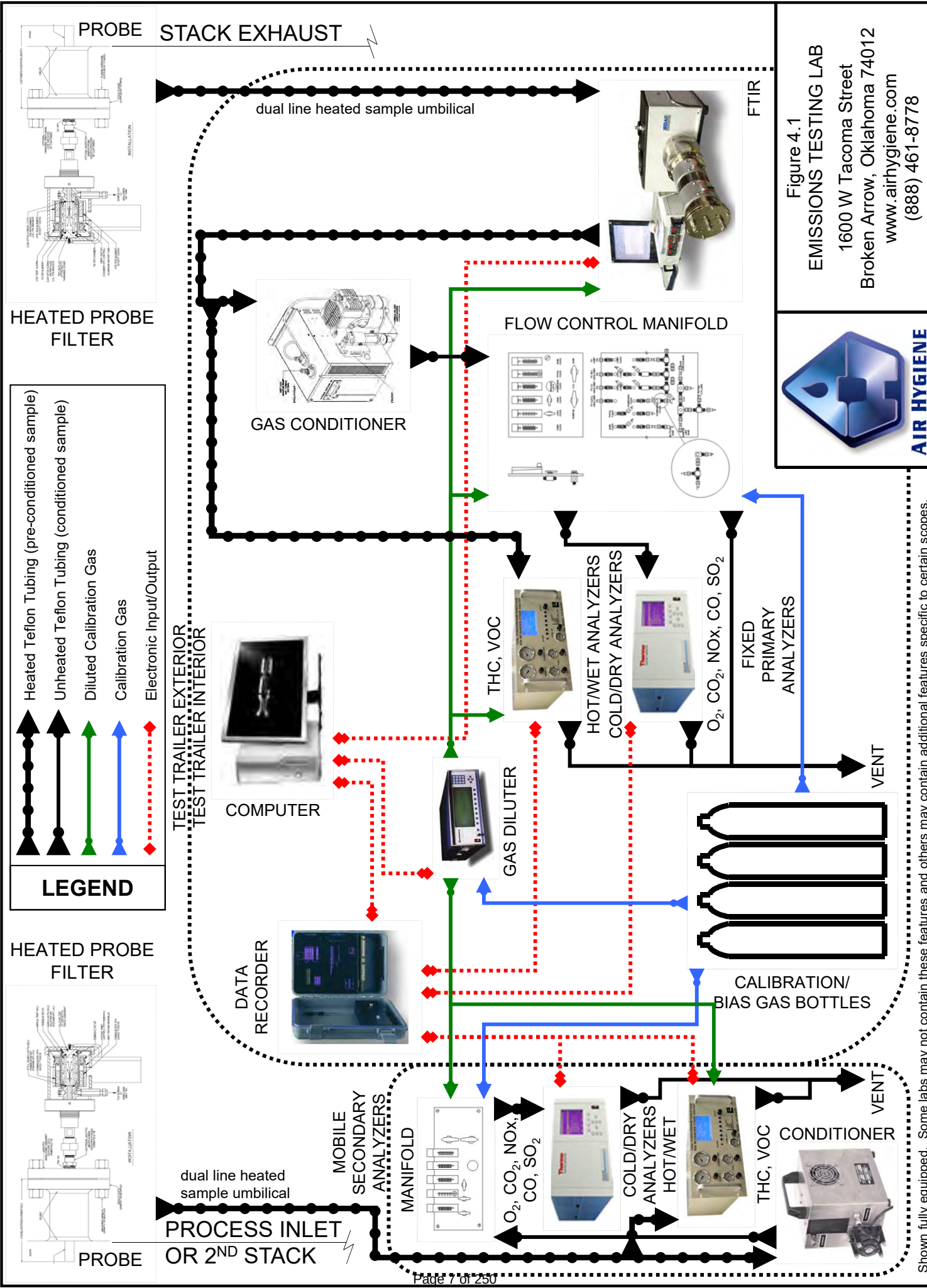


Figure 4.1
EMISSIONS TESTING LAB
 1600 W Tacoma Street
 Broken Arrow, Oklahoma 74012
www.airhygiene.com
 (888) 461-8778



Shown fully equipped. Some labs may not contain these features and others may contain additional features specific to certain scopes.

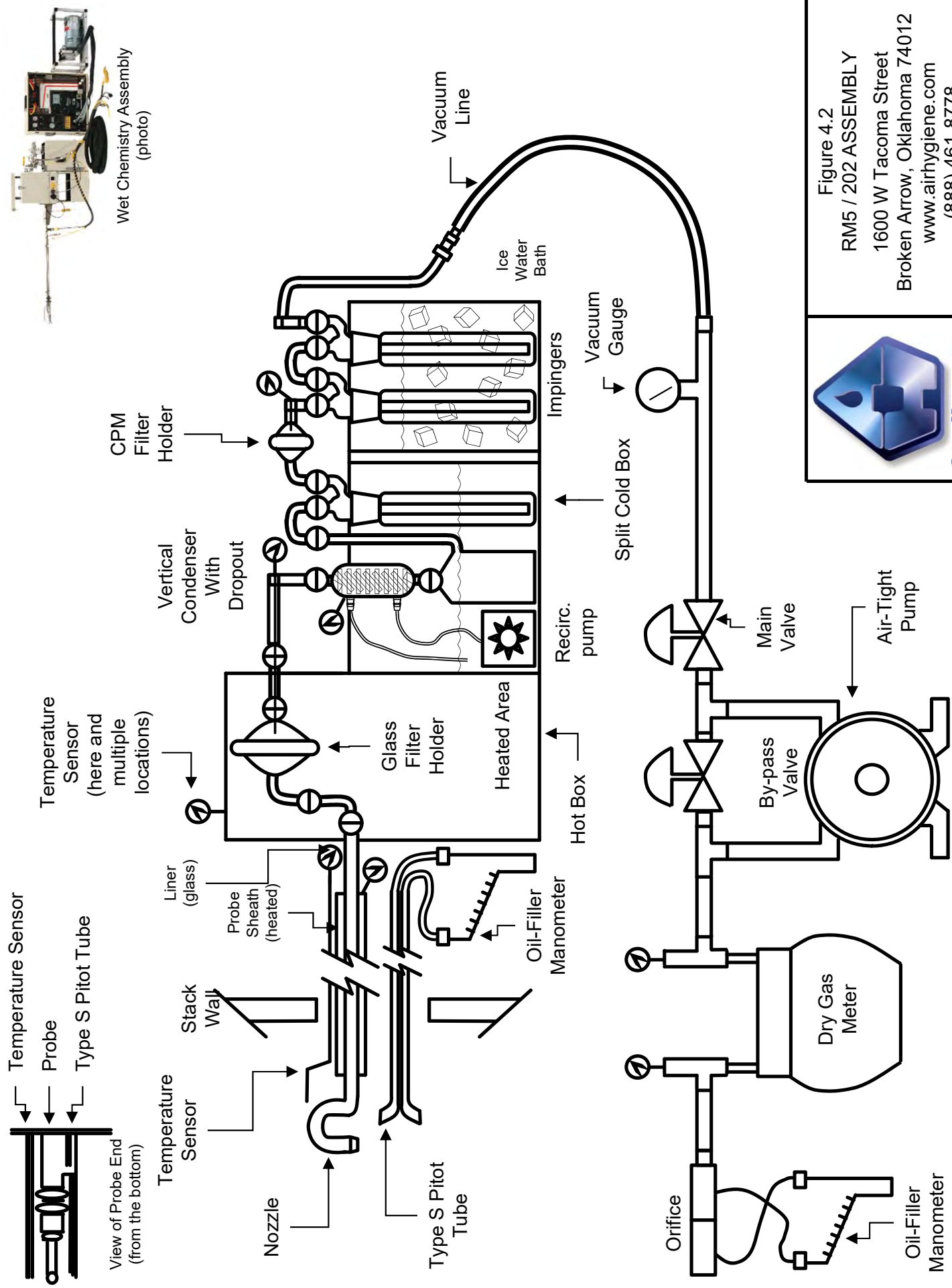


Figure 4.2
 RM5 / 202 ASSEMBLY
 1600 W Tacoma Street
 Broken Arrow, Oklahoma 74012
 www.airhygiene.com
 (888) 461-8778

APPENDIX A

TEST RESULTS AND CALCULATIONS

TABLE A.1: EMISSIONS TESTING SCHEDULE

Unit	Load	Component	Run	Date	Start	Stop	Time Sync	Duration
G3520 TALE	50%	Stratification Test	1	07/29/21	11:00	12:10	DAHS	01:10
G3520 TALE	50%	NOx, CO, THC, etc.	1-1	07/29/21	09:34	10:33	DAHS	01:00
G3520 TALE	50%	NOx, CO, THC, etc.	1-2	07/29/21	12:05	13:04	DAHS	01:00
G3520 TALE	50%	NOx, CO, THC, etc.	1-3	07/29/21	14:23	15:22	DAHS	01:00
							DAHS	
G3520 TALE	50%	Cyc. Flow Chk.	R-1 50%-V1	07/28/21	08:46	08:59	DAHS	00:13
G3520 TALE	50%	PM	R-1 50%-1	07/29/21	09:34	11:24	DAHS	01:50
G3520 TALE	50%	PM	R-1 50%-2	07/29/21	12:05	13:59	DAHS	01:54
G3520 TALE	50%	PM	R-1 50%-3	07/29/21	14:23	15:58	DAHS	01:35
							DAHS	
G3520 TALE	75%	NOx, CO, THC, etc.	2-1	07/30/21	13:45	14:44	DAHS	01:00
G3520 TALE	75%	NOx, CO, THC, etc.	2-2	07/30/21	15:00	15:59	DAHS	01:00
G3520 TALE	75%	NOx, CO, THC, etc.	2-3	07/30/21	16:27	17:26	DAHS	01:00
							DAHS	
G3520 TALE	75%	PM	R-1 75%-1	07/30/21	08:08	09:42	DAHS	01:34
G3520 TALE	75%	PM	R-1 75%-2	07/30/21	13:17	14:56	DAHS	01:39
G3520 TALE	75%	PM	R-1 75%-3	07/30/21	15:25	17:01	DAHS	01:36
G3520 TALE	100%	NOx, CO, THC, etc.	3-1	09/01/21	09:23	10:25	DAHS	01:02
G3520 TALE	100%	NOx, CO, THC, etc.	3-2	09/01/21	10:26	12:02	DAHS	01:37
G3520 TALE	100%	NOx, CO, THC, etc.	3-3	09/02/21	12:03	13:06	DAHS	01:03
G3520 TALE	100%	Cyc. Flow Chk.	R-1 100%-V1	08/31/21	07:14	07:38	DAHS	00:24
G3520 TALE	100%	PM	R-1 100%-1	08/31/21	09:36	11:17	DAHS	01:41
G3520 TALE	100%	PM	R-1 100%-2	08/31/21	12:05	13:44	DAHS	01:39
G3520 TALE	100%	PM	R-1 100%-3	08/31/21	14:24	16:05	DAHS	01:41

TEST RESULTS AND CALCULATIONS

50% Load

NO_x, CO, THC, N₂O, C₂H₄O, NH₃, HCHO, CH₄, C₂H₆, and H₂O Emissions Data

CATERPILLAR, G3520 TALE 50% LOAD DATA SUMMARY

Parameter	50% Load, Run - 1-1	50% Load, Run - 1-2	50% Load, Run - 1-3	Average
Date (mm/dd/yy)	07/29/21	07/29/21	07/29/21	07/29/21
Start Time (hh:mm:ss)	9:34:23	12:05:23	14:23:23	9:34:23
End Time (hh:mm:ss)	10:33:53	13:04:53	15:22:53	15:22:53
Run Duration (min / run)	60	60	60	60
Bar. Pressure (in. Hg)	29.90	29.90	29.84	29.88
Amb. Temp. (°F)	98	99	96	98
Rel. Humidity (%)	53	49	49	50
Spec. Humidity (lb water / lb air)	0.020978	0.019455	0.018009	0.019481
Engine Fuel Flow (SCFH)	14,625	14,511	14,541	14,559
Stack Flow (RM19) (SCFH)	215,406	215,084	216,383	215,625
Stack Moisture (% Method 320)	14.4	14.4	14.4	14.4
Power Output (horsepower)	1,810.4	1,813.0	1,810.4	1,811.2
Engine Timing (BTDC)	23.0	23.0	23.0	23.00
Actual Power (kW)	1,350.0	1,352.0	1,350.0	1,350.67
Amperes (A)	56.0	57.0	56.0	56.33
Air Manifold Temp. (F)	122.0	122.0	124.0	122.67
Engine Speed (rpm)	1,799.0	1,799.0	1,800.0	1,799.33
NOx (as NO ₂) (ppmvd)	8.15	6.92	6.67	7.24
NOx (as NO ₂) (ppm@15%O ₂)	3.93	3.36	3.25	3.51
NOx (as NO ₂) (g/kW*hr)	0.0704	0.0596	0.0579	0.06
NO (ppmvd)	8.15	6.91	6.67	7.24
NO (ppm@15%O ₂)	3.93	3.35	3.25	3.51
NO (g/kW*hr)	0.0459	0.0388	0.0378	0.0408
NO ₂ (ppmvd)	0.00	0.01	0.00	0.00
NO ₂ (ppm@15%O ₂)	0.00	0.00	0.00	0.00
NO ₂ (g/kW*hr)	0.0000	0.0001	0.0000	0.0000
CO (ppmvd)	6.03	5.97	6.40	6.14
CO (ppm@15%O ₂)	2.91	2.90	3.12	2.98
CO (g/kW*hr)	0.03	0.03	0.03	0.03
THC (as C ₃ H ₈) (ppmvd)	183.85	190.60	197.00	190.48
THC (as C ₃ H ₈) (ppm@15%O ₂)	75.89	79.16	82.17	79.07
THC (as C ₃ H ₈) (g/kW*hr)	1.30	1.34	1.40	1.35
VOC (as C ₃ H ₈) (ppmvd)	4.67	4.59	6.87	5.38
VOC (as C ₃ H ₈) (ppm@15%O ₂)	1.93	1.91	2.86	2.23
VOC (as C ₃ H ₈) (g/kW*hr)	0.03	0.03	0.05	0.04
CH ₄ (as C ₃ H ₈) (ppmvd)	178.78	185.57	190.04	184.80
CH ₄ (as C ₃ H ₈) (ppm@15%O ₂)	86.22	90.07	92.60	89.63
CH ₄ (as C ₃ H ₈) (g/kW*hr)	1.4813	1.5330	1.5817	1.5320
C ₂ H ₆ (as C ₃ H ₈) (ppmvd)	0.40	0.44	0.09	0.31
C ₂ H ₆ (as C ₃ H ₈) (ppm@15%O ₂)	0.19	0.21	0.04	0.15
C ₂ H ₆ (as C ₃ H ₈) (g/kW*hr)	0.0033	0.0036	0.0007	0.0025
N ₂ O (ppmvd)	1.59	1.97	2.05	1.87
N ₂ O (ppm@15%O ₂)	0.77	0.95	1.00	0.907
N ₂ O (g/kW*hr)	0.0132	0.0162	0.0170	0.0155
C ₂ H ₄ O (ppmvd)	0.52	0.68	4.04	1.74
C ₂ H ₄ O (ppm@15%O ₂)	0.25	0.33	1.97	0.848
C ₂ H ₄ O (g/kW*hr)	0.0043	0.0056	0.0336	0.0145
HCHO (ppmvd)	0.11	0.07	0.05	7.48E-02
HCHO (ppm@15%O ₂)	0.05	0.03	0.02	3.62E-02
HCHO (g/kW*hr)	0.0006	0.0004	0.0003	0.0004
NH ₃ (ppmvd)	0.54	0.29	0.57	0.47
NH ₃ (ppm@15%O ₂)	0.26	0.14	0.28	0.23
NH ₃ (g/kW*hr)	0.0017	0.0009	0.0018	0.0015
CO ₂ (%)	6.71	6.69	6.75	6.72
CO ₂ (lb/hr)	1,651.80	1,643.88	1,669.41	1,655.03
CO ₂ (lb/kW*hr)	1,223.58	1,215.91	1,236.62	1,225.37
CO ₂ (ton/year) at 8760 hr/year	7,234.89	7,200.20	7,312.00	7,249.03
CO ₂ (lb/MMBtu)	115.56	115.56	115.56	115.56
CO ₂ (g/kW*hr)	555.01	551.53	560.92	555.82
O ₂ (%)	8.67	8.74	8.79	8.73

Calculations, Formulas, and Constants

The following information supports the spreadsheets for this testing project.

Given Data:

Ideal Gas Conversion Factor = 385.23 SCF/lb-mol at 68 deg F & 14.696 psia

Fuel Heating Value is based upon Air Hygiene's fuel gas calculation sheet. All calculations are based upon a correction to 68 deg F & 14.696 psia

High Heating Values (HHV) are used for the Fuel Heating Value, F-Factor, and Fuel Flow Data per EPA requirements.

ASTM D 3588

Molecular Weight of NOx (lb/lb-mole)	= 46.01
Molecular Weight of CO (lb/lb-mole)	= 28.00
Molecular Weight of N2O (lb/lb-mole)	= 64.00
Molecular Weight of THC (propane) (lb/lb-mole)	= 44.00
Molecular Weight of VOC (methane) (lb/lb-mole)	= 16.00
Molecular Weight of NH ₃ (lb/lb-mole)	= 17.03
Molecular Weight of HCHO (lb/lb-mole)	= 30.03
Molecular Weight of CO ₂ (lb/lb-mole)	= 44.01

Formulas:

1. Corrected Raw Average (C_{Gas}), 40CFR60, App. A, RM 7E, Eq. 7E-5 (08/15/06)

$$C_{Gas} = (C_{Avg} - C_o) \times \left(\frac{C_M}{C_M - C_o} \right)$$

2. Correction to % O₂, 40CFR60, App. A, RM 20, Eq. 20-5 (11/26/02)

$$C_{adj} = C_{Gas(T_{avg})} \times \left(\frac{20.9\% - AdjFactor}{20.9\% - C_{Gas(O_2)}} \right)$$

3. Correction to % O₂ and ISO Conditions

$$C_{ISO} = C_{Adj} \times \sqrt{\frac{P_r}{P_o}} \times e^{(19 \times (H_o - 0.00633))} \times \left(\frac{288}{T_a} \right)^{1.53}$$

4. Method 19 stack exhaust flow (scfh) [ref. EPA EMC FAQ Method 19]

$$Q_s = \left(\frac{FFactor \times Q_f \times HHV}{1,000,000} \right) \times \left(\frac{20.9\%}{20.9\% - C_{Gas(O_2)}} \right)$$

40CFR60, App. A, RM 19, Table 19-1

Conversion Constant for NOx = 0.0000001194351

Conversion Constant for CO = 0.0000000726839

Conversion Constant for N2O = 0.0000001661345

Conversion Constant for THC = 0.0000001142175

Conversion Constant for VOC (methane) = 0.0000000415336

Conversion Constant for NH₃ = 0.0000000442074

Conversion Constant for HCHO = 0.0000000779534

Conversion Constant for CO₂ = 0.0000001142434

NOTE: units are lb/ppm*ft³

5. Emission Rate in lb/hr

$$E_{lb/hr} = \frac{C_{Gas}}{10^6} \times \frac{Q_s \times MW}{G}$$

6. Emission Rate in tons per year

$$E_{ton/yr} = \frac{E_{lb/hr} \times hr_{year}}{2000}$$

7. Emission Concentration in lb/MMBtu (O₂ based)

$$E_{lb/MMBtu} = \frac{C_{Gas} \times F_dFactor \times Conv_c \times 20.9\%}{20.9\% - C_{Gas(O_2)}}$$

8. Emission Concentration in g/hp*hr

$$E_{g/hp-hr} = \frac{E_{lb/hr} \times 453.6}{mw \times 1341.022} \text{ or } \frac{E_{lb/hr} \times 453.6}{hp}$$

RM 7E, (08-15-06), 12.1 Nomenclature. The terms used in the equations are defined as follows:

ACE = Analyzer calibration error, percent of calibration span.
B_{WS} = Moisture content of sample gas as measured by Method 4 or other approved method, percent/100.
C_{Adj} = Average unadjusted gas concentration indicated by data recorder for the test run.
C_D = Pollutant concentration adjusted to dry conditions.
C_{Dir} = Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode.
C_{Gas} = Average effluent gas concentration adjusted for bias.
C_M = Average of initial and final system calibration bias (or 2-point system calibration error) check responses for the upscale calibration gas.
C_{MA} = Actual concentration of the upscale calibration gas, ppmv.
C_O = Average of the initial and final system calibration bias (or 2-point system calibration error) check responses from the low-level (or zero) calibration gas.
C_S = Measured concentration of a calibration gas (low, mid, or high) when introduced in system calibration mode.
C_{SS} = Concentration of NO_x measured in the spiked sample.
C_{Spike} = Concentration of NO_x in the undiluted spike gas.
C_{Calc} = Calculated concentration of NO_x in the spike gas diluted in the sample.
C_V = Manufacturer certified concentration of a calibration gas (low, mid, or high).
C_W = Pollutant concentration measured under moist sample conditions, wet basis.
CS = Calibration span.
D = Drift assessment, percent of calibration span.
E_p = The predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level response.
Eff_{NO₂} = NO₂ to NO converter efficiency, percent.
H = High calibration gas, designator.
L = Low calibration gas, designator.
M = Mid calibration gas, designator.
NO_{Final} = The average NO concentration observed with the analyzer in the NO mode during the converter efficiency test in Section 16.2.2.
NO_xCorr = The NO_x concentration corrected for the converter efficiency.
NO_xFinal = The final NO_x concentration observed during the converter efficiency test in Section 16.2.2.
NO_xPeak = The highest NO_x concentration observed during the converter efficiency test in Section 16.2.2.
Q_{Spike} = Flow rate of spike gas introduced in system calibration mode, L/min.
Q_{Total} = Total sample flow rate during the spike test, L/min.
R = Spike recovery, percent.
SB = System bias, percent of calibration span.
SB_i = Pre-run system bias, percent of calibration span.
SB_f = Post-run system bias, percent of calibration span.
SB / D_{Alt} = Alternative absolute difference criteria to pass bias and/or drift checks.
SCE = System calibration error, percent of calibration span.
SCE_i = Pre-run system calibration error, percent of calibration span.
SCE_{Final} = Post-run system calibration error, percent of calibration span.
Z = Zero calibration gas, designator.

40CFR60.355(b)(1), (09-20-06), Nomenclature. The terms used in the equations are defined as follows:

P_r = reference combustor inlet absolute pressure at 101.3 kilopascals ambient pressure, mm Hg
P_o = observed combustor inlet absolute pressure at test, mm Hg
H_o = observed humidity of ambient air, g H₂O/g air
e = transcendental constant, 2.718
T_a = ambient temperature, K

Small Engine and FTIR Nomenclature. The terms used in the equations are defined as follows:

bhp = brake horsepower
hp = horsepower
Q_{sys} = system flow (lpm)
Q_m = matrix spike flow (lpm)

RM 19, (07-29-06), 12.1 Nomenclature. The terms used in the equations are defined as follows:

AdjFactor = Percent oxygen or carbon dioxide adjustment applied to a target pollutant
 B_{wa} = Moisture fraction of ambient air, percent.
 Btu = British thermal unit
 $\%C$ = Concentration of carbon from an ultimate analysis of fuel, weight percent.
 $\%CO_{2d}, \%CO_{2w}$ = Concentration of carbon dioxide on a dry and wet basis, respectively, percent.
 CIP / CDP = Combustor inlet pressure / compressor discharge pressure (mm Hg); note, some manufactures reference as PCD.
 E = Pollutant emission rate, ng/J (lb/million Btu).
 E_a = Average pollutant rate for the specified performance test period, ng/J (lb/million Btu).
 E_{aot}, E_{ai} = Average pollutant rate of the control device, outlet and inlet, respectively, for the performance test period, ng/J (lb/million Btu).
 E_{bi} = Pollutant rate from the steam generating unit, ng/J (lb/million Btu).
 E_{bo} = Pollutant emission rate from the steam generating unit, ng/J (lb/million Btu).
 E_{ci} = Pollutant rate in combined effluent, ng/J (lb/million Btu).
 E_{co} = Pollutant emission rate in combined effluent, ng/J (lb/million Btu).
 E_d = Average pollutant rate for each sampling period (e.g., 24-hr Method 6B sample or 24-hr fuel sample) or for each fuel lot (e.g., amount of fuel bunkered), ng/J (lb/million Btu).
 E_{di} = Average inlet SO₂ rate for each sampling period d, ng/J (lb/million Btu).
 E_g = Pollutant rate from gas turbine, ng/J (lb/million Btu).
 E_{ga} = Daily geometric average pollutant rate, ng/J (lbs/million Btu) or ppm corrected to 7 percent O₂.
 $E_{j,e}$ = Matched pair hourly arithmetic average pollutant rate, outlet and inlet, respectively, ng/J (lb/million Btu) or ppm corrected to 7 percent O₂.
 E_{hj} = Hourly average pollutant, ng/J (lb/million Btu).
 E_{hj} = Hourly arithmetic average pollutant rate for hour "j," ng/J (lb/million Btu) or ppm corrected to 7 percent O₂.
 EXP = Natural logarithmic base (2.718) raised to the value enclosed by brackets.
 Fc = Ratio of the volume of carbon dioxide produced to the gross calorific value of the fuel from Method 19
 F_d, F_w, F_c = Volumes of combustion components per unit of heat content, scm/J (scf/million Btu).
 ft³ = cubic feet
 G = ideal gas conversion factor
 (385.23 SCF/lb-mol at 68 deg F & 14.696 psia)
 GCM = gross Btu per SCF (constant, compound based)
 GCV = Gross calorific value of the fuel consistent with the ultimate analysis, kJ/kg (Btu/lb).
 GCV_p, GCV_r = Gross calorific value for the product and raw fuel lots, respectively, dry basis, kJ/kg (Btu/lb).
 $\%H$ = Concentration of hydrogen from an ultimate analysis of fuel, weight percent.
 H_b = Heat input rate to the steam generating unit from fuels fired in the steam generating unit, J/hr (million Btu/hr).
 H_g = Heat input rate to gas turbine from all fuels fired in the gas turbine, J/hr (million Btu/hr).
 $\%H_2O$ = Concentration of water from an ultimate analysis of fuel, weight percent.
 H_t = Total numbers of hours in the performance test period (e.g., 720 hours for 30-day performance test period).
 K = volume of combustion component per pound of component (constant)
 K = Conversion factor, 10⁻⁵ (kJ/J)/(%) [10⁶ Btu/million Btu].
 $K_c = (9.57 \text{ scm/kg})/\% [(1.53 \text{ scf/lb})/\%]$.
 $K_{cc} = (2.0 \text{ scm/kg})/\% [(0.321 \text{ scf/lb})/\%]$.
 $K_{hd} = (22.7 \text{ scm/kg})/\% [(3.64 \text{ scf/lb})/\%]$.
 $K_{hw} = (34.74 \text{ scm/kg})/\% [(5.57 \text{ scf/lb})/\%]$.
 $K_n = (0.86 \text{ scm/kg})/\% [(0.14 \text{ scf/lb})/\%]$.
 $K_o = (2.85 \text{ scm/kg})/\% [(0.46 \text{ scf/lb})/\%]$.
 $K_s = (3.54 \text{ scm/kg})/\% [(0.57 \text{ scf/lb})/\%]$.
 $K_{sulfur} = 2 \times 10^4 \text{ Btu/wt\%-MMBtu}$
 $K_w = (1.30 \text{ scm/kg})/\% [(0.21 \text{ scf/lb})/\%]$.
 lb = pound
 ln = Natural log of indicated value.
 L_p, L_r = Weight of the product and raw fuel lots, respectively, metric ton (ton).
 $\%N$ = Concentration of nitrogen from an ultimate analysis of fuel, weight percent.
 $M_{\%}$ = mole percent
 mol = mole
 MW = molecular weight (lb/lb-mol)
 MW_{AIR} = molecular weight of air (28.9625 lb/lb-mole)¹
 NCM = net Btu per SCF (constant based on compound)
 $\%O$ = Concentration of oxygen from an ultimate analysis of fuel, weight percent.
 $\%O_{2d}, \%O_{2w}$ = Concentration of oxygen on a dry and wet basis, respectively, percent.
 P_B = barometric pressure, in Hg
 P_s = Potential SO₂ emissions, percent.
 $\%S$ = Sulfur content of as-fired fuel lot, dry basis, weight percent.
 S_e = Standard deviation of the hourly average pollutant rates for each performance test period, ng/J (lb/million Btu).
 $\%S_r$ = Concentration of sulfur from an ultimate analysis of fuel, weight percent.
 $S(\text{wt}\%)$ = weight percent of sulfur, per lab analysis by appropriate ASTM standard
 S_t = Standard deviation of the hourly average inlet pollutant rates for each performance test period, ng/J (lb/million Btu).
 S_o = Standard deviation of the hourly average emission rates for each performance test period, ng/J (lb/million Btu).
 $\%S_p, \%S_r$ = Sulfur content of the product and raw fuel lots respectively, dry basis, weight percent.
 SCF = standard cubic feet
 SH = specific humidity, pounds of water per pound of air
 $t_{0.95}$ = Values shown in Table 19-3 for the indicated number of data points n.
 T_{amb} = ambient temperature, °F
 $W/D \text{ Factor} = 1.0236 = \text{conv. at } 14.696 \text{ psia and } 68 \text{ deg F (ref. Civil Eng. Ref. Manual, 7th Ed.)}$
 X_{CO_2} = CO₂ Correction factor, percent.
 X_k = Fraction of total heat input from each type of fuel k.

EXAMPLE CALCULATIONS (FFACTOR)

RM 19, (02-27-14),
2.0 Summary of Method,
2.1 Emission Rates. Oxygen (O₂) or carbon dioxide (CO₂) concentrations and appropriate F factors (ratios of combustion gas volumes to heat inputs) are used to calculate pollutant emission rates from pollutant concentrations.

RM 19, (02-27-14),
12.2 Emission Rates of PM, SO₂, and NO_x. Select from the following sections the applicable procedure to compute the PM, SO₂, or NO_x emission rate (E) in lb/MMBtu. The pollutant concentration must be in lb/scf and the F factor must be in scf/MMBtu. If the pollutant concentration (C) is not in the appropriate units, use Table 19-1 in Section 17.0 to make the proper conversion. An F factor is the ratio of the gas volume of the products of combustion to the heat content of the fuel. The dry F factor (F_d) includes all components of combustion less water, the wet F factor (F_w) includes all components of combustion, and the carbon F factor (F_c) includes only carbon dioxide.

Mark's Std Hdbk, 10th ed., pg 4-26

High Heat Value Dry (HHV_{dry}), calc for Methane (single component for the fuel gas)

$$HHV_{dry} (Btu / SCF) = \left[\left(\frac{M_{\%}}{100} \right) \times GCM \right] \quad HHV_{dry} = \frac{98.35 \%}{100.00} \times \frac{994.85 \text{ Btu}}{SCF} = \frac{978.48 \text{ Btu}}{SCF}$$

Mark's Std Hdbk, 10th ed., pg 4-26

Low Heat Value Dry (LHV_{dry}), calc for Methane (single component for the fuel gas)

$$LHV_{dry} (Btu / SCF) = \left[\left(\frac{M_{\%}}{100} \right) \times NCM \right] \quad LHV_{dry} = \frac{98.35 \%}{100.00} \times \frac{895.75 \text{ Btu}}{SCF} = \frac{881.02 \text{ Btu}}{SCF}$$

Civil Eng. Ref. Man., 7th Ed., pg 14-9/GPA Ref. Bulletin 181-86, App. C

High Heat Value Wet (HHV_{wet}), calc for entire sample (all components of the fuel gas)

$$HHV_{wet} (Btu / SCF) = \frac{HHV_{dry}}{W / D. factor} \quad HHV_{wet} = \frac{998.79 \text{ Btu/SCF}}{1.0236} = 975.76 \text{ Btu/SCF}$$

Civil Eng. Ref. Man., 7th Ed., pg 14-9/GPA Ref. Bulletin 181-86, App. C

Low Heat Value Wet (LHV_{wet}), calc for entire sample (all components of the fuel gas)

$$LHV_{wet} (Btu / SCF) = \frac{LHV_{dry}}{W / D. factor} \quad LHV_{wet} = \frac{899.60 \text{ Btu/SCF}}{1.0236} = 878.86 \text{ Btu/SCF}$$

Lbs Component per Lb-Mol of Gas (CM), calc for Methane (single component for the fuel gas)

$$CM (lb / lb - mol) = \left[\left(\frac{M_{\%}}{100} \right) \times MW \right] \quad CM = \frac{98.35 \%}{100.00} \times \frac{16.04 \text{ lb}}{lb - mol} = 15.78 \text{ lb/lb-mol}$$

ASTM D 3588

Fuel Molecular Weight (MW_{Fuel})

$$MW_{Fuel} (lb / lb \cdot mol) = \sum (CM) \quad MW_{Fuel} = 15.78 \text{ lb/lb-mol} + 0.34 \text{ lb/lb-mol} + \text{etc.} = 16.307 \text{ lb/lb-mol}$$

Btu per Lb of Gas Gross (GCV)

$$GCV (Btu / lb) = \left[\frac{HHV_{dry} \times G}{MW_{Fuel}} \right] \quad GCV = \frac{998.79 \text{ Btu/SCF} \times 385.23 \text{ ft}^3/\text{lbmol}}{16.307 \text{ lb/lb-mol}} = 23,595.43 \text{ Btu/lb}$$

ASTM D 3588 (SG)

Specific Gravity

$$SG = \left[\frac{MW_{Fuel}}{MW_{AIR}} \right] \quad SG = \frac{16.31 \text{ lb/lb-mol}}{28.96 \text{ lb/lb-mol}} = 0.5630$$

Btu per Lb of Gas Net (NCV)

$$NCV (Btu / lb) = \left[\frac{LHV_{dry} \times G}{MW_{Fuel}} \right] \quad NCV = \frac{899.60 \text{ Btu/SCF} \times 385.23 \text{ ft}^3/\text{lbmol}}{16.307 \text{ lb/lb-mol}} = 21,252.13 \text{ Btu/lb}$$

Weight Percent of Component (C_%), methane

$$C_{\%} (\%) = \left[\left(\frac{CM}{MW_{Fuel}} \right) \times 100 \right] \quad C_{\%} = \frac{15.78 \text{ lb/lb-mol}}{16.31 \text{ lb/lb-mol}} \times 100 = 96.76 \%$$

Weight Percent of Volatile Organic Compounds (VOC_%)

$$VOC_{\%} (\%) = \left[\sum_{C_3H_8}^{C_8H_{18}} Wt_{\%} \right] \quad VOC_{\%} = 0.05 \% + 0.00 \% + 0.00 \% + \text{etc.} = 0.06 \%$$

RM 19, (02-27-14), 12.3.2 Determined **F Factors**. If the fuel burned is not listed in Table 19-2 or if the owner or operator chooses to determine an F factor rather than use the values in Table 19-2, use the procedure below: 12.3.2.1 Equations. Use the eq

RM 19, (02-27-14),

12.1 Nomenclature

K (scf/lb)/%

H 3.64
C 1.53
S 0.57
N₂ 0.14
O₂ 0.46

$$F_d = \frac{K(K_{hd} \%H + K_c \%C + K_s \%S + K_n \%N - K_o \%O)}{GCV} \quad \text{Eq. 19-13}$$

$$F_d = \frac{10^6 \text{ Btu}}{\text{MMBtu}} \times \left[\frac{3.64 \text{ SCF}}{\text{lb} \cdot \%} \times 24.75 \% + \frac{1.53 \text{ SCF}}{\text{lb} \cdot \%} \times 74.35 \% + \frac{0.57 \text{ SCF}}{\text{lb} \cdot \%} \times 0.00 \% + \frac{0.14 \text{ SCF}}{\text{lb} \cdot \%} \times 0.38 \% - \frac{0.46 \text{ SCF}}{\text{lb} \cdot \%} \times 0.51 \% \right] \times \frac{\text{lb}}{23,595.43 \text{ Btu}} = \frac{8,631.70 \text{ SCF}}{\text{MMBtu}}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Methane and Ethane subtraction from THC to determine VOC)**VOC (as propane)**

Using a THC analyzer calibrated with propane and an FTIR, GC, or other type of analyzer that reads methane and ethane on a methane and ethane basis, respectively; first convert the wet based methane to a wet based propane equivalent by dividing the number by three, if FTIR is the analysis method, a 1.1 multiplier is applied as the correction factor; then convert the wet based ethane to a wet based propane equivalent by multiplying the number by two and then dividing by three. Once all concentrations are in wet based equivalent units, subtract the methane (as propane) and ethane (as propane) from the THC concentration. If the calculation results in a negative number, which is fairly common when subtracting fairly large numbers, the result will be assumed as zero.

$$VOC(ppm) = C_{THC (propane)} - \left(\frac{C_{CH_4 (methane)}}{3} \right) \times 1.1 - \left(\frac{C_{C_2H_6 (ethane)} \times 2}{3} \right)_{(propane)}$$

$$VOC (ppm) = 157.35 \text{ ppm} - \frac{417.32 \text{ ppm}}{3} \times 1.1 - \frac{0.52 \text{ ppm} \times 2}{3} = 3.99 \text{ ppm}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (INFORMATION)**Specific Humidity (RH_{sp})**

Note: RH_{sp} (gr/lb) calculated using temperature, relative humidity, and barometric pressure with psychrometric chart, psychrometric calculator, or built in psychrometric algorithm.

$$RH_{sp} (lb / lb) = \left[\left(\frac{gr}{lb} \right) \times \frac{lb}{7000 gr} \right]$$

$$RH_{sp} = \frac{146.84 \text{ gr}}{lb} \times \frac{1 lb}{7000 \text{ gr}} = 0.020978 \frac{lb H_2O}{lb Air}$$

EXAMPLE CALCULATIONS (CALIBRATION)**Calibration Error and Estimated Point, RM 25A, THC/VOC Analyzer**

RM 25A, (02-27-14), 8.4 Calibration Error Test. Immediately prior to the test series (within 2 hours of the start of the test), introduce zero gas and high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary. Calculate the predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level response. Then introduce low-level and mid-level calibration gases successively to the measurement system. ... These differences must be less than 5 percent of the respective calibration gas value. (calc for THC/VOC analyzer mid gas, if applicable)

$$E_p = \frac{C_{Dir(H)} - C_{Dir(Z)}}{C_{V(H)} - C_{V(Z)}} \times C_{Dir(M)} + C_{Dir(Z)}$$

Eq. of a line
y=mx+b

$$E_p = \frac{808.45 \text{ ppm} - 1.42 \text{ ppm}}{802.00 \text{ ppm} - 0.00 \text{ ppm}} \times 456.00 \text{ ppm} + 1.42 = 460.28 \text{ ppm}$$

$$ACE = \left(\frac{C_{Dir} - C_V}{CS} \right) \times 100 \quad \text{Eq. 7E-1}$$

$$ACE_{THC} = \frac{461.70 \text{ ppm} - 460.28 \text{ ppm}}{456.00 \text{ ppm}} \times 100 = 0.31 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (RUNS)

Stack Exhaust Flow (Q_S) - RM19

$$Q_S = \left(\frac{FFactor \times Q_f \times HHV}{1,000,000} \right) \times \left(\frac{20.9\%}{20.9\% - C_{Gas(O_2)}} \right)$$

Note: Equation presented in EPA Emission Measurement Center (EMC), Frequently Asked Questions (FAQ) for Method 19

$$Q_S = \frac{8,631.70 \text{ SCF}}{\text{MMBtu}} \times \frac{14,625.00 \text{ SCF}}{\text{hr}} \times \frac{998.79 \text{ Btu}}{\text{SCF}} \times \frac{\text{MMBtu}}{10^6 \text{ Btu}} \times \left(\frac{20.90\%}{20.9\% - 8.7\%} \right) = 215,406.45 \text{ SCFH}$$

Moisture Correction

RM 7E, (02-27-14), 12.10 Moisture Correction. Use Equation 7E-10 if your measurements need to be corrected to a dry basis. (calc for NOx analyzer, Run 1, if applicable) Note: Calculations may not match as Run 1 results are typically also bias adjusted

$$C_D = \frac{C_W}{1 - B_{WS}} \quad \text{Eq. 7E-10} \quad C_D = \frac{6.97 \text{ ppmvw}}{1 - 0.14} = 8.15 \text{ ppmvd} \quad \text{or inversely,} \quad C_W = 8.15 \text{ ppmvd} \times \left(1 - 0.14 \right) = 6.97 \text{ ppmvw}$$

Diluent-Corrected Pollutant Concentration, O₂ Based

RM 20, (11-26-02), 7.3.1 Correction of Pollutant Concentration Using O₂ Concentration. Calculate the O₂ corrected pollutant concentration, as follows: (calc for NOx gas, Run 1, if applicable) [now contained in applicable Subpart]

$$C_{adj} = C_{Gas(Targ)} \times \left(\frac{20.9\% - AdjFactor}{20.9\% - C_{Gas(O_2)}} \right) \quad \text{Eq. 20-4} \quad C_{adj} = 8.15 \text{ ppm} \times \left(\frac{20.9\% - 15.00\%}{20.9\% - 8.67\%} \right) = 3.93 \text{ ppm@15\%O}_2$$

Emissions Rate (lb/hr)

Calculation for pound per hour emission rate. Calculate, as follows: (calc for NOx gas Run 1, if applicable)

$$E_{lb/hr} = \frac{C_{Gas} \times Q_S \times MW}{10^6 \times G} \quad E_{lb/hr} = \frac{8.15 \text{ ppmvd}}{10^6 \text{ ppm/part}} \times \frac{215,406 \text{ DSCFH} \times 46.01 \text{ lb/lb-mol}}{385.23 \text{ SCF/lb-mol}} = \frac{0.21 \text{ lb}}{\text{hr}}$$

Emissions Rate (g/kW-hr)

Calculation for grams per horsepower-hour. Calculate, as follows: (calc for NOx gas Run 1, if applicable)

$$E_{g/hp-hr} = \frac{E_{lb/hr} \times 453.6}{mw \times 1341.022} \text{ or } \frac{E_{lb/hr} \times 453.6}{hp} \quad E_{g/hp-hr} = \frac{0.21 \text{ lb}}{\text{hr}} \times \frac{453.6 \text{ g}}{\text{lb}} \times \frac{1}{1,810 \text{ hp}} \times \frac{\text{hp}}{0.7456 \text{ kW}} = \frac{0.0704 \text{ g}}{\text{kW*hr}}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

Method 320 Equation 3, Dilution Factor (DF)*(example calculation for Trial #1, where applicable)*

$$DF = \frac{SF_6(\text{spk})}{SF_6(\text{dir})} = \frac{(SF_6(\text{spk}+\text{native}) - SF_6(\text{native}))}{SF_6(\text{dir})} \text{ OR } \frac{(CO_2(\text{native}) - CO_2(\text{spk}+\text{native}))}{CO_2(\text{native})}$$

$$DF (SF_6) = \frac{0.4082 \text{ ppmvw} - (-0.0034 \text{ ppmvw})}{5.61 \text{ ppmvw}} = 0.0734$$

Test Method 320, Section 9.0 Quality Control

Where,

$SF_6(\text{dir})$ = SF_6 (or tracer gas) concentration measured directly in undiluted spike gas

$SF_6(\text{spk})$ = Diluted SF_6 (or tracer gas) concentration measured in a spiked sample

$$SF_6(\text{spk}) = SF_6(\text{spk}+\text{native}) - SF_6(\text{native})$$

$SF_6(\text{spk}+\text{native})$ = Diluted SF_6 (or tracer gas) concentration measured in a spiked sample in stack gas

$SF_6(\text{native})$ = SF_6 (or tracer gas) concentration measured in a native stack gas sample

Dilution Factor Ratio*(example calculation for Trial #1, where applicable)*

$$DF \text{ Ratio} = \frac{SF_6(\text{dir})}{SF_6(\text{spk})} = \frac{SF_6(\text{dir})}{(SF_6(\text{spk}+\text{native}) - SF_6(\text{native}))} \text{ OR } \frac{CO_2(\text{native})}{CO_2(\text{native}) - CO_2(\text{spk}+\text{native})} \geq 10$$

$$DF \text{ Ratio} = \frac{5.61 \text{ ppmvw}}{0.4082 \text{ ppmvw} - (-0.0034 \text{ ppmvw})} =$$

$$\text{Spike Ratio} = 13.6 : 1 \geq 10$$

Unspike = Native concentration of analytes in unspiked samples

$Spike_{\text{dir}}$ = Concentration of the analyte in the spike standard measured by filling the FTIR cell directly

Method 320 Equation 4 [Method 321 Equation 2], Excepted Concentration of the Spiked Samples**Ideal Spike Yield***(example calculation for Trial #1 (SF_6), where applicable)*

$$CS = DF \times Spike_{\text{dir}} + \text{Unspike} (1 - DF)$$

$$CS = 0.0734 \times 5.6103 \text{ ppmvw} + (-0.0034 \text{ ppmvw}) \times (1 - 0.0734) = 0.4085 \text{ ppmvw}$$

Method 320 Spiked vs Expected

$$\text{Spiked vs Expected} = \frac{\text{Actual Spike Yield}}{\text{Ideal Spike Yield}} \times 100 \quad \text{(example calculation for Trial \#1 (} SF_6 \text{), where applicable)}$$

$$\% \text{ Recovery} = \frac{0.4082 \text{ ppmvw}}{0.4085 \text{ ppmvw}} \times 100 = 99.940 \%$$

Method 320 Equation 4 [Method 321 Equation 2], Excepted Concentration of the Spiked Samples**Ideal Spike Yield***(example calculation for Trial #1 (C_2H_4O), where applicable)*

$$CS = DF \times Spike_{\text{dir}} + \text{Unspike} (1 - DF)$$

$$CS = 0.0734 \times 47.1138 \text{ ppmvw} + 0.4382 \text{ ppmvw} \times (1 - 0.0734) = 3.8626 \text{ ppmvw}$$

Method 320 Spiked vs Expected

$$\text{Spiked vs Expected} = \frac{\text{Actual Spike Yield}}{\text{Ideal Spike Yield}} \times 100 \quad \text{(example calculation for Trial \#1 (} C_2H_4O \text{), where applicable)}$$

$$\% \text{ Recovery} = \frac{3.6232 \text{ ppmvw}}{3.8626 \text{ ppmvw}} \times 100 = 93.802 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

Method 320 Equation 3, Dilution Factor (DF)*(example calculation for Trial #2, where applicable)*

$$DF = \frac{SF_6(\text{spk})}{SF_6(\text{dir})} = \frac{(SF_6(\text{spk}+\text{native}) - SF_6(\text{native}))}{SF_6(\text{dir})} \text{ OR } \frac{(CO_2(\text{native}) - CO_2(\text{spk}+\text{native}))}{CO_2(\text{native})}$$

$$DF (SF_6) = \frac{0.4291 \text{ ppmvw} - (-0.0011 \text{ ppmvw})}{5.61 \text{ ppmvw}} = 0.0767$$

Test Method 320, Section 9.0 Quality Control

Where,

$SF_6(\text{dir})$ = SF_6 (or tracer gas) concentration measured directly in undiluted spike gas

$SF_6(\text{spk})$ = Diluted SF_6 (or tracer gas) concentration measured in a spiked sample

$$SF_6(\text{spk}) = SF_6(\text{spk}+\text{native}) - SF_6(\text{native})$$

$SF_6(\text{spk}+\text{native})$ = Diluted SF_6 (or tracer gas) concentration measured in a spiked sample in stack gas

$SF_6(\text{native})$ = SF_6 (or tracer gas) concentration measured in a native stack gas sample

Dilution Factor Ratio*(example calculation for Trial #2, where applicable)*

$$DF \text{ Ratio} = \frac{SF_6(\text{dir})}{SF_6(\text{spk})} = \frac{SF_6(\text{dir})}{(SF_6(\text{spk}+\text{native}) - SF_6(\text{native}))} \text{ OR } \frac{CO_2(\text{native})}{CO_2(\text{native}) - CO_2(\text{spk}+\text{native})} \geq 10$$

$$DF \text{ Ratio} = \frac{5.61 \text{ ppmvw}}{0.4291 \text{ ppmvw} - (-0.0011 \text{ ppmvw})} =$$

$$\text{Spike Ratio} = 13.0 : 1 \geq 10$$

Unspike = Native concentration of analytes in unspiked samples

$Spike_{\text{dir}}$ = Concentration of the analyte in the spike standard measured by filling the FTIR cell directly

Method 320 Equation 4 [Method 321 Equation 2], Excepted Concentration of the Spiked Samples**Ideal Spike Yield***(example calculation for Trial #2 (SF_6), where applicable)*

$$CS = DF \times Spike_{\text{dir}} + \text{Unspike} (1 - DF)$$

$$CS = 0.0767 \times 5.6103 \text{ ppmvw} + (-0.0011 \text{ ppmvw}) \times (1 - 0.0767) = 0.4292 \text{ ppmvw}$$

Method 320 Spiked vs Expected

$$\text{Spiked vs Expected} = \frac{\text{Actual Spike Yield}}{\text{Ideal Spike Yield}} \times 100 \quad \text{(example calculation for Trial \#2 (} SF_6 \text{), where applicable)}$$

$$\% \text{ Recovery} = \frac{0.4291 \text{ ppmvw}}{0.4292 \text{ ppmvw}} \times 100 = 99.981 \%$$

Method 320 Equation 4 [Method 321 Equation 2], Excepted Concentration of the Spiked Samples**Ideal Spike Yield***(example calculation for Trial #2 (C_2H_4O), where applicable)*

$$CS = DF \times Spike_{\text{dir}} + \text{Unspike} (1 - DF)$$

$$CS = 0.0767 \times 47.1138 \text{ ppmvw} + 0.4477 \text{ ppmvw} \times (1 - 0.0767) = 4.0257 \text{ ppmvw}$$

Method 320 Spiked vs Expected

$$\text{Spiked vs Expected} = \frac{\text{Actual Spike Yield}}{\text{Ideal Spike Yield}} \times 100 \quad \text{(example calculation for Trial \#2 (} C_2H_4O \text{), where applicable)}$$

$$\% \text{ Recovery} = \frac{4.1004 \text{ ppmvw}}{4.0257 \text{ ppmvw}} \times 100 = 101.856 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

Method 320 Equation 3, Dilution Factor (DF)*(example calculation for Trial #3, where applicable)*

$$DF = \frac{SF_6(\text{spk})}{SF_6(\text{dir})} = \frac{(SF_6(\text{spk}+\text{native}) - SF_6(\text{native}))}{SF_6(\text{dir})} \text{ OR } \frac{(CO_2(\text{native}) - CO_2(\text{spk}+\text{native}))}{CO_2(\text{native})}$$

$$DF (SF_6) = \frac{0.4383 \text{ ppmvw} - 0.0018 \text{ ppmvw}}{5.61 \text{ ppmvw}} = 0.0778$$

Test Method 320, Section 9.0 Quality Control

Where,

$SF_6(\text{dir})$ = SF_6 (or tracer gas) concentration measured directly in undiluted spike gas

$SF_6(\text{spk})$ = Diluted SF_6 (or tracer gas) concentration measured in a spiked sample

$$SF_6(\text{spk}) = SF_6(\text{spk}+\text{native}) - SF_6(\text{native})$$

$SF_6(\text{spk}+\text{native})$ = Diluted SF_6 (or tracer gas) concentration measured in a spiked sample in stack gas

$SF_6(\text{native})$ = SF_6 (or tracer gas) concentration measured in a native stack gas sample

Dilution Factor Ratio*(example calculation for Trial #3, where applicable)*

$$DF \text{ Ratio} = \frac{SF_6(\text{dir})}{SF_6(\text{spk})} = \frac{SF_6(\text{dir})}{(SF_6(\text{spk}+\text{native}) - SF_6(\text{native}))} \text{ OR } \frac{CO_2(\text{native})}{CO_2(\text{native}) - CO_2(\text{spk}+\text{native})} \geq 10$$

$$DF \text{ Ratio} = \frac{5.61 \text{ ppmvw}}{0.4383 \text{ ppmvw} - 0.0018 \text{ ppmvw}} =$$

$$\text{Spike Ratio} = 12.9 : 1 \geq 10$$

Unspike = Native concentration of analytes in unspiked samples

$Spike_{\text{dir}}$ = Concentration of the analyte in the spike standard measured by filling the FTIR cell directly

Method 320 Equation 4 [Method 321 Equation 2], Excepted Concentration of the Spiked Samples**Ideal Spike Yield***(example calculation for Trial #3 (SF_6), where applicable)*

$$CS = DF \times Spike_{\text{dir}} + \text{Unspike} (1 - DF)$$

$$CS = 0.0778 \times 5.6103 \text{ ppmvw} + 0.0018 \text{ ppmvw} \times (1 - 0.0778) = 0.4382 \text{ ppmvw}$$

Method 320 Spiked vs Expected

$$\text{Spiked vs Expected} = \frac{\text{Actual Spike Yield}}{\text{Ideal Spike Yield}} \times 100 \quad \text{(example calculation for Trial \#3 (} SF_6 \text{), where applicable)}$$

$$\% \text{ Recovery} = \frac{0.4383 \text{ ppmvw}}{0.4382 \text{ ppmvw}} \times 100 = 100.031 \%$$

Method 320 Equation 4 [Method 321 Equation 2], Excepted Concentration of the Spiked Samples**Ideal Spike Yield***(example calculation for Trial #3 (C_2H_4O), where applicable)*

$$CS = DF \times Spike_{\text{dir}} + \text{Unspike} (1 - DF)$$

$$CS = 0.0778 \times 47.1138 \text{ ppmvw} + 0.3622 \text{ ppmvw} \times (1 - 0.0778) = 4.0003 \text{ ppmvw}$$

Method 320 Spiked vs Expected

$$\text{Spiked vs Expected} = \frac{\text{Actual Spike Yield}}{\text{Ideal Spike Yield}} \times 100 \quad \text{(example calculation for Trial \#3 (} C_2H_4O \text{), where applicable)}$$

$$\% \text{ Recovery} = \frac{4.3142 \text{ ppmvw}}{4.0003 \text{ ppmvw}} \times 100 = 107.849 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

TEST RESULTS AND CALCULATIONS

75% Load

NO_x, CO, THC, N₂O, C₂H₄O, NH₃, HCHO, CH₄, C₂H₆, and H₂O Emissions Data

CATERPILLAR, G3520 TALE 75% LOAD DATA SUMMARY

Parameter	75% Load, Run - 2-1	75% Load, Run - 2-2	75% Load, Run - 2-3	Average
Date (mm/dd/yy)	07/30/21	07/30/21	07/30/21	07/30/21
Start Time (hh:mm:ss)	13:45:23	15:00:23	16:27:23	13:45:23
End Time (hh:mm:ss)	14:44:53	15:59:53	17:26:53	17:26:53
Run Duration (min / run)	60	60	60	60
Bar. Pressure (in. Hg)	29.89	29.87	29.85	29.87
Amb. Temp. (°F)	94	97	97	96
Rel. Humidity (%)	53	47	42	47
Spec. Humidity (lb water / lb air)	0.018296	0.017841	0.015856	0.017331
Engine Fuel Flow (SCFH)	20,603	20,591	20,172	20,455
Stack Flow (RM19) (SCFH)	310,849	310,873	303,928	308,550
Stack Moisture (% Method 320)	13.9	13.9	13.6	13.8
Power Output (horsepower)	2,691.4	2,698.1	2,616.3	2,668.6
Engine Timing (BTDC)	23.0	23.0	23.0	23.00
Actual Power (kW)	2,007.0	2,012.0	1,951.0	1,990.00
Amperes (A)	89.0	90.0	97.0	92.00
Air Manifold Temp. (F)	131.0	131.0	129.0	130.33
Engine Speed (rpm)	1,800.0	1,800.0	1,800.0	1,800.00
NOx (as NO ₂) (ppmvd)	6.49	6.25	6.05	6.26
NOx (as NO ₂) (ppm@15%O ₂)	3.20	3.09	2.98	3.09
NOx (as NO ₂) (g/kW*hr)	0.0544	0.0523	0.0511	0.05
NO (ppmvd)	6.49	6.24	5.96	6.23
NO (ppm@15%O ₂)	3.20	3.08	2.94	3.08
NO (g/kW*hr)	0.0355	0.0341	0.0328	0.0341
NO ₂ (ppmvd)	0.00	0.01	0.09	0.03
NO ₂ (ppm@15%O ₂)	0.00	0.00	0.04	0.02
NO ₂ (g/kW*hr)	0.0000	0.0000	0.0008	0.0003
CO (ppmvd)	3.23	4.20	3.59	3.68
CO (ppm@15%O ₂)	1.60	2.08	1.77	1.81
CO (g/kW*hr)	0.02	0.02	0.02	0.02
THC (as C ₃ H ₈) (ppmvd)	176.40	197.01	190.89	188.10
THC (as C ₃ H ₈) (ppm@15%O ₂)	74.99	83.86	81.34	80.06
THC (as C ₃ H ₈) (g/kW*hr)	1.22	1.36	1.33	1.30
VOC (as C ₃ H ₈) (ppmvd)	0.83	4.90	6.61	4.11
VOC (as C ₃ H ₈) (ppm@15%O ₂)	0.35	2.09	2.82	1.75
VOC (as C ₃ H ₈) (g/kW*hr)	0.01	0.03	0.05	0.03
CH ₄ (as C ₃ H ₈) (ppmvd)	174.98	191.69	183.99	183.55
CH ₄ (as C ₃ H ₈) (ppm@15%O ₂)	86.41	94.72	90.73	90.62
CH ₄ (as C ₃ H ₈) (g/kW*hr)	1.4073	1.5380	1.4883	1.4779
C ₂ H ₆ (as C ₃ H ₈) (ppmvd)	0.59	0.42	0.30	0.43
C ₂ H ₆ (as C ₃ H ₈) (ppm@15%O ₂)	0.29	0.21	0.15	0.21
C ₂ H ₆ (as C ₃ H ₈) (g/kW*hr)	0.0047	0.0033	0.0024	0.0035
N ₂ O (ppmvd)	1.68	1.86	1.70	1.75
N ₂ O (ppm@15%O ₂)	0.83	0.92	0.84	0.86
N ₂ O (g/kW*hr)	0.0135	0.0149	0.0137	0.0140
C ₂ H ₄ O (ppmvd)	1.12	3.50	4.87	3.16
C ₂ H ₄ O (ppm@15%O ₂)	0.55	1.73	2.40	1.56
C ₂ H ₄ O (g/kW*hr)	0.0090	0.0280	0.0393	0.0255
HCHO (ppmvd)	0.00	0.00	0.00	0.00
HCHO (ppm@15%O ₂)	0.00	0.00	0.00	0.00
HCHO (g/kW*hr)	0.0000	0.0000	0.0000	0.0000
NH ₃ (ppmvd)	18.17	16.63	15.56	16.79
NH ₃ (ppm@15%O ₂)	8.97	8.22	7.67	8.29
NH ₃ (g/kW*hr)	0.0564	0.0515	0.0486	0.0522
CO ₂ (%)	6.57	6.55	6.66	6.59
CO ₂ (lb/hr)	2,333.03	2,325.95	2,312.44	2,323.80
CO ₂ (lb/kW*hr)	1,162.47	1,156.06	1,185.28	1,167.93
CO ₂ (ton/year) at 8760 hr/year	10,218.67	10,187.65	10,128.47	10,178.26
CO ₂ (lb/MMBtu)	115.63	115.63	115.63	115.63
CO ₂ (g/kW*hr)	527.29	524.38	537.63	529.77
O ₂ (%)	8.95	8.96	8.94	8.95

TEST RESULTS AND CALCULATIONS

100% Load

NO_x, CO, THC, N₂O, C₂H₄O, NH₃, HCHO, CH₄, C₂H₆, and H₂O Emissions Data

CATERPILLAR, G3520 TALE 100% LOAD DATA SUMMARY

Parameter	100% Load, Run - 3-1	100% Load, Run - 3-2	100% Load, Run - 3-3	Average
Date (mm/dd/yy)	09/01/21	09/01/21	09/02/21	09/01/21
Start Time (hh:mm:ss)	9:23:57	10:26:27	12:03:27	9:23:57
End Time (hh:mm:ss)	10:25:57	12:02:57	13:06:27	13:06:27
Run Duration (min / run)	62	97	64	74
Bar. Pressure (in. Hg)	29.73	29.73	29.74	29.73
Amb. Temp. (°F)	88	93	95	92
Rel. Humidity (%)	70	57	46	58
Spec. Humidity (lb water / lb air)	0.020202	0.019207	0.016410	0.018606
Engine Fuel Flow (SCFH)	26,278	26,278	26,278	26,278
Stack Flow (RM19) (SCFH)	386,201	399,898	406,400	397,500
Stack Moisture (% Method 320)	13.6	12.9	13.0	13.2
Power Output (horsepower)	3,598.0	3,598.0	3,598.0	3,598.0
Engine Timing (BTDC)	22.0	22.0	22.0	22.00
Actual Power (kW)	2,613.0	2,613.0	2,613.0	2,613.00
Amperes (A)	109.0	109.0	109.0	109.00
Air Manifold Temp. (F)	136.0	136.0	136.0	136.00
Engine Speed (rpm)	1,800.0	1,800.0	1,800.0	1,800.00
NOx (as NO ₂) (ppmvd)	10.21	9.38	9.85	9.81
NOx (as NO ₂) (ppm@15%O ₂)	4.92	4.67	4.99	4.86
NOx (as NO ₂) (g/kW*hr)	0.080	0.076	0.081	0.08
NO (ppmvd)	8.60	8.67	9.35	8.87
NO (ppm@15%O ₂)	4.14	4.32	4.12	4.19
NO (g/kW*hr)	0.044	0.046	0.050	0.05
NO ₂ (ppmvd)	1.61	0.71	0.50	0.94
NO ₂ (ppm@15%O ₂)	0.78	0.35	0.90	0.68
NO ₂ (g/kW*hr)	0.013	0.006	0.004	0.01
CO (ppmvd)	4.36	2.18	1.58	2.71
CO (ppm@15%O ₂)	2.10	1.09	0.80	1.33
CO (g/kW*hr)	0.021	0.011	0.008	0.01
THC (as C ₃ H ₈) (ppmvd)	114.77	107.19	108.68	110.21
THC (as C ₃ H ₈) (ppm@15%O ₂)	47.70	46.52	47.86	47.36
THC (as C ₃ H ₈) (g/kW*hr)	0.739	0.721	0.742	0.73
VOC (as C ₃ H ₈) (ppmvd)	0.00	0.00	0.00	0.00
VOC (as C ₃ H ₈) (ppm@15%O ₂)	0.00	0.00	0.00	0.00
VOC (as C ₃ H ₈) (g/kW*hr)	0.000	0.000	0.000	0.00
CH ₄ (as C ₃ H ₈) (ppmvd)	176.10	165.42	161.29	167.60
CH ₄ (as C ₃ H ₈) (ppm@15%O ₂)	84.74	82.43	81.68	82.95
CH ₄ (as C ₃ H ₈) (g/kW*hr)	1.316	1.280	1.269	1.29
C ₂ H ₆ (as C ₃ H ₈) (ppmvd)	0.00	0.28	0.45	0.24
C ₂ H ₆ (as C ₃ H ₈) (ppm@15%O ₂)	0.00	0.14	0.23	0.12
C ₂ H ₆ (as C ₃ H ₈) (g/kW*hr)	0.000	0.002	0.004	0.00
N ₂ O (ppmvd)	2.40	1.16	0.80	1.45
N ₂ O (ppm@15%O ₂)	1.16	0.58	0.40	0.713
N ₂ O (g/kW*hr)	0.018	0.009	0.006	0.01
C ₂ H ₄ O (ppmvd)	0.91	0.96	0.94	0.94
C ₂ H ₄ O (ppm@15%O ₂)	0.44	0.48	0.48	0.464
C ₂ H ₄ O (g/kW*hr)	0.007	0.007	0.007	0.0072
HCHO (ppmvd)	1.29	0.82	0.61	9.07E-01
HCHO (ppm@15%O ₂)	0.62	0.41	0.31	4.46E-01
HCHO (g/kW*hr)	0.007	0.004	0.003	0.005
NH ₃ (ppmvd)	0.68	2.65	13.33	5.56
NH ₃ (ppm@15%O ₂)	0.33	1.32	6.75	2.80
NH ₃ (g/kW*hr)	0.002	0.008	0.041	0.02
CO ₂ (%)	6.81	6.58	6.53	6.64
CO ₂ (lb/hr)	3,004.47	3,005.35	3,030.75	3,013.53
CO ₂ (lb/kW*hr)	1,119.81	1,120.14	1,129.60	1,123.18
CO ₂ (ton/year) at 8760 hr/year	13,159.59	13,163.45	13,274.70	13,199.25
CO ₂ (lb/MMBtu)	115.57	115.57	115.57	115.57
CO ₂ (g/kW*hr)	507.94	508.08	512.38	509.47
O ₂ (%)	8.64	9.06	9.25	8.98

TEST RESULTS AND CALCULATIONS

50% Load PM Emissions Data

METHOD 5 (FRONT) AND 202 (BACK) - RESULTS

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Historical Data	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
Run Start Time	09:34	12:05	14:23		hh:mm
Run Stop Time	11:24	13:59	15:58		hh:mm
Test Date	07/29/21	07/29/21	07/29/21		mm/dd/yy
Load	50%	50%	50%		% or w/DB
Meter Calibration Factor	0.986	0.986	0.986		
Pitot Tube Coefficient	0.8215	0.8230	0.8215		
Average Nozzle Diameter	0.311	0.311	0.311		in
Stack Test Data	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
Initial Meter Volume	59.000	96.035	133.977		ft ³
Final Meter Volume	95.989	133.682	171.362		ft ³
Total Meter Volume	36.989	37.647	37.385	37.340	ft ³
Total Sampling Time	90.00	90.00	90.00	90.00	min
Average Meter Temperature	87.00	94.63	93.96	91.86	°F
Average Stack Temperature	906.00	904.83	922.71	911.18	°F
Barometric Pressure	29.87	29.90	29.85	29.87	in Hg
Stack Static Pressure	0.07	0.07	0.07	0.07	in H ₂ O
Absolute Stack Pressure	29.88	29.91	29.86	29.88	in Hg
Average Orifice Pressure Drop	0.52	0.53	0.53	0.53	in H ₂ O
Absolute Meter Pressure	30.00	30.03	29.98	30.01	in Hg
Avg Square Root Pitot Pressure	0.41	0.42	0.41	0.41	√(in H ₂ O)
Moisture Content Data	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
Impinger Water Weight Gain	117.70	117.80	115.30	116.93	g
Silica Gel Weight Gain	8.40	6.90	7.00	7.43	g
Total Water Volume Collected	126.33	124.92	122.52	124.59	ml
Standard Water Vapor Volume	5.95	5.88	5.77	5.86	scf
Standard Meter Volume	35.2	35.4	35.1	35.2	dscf
Standard Metric Meter Volume	1.0	1.0	1.0	1.0	dscm
Calculated Stack Moisture	14.45	14.26	14.11	14.27	%
Saturated Stack Moisture	100.00	100.00	100.00	100.00	%
Reported Stack Moisture Content	14.45	14.26	14.11	14.27	%
Gas Analysis Data	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
Carbon Dioxide Content	6.7	6.7	6.8	6.7	%
Oxygen Content	8.7	8.7	8.8	8.7	%
Carbon Monoxide Content	6.0	6.0	6.4	6.1	ppm
Nitrogen Content	84.6	84.6	84.5	84.5	%
Stack Dry Molecular Weight	29.42	29.42	29.43	29.42	lb/lb-mole
Stack Wet Molecular Weight	27.77	27.79	27.82	27.79	lb/lb-mole
Calculated Fuel Factor	1.822	1.817	1.793	1.811	
Fuel F-Factor	8631.70	8631.70	8631.70	8631.70	dscf/MMBtu
Percent Excess Air	63.4	64.4	65.1	64.3	%

METHOD 5 (FRONT) AND 202 (BACK) - RESULTS

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Volumetric Flow Rate Data	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
Average Stack Gas Velocity	37.36	37.43	37.48	37.42	ft/sec
Stack Cross-Sectional Area	5.54	5.54	5.54	5.54	ft²
Actual Stack Flow Rate	12,421	12,445	12,462	12,443	acfm
Wet Standard Stack Flow Rate	288	289	285	287	wkscfh
Dry Standard Stack Flow Rate	246,059	247,565	244,695	246,106	dscfh
Percent of Isokinetic Rate	100.2	99.9	100.3	100.1	%
Gravimetric Analysis	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
NH ₄ OH Correction	0.0000	0.0000	0.0000	0.0000	ml
NH ₄ OH Correction	0.0000	0.0000	0.0000	0.0000	mg
Emission Rate Data	R-1 50%-1	R-1 50%-2	R-1 50%-3	Average	Units
Total PM Mass	18.09	14.54	9.68	14.10	mg
Total PM Concentration	5.14E-04	4.11E-04	2.76E-04	4.00E-04	g/dscf
	7.93E-03	6.34E-03	4.26E-03	6.18E-03	gr/dscf
Total PM Emission Rate	0.13	0.10	0.07	0.10	kg/hr
	0.28	0.22	0.15	0.22	lb/hr
	1.22	0.98	0.65	0.95	tpy
	0.0167	0.0134	0.0091	0.0131	lb/MMBtu
Filterable PM Mass	11.69	10.89	7.98	10.19	mg
Filterable PM Concentration	3.32E-04	3.08E-04	2.27E-04	2.89E-04	g/dscf
	5.13E-03	4.75E-03	3.51E-03	4.46E-03	gr/dscf
Filterable PM Emission Rate	0.08	0.08	0.06	0.07	kg/hr
	0.18	0.17	0.12	0.16	lb/hr
	0.79	0.74	0.54	0.69	tpy
	0.0108	0.0101	0.0075	0.0094	lb/MMBtu
Condensable PM Mass	6.40	3.65	1.70	3.92	mg
Condensable PM Concentration	1.82E-04	1.03E-04	4.84E-05	1.11E-04	g/dscf
	2.81E-03	1.59E-03	7.47E-04	1.72E-03	gr/dscf
Condensable PM Emission Rate	0.04	0.03	0.01	0.03	kg/hr
	0.10	0.06	0.03	0.06	lb/hr
	0.43	0.25	0.11	0.26	tpy
	0.0059	0.0034	0.0016	0.0036	lb/MMBtu

Nomenclature

- %CO = carbon monoxide concentration (%)
- %CO₂ = carbon dioxide concentration (%)
- %N₂ = nitrogen concentration (%)
- %O₂ = oxygen concentration (%)
- %O_{2,wet} = Oxygen content of gas stream, % by volume of wet gas. (Note: The oxygen percentage used in Method 201A, Equation 3 is on a wet gas basis. That means that since oxygen is typically measured on a dry gas basis, the measured percent O₂ must be multiplied by the quantity (1 - B_{ws}) to convert to the actual volume fraction. Therefore, %O_{2,wet} = (1 - B_{ws}) * %O_{2, dry})
- (%EA)_{avg} = average excess air (%)
- (F_o)_{avg} = average calculated fuel factor
- [(Δp)^{0.5}]_{avg} = Average of square roots of the velocity pressures measured during the preliminary traverse, inches W.C.
- μ = Gas viscosity, micropoise
- 12.0 = Constant calculated as 60 percent of 20.5 square inch cross-sectional area of combined cyclone head, square inches
- 17.03 = mg/milliequivalents for ammonium ion
- 22.4 = liters of ideal gas per lb-mol of substance at 0°C and 1 atm (ref. Civil Engineering Reference Manual, 7th ed. - Michael R. Lindeburg)
- 24.04 = liters of ideal gas per lb-mol of substance at 20°C and 1 atm (ref. Civil Engineering Reference Manual, 7th ed. - Michael R. Lindeburg)
- 5.02 x 10⁴ = constant derived from the molecular weight and correcting standard temperature and pressure (ref. Bay Area Air Quality Management District, Source Test Procedure ST-1B, Ammonia Integrated Sampling, Adopted January 20, 1982, Regulation 7-303)
- A = distance upstream (in.)
- A_D = stack diameters upstream (dia.)
- A_n = Area of nozzle, square feet
- A_s = area of stack (ft²)
- B = distance downstream (in.)
- B_D = stack diameters downstream (dia.)
- b_f = Average blockage factor calculated in Equation 26, dimensionless
- B_{wm} = meter moisture content (%)
- B_{ws} = stack moisture content (%)
- C = Cunningham correction factor for particle diameter, D_p, and calculated using the actual stack gas temperature, dimensionless
- C₁ = -150.3162 (micropoise)
- C₂ = 18.0614 (micropoise/K^{0.5}) = 13.4622 (micropoise/R^{0.5})
- C₃ = 1.19183 × 10⁶ (micropoise/K²) = 3.86153 × 10⁶ (micropoise/R²)
- C₄ = 0.591123 (micropoise)
- C₅ = 91.9723 (micropoise)
- C₆ = 4.91705 × 10⁻⁵ (micropoise/K²) = 1.51761 × 10⁻⁵ (micropoise/R²)
- C_a = Acetone blank concentration, mg/mg
- C_b = Concentration of NH₃ ion in the back half of train (breakthrough)
- C_f = Concentration of NH₃ ion in the front half of train (main catch)
- C_{fPM10} = Conc. of filterable PM₁₀, gr/dscf
- C_{fPM2.5} = Conc. of filterable PM_{2.5}, gr/dscf
- C_k = K Factor Constant, 849.8

Nomenclature

- C_n = nozzle diameter constant, 0.03575
- C_p' = Coefficient for the pitot used in the preliminary traverse, dimensionless
- C_p = Pitot coefficient for the combined cyclone pitot, dimensionless
- C_{cpm} = Concentration of the condensable PM in the stack gas, dry basis, corrected to standard conditions, milligrams/dry standard cubic foot.
- C_r = Re-estimated Cunningham correction factor for particle diameter equivalent to the actual cut size diameter and calculated using the actual stack gas temperature, dimensionless
- D_{50} = Particle cut diameter, micrometers
- $D_{50(N+1)}$ = D_{50} value for cyclone IV calculated during the N+1 iterative step, micrometers
- D_{50-1} = Re-calculated particle cut diameters based on re-estimated C_r , micrometers
- D_{50LL} = Cut diameter for cyclone I corresponding to the 2.25 micrometer cut diameter for cyclone IV, micrometer
- D_{50N} = D_{50} value for cyclone IV calculated during the Nth iterative step, micrometers
- D_{50T} = Cyclone I cut diameter corresponding to the middle of the overlap zone shown in Method 201A, Figure 10 of Section 17, micrometers
- D_e = equivalent stack diameter (in.)
- $\Delta H@$ = ΔH @ 0.75 scfm (in. H₂O)
- ΔH_{avg} = average orifice pressure (in. H₂O)
- D_n = Inner diameter of sampling nozzle mounted on Cyclone I, inches
- D_{na} = actual nozzle diameter (in.)
- D_p = Physical particle size, micrometers
- Δp = velocity head (in. H₂O)
- Δp_1 = velocity head at first current traverse point (in. H₂O)
- $\Delta p'_1$ = velocity head at first preliminary traverse point (in. H₂O)
- Δp_{avg} = average pitot tube differential pressure (in. H₂O)
- Δp_n = velocity head at subsequent current traverse point (in. H₂O)
- Δp_{RM2} = method 2 velocity head (in. H₂O)
- D_s = diameter of stack (in.)
- F_d = fuel f-factor (dscf/MMBtu)
- f_{O_2} = stack gas fraction of O₂, by volume, dry basis
- I = Percent isokinetic sampling, dimensionless
- K_1 = standard volume correction, 17.65°R/in. Hg
- K_4 = isokinetic conversion constant, 0.0945min•in.Hg/sec•°R
- K_5 = water mass to std water vapor, 0.04715 ft³/g
- K_p = 85.49, ((ft/sec)/(pounds/mole -°R))
- L = length of stack (in.)
- L_{fw} = distance to far wall of stack (in.)
- L_{nw} = distance to near wall of stack (in.) [reference]
- $m_{\#x}$ = weight measurements (g)
- M_1 = Milligrams of PM collected on the filter, less than or equal to 2.5 micrometers
- M_2 = Milligrams of PM recovered from Container #2 (acetone blank corrected), greater than 10 micrometers
- M_3 = Milligrams of PM recovered from Container #3 (acetone blank corrected), less than or equal to 10 and greater than 2.5 micrometers
- M_4 = Milligrams of PM recovered from Container #4 (acetone blank corrected), less than or equal to 2.5 micrometers

Nomenclature

- m_a = Mass of residue of acetone after evaporation, mg
- m_c = Mass of the NH_4^+ added to sample to form ammonium sulfate, mg
- m_{cpm} = Mass of the total condensable PM, mg
- M_d = Molecular weight of dry gas, pounds/pound mole
- m_{fb} = Mass of total CPM in field train recovery blank, mg
- m_{fx} = final weight, avg of last two measurements (g)
- mg = Milligram
- mg/L = Milligram per liter
- m_i = Mass of inorganic CPM, mg
- m_{ib} = Mass of inorganic CPM in field train recovery blank, mg
- M_n = total particulates (mg)
- m_o = Mass of organic CPM, mg
- m_{ob} = Mass of organic CPM in field train blank, mg
- m_r = Mass of dried sample from inorganic fraction, mg
- m_{tx} = tare weight (g)
- MW = molecular weight (lb/lb-mole)
- M_w = Molecular weight of wet gas, pounds/pound mole
- N = Normality of ammonium hydroxide titrant
- N_a = null angle (deg.)
- N_{re} = Reynolds number, dimensionless
- N_{tp} = Number of iterative steps or total traverse points
- $P_b = P_{bar}$ = barometric pressure (in. Hg)
- P_{bar} = barometric pressure (in. Hg)
- ppmCO = carbon monoxide concentration (ppm)
- ppmv = Parts per million by volume
- ppmw = Parts per million by weight
- P_s = absolute stack pressure (in. Hg)
- P_{static} = static pressure (in. H_2O)
- P_{std} = standard pressure, 29.92 in. Hg
- Θ = total sampling time (min)
- Q_{aw} = average stack wet flow rate (ascf/min)
- Q_l = Sampling rate for cyclone I to achieve specified D_{50}
- Q_m = estimated orifice flow rate, 0.750 acfm, else V_m/Q from previous run
- Q_s = Sampling rate for cyclone I to achieve specified D_{50}
- $Q_{s(std)}$ = total cyclone flow rate at standard conditions (dscf/min)
- Q_{sd} = dry standard stack flow rate (dscfm)
- Q_{sST} = Dry gas sampling rate through the sampling assembly, dscfm
- Q_{sw} = wet standard stack flow rate (ascfm)
- R_{max} = Nozzle/stack velocity ratio parameter, dimensionless
- R_{min} = Nozzle/stack velocity ratio parameter, dimensionless
- t_1 = Sampling time at point 1, min
- t_m = average gas meter temperature ($^{\circ}F$)
- t_m = average meter temperature ($^{\circ}F$)
- T_m = Meter box and orifice gas temperature, $^{\circ}R$
- t_n = Sampling time at point n, min

Nomenclature

- t_r = Total projected run time, min
- T_s = Absolute stack gas temperature, °R
- T_{std} = standard temperature, 68°F, 528°R
- T_u = absolute temperature offset, 460°R
- V_a = Volume of acetone blank, ml
- V_{aw} = Volume of acetone used in sample recovery wash, ml
- V_b = Volume of aliquot taken for IC analysis, ml
- V_c = Quantity of water captured in impingers and silica gel, ml
- V_f = final impinger volume (ml)
- V_i = initial impinger volume (ml)
- V_{ic} = Volume of impinger contents sample, ml
- V_m = Dry gas meter volume sampled, acf
- $V_{m(std)}$ = standard meter volume (dscf)
- v_{max} = Maximum gas velocity calculated from Equations 18 or 19, ft/sec
- v_{max} = maximum nozzle velocity (ft/sec)
- V_{mf} = final dry gas meter reading (dcf)
- V_{mi} = initial dry gas meter reading (dcf)
- v_{min} = Minimum gas velocity calculated from Method 201A, Equations 16 or 17, ft/sec
- V_{ms} = Dry gas meter volume sampled, corrected to standard conditions, dscf
- v_n = Sample gas velocity in the nozzle, ft/sec
- v_{org} = organics wash volume (ml)
- V_p = Volume of water added during train purge
- v_s = average stack gas velocity (ft/sec)
- v_{sl} = local velocity (ft/sec)
- V_t = total impinger volume (ml) = $;(V_f - V_i)$
- V_t = Volume of NH₄OH titrant, ml
- $V_{w(std)}$ = volume of water vapor in gas sample at standard conditions (scf)
- v_x = blank volume (ml)
- W = width of stack (in.)
- $W_{2,3,4}$ = Weight of PM recovered from Containers #2, #3, and #4, mg
- W_a = Weight of blank residue in acetone used to recover samples, mg
- W_f = final impinger weight (g)
- W_i = initial impinger weight (g)
- W_t = total impinger weight (g) = $;(W_f - W_i)$
- w_x = blank weight of solids (g)
- Y = meter calibration factor (a.k.a gamma)
- Z = Ratio between estimated cyclone IV D_{50} values, dimensionless
- γ = Dry gas meter gamma value, dimensionless
- ΔH = Meter box orifice pressure drop, inches W.C.
- $\Delta H@$ = Pressure drop across orifice at flow rate of 0.75 scfm at standard conditions, inches W.C.
(Note: Specific to each orifice and meter box.)
- Δp_1 = Velocity pressure measured at point 1, inches W.C.
- Δp_{avg} = Average velocity pressure, inches W.C.
- Δp_m = Observed velocity pressure using S-type pitot tube in preliminary traverse, inches W.C.
- Δp_{max} = Maximum velocity pressure, inches W.C.

Nomenclature

- $\Delta p_{\min}$ = Minimum velocity pressure, inches W.C.
- Δp_n = Velocity pressure measured at point n during the test run, inches W.C.
- Δp_s = Velocity pressure calculated in Method 201a, Equation 25, inches W.C.
- Δp_{s1} = Velocity pressure adjusted for combined cyclone pitot tube, inches W.C.
- Δp_{s2} = Velocity pressure corrected for blockage, inches W.C.
- θ = Total run time, min
- ρ_a = Density of acetone, mg/ml (see label on bottle)
- Σ_n = total number of sampling points

EXAMPLE CALCULATIONS (Reference Method 1 - Circular Stack)

Diameter of Stack (in.)

$$D(in.) = L_{fv} - L_{mv}$$

$$D(in.) = 32.00 \text{ in.} - 0.13 \text{ in.} = 31.88 \text{ in.}$$

Stack Diameters Downstream

$$B_D(dia.) = \frac{B}{D}$$

$$B_D(dia.) = \frac{64.00 \text{ in.}}{31.88 \text{ in.}} = 2.01 \text{ diameters}$$

Area of Stack (ft²)

$$A_s(ft^2) = \pi \times \left(\frac{D}{2 \times 12} \right)^2$$

$$A_s(ft^2) = 3.14 \times \left(\frac{31.88 \text{ in.}}{2 \times 12 \text{ in./ft}} \right)^2 = 5.54 \text{ ft}^2$$

Stack Diameters Upstream

$$A_D(dia.) = \frac{A}{D}$$

$$A_D(dia.) = \frac{16.00 \text{ in.}}{31.88 \text{ in.}} = 0.50 \text{ diameters}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Reference Method 3a) [Values from Run 1 test]**Carbon Monoxide Concentration (%)**

$$\%CO = \frac{ppmCO}{10,000}$$

$$\%CO (\%) = \frac{6.03 \text{ ppm}}{10,000 \text{ ppm/\%}} = 0.0006 \%$$

Nitrogen Concentration (%)

$$\%N_2 = 100 - \%CO_2 - \%O_2 - \%CO$$

$$\%N_2 (\%) = 100 - 6.71 \% - 8.67 \% - 6.03 / 10,000 \% = 84.62 \%$$

Stack Dry Molecular Weight (lb/lb-mole)

$$M_d (\text{lb} / \text{lb} - \text{mol}) = \sum \left(\frac{MW_{comp}}{100} \times \%component \right)$$

$$M_d (\text{lb/lb-mol}) = \left(\frac{44 \text{ lb/lb-mol}}{100} \times 6.71 \% \right) +$$

$$\left(\frac{32 \text{ lb/lb-mol}}{100} \times 8.67 \% \right) + \left(\frac{28 \text{ lb/lb-mol}}{100} \times \left[\frac{6.03}{10,000} + 84.62 \right] \right) = \frac{29.42 \text{ lb}}{\text{lb-mol}}$$

Stack Wet Molecular Weight (lb/lb-mole)

$$M_s (\text{lb} / \text{lb} - \text{mol}) = \left[M_d \times \left(1 - \frac{B_{ws}}{100} \right) \right] + \left[MW_{H_2O} \times \frac{B_{ws}}{100} \right]$$

$$M_s (\text{lb/lb-mol}) = \left\{ \frac{29.42 \text{ lb}}{\text{lb-mol}} \times \left(1 - \frac{14.45 \%}{100} \right) \right\} + \left\{ \frac{18 \text{ lb}}{\text{lb-mol}} \times \frac{14.45 \%}{100} \right\} = \frac{27.77 \text{ lb}}{\text{lb-mol}}$$

Average Calculated Fuel Factor (F_o)

$$F_{o(avg)} = \frac{[20.9 - (\%O_2)_{avg} - (0.5 \times (\%CO)_{avg})]}{[(\%CO_2)_{avg} + (\%CO)_{avg}]}$$

$$F_{o(avg)} = \frac{20.9\% - 8.67 \% - (0.5 \times 0.001 \%)}{6.71 \% + 0.001 \%} = 1.822$$

Average Excess Air (%)

$$\%EA_{avg} (\%) = \frac{100 \times [(\%O_2)_{avg} - (0.5 \times (\%CO)_{avg})]}{[0.264 \times (N_2)_{avg}] - [(\%O_2)_{avg} - (0.5 \times (\%CO)_{avg})]}$$

$$(\%EA)_{AVG} = \frac{100 \times \{ 8.67 \% - (0.5 \times 0.001 \%) \}}{(0.264 \times 84.62 \%) - \{ 8.67 \% - (0.5 \times 0.001 \%) \}} = 63.38 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Reference Method 2) [Values from Run 1 test]

Absolute Stack Pressure (in. Hg)

$$P_s (\text{in. Hg}) = P_b + \frac{P_{\text{static}}}{13.6}$$

$$P_s (\text{in. Hg}) = 29.87 \text{ in. Hg} + \frac{0.07 \text{ in. H}_2\text{O}}{13.6 \text{ in. H}_2\text{O/in. Hg}} = 29.88 \text{ in. Hg}$$

Average Stack Gas Velocity (ft/sec)

$$v_s (\text{ft / sec}) = K_p \times C_p \times (\sqrt{\Delta p})_{\text{avg}} \times \sqrt{\frac{(t_s)_{\text{avg}} + T_u}{P_s \times M_s}}$$

$v_{sl} (\text{ft/sec}) =$

$$\left(\frac{85.49 \text{ ft (lb/lb-mol)(in. Hg)}}{\text{sec (}^\circ\text{R)(in. H}_2\text{O)}} \right)^{1/2} \times 0.82 \times 0.41 \text{ in. H}_2\text{O}^{1/2} \times \sqrt{\frac{906.00 + 460^\circ\text{R}}{29.88 \text{ in. Hg} \times 27.77 \text{ lb/lb-mol}}} = \frac{37.3 \text{ ft}}{\text{sec}}$$

Average Stack Dry Standard Flow Rate (dscfh)

$$Q_{sd} (\text{dscfh}) = \frac{60 \times 60 \times \left(1 - \frac{B_{\text{H}_2\text{O}}}{100} \right) \times v_s \times A_s \times T_{std} \times P_s}{(t_s + T_u) \times P_{std}}$$

$$Q_{sd} (\text{dscf/hr}) = \frac{3600 \text{ sec}}{\text{hr}} \times \left(1 - \frac{14.45 \%}{100} \right) \times \frac{37.36 \text{ ft}}{\text{sec}} \times 5.54 \text{ ft}^2 \times \frac{68.00 + 460^\circ\text{R}}{906.00 + 460^\circ\text{R}} \times \frac{29.88 \text{ in. Hg}}{29.92 \text{ in. Hg}} = \frac{246,058.86 \text{ dscf}}{\text{hr}}$$

Average Stack Wet Flow Rate (acfm)

$$Q_{aw} (\text{acfm}) = 60 \times v_s \times A_s$$

$$Q_{aw} (\text{acf/min}) = \frac{60 \text{ sec}}{\text{min}} \times \frac{37.36 \text{ ft}}{\text{sec}} \times 5.54 \text{ ft}^2 = \frac{12,420.94 \text{ acf}}{\text{min}}$$

Average Stack Wet Standard Flow Rate (ascfh)

$$Q_{sw} (\text{ascfh}) = \frac{60 \times Q_{aw} \times T_{std} \times P_s}{(t_s + T_u) \times P_{std}}$$

$$Q_{sw} (\text{ascf/hr}) = \frac{60 \text{ min}}{\text{hr}} \times \frac{12,420.94 \text{ acf}}{\text{min}} \times \frac{68.00 + 460^\circ\text{R}}{906.00 + 460^\circ\text{R}} \times \frac{29.88 \text{ in. Hg}}{29.92 \text{ in. Hg}} = \frac{287,632.16 \text{ ascf}}{\text{hr}}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Reference Method 4) [Values from Run 1 test]**Water Volume Weighed (scf)**

$$V_{wsg (std)} (scf) = W_t \times K_s$$

$$V_{wsa(std)} = 126.10 \text{ g} \times 0.04715 \text{ ft}^3/\text{g} = 5.946 \text{ scf}$$

Standard Meter Volume (dscf)

$$V_{m(std)} (dscf) = \frac{K_1 \times Y \times V_m \times \left(P_b + \frac{\Delta H_{avg}}{13.6} \right)}{(t_m)_{avg} + T_u}$$

$$V_{m(std)} = \frac{17.65 \text{ }^{\circ}\text{R}}{\text{in. Hg}} \times 0.99 \times 36.99 \text{ dcf} \times \left(29.87 \text{ in. Hg} + \frac{0.52 \text{ in. H}_2\text{O}}{13.6 \text{ in. H}_2\text{O} / \text{in. Hg}} \right) = 35.19 \text{ dscf}$$

$$87.00 \text{ }^{\circ}\text{F} + 460 \text{ }^{\circ}\text{R}$$

Calculated Moisture Content (%)

$$B_{ws(calc)} (\%) = 100 \times \frac{V_{wsg (std)}}{V_{wsg (std)} + V_{m (std)}}$$

$$B_{ws(calc)} = 100 \times \frac{5.95 \text{ dscf}}{5.95 \text{ dscf} + 35.19 \text{ dscf}} = 14.45 \%$$

Saturated Moisture Content (%)

$$B_{ws(svp)} (\%) = 100 \times \frac{10^{\frac{6.691 - \frac{3144}{t_{s(avg)} + 390.86}}{P_b + \frac{P_{static}}{13.6}}}}{\leq 100}$$

$$B_{ws(svp)} = 100 \times \frac{10^{\left(6.691 - \frac{3144}{906.00 \text{ }^{\circ}\text{F} + 390.86} \right)}}{29.87 \text{ in. Hg} + \frac{0.07 \text{ in. H}_2\text{O}}{13.6 \text{ in. H}_2\text{O} / \text{in. Hg}}} \leq 100 = 100.00 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Isokinetic Sampling) [Values from Run 1 test]

Desired Orifice (in. H₂O) (first point)

$$\Delta H_d (\text{in. H}_2\text{O}) = K \times \Delta p$$

$$\Delta H_d (\text{in. H}_2\text{O}) = 3.05 \times$$

$$0.15 \text{ in. H}_2\text{O} = 0.46 \text{ in. H}_2\text{O}$$

Absolute Meter Pressure (in. Hg)

$$P_m (\text{in. Hg}) = P_b + \frac{\Delta H @}{13.6}$$

$$P_m (\text{in. Hg}) = 29.87 \text{ in. Hg} + \frac{1.83 \text{ in. H}_2\text{O}}{13.6 \text{ in. H}_2\text{O/in. Hg}} = 30.00 \text{ in. Hg}$$

Recommended Nozzle Diameter (in.)

$$D_m (\text{in.}) = \sqrt{\frac{C_u \times Q_m \times P_m}{(t_m + T_u) \times C_p} \times \left(\frac{1 - \frac{B_{wm}}{100}}{1 - \frac{B_{ws}}{100}} \right) \times \left(t_s + T_u \right) \times \left[\frac{M_d \times \left(1 - \frac{B_{ws}}{100} \right) + \left(18 \times \frac{B_{ws}}{100} \right)}{P_s \times \Delta p_{avg}} \right]}$$

$$D_{ni} (\text{in.}) = \frac{0.03575 (\text{lb-mole} \cdot ^\circ\text{R} \cdot \text{in. H}_2\text{O})^{1/2} \cdot \text{min} \cdot \text{in.}^2}{\text{acf} \cdot \text{in. Hg}^{3/4} \cdot \text{lb}^{1/2}} \times 0.75 \text{ acf} \times 30.00 \text{ in. Hg} \times \left(1 - \frac{0.00 \%}{100} \right) \times \left(\frac{87.00 ^\circ\text{F} + 460 ^\circ\text{R}}{1 - \frac{14.45 \%}{100}} \right) \times \left(\frac{29.42 \text{ lb}}{\text{lb-mole}} \times \left(1 - \frac{14.45 \%}{100} \right) + \left(\frac{18 \text{ lb}}{\text{lb-mol}} \times \frac{14.45 \%}{100} \right) \right) \times \left(\frac{906.00 ^\circ\text{F} + 460 ^\circ\text{R}}{29.88 \text{ in. Hg} \times 0.41 \text{ in. H}_2\text{O}} \right) = 0.315 \text{ in.}$$

ΔP to ΔH Isokinetic Factor

$$K = C_k \times C_p^2 \times \Delta H @ \times D_{na}^4 \times \left[\frac{M_d \times \left(1 - \frac{B_{wm}}{100} \right) + \left(18 \times \frac{B_{wm}}{100} \right)}{M_d \times \left(1 - \frac{B_{ws}}{100} \right) + \left(18 \times \frac{B_{ws}}{100} \right)} \right] \times \left(\frac{1 - \frac{B_{ws}}{100}}{1 - \frac{B_{wm}}{100}} \right)^2 \times \left(\frac{t_m + T_u}{t_s + T_u} \right) \times \frac{P_s}{P_m}$$

$$K = \frac{849.8}{\text{in. H}_2\text{O} \cdot \text{in.}^4} \times 0.82^2 \times 1.83 \text{ in. H}_2\text{O} \times 0.31^4 \times \left(\frac{1 - \frac{14.45 \%}{100}}{1 - \frac{0.00 \%}{100}} \right)^2 \times \frac{87.00 ^\circ\text{F} + 460 ^\circ\text{R}}{906.00 ^\circ\text{F} + 460 ^\circ\text{R}} \times \left(\frac{29.42 \text{ lb}}{\text{lb-mole}} \times \left(1 - \frac{0.00 \%}{100} \right) + \left(\frac{18 \text{ lb}}{\text{lb-mol}} \times \frac{0.00 \%}{100} \right) \right) \times \left(\frac{29.42 \text{ lb}}{\text{lb-mole}} \times \left(1 - \frac{14.45 \%}{100} \right) + \left(\frac{18 \text{ lb}}{\text{lb-mol}} \times \frac{14.45 \%}{100} \right) \right) \times \frac{29.88 \text{ in. Hg}}{30.00 \text{ in. Hg}} = 3.05$$

Percent Isokinetic (%) (first point)

$$I(\%) = \frac{K_4 \times ((t_s)_{avg} + T_u) \times V_m (std)}{\left(\Theta \times (v_{s(I)})_{avg} \times P_s \times \pi \times \left(\frac{D_{na}}{2} \times \frac{1}{12} \right)^2 \right) \times \left(1 - \frac{B_{ws}}{100} \right)}$$

$$I(\%) = \frac{0.0945 \text{ min} \cdot \text{in. Hg}}{\text{sec} \cdot ^\circ\text{R}} \times (900.00 ^\circ\text{F} + 460 ^\circ\text{R}) \times 1.32 \text{ dscf} \times \frac{3.75 \text{ min} \times \frac{34.83 \text{ ft}}{\text{sec}} \times 29.88 \text{ in. Hg} \times 3.14 \times \left(\frac{0.31 \text{ in.}}{2} \times \frac{\text{ft.}}{12 \text{ in.}} \right)^2 \times \left(1 - \frac{14.45 \%}{100} \right)} = 95.97 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Isokinetic Sampling) [Values from Run 1 test]

Cumulative Percent Isokinetic (%) (weighted average of all points)

Using Method 5, Eq 5-8 to determine intermediate isokinetics at each point, weighted averaging of the cumulative isokinetics is necessary since all points are not equal, and determined by using the dry standard meter volume collected at each point to weight the cumulative average. Intermediate isokinetics and dry standard meter volumes are found at each point. At each point the cumulative sum is found of each value and the quotient of the two used to determine the cumulative isokinetics for each residual point (n).

$$I(\%) = \sum_{1-n} \frac{I(\%) \times V_{m(std)}_{1-n}}{V_{m(std)}_{1-n}}$$

Pt	In (%)	x	Vm(std)n	=	I (%)n	Σ(I (%)n)	/	Σ(Vm(std)n)	=	I (%)	Pt	In (%)	x	Vm(std)n	=	I (%)n	Σ(I (%)n)	/	Σ(Vm(std)n)	=	I (%)
A-1	95.97	x	1.318	=	126.45	126.45	/	1.32	=	96.0	B-9	97.00	x	1.417	=	137.41	3040.43	/	30.63	=	99.3
A-2	98.04	x	1.472	=	144.30	270.76	/	2.79	=	97.1	B-10	107.27	x	1.565	=	167.87	3208.29	/	32.20	=	99.6
A-3	97.62	x	1.424	=	138.97	409.72	/	4.21	=	97.3	B-11	98.32	x	1.393	=	136.93	3345.22	/	33.59	=	99.6
A-4	98.77	x	1.354	=	133.70	543.42	/	5.57	=	97.6	B-12	112.75	x	1.599	=	180.25	3525.47	/	35.19	=	100.2
A-5	99.56	x	1.450	=	144.34	687.76	/	7.02	=	98.0	Last Pt										
A-6	101.42	x	1.601	=	162.36	850.12	/	8.62	=	98.7											
A-7	97.68	x	1.505	=	146.99	997.11	/	10.12	=	98.5											
A-8	99.63	x	1.492	=	148.69	1145.80	/	11.61	=	98.7											
A-9	99.91	x	1.538	=	153.61	1299.41	/	13.15	=	98.8											
A-10	100.38	x	1.544	=	155.01	1454.42	/	14.70	=	99.0											
A-11	102.86	x	1.541	=	158.54	1612.95	/	16.24	=	99.3											
A-12	95.96	x	1.398	=	134.20	1747.16	/	17.64	=	99.1											
B-1	100.45	x	1.384	=	139.00	1886.16	/	19.02	=	99.2											
B-2	97.66	x	1.384	=	135.15	2021.30	/	20.40	=	99.1											
B-3	99.15	x	1.403	=	139.08	2160.39	/	21.81	=	99.1											
B-4	101.47	x	1.479	=	150.04	2310.43	/	23.29	=	99.2											
B-5	92.93	x	1.393	=	129.49	2439.92	/	24.68	=	98.9											
B-6	109.72	x	1.646	=	180.64	2620.56	/	26.33	=	99.5											
B-7	98.33	x	1.473	=	144.88	2765.45	/	27.80	=	99.5											
B-8	97.10	x	1.417	=	137.57	2903.01	/	29.22	=	99.4											

Percent Isokinetic (%) (intermediate equation, all points)

[equivalent to taking an average of point-by-point isokinetics without weighting the average (e.g. all points equal)]

$$I(\%) = \frac{K_4 \times ((t_s)_{avg} + T_u) \times V_{m(std)}}{\left(\Theta \times (v_{s(l)})_{avg} \times P_s \times \pi \times \left(\frac{D_{na}}{2} \times \frac{1}{12} \right)^2 \right) \times \left(1 - \frac{B_{ws}}{100} \right)}$$

$$I(\%) = \frac{0.0945 \text{ min} \cdot \text{in. Hg}}{\text{sec} \cdot ^\circ \text{R}} \times (906.00 \text{ } ^\circ \text{F} + 460 \text{ } ^\circ \text{R}) \times \frac{35.19 \text{ dscf}}{\text{sec}}$$

$$90.00 \text{ min} \times \frac{37.36 \text{ ft}}{\text{sec}} \times 29.88 \text{ in. Hg} \times 3.14 \times \left(\frac{0.31 \text{ in.}}{2} \times \frac{\text{ft.}}{12 \text{ in.}} \right)^2 \times \left(1 - \frac{14.45 \%}{100} \right) = 100.00 \%$$

Raw Data Percent Isokinetic (%)

[utilizes the raw data equation for isokinetics from Method 5]

$$I(\%) = \frac{100 \left((t_s)_{avg} + T_u \right) \left[K_4 V_{1c} + \frac{V_m Y}{(t_m)_{avg} + T_u} \left(P_{bar} + \frac{\Delta H}{13.6} \right) \right]}{60 \left(\Theta \times (v_{s(l)})_{avg} \times P_s \times \pi \times \left(\frac{D_{na}}{2} \times \frac{1}{12} \right)^2 \right)}$$

$$I(\%) =$$

$$100 \times (906.00 \text{ } ^\circ \text{F} + 460 \text{ } ^\circ \text{R}) \times \left[\frac{0.002669 \text{ ft}^3 \cdot \text{in. Hg}}{\text{ml} \cdot ^\circ \text{R}} \times 126.3 \text{ ml} + \frac{36.99 \text{ dcf} \times 0.986}{87.00 \text{ } ^\circ \text{F} + 460 \text{ } ^\circ \text{R}} \left(29.87 \text{ in Hg} + \frac{0.415}{13.6} \right) \right]$$

$$60 \times 90.00 \text{ min} \times \frac{37.36 \text{ ft}}{\text{sec}} \times 29.88 \text{ in. Hg} \times 3.14 \times \left(\frac{0.31 \text{ in.}}{2} \times \frac{\text{ft.}}{12 \text{ in.}} \right)^2 = 99.93 \%$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Gravimetric Analysis) [Values from Run 1 test]**Blank Concentration [Acetone Blank Weight of Solids] (mg/ml)**

$$C_x (mg / ml) = \frac{1000 \times w_x}{v_x}$$

$$C_x (mg/ml) = \frac{1000 \text{ mg}}{\text{g}} \times \frac{0.0004 \text{ g}}{137.00 \text{ ml}} = \frac{0.0026 \text{ mg}}{\text{ml}} = \frac{\text{mg}}{\text{ml}}$$

Blank Adjustment [Acetone Blank Weight of Solids and Probe Wash] (mg)

$$W_x (mg) = v_x \times C_x$$

$$W_x (mg) = 200.00 \text{ ml} \times 0.0026 \text{ mg/ml} = 0.51 \text{ mg} < \text{Sample Gain}$$

Sample Gain [Probe Wash] (mg)

$$m_x (mg) = (m_{fx} - m_{tx}) \times 1000$$

$$m_x (mg) = \frac{1000 \text{ mg}}{\text{g}} \times (126.00 \text{ g} - 125.99 \text{ g}) = 9.50 \text{ mg}$$

Adjusted Sample Gain [Probe Wash] (mg)

$$m_{xadj} (mg) = m_x - W_x$$

$$m_{xadj} (mg) = 9.50 \text{ mg} - 0.51 \text{ mg} = 8.99 \text{ mg}$$

0.1N NH₄OH Correction (mg)

$$m_c (mg) = 17.03 \times V_t \times N$$

$$m_c (mg) = 17.03 \times 0.00 \text{ ml} \times 0.1 \text{ N} = 0.00 \text{ mg}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

EXAMPLE CALCULATIONS (Analysis) [Values from Run 1 test - Total PM Mass]**Stack Total Concentration (g/dscf)**

$$c_s (g / dscf) = 0.001 \times \frac{M_n}{V_{m(std)}}$$

$$c_s (g/dscf) = \frac{g}{1000 \text{ mg}} \times \frac{18.09 \text{ mg}}{35.19 \text{ dscf}} = \frac{5.14\text{E-}04 \text{ g}}{\text{dscf}}$$

Stack Total Concentration (gr/dscf)

$$c'_s (gr / dscf) = 0.001 \times \frac{M_n}{V_{m(std)}} \times \frac{7000}{453.592}$$

$$c'_s (gr/dscf) = \frac{g}{1000 \text{ mg}} \times \frac{18.09 \text{ mg}}{35.19 \text{ dscf}} \times \frac{7000 \text{ gr}}{\text{lb}} \times \frac{\text{lb}}{453.592 \text{ g}} = \frac{7.93\text{E-}03 \text{ gr}}{\text{dscf}}$$

Total Emissions Rate (kg/hr)

$$E (kg / hr) = c_s \times Q_{sd} \times \frac{kg}{1000 \text{ g}}$$

$$E (kg/hr) = \frac{kg}{1000 \text{ g}} \times \frac{5.14\text{E-}04 \text{ g}}{\text{dscf}} \times \frac{246,059 \text{ dscf}}{\text{hr}} = \frac{0.13 \text{ kg}}{\text{hr}}$$

Total Emissions Rate (lb/hr)

$$E' (lb / hr) = \frac{M_n \times Q_{sd}}{V_{m(std)}} \times \frac{lb \times g}{453.592 \text{ g} \times 1000 \text{ mg}}$$

$$E' (lb/hr) = \frac{g}{1000 \text{ mg}} \times \frac{\text{lb}}{453.592 \text{ g}} \times \frac{18.09 \text{ mg}}{35.19 \text{ dscf}} \times \frac{246,059 \text{ dscf}}{\text{hr}} = \frac{0.28 \text{ lb}}{\text{hr}}$$

Total Emissions Rate (tpy)

$$E'' (ton / yr) = E' \times \frac{8760}{2000}$$

$$E'' (tpy) = \frac{\text{ton}}{2000 \text{ lb}} \times \frac{8,760 \text{ hr}}{\text{yr}} \times \frac{0.28 \text{ lb}}{\text{hr}} = \frac{1.22 \text{ ton}}{\text{yr}}$$

Total Emissions Rate (lb/MMBtu)

Oxygen Based:

$$E''' (lb/MMBtu) = \frac{M_n \times F_d}{V_{m(std)} \times 1000 \times 453.592} \times \left(\frac{20.9}{20.9 - \%O_2} \right)$$

$$E''' (lb/MMBtu) = \frac{g}{1000 \text{ mg}} \times \frac{\text{lb}}{453.592 \text{ g}} \times \frac{18.09 \text{ mg}}{35.19 \text{ dscf}} \times \frac{8,631.70 \text{ dscf}}{\text{MMBtu}} \times \left(\frac{20.9}{20.9 - 8.7 \%} \right) = \frac{0.0167 \text{ lb}}{\text{MMBtu}}$$

Note: Lack of significant figures may cause rounding errors between actual calculations and example calculations.

TEST RESULTS AND CALCULATIONS

75% Load PM Emissions Data

METHOD 5 (FRONT) AND 202 (BACK) - RESULTS

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Historical Data	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
Run Start Time	08:08	13:17	15:25		hh:mm
Run Stop Time	09:42	14:56	17:01		hh:mm
Test Date	07/30/21	07/30/21	07/30/21		mm/dd/yy
Load	75%	75%	75%		% or w/DB
Meter Calibration Factor	0.986	0.986	0.986		
Pitot Tube Coefficient	0.8230	0.8230	0.8230		
Average Nozzle Diameter	0.311	0.311	0.311		in
Stack Test Data	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
Initial Meter Volume	171.591	224.575	278.408		ft ³
Final Meter Volume	224.305	278.151	332.354		ft ³
Total Meter Volume	52.714	53.576	53.946	53.412	ft ³
Total Sampling Time	90.00	90.00	90.00	90.00	min
Average Meter Temperature	82.33	92.13	94.79	89.75	°F
Average Stack Temperature	911.54	908.79	910.17	910.17	°F
Barometric Pressure	29.89	29.90	29.86	29.88	in Hg
Stack Static Pressure	0.21	0.21	0.21	0.21	in H ₂ O
Absolute Stack Pressure	29.91	29.92	29.88	29.90	in Hg
Average Orifice Pressure Drop	1.14	1.09	1.12	1.11	in H ₂ O
Absolute Meter Pressure	30.02	30.03	29.99	30.02	in Hg
Avg Square Root Pitot Pressure	0.60	0.59	0.60	0.60	√(in H ₂ O)
Moisture Content Data	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
Impinger Water Weight Gain	168.90	161.90	157.20	162.67	g
Silica Gel Weight Gain	9.20	9.70	11.10	10.00	g
Total Water Volume Collected	178.42	171.91	168.60	172.98	ml
Standard Water Vapor Volume	8.40	8.09	7.94	8.14	scf
Standard Meter Volume	50.7	50.6	50.7	50.7	dscf
Standard Metric Meter Volume	1.4	1.4	1.4	1.4	dscm
Calculated Stack Moisture	14.21	13.78	13.54	13.85	%
Saturated Stack Moisture	100.00	100.00	100.00	100.00	%
Reported Stack Moisture Content	14.21	13.78	13.54	13.85	%
Gas Analysis Data	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
Carbon Dioxide Content	6.6	6.5	6.7	6.6	%
Oxygen Content	9.0	9.0	8.9	8.9	%
Carbon Monoxide Content	3.2	4.2	3.6	3.7	ppm
Nitrogen Content	84.5	84.5	84.4	84.5	%
Stack Dry Molecular Weight	29.41	29.41	29.42	29.41	lb/lb-mole
Stack Wet Molecular Weight	27.79	27.83	27.88	27.83	lb/lb-mole
Calculated Fuel Factor	1.819	1.823	1.796	1.813	
Fuel F-Factor	8632.09	8632.09	8632.09	8632.09	dscf/MMBtu
Percent Excess Air	67.1	67.1	67.0	67.1	%

METHOD 5 (FRONT) AND 202 (BACK) - RESULTS

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Volumetric Flow Rate Data	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
Average Stack Gas Velocity	53.86	53.62	53.76	53.75	ft/sec
Stack Cross-Sectional Area	5.54	5.54	5.54	5.54	ft²
Actual Stack Flow Rate	17,907	17,828	17,876	17,870	acfm
Wet Standard Stack Flow Rate	413	413	413	413	wkscfh
Dry Standard Stack Flow Rate	354,670	355,692	356,802	355,721	dscfh
Percent of Isokinetic Rate	100.0	99.5	99.4	99.6	%
Gravimetric Analysis	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
NH ₄ OH Correction	0.0000	0.0000	0.0000	0.0000	ml
NH ₄ OH Correction	0.0000	0.0000	0.0000	0.0000	mg
Emission Rate Data	R-1 75%-1	R-1 75%-2	R-1 75%-3	Average	Units
Total PM Mass	6.11	7.36	5.34	6.27	mg
Total PM Concentration	1.20E-04	1.45E-04	1.05E-04	1.24E-04	g/dscf
	1.86E-03	2.24E-03	1.63E-03	1.91E-03	gr/dscf
Total PM Emission Rate	0.04	0.05	0.04	0.04	kg/hr
	0.09	0.11	0.08	0.10	lb/hr
	0.41	0.50	0.36	0.43	tpy
	0.0040	0.0048	0.0035	0.0041	lb/MMBtu
Filterable PM Mass	4.31	5.91	3.89	4.70	mg
Filterable PM Concentration	8.50E-05	1.17E-04	7.68E-05	9.29E-05	g/dscf
	1.31E-03	1.80E-03	1.19E-03	1.43E-03	gr/dscf
Filterable PM Emission Rate	0.03	0.04	0.03	0.03	kg/hr
	0.07	0.09	0.06	0.07	lb/hr
	0.29	0.40	0.26	0.32	tpy
	0.0028	0.0039	0.0026	0.0031	lb/MMBtu
Condensable PM Mass	1.80	1.45	1.45	1.57	mg
Condensable PM Concentration	3.55E-05	2.86E-05	2.86E-05	3.09E-05	g/dscf
	5.48E-04	4.42E-04	4.42E-04	4.77E-04	gr/dscf
Condensable PM Emission Rate	0.01	0.01	0.01	0.01	kg/hr
	0.03	0.02	0.02	0.02	lb/hr
	0.12	0.10	0.10	0.11	tpy
	0.0012	0.0010	0.0010	0.0010	lb/MMBtu

TEST RESULTS AND CALCULATIONS

100% Load PM Emissions Data

METHOD 5 (FRONT) AND 202 (BACK) - RESULTS

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Historical Data	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
Run Start Time	09:36	12:05	14:24		hh:mm
Run Stop Time	11:17	13:44	16:05		hh:mm
Test Date	08/31/21	08/31/21	08/31/21		mm/dd/yy
Load	100%	100%	100%		% or w/DB
Meter Calibration Factor	0.970	0.970	0.970		
Pitot Tube Coefficient	0.8230	0.8230	0.8230		
Average Nozzle Diameter	0.293	0.293	0.293		in
Stack Test Data	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
Initial Meter Volume	921.610	984.410	48.125		ft ³
Final Meter Volume	984.105	1046.875	110.390		ft ³
Total Meter Volume	62.495	62.465	62.265	62.408	ft ³
Total Sampling Time	90.00	90.00	90.00	90.00	min
Average Meter Temperature	83.54	91.46	76.50	83.83	°F
Average Stack Temperature	877.75	878.08	876.67	877.50	°F
Barometric Pressure	29.72	29.71	29.66	29.70	in Hg
Stack Static Pressure	-0.36	-0.36	-0.36	-0.36	in H ₂ O
Absolute Stack Pressure	29.69	29.68	29.63	29.67	in Hg
Average Orifice Pressure Drop	1.41	1.43	1.47	1.43	in H ₂ O
Absolute Meter Pressure	29.85	29.84	29.79	29.83	in Hg
Avg Square Root Pitot Pressure	0.76	0.76	0.76	0.76	√(in H ₂ O)
Moisture Content Data	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
Impinger Water Weight Gain	189.10	184.70	233.10	202.30	g
Silica Gel Weight Gain	15.10	15.60	15.30	15.33	g
Total Water Volume Collected	204.57	200.66	248.85	218.03	ml
Standard Water Vapor Volume	9.63	9.44	11.71	10.26	scf
Standard Meter Volume	58.7	57.8	59.1	58.5	dscf
Standard Metric Meter Volume	1.7	1.6	1.7	1.7	dscm
Calculated Stack Moisture	14.09	14.04	16.53	14.89	%
Saturated Stack Moisture	100.00	100.00	100.00	100.00	%
Reported Stack Moisture Content	14.09	14.04	16.53	14.89	%
Gas Analysis Data	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
Carbon Dioxide Content	6.8	6.6	6.6	6.7	%
Oxygen Content	8.6	9.1	9.1	8.9	%
Carbon Monoxide Content	4.4	2.2	2.2	2.9	ppm
Nitrogen Content	84.6	84.4	84.4	84.4	%
Stack Dry Molecular Weight	29.44	29.41	29.41	29.42	lb/lb-mole
Stack Wet Molecular Weight	27.82	27.81	27.53	27.72	lb/lb-mole
Calculated Fuel Factor	1.800	1.800	1.800	1.800	
Fuel F-Factor	8631.42	8631.42	8631.42	8631.42	dscf/MMBtu
Percent Excess Air	63.2	68.6	68.6	66.8	%

METHOD 5 (FRONT) AND 202 (BACK) - RESULTS

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Volumetric Flow Rate Data	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
Average Stack Gas Velocity	68.00	68.19	68.64	68.28	ft/sec
Stack Cross-Sectional Area	5.54	5.54	5.54	5.54	ft²
Actual Stack Flow Rate	22,611	22,673	22,821	22,702	acfm
Wet Standard Stack Flow Rate	531	533	536	533	wkscfh
Dry Standard Stack Flow Rate	456,526	457,773	447,146	453,815	dscfh
Percent of Isokinetic Rate	102.0	99.9	104.6	102.2	%
Gravimetric Analysis	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
NH ₄ OH Correction	0.0000	0.0000	0.0000	0.0000	ml
NH ₄ OH Correction	0.0000	0.0000	0.0000	0.0000	mg
Emission Rate Data	R-1 100%-1	R-1 100%-2	R-1 100%-3	Average	Units
Total PM Mass	6.05	1.64	2.75	3.48	mg
Total PM Concentration	1.03E-04	2.84E-05	4.65E-05	5.93E-05	g/dscf
	1.59E-03	4.38E-04	7.18E-04	9.15E-04	gr/dscf
Total PM Emission Rate	0.05	0.01	0.02	0.03	kg/hr
	0.10	0.03	0.05	0.06	lb/hr
	0.45	0.13	0.20	0.26	tpy
	0.0033	0.0010	0.0016	0.0020	lb/MMBtu
Filterable PM Mass	3.60	1.05	0.00	1.55	mg
Filterable PM Concentration	6.13E-05	1.82E-05	0.00E+00	2.65E-05	g/dscf
	9.46E-04	2.80E-04	0.00E+00	4.09E-04	gr/dscf
Filterable PM Emission Rate	0.03	0.01	0.00	0.01	kg/hr
	0.06	0.02	0.00	0.03	lb/hr
	0.27	0.08	0.00	0.12	tpy
	0.0020	0.0006	0.0000	0.0009	lb/MMBtu
Condensable PM Mass	2.45	0.59	2.75	1.93	mg
Condensable PM Concentration	4.17E-05	1.02E-05	4.65E-05	3.28E-05	g/dscf
	6.44E-04	1.58E-04	7.18E-04	5.06E-04	gr/dscf
Condensable PM Emission Rate	0.02	0.00	0.02	0.01	kg/hr
	0.04	0.01	0.05	0.03	lb/hr
	0.18	0.05	0.20	0.14	tpy
	0.0014	0.0003	0.0016	0.0011	lb/MMBtu

APPENDIX B

EMISSION DATA RECORDS

EMISSION DATA RECORDS

Operating Data
(provided by Catalytic Combustion Corporation)

Catalytic Combustion Corporation

Plant Name or Location:	Stewart & Stevenson Integration Center
Project Number:	catc-21-houston.tx-start#1
Manufacturer & Equipment:	Caterpillar
Model:	G3520 TALE
Test Load:	multiple
Tester(s) / Test Unit(s):	C. King / P. McGovern / J. Wolrab / 217

		RUN								
	UNITS	1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3
Start Time	hh:mm:ss	09:34:23	12:05:23	14:23:23	13:45:23	15:00:23	16:27:23	09:23:57	10:26:27	12:03:27
End Time	hh:mm:ss	10:33:53	13:04:53	15:22:53	14:44:53	15:59:53	17:26:53	10:25:57	12:02:57	13:06:27
Bar. Pressure	in. Hg	29.90	29.90	29.84	29.89	29.87	29.85	29.73	29.73	29.74
Amb. Temp.	°F	98	99	96	94	97	97	88	93	95
Rel. Humidity	%	53	49	49	53	47	42	70	57	46
Spec. Humidity	lb water / lb air	0.020978	0.019455	0.018009	0.018296	0.017841	0.015856	0.020202	0.019207	0.016410
Date	mm/dd/yy	07/29/21	07/29/21	07/29/21	07/30/21	07/30/21	07/30/21	09/01/21	09/01/21	09/02/21
Load Designator		50%	50%	50%	75%	75%	75%	100%	100%	100%
Engine Fuel Flow	SCFH	14,625	14,511	14,541	20,603	20,591	20,172	26,278	26,278	26,278
Stack Moisture	% Method 320	14.41	14.43	14.39	13.91	13.86	13.59	13.64	12.89	13.03
Power Output	horsepower	1,810.4	1,813.0	1,810.4	2,691.4	2,698.1	2,616.3	3,598.0	3,598.0	3,598.0
Air Manifold Press.	psia	25.20	25.40	25.30	36.80	36.70	35.60	473.00	473.00	473.00
Air Manifold Temp.	F	122.00	122.00	124.00	131.00	131.00	129.00	136.00	136.00	136.00
Engine Speed	rpm	1,799.00	1,799.00	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00	1,800.00
Actual Power	kW	1,350.00	1,352.00	1,350.00	2,007.00	2,012.00	1,951.00	2,613.00	2,613.00	2,613.00
Amperes	A	56.00	57.00	56.00	89.00	90.00	97.00	109.00	109.00	109.00
Engine Timing	BTDC	23.00	23.00	23.00	23.00	23.00	23.00	22.00	22.00	22.00

-Brake horsepower available from engine panel and/or site personnel.

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EMISSION DATA RECORDS

50% Load

NO_x, CO, THC, N₂O, C₂H₄O, NH₃, HCHO, CH₄, C₂H₆, and H₂O
Reference Method Data

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	14.625	SCFH

Weather Data

Barometric Pressure	29.90	in. Hg
Relative Humidity	53	%
Ambient Temperature	98	°F
Specific Humidity	0.020978	lb H ₂ O / lb air

Unit Data

Unit Load	1,810.4	horsepower
Meas. Stack Moisture	14.4	%
Stack Exhaust Flow (M19)	215,406	SCFH

50% Load, Run - 1-1

Date/Time (mm/dd/yyyy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmw)	CO (ppmw)	THC (as C ₂ H ₆) (ppmw)	CO ₂ (%vvd)	N ₂ O (ppmw)	C ₂ H ₆ O (ppmw)	NO (ppmw)	NO ₂ (ppmw)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (ppmw)	C ₂ H ₆ (ppmw)	H ₂ O (%)
07/29/21 09:34:23	64260	8.64	7.86	5.26	154.78	5.81	1.26	0.25	7.86	0.00	0.62	0.06	412.89	0.43	13.81
07/29/21 09:34:53	64290	8.65	7.74	5.30	155.11	5.79	1.21	0.44	7.74	0.00	0.64	0.10	411.55	0.56	14.08
07/29/21 09:35:23	64320	8.65	7.58	5.22	154.88	5.75	1.29	0.43	7.58	0.00	0.63	0.09	410.71	0.57	14.48
07/29/21 09:35:53	64350	8.64	7.82	5.31	155.59	5.81	1.28	0.48	7.82	0.00	0.60	0.09	411.45	0.58	13.77
07/29/21 09:36:23	64380	8.66	7.59	5.21	156.36	5.80	1.29	0.17	7.59	0.00	0.62	0.02	413.14	0.39	13.89
07/29/21 09:36:53	64410	8.67	7.66	5.22	154.14	5.72	1.23	0.58	7.66	0.00	0.59	0.16	407.82	0.41	14.77
07/29/21 09:37:23	64440	8.67	7.60	5.33	155.38	5.80	1.28	0.69	7.60	0.00	0.59	0.10	413.59	0.41	13.93
07/29/21 09:37:53	64470	8.68	7.65	5.30	158.32	5.85	1.29	0.25	7.65	0.00	0.57	0.03	418.84	0.54	13.40
07/29/21 09:38:23	64500	8.66	8.33	5.33	157.36	5.91	1.29	0.53	8.32	0.01	0.58	0.00	418.45	0.50	12.81
07/29/21 09:38:53	64530	8.67	7.37	5.20	155.95	5.74	1.27	0.66	7.37	0.00	0.60	0.09	413.16	0.60	14.45
07/29/21 09:39:23	64560	8.67	7.57	5.27	157.13	5.84	1.32	0.51	7.57	0.00	0.57	0.03	417.11	0.56	13.50
07/29/21 09:39:53	64590	8.66	7.52	5.27	156.37	5.82	1.32	0.08	7.52	0.00	0.54	0.06	414.39	0.44	13.72
07/29/21 09:40:23	64620	8.66	7.53	5.28	157.35	5.85	1.32	-0.02	7.53	0.00	0.56	0.15	417.90	0.47	13.41
07/29/21 09:40:53	64650	8.65	7.27	5.24	156.81	5.80	1.34	0.28	7.27	0.00	0.57	0.08	415.08	0.60	13.89
07/29/21 09:41:23	64680	8.66	6.98	5.23	153.86	5.64	1.29	0.37	6.98	0.00	0.58	0.13	406.46	0.53	15.59
07/29/21 09:41:53	64710	8.66	6.98	5.24	155.66	5.72	1.29	0.41	6.98	0.00	0.55	0.09	411.26	0.51	14.77
07/29/21 09:42:23	64740	8.66	7.08	5.29	155.72	5.74	1.29	0.39	7.08	0.00	0.58	0.07	412.49	0.52	14.72
07/29/21 09:42:53	64770	8.65	7.42	5.35	154.90	5.79	1.27	0.25	7.42	0.00	0.57	0.09	412.41	0.45	14.19
07/29/21 09:43:23	64800	8.65	7.46	5.21	156.74	5.80	1.30	0.38	7.46	0.00	0.52	0.11	414.00	0.47	13.82
07/29/21 09:43:53	64830	8.65	7.85	5.23	156.47	5.84	1.34	0.58	7.85	0.00	0.55	0.08	415.90	0.48	13.49
07/29/21 09:44:23	64860	8.65	7.19	5.23	155.54	5.69	1.27	0.05	7.19	0.00	0.54	0.03	410.51	0.64	14.97
07/29/21 09:44:53	64890	8.65	7.27	5.29	156.10	5.83	1.33	0.31	7.27	0.00	0.53	0.02	415.84	0.46	13.68
07/29/21 09:45:23	64920	8.65	7.64	5.32	156.06	5.83	1.32	0.72	7.64	0.00	0.52	0.05	414.28	0.69	13.67
07/29/21 09:45:53	64950	8.66	7.76	5.18	151.33	5.56	1.23	0.62	7.76	0.00	0.57	0.31	400.48	0.53	16.76
07/29/21 09:46:23	64980	8.66	7.68	5.36	156.15	5.82	1.33	0.51	7.68	0.00	0.53	0.10	413.91	0.58	13.79
07/29/21 09:46:53	65010	8.66	7.94	5.41	156.70	5.85	1.37	0.73	7.94	0.00	0.53	0.15	415.92	0.52	13.53
07/29/21 09:47:23	65040	8.67	7.41	5.26	156.29	5.75	1.31	0.21	7.41	0.00	0.53	0.06	413.46	0.51	14.44
07/29/21 09:47:53	65070	8.66	7.54	5.38	157.28	5.79	1.32	0.48	7.54	0.00	0.52	0.10	416.22	0.52	13.93
07/29/21 09:48:23	65100	8.65	7.31	5.35	155.73	5.78	1.31	0.51	7.31	0.00	0.52	0.10	413.92	0.53	14.18
07/29/21 09:48:53	65130	8.67	7.54	5.24	152.05	5.65	1.26	0.43	7.54	0.00	0.57	0.16	404.25	0.36	16.05
07/29/21 09:49:23	65160	8.67	6.93	5.25	155.15	5.72	1.29	0.31	6.93	0.00	0.51	0.08	412.31	0.52	14.72
07/29/21 09:49:53	65190	8.67	7.61	5.24	157.01	5.79	1.34	0.26	7.61	0.00	0.51	0.01	414.69	0.55	14.03
07/29/21 09:50:23	65220	8.67	7.36	5.25	158.02	5.80	1.36	0.36	7.36	0.00	0.50	0.07	417.65	0.35	13.99
07/29/21 09:50:53	65250	8.67	7.17	5.11	152.90	5.63	1.29	0.39	7.17	0.00	0.55	0.21	405.00	0.39	16.22
07/29/21 09:51:23	65280	8.67	7.26	5.24	156.56	5.76	1.31	0.53	7.26	0.00	0.49	0.02	414.46	0.46	14.34
07/29/21 09:51:53	65310	8.68	7.53	5.27	157.12	5.80	1.37	0.58	7.53	0.00	0.52	0.03	415.96	0.49	13.91
07/29/21 09:52:23	65340	8.68	7.31	5.25	155.62	5.76	1.39	0.56	7.31	0.00	0.49	0.10	413.86	0.40	14.28
07/29/21 09:52:53	65370	8.69	6.93	5.01	152.16	5.46	1.26	0.51	6.93	0.00	0.55	0.30	400.23	0.53	17.60
07/29/21 09:53:23	65400	8.68	6.93	5.25	157.83	5.74	1.33	0.00	6.93	0.00	0.49	0.00	416.19	0.63	14.47
07/29/21 09:53:53	65430	8.67	6.42	5.22	156.91	5.65	1.30	0.40	6.42	0.00	0.49	0.20	413.78	0.51	15.42
07/29/21 09:54:23	65460	8.67	6.94	5.06	152.99	5.49	1.26	0.48	6.94	0.00	0.56	0.24	402.97	0.43	17.51
07/29/21 09:54:53	65490	8.67	6.91	5.17	157.38	5.74	1.34	0.26	6.91	0.00	0.51	0.07	416.00	0.45	14.44
07/29/21 09:55:23	65520	8.67	6.85	5.16	156.86	5.70	1.32	0.58	6.85	0.00	0.49	0.02	413.18	0.33	14.89
07/29/21 09:55:53	65550	8.67	6.90	5.07	153.00	5.63	1.28	0.31	6.90	0.00	0.51	0.19	406.91	0.42	16.15
07/29/21 09:56:23	65580	8.66	6.69	5.24	155.68	5.68	1.32	0.43	6.69	0.00	0.48	0.08	412.23	0.37	15.24
07/29/21 09:56:53	65610	8.67	6.97	5.09	152.57	5.60	1.28	0.43	6.97	0.00	0.53	0.13	404.35	0.34	16.62
07/29/21 09:57:23	65640	8.66	6.58	5.28	155.53	5.66	1.34	0.44	6.58	0.00	0.49	0.13	412.16	0.52	15.34
07/29/21 09:57:53	65670	8.67	6.36	5.22	156.76	5.66	1.31	0.41	6.36	0.00	0.49	0.11	413.16	0.58	15.30
07/29/21 09:58:23	65700	8.66	6.58	5.21	154.91	5.65	1.26	0.40	6.58	0.00	0.49	0.06	408.84	0.50	15.58
07/29/21 09:58:53	65730	8.67	7.30	5.03	153.53	5.68	1.30	0.57	7.30	0.00	0.52	0.07	407.78	0.38	15.67
07/29/21 09:59:23	65760	8.66	7.43	5.20	153.92	5.68	1.33	0.57	7.43	0.00	0.53	0.03	408.27	0.34	15.67
07/29/21 09:59:53	65790	8.67	6.87	5.30	155.32	5.67	1.33	0.48	6.87	0.00	0.47	0.13	410.96	0.46	15.29
07/29/21 10:00:23	65820	8.67	6.83	5.20	157.56	5.72	1.31	0.27	6.83	0.00	0.48	0.15	414.63	0.64	14.74
07/29/21 10:00:53	65850	8.67	7.35	5.25	157.37	5.81	1.40	0.33	7.35	0.00	0.47	0.07	417.59	0.57	13.78
07/29/21 10:01:23	65880	8.67	7.53	5.26	159.10	5.89	1.43	0.62	7.53	0.00	0.44	0.06	422.35	0.44	12.91
07/29/21 10:01:53	65910	8.67	7.14	5.38	159.41	5.88	1.45	0.12	7.14	0.00	0.44	-0.02	424.89	0.46	12.44
07/29/21 10:02:23	65940	8.69	7.37	5.33	160.28	5.90	1.45	0.38	7.37	0.00	0.41	0.07	425.29	0.58	12.09
07/29/21 10:02:53	65970	8.70	7.13	5.17	157.58	5.85	1.42	0.66	7.13	0.00	0.42	0.02	419.90	0.43	13.24
07/29/21 10:03:23	66000	8.69	7.10	5.14	157.75	5.79	1.41	0.62	7.10	0.00	0.42	0.06	419.81	0.51	13.73
07/29/21 10:03:53	66030	8.69	7.15	5.23	157.78	5.79	1.40	0.52	7.15	0.00	0.42	0.21	418.35	0.33	13.67
07/29/21 10:04:23	66060	8.69	7.44	5.21	157.72	5.80	1.43	0.49	7.44	0.00	0.39	0.08	419.66	0.62	13.52
07/29/21 10:04:53	66090	8.70	6.64	5.17	157.56	5.71	1.42	0.22	6.64	0.00	0.44	0.13	4		

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	14.625	SCFH

Weather Data

Barometric Pressure	29.90	in. Hg
Relative Humidity	53	%
Ambient Temperature	98	°F
Specific Humidity	0.020978	lb H ₂ O / lb air

Unit Data

Unit Load	1,810.4	horsepower
Meas. Stack Moisture	14.4	%
Stack Exhaust Flow (M19)	215,406	SCFH

50% Load, Run - 1-1

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmvw)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%vvd)	N ₂ O (ppmvw)	C ₂ H ₆ O (ppmvw)	NO (ppmvw)	NO ₂ (ppmvw)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (ppmvw)	C ₂ H ₆ (ppmvw)	H ₂ O (%)
07/29/21 10:24:23	67260	8.71	7.08	5.07	156.27	5.64	1.39	0.47	7.08	0.00	0.39	0.17	413.62	0.50	15.82
07/29/21 10:24:53	67290	8.72	6.60	5.11	160.35	5.81	1.44	0.56	6.60	0.00	0.37	0.04	426.11	0.47	13.57
07/29/21 10:25:23	67320	8.71	6.65	5.08	159.82	5.78	1.45	0.26	6.65	0.00	0.36	0.02	423.42	0.50	13.83
07/29/21 10:25:53	67350	8.72	6.28	5.07	157.14	5.66	1.42	0.56	6.28	0.00	0.38	0.09	415.31	0.52	15.27
07/29/21 10:26:23	67380	8.74	5.86	5.08	157.56	5.62	1.41	0.57	5.86	0.00	0.37	0.12	416.39	0.48	15.59
07/29/21 10:26:53	67410	8.72	6.63	4.96	156.44	5.65	1.37	0.43	6.63	0.00	0.41	0.10	413.82	0.45	15.79
07/29/21 10:27:23	67440	8.73	5.97	4.86	153.01	5.40	1.33	0.37	5.97	0.00	0.43	0.15	403.75	0.55	18.18
07/29/21 10:27:53	67470	8.75	6.32	5.09	158.31	5.65	1.41	0.08	6.32	0.00	0.39	0.11	417.51	0.64	15.24
07/29/21 10:28:23	67500	8.75	6.48	5.11	160.05	5.72	1.44	0.44	6.48	0.00	0.37	0.13	423.17	0.54	14.46
07/29/21 10:28:53	67530	8.73	6.34	5.05	161.20	5.77	1.47	0.59	6.34	0.00	0.36	0.07	425.53	0.41	13.89
07/29/21 10:29:23	67560	8.75	6.88	5.09	161.83	5.81	1.48	0.66	6.88	0.00	0.33	0.10	427.71	0.60	13.43
07/29/21 10:29:53	67590	8.75	6.79	5.07	160.96	5.83	1.46	0.38	6.79	0.00	0.35	0.12	428.39	0.50	13.22
07/29/21 10:30:23	67620	8.74	6.66	5.05	161.91	5.85	1.50	0.59	6.66	0.00	0.37	-0.02	430.14	0.45	13.16
07/29/21 10:30:53	67650	8.74	6.77	5.01	160.93	5.84	1.50	0.51	6.77	0.00	0.34	0.03	428.55	0.66	13.37
07/29/21 10:31:23	67680	8.74	6.20	5.05	160.09	5.76	1.44	0.66	6.20	0.00	0.35	0.01	426.08	0.56	13.99
07/29/21 10:31:53	67710	8.74	6.02	4.99	158.94	5.70	1.42	0.36	6.02	0.00	0.33	0.09	422.59	0.65	14.59
07/29/21 10:32:23	67740	8.73	6.44	4.96	160.40	5.76	1.43	0.62	6.44	0.00	0.34	0.17	425.67	0.50	13.81
07/29/21 10:32:53	67770	8.73	6.37	5.02	159.65	5.77	1.41	0.60	6.37	0.00	0.31	0.15	425.11	0.50	13.72
07/29/21 10:33:23	67800	8.73	6.12	5.00	160.39	5.71	1.44	0.46	6.12	0.00	0.37	0.09	424.68	0.37	14.53
07/29/21 10:33:53	67830	8.72	6.47	4.94	159.83	5.76	1.43	0.47	6.47	0.00	0.36	0.15	424.18	0.41	13.94
RAW AVERAGE		8.69	6.97	5.16	157.35	5.74	1.36	0.45	6.97	0.00	0.46	0.09	417.32	0.52	14.41

Bias	Serial Number:	INST-O2-0026	INST-IR-0005	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
	Initial Zero	0.03			2.53										
	Final Zero	0.07			0.12										
	Avg. Zero	0.05			1.33										
	Initial UpScale	12.03			306.71										
	Final UpScale	11.98			307.25										
	Avg. UpScale	12.01			306.98										
	Upscale Cal Gas	11.99			302.00										

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₆ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₃ H ₈)	C ₂ H ₆ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	8.67	8.15	6.03	183.85	6.71	1.59	0.52	8.15	0.00	0.54	0.11	178.78	0.40	4.67
Corrected Raw Average (ppm/% wet basis)	7.41	6.97	5.16	157.35	5.74	1.36	0.45	6.97	0.00	0.46	0.09	153.02	0.34	3.99
Concentration (ppm@ 15%O ₂)	N/A	3.93	2.91	75.89	3.24	0.77	0.25	3.93	0.00	0.26	0.05	86.22	0.19	1.93
Emission Rate (g/kW*hr)	N/A	0.0704	0.0317	1.3008	555	0.0132	0.0043	0.0459	0.0000	0.0017	0.0006	1.4813	0.0033	0.0330

Non-Bias Adjusted Averages Include:

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	14.511	SCFH

Weather Data

Barometric Pressure	29.90	in. Hg
Relative Humidity	49	%
Ambient Temperature	99	°F
Specific Humidity	0.019455	lb H ₂ O / lb air

Unit Data

Unit Load	1,813.0	horsepower
Meas. Stack Moisture	14.4	%
Stack Exhaust Flow (M19)	215,084	SCFH

50% Load, Run - 1-2

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmw)	CO (ppmw)	THC (as C ₂ H ₆) (ppmw)	CO ₂ (%vvd)	N ₂ O (ppmw)	C ₂ H ₆ O (ppmw)	NO (ppmw)	NO ₂ (ppmw)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (ppmw)	C ₂ H ₆ (ppmw)	H ₂ O (%)
07/29/21 12:05:23	73320	8.74	5.65	4.97	157.72	5.52	1.61	0.36	5.65	0.00	0.33	0.20	417.26	0.55	16.96
07/29/21 12:05:53	73350	8.74	6.03	4.98	157.68	5.64	1.61	0.81	6.03	0.00	0.32	0.06	421.08	0.48	15.97
07/29/21 12:06:23	73380	8.74	6.02	4.99	158.22	5.59	1.59	0.76	6.02	0.00	0.34	0.19	420.26	0.50	16.24
07/29/21 12:06:53	73410	8.75	5.75	5.02	161.33	5.69	1.61	0.28	5.75	0.00	0.23	0.08	428.43	0.69	14.82
07/29/21 12:07:23	73440	8.75	5.85	5.07	162.11	5.72	1.67	0.53	5.85	0.00	0.29	0.06	429.42	0.55	14.38
07/29/21 12:07:53	73470	8.76	5.84	5.07	162.44	5.65	1.63	0.61	5.84	0.00	0.27	0.01	429.28	0.59	14.98
07/29/21 12:08:23	73500	8.76	5.90	5.23	163.11	5.72	1.65	0.71	5.90	0.00	0.27	0.06	432.71	0.51	14.28
07/29/21 12:08:53	73530	8.75	5.97	5.05	163.07	5.73	1.62	0.38	5.97	0.00	0.27	-0.07	431.95	0.50	14.29
07/29/21 12:09:23	73560	8.76	6.16	5.01	159.80	5.58	1.60	0.49	6.16	0.00	0.29	0.19	422.74	0.46	16.30
07/29/21 12:09:53	73590	8.76	5.53	5.17	162.08	5.66	1.63	0.65	5.53	0.00	0.26	0.06	429.14	0.52	14.97
07/29/21 12:10:23	73620	8.76	5.75	5.01	162.41	5.70	1.64	0.70	5.75	0.00	0.28	0.05	430.34	0.59	14.61
07/29/21 12:10:53	73650	8.76	5.95	5.02	160.19	5.60	1.59	0.69	5.95	0.00	0.34	0.05	422.99	0.50	16.17
07/29/21 12:11:23	73680	8.77	5.99	4.93	159.46	5.62	1.59	0.72	5.99	0.00	0.31	0.06	422.94	0.40	16.00
07/29/21 12:11:53	73710	8.75	5.34	5.08	161.91	5.65	1.60	0.81	5.34	0.00	0.26	0.10	428.06	0.54	14.98
07/29/21 12:12:23	73740	8.76	5.42	5.09	163.03	5.67	1.63	0.68	5.42	0.00	0.25	0.09	431.63	0.58	14.81
07/29/21 12:12:53	73770	8.76	6.03	5.09	159.97	5.64	1.62	0.52	6.03	0.00	0.29	-0.04	425.37	0.59	15.70
07/29/21 12:13:23	73800	8.75	5.49	4.99	162.34	5.65	1.61	0.55	5.49	0.00	0.25	0.04	428.83	0.67	15.12
07/29/21 12:13:53	73830	8.75	5.38	5.09	162.23	5.67	1.64	0.66	5.38	0.00	0.28	0.02	430.28	0.50	14.83
07/29/21 12:14:23	73860	8.75	5.76	5.04	162.72	5.71	1.65	0.65	5.76	0.00	0.26	0.05	431.55	0.51	14.57
07/29/21 12:14:53	73890	8.75	6.15	5.02	164.38	5.82	1.67	0.50	6.15	0.00	0.23	0.04	436.74	0.41	13.44
07/29/21 12:15:23	73920	8.75	6.26	5.17	164.12	5.85	1.65	0.65	6.26	0.00	0.25	-0.03	437.36	0.41	13.25
07/29/21 12:15:53	73950	8.74	5.80	5.04	163.03	5.75	1.65	0.45	5.80	0.00	0.26	0.00	433.84	0.51	14.21
07/29/21 12:16:23	73980	8.74	6.14	5.08	163.39	5.81	1.67	0.19	6.14	0.00	0.26	0.01	435.61	0.59	13.54
07/29/21 12:16:53	74010	8.75	6.02	5.04	162.71	5.76	1.66	0.21	6.02	0.00	0.26	0.07	434.03	0.53	14.00
07/29/21 12:17:23	74040	8.75	6.47	5.25	164.94	5.84	1.72	0.58	6.47	0.00	0.25	0.01	438.59	0.53	13.05
07/29/21 12:17:53	74070	8.74	6.12	5.10	163.82	5.80	1.71	0.20	6.12	0.00	0.26	0.06	435.23	0.70	13.60
07/29/21 12:18:23	74100	8.75	6.05	5.15	163.94	5.81	1.68	0.60	6.05	0.00	0.26	0.04	436.18	0.58	13.60
07/29/21 12:18:53	74130	8.75	6.10	5.08	163.23	5.78	1.67	0.55	6.10	0.00	0.25	0.05	434.74	0.56	13.79
07/29/21 12:19:23	74160	8.74	6.47	5.11	165.21	5.88	1.71	0.38	6.37	0.09	0.24	0.12	440.00	0.48	12.74
07/29/21 12:19:53	74190	8.74	6.21	5.07	163.65	5.80	1.69	0.55	6.21	0.00	0.25	0.05	436.94	0.62	13.63
07/29/21 12:20:23	74220	8.74	6.18	5.19	163.88	5.79	1.70	0.81	6.18	0.00	0.23	0.01	436.29	0.59	13.73
07/29/21 12:20:53	74250	8.73	6.15	5.18	163.61	5.85	1.72	0.35	6.15	0.00	0.25	0.05	437.19	0.44	13.17
07/29/21 12:21:23	74280	8.74	6.20	5.06	163.47	5.82	1.69	0.72	6.20	0.00	0.23	0.08	435.26	0.59	13.46
07/29/21 12:21:53	74310	8.73	5.79	5.11	162.29	5.66	1.63	0.52	5.79	0.00	0.25	0.04	427.68	0.61	15.15
07/29/21 12:22:23	74340	8.73	6.17	5.17	163.74	5.80	1.70	0.33	6.17	0.00	0.26	-0.02	434.80	0.60	13.69
07/29/21 12:22:53	74370	8.74	6.33	5.08	164.41	5.83	1.73	0.25	6.33	0.00	0.27	0.03	435.66	0.58	13.35
07/29/21 12:23:23	74400	8.73	5.27	5.06	160.25	5.62	1.65	0.61	5.27	0.00	0.26	0.08	425.18	0.53	15.56
07/29/21 12:23:53	74430	8.73	5.98	5.11	158.20	5.57	1.57	0.49	5.98	0.00	0.32	0.20	418.90	0.49	16.73
07/29/21 12:24:23	74460	8.73	5.57	4.96	157.07	5.48	1.62	0.75	5.57	0.00	0.28	0.16	415.73	0.55	17.73
07/29/21 12:24:53	74490	8.74	5.37	5.07	157.41	5.49	1.61	0.43	5.37	0.00	0.29	0.20	417.50	0.59	17.52
07/29/21 12:25:23	74520	8.74	5.58	5.10	158.52	5.58	1.62	0.69	5.58	0.00	0.32	0.18	421.52	0.53	16.56
07/29/21 12:25:53	74550	8.75	5.53	5.14	162.47	5.68	1.65	0.47	5.53	0.00	0.26	0.06	432.09	0.51	14.99
07/29/21 12:26:23	74580	8.75	5.80	5.21	164.01	5.78	1.67	0.59	5.80	0.00	0.25	0.13	435.94	0.47	13.87
07/29/21 12:26:53	74610	8.74	6.47	5.26	164.86	5.90	1.74	0.85	6.34	0.13	0.26	0.10	438.28	0.58	12.72
07/29/21 12:27:23	74640	8.74	6.22	5.22	166.45	5.88	1.77	0.54	6.22	0.00	0.26	-0.05	442.81	0.69	12.23
07/29/21 12:27:53	74670	8.74	5.91	5.30	165.83	5.86	1.73	0.41	5.91	0.00	0.24	0.03	441.50	0.69	12.59
07/29/21 12:28:23	74700	8.73	6.07	5.32	166.04	5.87	1.78	0.02	6.07	0.00	0.26	0.03	442.40	0.62	12.23
07/29/21 12:28:53	74730	8.73	6.27	5.28	166.98	5.92	1.77	0.43	6.27	0.00	0.20	-0.05	444.80	0.80	11.80
07/29/21 12:29:23	74760	8.74	6.11	5.30	166.98	5.91	1.79	0.30	6.11	0.00	0.23	0.00	444.26	0.77	12.00
07/29/21 12:29:53	74790	8.74	6.58	5.25	162.42	5.88	1.75	0.53	6.50	0.08	0.25	0.03	436.52	0.57	12.95
07/29/21 12:30:23	74820	8.75	5.78	5.29	166.17	5.86	1.76	0.44	5.78	0.00	0.21	0.11	442.71	0.62	12.33
07/29/21 12:30:53	74850	8.75	6.15	5.18	166.93	5.86	1.81	0.50	6.15	0.00	0.21	0.01	442.86	0.73	12.32
07/29/21 12:31:23	74880	8.75	6.48	5.21	163.60	5.86	1.76	0.48	6.44	0.04	0.27	-0.03	436.85	0.64	12.95
07/29/21 12:31:53	74910	8.75	6.59	5.24	164.08	5.90	1.79	0.59	6.47	0.13	0.26	-0.06	440.15	0.54	12.68
07/29/21 12:32:23	74940	8.75	5.79	5.18	162.49	5.67	1.72	1.04	5.79	0.00	0.26	0.13	430.90	0.64	15.02
07/29/21 12:32:53	74970	8.77	6.46	5.17	163.21	5.81	1.77	0.51	6.46	0.00	0.23	0.11	435.69	0.61	13.41
07/29/21 12:33:23	75000	8.77	6.39	5.22	164.40	5.81	1.71	0.83	6.39	0.00	0.24	0.16	437.64	0.62	13.43
07/29/21 12:33:53	75030	8.77	6.04	5.19	163.14	5.73	1.70	0.61	6.04	0.00	0.24	-0.01	434.37	0.64	14.22
07/29/21 12:34:23	75060	8.76	6.39	5.07	159.93	5.62	1.66	0.59	6.14	0.25	0.31	0.16	426.09	0.51	15.71
07/29/21 12:34:53	75090	8.77	6.12	5.05	162.94	5.73	1.70	0.86	6.12	0.00	0.24	0.09	434.06	0.58	14.36
07/29/21 12:35:23	75120	8.77	6.13	5.12	164.71	5.74	1.71	0.76	6.13	0.00	0.25	0.07	437.40	0.63	14.16
07/29/21 12:35:53	75150	8.76	6.16	5.21	164.42	5.78	1.7								

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	14.511	SCFH

Weather Data

Barometric Pressure	29.90	in. Hg
Relative Humidity	49	%
Ambient Temperature	99	°F
Specific Humidity	0.019455	lb H ₂ O / lb air

Unit Data

Unit Load	1,813.0	horsepower
Meas. Stack Moisture	14.4	%
Stack Exhaust Flow (M19)	215,084	SCFH

50% Load, Run - 1-2

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmvw)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%vvd)	N ₂ O (ppmvw)	C ₂ H ₆ O (ppmvw)	NO (ppmvw)	NO ₂ (ppmvw)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (ppmvw)	C ₂ H ₆ (ppmvw)	H ₂ O (%)
07/29/21 12:55:23	76320	8.76	6.06	5.10	167.19	5.86	1.74	0.41	6.06	0.00	0.18	-0.07	445.98	0.62	12.24
07/29/21 12:55:53	76350	8.76	5.92	5.16	167.99	5.86	1.75	0.55	5.92	0.00	0.21	-0.03	445.39	0.45	12.28
07/29/21 12:56:23	76380	8.76	5.93	5.23	167.33	5.84	1.75	0.29	5.93	0.00	0.19	-0.02	444.51	0.60	12.45
07/29/21 12:56:53	76410	8.75	6.08	5.05	163.58	5.73	1.68	0.58	6.08	0.00	0.24	0.12	434.27	0.47	14.32
07/29/21 12:57:23	76440	8.76	5.80	5.20	167.64	5.85	1.73	0.50	5.80	0.00	0.19	-0.09	445.33	0.52	12.41
07/29/21 12:57:53	76470	8.75	6.40	5.17	165.84	5.84	1.74	0.46	6.40	0.00	0.18	0.05	440.59	0.54	13.04
07/29/21 12:58:23	76500	8.76	6.01	5.12	167.99	5.85	1.75	0.51	6.01	0.00	0.19	-0.07	446.51	0.59	12.43
07/29/21 12:58:53	76530	8.77	6.31	5.12	167.32	5.85	1.76	0.69	6.31	0.00	0.21	-0.02	443.84	0.43	12.92
07/29/21 12:59:23	76560	8.75	6.21	5.26	164.10	5.76	1.72	1.11	6.21	0.00	0.21	-0.02	436.99	0.65	13.94
07/29/21 12:59:53	76590	8.75	6.01	5.18	163.97	5.73	1.73	0.53	6.01	0.00	0.20	-0.01	435.04	0.53	14.37
07/29/21 13:00:23	76620	8.75	5.60	5.03	160.43	5.57	1.63	0.75	5.60	0.00	0.26	0.11	423.43	0.33	16.72
07/29/21 13:00:53	76650	8.75	5.60	4.94	159.29	5.56	1.64	0.59	5.60	0.00	0.28	0.19	421.81	0.39	16.76
07/29/21 13:01:23	76680	8.75	5.64	4.93	158.82	5.53	1.65	0.57	5.64	0.00	0.26	0.13	420.39	0.33	17.09
07/29/21 13:01:53	76710	8.75	5.70	5.08	159.50	5.57	1.64	0.81	5.70	0.00	0.26	0.03	422.34	0.49	16.78
07/29/21 13:02:23	76740	8.76	5.64	5.11	159.63	5.58	1.68	0.75	5.64	0.00	0.27	0.05	424.61	0.45	16.71
07/29/21 13:02:53	76770	8.76	5.52	5.04	159.95	5.56	1.66	0.68	5.52	0.00	0.27	0.19	423.86	0.58	16.81
07/29/21 13:03:23	76800	8.77	5.67	5.04	161.08	5.59	1.66	0.63	5.67	0.00	0.27	0.26	427.24	0.49	16.33
07/29/21 13:03:53	76830	8.76	5.26	5.05	163.14	5.62	1.65	0.43	5.26	0.00	0.22	0.04	431.38	0.58	15.40
07/29/21 13:04:23	76860	8.77	5.78	5.15	163.71	5.70	1.71	0.32	5.78	0.00	0.22	0.08	433.27	0.63	14.61
07/29/21 13:04:53	76890	8.78	6.05	5.14	164.89	5.78	1.75	0.54	6.05	0.00	0.23	0.13	439.92	0.49	13.61
RAW AVERAGE		8.75	5.92	5.11	163.11	5.72	1.68	0.58	5.91	0.01	0.25	0.06	433.10	0.56	14.43

Bias	Serial Number:	INST-O2-0026	INST-IR-0005	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
	Initial Zero	0.07			0.12										
	Final Zero	0.08			0.21										
	Avg. Zero	0.08			0.17										
	Initial UpScale	11.98			307.25										
	Final UpScale	11.97			317.42										
	Avg. UpScale	11.98			312.34										
	Upscale Cal Gas	11.99			302.00										

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₆ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₂ H ₆)	C ₂ H ₆ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	8.74	6.92	5.97	190.60	6.69	1.97	0.68	6.91	0.01	0.29	0.07	185.57	0.44	4.59
Corrected Raw Average (ppm/% wet basis)	7.47	5.92	5.11	163.11	5.72	1.68	0.58	5.91	0.01	0.25	0.06	158.80	0.37	3.93
Concentration (ppm@ 15%O ₂)	N/A	3.36	2.90	79.16	3.25	0.95	0.33	3.35	0.004	0.14	0.03	90.07	0.21	1.91
Emission Rate (g/hp*hr)	N/A	0.0596	0.0313	1.3443	552	0.0162	0.0056	0.0388	0.0001	0.0009	0.0004	1.5330	0.0036	0.0324

Non-Bias Adjusted Averages Include:

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	14.541	SCFH

Weather Data

Barometric Pressure	29.84	in. Hg
Relative Humidity	49	%
Ambient Temperature	96	°F
Specific Humidity	0.018009	lb H ₂ O / lb air

Unit Data

Unit Load	1,810.4	horsepower
Meas. Stack Moisture	14.4	%
Stack Exhaust Flow (M19)	216,383	SCFH

50% Load, Run - 1-3

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmw)	CO (ppmw)	THC (as C ₂ H ₆) (ppmw)	CO ₂ (%vvd)	N ₂ O (ppmw)	C ₂ H ₄ O (ppmw)	NO (ppmw)	NO ₂ (ppmw)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (ppmw)	C ₂ H ₆ (ppmw)	H ₂ O (%)
07/29/21 14:23:23	81600	8.78	4.95	5.16	160.80	5.49	1.63	2.32	4.95	0.00	0.53	-0.04	424.48	0.33	17.94
07/29/21 14:23:53	81630	8.80	5.37	5.46	161.71	5.56	1.63	2.68	5.37	0.00	0.53	0.19	427.08	0.20	17.27
07/29/21 14:24:23	81660	8.79	5.31	5.38	165.50	5.71	1.74	1.99	5.31	0.00	0.48	-0.04	437.77	0.18	15.00
07/29/21 14:24:53	81690	8.79	5.86	5.38	167.69	5.82	1.74	2.19	5.86	0.00	0.49	0.14	442.26	0.28	13.92
07/29/21 14:25:23	81720	8.79	6.05	5.45	168.15	5.88	1.81	2.56	6.05	0.00	0.47	0.04	446.56	0.07	13.27
07/29/21 14:25:53	81750	8.80	6.27	5.44	169.12	5.92	1.77	2.07	6.27	0.00	0.49	0.09	449.64	0.14	12.83
07/29/21 14:26:23	81780	8.79	5.52	5.43	170.76	5.88	1.80	2.33	5.52	0.00	0.46	-0.05	452.62	0.34	12.62
07/29/21 14:26:53	81810	8.78	5.61	5.46	171.47	5.91	1.85	2.73	5.61	0.00	0.46	-0.10	452.40	0.08	12.43
07/29/21 14:27:23	81840	8.79	5.77	5.52	169.64	5.93	1.82	3.17	5.77	0.00	0.46	-0.14	452.20	0.28	12.27
07/29/21 14:27:53	81870	8.80	5.66	5.54	170.61	5.91	1.80	2.67	5.66	0.00	0.46	-0.01	452.92	0.41	12.32
07/29/21 14:28:23	81900	8.80	5.91	5.48	172.15	5.93	1.81	2.80	5.91	0.00	0.48	0.09	453.61	0.46	12.23
07/29/21 14:28:53	81930	8.80	6.28	5.45	169.39	5.92	1.78	2.81	6.28	0.00	0.48	0.08	449.09	0.27	12.78
07/29/21 14:29:23	81960	8.79	6.28	5.44	168.54	5.88	1.82	2.37	6.28	0.00	0.50	0.01	445.93	0.21	13.28
07/29/21 14:29:53	81990	8.79	5.36	5.54	166.36	5.64	1.69	2.73	5.36	0.00	0.54	0.07	436.27	0.31	15.67
07/29/21 14:30:23	82020	8.79	5.22	5.39	165.98	5.72	1.71	2.83	5.22	0.00	0.55	0.04	439.28	0.01	15.06
07/29/21 14:30:53	82050	8.79	5.43	5.55	166.77	5.75	1.70	2.43	5.43	0.00	0.51	0.07	441.40	0.14	14.62
07/29/21 14:31:23	82080	8.78	6.19	5.48	169.12	5.91	1.82	3.16	6.19	0.00	0.51	0.02	449.39	-0.01	12.93
07/29/21 14:31:53	82110	8.78	5.34	5.43	168.06	5.72	1.74	2.96	5.34	0.00	0.53	0.09	441.58	0.19	15.00
07/29/21 14:32:23	82140	8.77	5.89	5.57	167.80	5.84	1.69	2.57	5.89	0.00	0.51	0.04	444.75	0.10	13.63
07/29/21 14:32:53	82170	8.78	5.16	5.45	164.86	5.66	1.72	3.25	5.16	0.00	0.50	-0.09	434.52	0.03	15.59
07/29/21 14:33:23	82200	8.79	5.16	5.45	166.79	5.70	1.72	3.17	5.16	0.00	0.53	-0.05	438.21	0.22	15.35
07/29/21 14:33:53	82230	8.78	5.78	5.49	167.12	5.80	1.78	2.88	5.78	0.00	0.53	0.07	442.07	0.03	14.33
07/29/21 14:34:23	82260	8.78	5.58	5.58	167.75	5.77	1.74	3.29	5.58	0.00	0.52	0.10	442.15	0.17	14.54
07/29/21 14:34:53	82290	8.78	6.06	5.47	168.78	5.87	1.82	2.75	6.06	0.00	0.51	0.12	444.97	-0.08	13.60
07/29/21 14:35:23	82320	8.79	5.56	5.45	166.09	5.73	1.72	3.07	5.56	0.00	0.50	-0.13	440.25	0.18	14.83
07/29/21 14:35:53	82350	8.80	5.09	5.58	164.50	5.66	1.74	3.84	5.09	0.00	0.51	0.11	435.81	-0.11	15.61
07/29/21 14:36:23	82380	8.80	5.39	5.38	166.11	5.69	1.76	3.86	5.39	0.00	0.53	0.15	438.50	0.33	15.35
07/29/21 14:36:53	82410	8.80	5.16	5.48	166.36	5.68	1.73	3.63	5.16	0.00	0.49	-0.02	438.78	0.17	15.48
07/29/21 14:37:23	82440	8.80	5.38	5.47	167.09	5.72	1.79	2.63	5.38	0.00	0.50	0.03	440.56	0.23	15.21
07/29/21 14:37:53	82470	8.79	5.73	5.49	167.74	5.77	1.76	2.23	5.73	0.00	0.53	0.05	442.68	0.30	14.51
07/29/21 14:38:23	82500	8.79	5.93	5.57	167.54	5.84	1.81	2.20	5.93	0.00	0.50	0.05	442.88	0.33	13.72
07/29/21 14:38:53	82530	8.80	5.92	5.52	167.15	5.85	1.78	1.34	5.92	0.00	0.46	-0.08	444.54	0.37	13.64
07/29/21 14:39:23	82560	8.80	5.96	5.39	168.48	5.86	1.81	1.79	5.96	0.00	0.43	-0.07	446.71	0.10	13.57
07/29/21 14:39:53	82590	8.80	6.15	5.53	168.85	5.85	1.79	2.09	6.15	0.00	0.49	-0.01	445.04	0.05	13.56
07/29/21 14:40:23	82620	8.80	5.75	5.52	164.93	5.67	1.72	2.59	5.75	0.00	0.55	0.10	434.83	-0.15	15.92
07/29/21 14:40:53	82650	8.80	5.73	5.42	167.39	5.81	1.77	2.46	5.73	0.00	0.50	0.11	444.58	0.13	14.15
07/29/21 14:41:23	82680	8.80	5.98	5.47	168.67	5.81	1.80	2.56	5.98	0.00	0.49	-0.04	444.49	0.10	13.93
07/29/21 14:41:53	82710	8.80	5.91	5.49	168.80	5.81	1.73	2.74	5.91	0.00	0.50	0.01	443.84	0.23	14.01
07/29/21 14:42:23	82740	8.81	6.11	5.59	169.71	5.90	1.79	2.94	6.11	0.00	0.46	0.03	448.08	0.23	13.04
07/29/21 14:42:53	82770	8.81	5.80	5.47	172.69	5.90	1.83	3.45	5.80	0.00	0.48	-0.14	452.83	0.24	12.42
07/29/21 14:43:23	82800	8.80	5.81	5.67	172.59	5.91	1.78	3.07	5.81	0.00	0.42	0.02	453.92	0.20	12.45
07/29/21 14:43:53	82830	8.81	5.09	5.50	167.01	5.66	1.72	3.62	5.09	0.00	0.47	0.08	438.48	0.14	15.58
07/29/21 14:44:23	82860	8.79	5.39	5.49	167.29	5.70	1.72	3.40	5.39	0.00	0.52	0.01	439.63	0.23	15.14
07/29/21 14:44:53	82890	8.81	5.62	5.48	163.22	5.61	1.70	3.82	5.62	0.00	0.55	0.05	429.02	-0.14	16.69
07/29/21 14:45:23	82920	8.81	5.73	5.30	164.65	5.69	1.71	2.95	5.73	0.00	0.52	0.13	434.04	-0.01	15.68
07/29/21 14:45:53	82950	8.81	5.69	5.28	163.51	5.67	1.70	3.23	5.69	0.00	0.54	0.05	432.98	0.05	16.07
07/29/21 14:46:23	82980	8.81	6.03	5.40	170.06	5.83	1.77	3.20	6.03	0.00	0.51	0.06	446.16	0.41	13.87
07/29/21 14:46:53	83010	8.82	6.23	5.39	170.35	5.89	1.76	3.11	6.23	0.00	0.49	0.01	449.65	0.18	13.15
07/29/21 14:47:23	83040	8.81	6.42	5.45	172.15	5.91	1.80	3.33	6.42	0.00	0.49	-0.06	451.03	0.22	12.83
07/29/21 14:47:53	83070	8.81	6.29	5.41	170.90	5.91	1.78	3.93	6.29	0.00	0.47	0.19	450.96	-0.10	13.04
07/29/21 14:48:23	83100	8.81	5.86	5.54	171.81	5.87	1.73	3.40	5.86	0.00	0.47	0.17	450.39	0.44	13.33
07/29/21 14:48:53	83130	8.79	5.77	5.48	168.01	5.79	1.75	3.23	5.77	0.00	0.49	0.08	442.59	0.37	14.26
07/29/21 14:49:23	83160	8.80	6.08	5.36	167.93	5.85	1.82	3.41	6.08	0.00	0.49	0.02	444.75	0.08	13.75
07/29/21 14:49:53	83190	8.80	6.31	5.45	170.99	5.91	1.77	3.96	6.31	0.00	0.48	0.19	449.23	0.05	13.02
07/29/21 14:50:23	83220	8.80	5.93	5.47	171.70	5.91	1.78	3.28	5.87	0.05	0.51	0.04	453.00	0.17	12.99
07/29/21 14:50:53	83250	8.79	6.14	5.57	168.75	5.85	1.79	3.45	6.14	0.00	0.47	-0.04	446.83	0.16	13.73
07/29/21 14:51:23	83280	8.79	5.42	5.64	167.50	5.73	1.75	2.88	5.42	0.00	0.54	0.11	442.06	0.09	14.99
07/29/21 14:51:53	83310	8.79	6.01	5.55	168.48	5.85	1.79	3.30	6.01	0.00	0.50	-0.03	444.62	0.41	13.68
07/29/21 14:52:23	83340	8.79	5.94	5.55	169.27	5.87	1.82	3.90	5.94	0.00	0.49	-0.04	446.93	0.16	13.47
07/29/21 14:52:53	83370	8.80	5.89	5.56	168.39	5.83	1.74	3.97	5.89	0.00	0.48	-0.04	445.78	0.05	13.98
07/29/21 14:53:23	83400	8.79	5.57	5.34	168.40	5.79	1.78	3.78	5.57	0.00	0.48	0.10	441.72	0.12	14.29
07/29/21 14:53:53	83430	8.79	5.23	5.32	166.81	5.67	1.70	3.95	5.23	0.00	0.48	-0.01			

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	14.541	SCFH

Weather Data

Barometric Pressure	29.84	in. Hg
Relative Humidity	49	%
Ambient Temperature	96	°F
Specific Humidity	0.018009	lb H ₂ O / lb air

Unit Data

Unit Load	1,810.4	horsepower
Meas. Stack Moisture	14.4	%
Stack Exhaust Flow (M19)	216,383	SCFH

50% Load, Run - 1-3

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmvw)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%vvd)	N ₂ O (ppmvw)	C ₂ H ₆ O (ppmvw)	NO (ppmvw)	NO ₂ (ppmvw)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (ppmvw)	C ₂ H ₆ (ppmvw)	H ₂ O (%)
07/29/21 15:13:23	84600	8.83	5.44	5.44	166.88	5.62	1.73	4.17	5.44	0.00	0.53	0.11	434.57	-0.12	16.46
07/29/21 15:13:53	84630	8.83	5.45	5.59	165.37	5.65	1.74	4.43	5.45	0.00	0.52	0.05	436.67	0.11	16.28
07/29/21 15:14:23	84660	8.84	5.64	5.58	166.92	5.67	1.71	4.63	5.64	0.00	0.51	0.08	439.81	0.23	15.99
07/29/21 15:14:53	84690	8.82	5.33	5.32	167.29	5.67	1.66	3.85	5.33	0.00	0.47	0.12	438.81	0.29	15.82
07/29/21 15:15:23	84720	8.83	5.72	5.51	167.33	5.70	1.68	4.61	5.72	0.00	0.49	0.19	439.77	0.12	15.62
07/29/21 15:15:53	84750	8.84	5.48	5.48	167.20	5.58	1.70	4.46	5.48	0.00	0.52	0.13	436.46	-0.02	16.86
07/29/21 15:16:23	84780	8.83	4.91	5.28	165.62	5.56	1.67	4.50	4.91	0.00	0.53	0.01	434.79	0.11	17.17
07/29/21 15:16:53	84810	8.82	5.64	5.51	167.92	5.71	1.75	4.60	5.64	0.00	0.51	0.09	438.72	0.29	15.73
07/29/21 15:17:23	84840	8.82	5.13	5.57	171.10	5.70	1.71	4.33	5.13	0.00	0.46	0.13	445.85	-0.17	15.16
07/29/21 15:17:53	84870	8.81	5.32	5.38	170.30	5.72	1.68	4.57	5.32	0.00	0.46	0.25	445.14	-0.16	14.85
07/29/21 15:18:23	84900	8.81	5.08	5.30	171.02	5.75	1.70	3.91	5.08	0.00	0.45	0.12	447.31	-0.31	14.63
07/29/21 15:18:53	84930	8.79	5.48	5.47	171.50	5.77	1.72	3.81	5.48	0.00	0.46	0.09	446.19	0.02	14.61
07/29/21 15:19:23	84960	8.80	5.41	5.48	171.19	5.78	1.69	4.40	5.41	0.00	0.44	-0.08	447.68	-0.01	14.47
07/29/21 15:19:53	84990	8.79	5.67	5.46	169.93	5.81	1.78	4.45	5.67	0.00	0.47	0.03	445.17	0.23	14.41
07/29/21 15:20:23	85020	8.79	5.59	5.39	169.78	5.81	1.79	3.92	5.59	0.00	0.46	0.10	445.79	0.26	14.37
07/29/21 15:20:53	85050	8.79	5.52	5.50	171.61	5.80	1.70	4.43	5.52	0.00	0.49	0.00	445.75	-0.18	14.27
07/29/21 15:21:23	85080	8.78	5.59	5.52	170.83	5.80	1.71	4.20	5.59	0.00	0.49	0.25	446.24	-0.02	14.29
07/29/21 15:21:53	85110	8.78	5.50	5.50	169.00	5.82	1.69	5.14	5.50	0.00	0.45	0.10	446.38	-0.10	14.24
07/29/21 15:22:23	85140	8.79	5.73	5.27	171.34	5.82	1.74	4.55	5.73	0.00	0.45	-0.17	447.28	0.18	14.15
07/29/21 15:22:53	85170	8.79	5.84	5.43	172.11	5.82	1.74	3.65	5.84	0.00	0.44	-0.16	446.95	-0.30	14.16
RAW AVERAGE		8.80	5.71	5.48	168.64	5.78	1.75	3.45	5.71	0.00	0.49	0.04	443.69	0.11	14.39

Bias	Serial Number:	INST-O2-0026	INST-IR-0005	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
		O ₂		NOx		CO		THC (as C ₃ H ₈)		CO ₂		N ₂ O		C ₂ H ₆ O	
		(%)		(ppmvw)		(ppmvw)		(ppmvw)		(ppmvw)		(ppmvw)		(ppmvw)	
	Initial Zero	0.08		0.21		0.17		0.19							
	Final Zero	0.09		0.17		0.17		0.19							
	Avg. Zero	0.09		0.19											
	Initial UpScale	11.97		317.42											
	Final UpScale	11.98		314.03											
	Avg. UpScale	11.98		315.73											
Upscale Cal Gas		11.99		302.00											

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₆ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₃ H ₈)	C ₂ H ₆ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	8.79	6.67	6.40	197.00	6.75	2.05	4.04	6.67	0.00	0.57	0.05	190.04	0.09	6.87
Corrected Raw Average (ppm/% wet basis)	7.51	5.71	5.48	168.64	5.78	1.75	3.45	5.71	0.00	0.49	0.04	162.69	0.07	5.88
Concentration (ppm@ 15%O ₂)	N/A	3.25	3.12	82.17	3.29	1.00	1.97	3.25	0.00	0.28	0.02	92.60	0.04	2.86
Emission Rate (g/hp*hr)	N/A	0.0579	0.0338	1.4004	561	0.0170	0.0336	0.0378	0.0000	0.0018	0.0003	1.5817	0.0007	0.0488

Non-Bias Adjusted Averages Include:

EMISSION DATA RECORDS

75% Load

NO_x, CO, THC, N₂O, C₂H₄O, NH₃, HCHO, CH₄, C₂H₆, and H₂O
Reference Method Data

Catalytic Combustion Corporation
July 30, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	20.603	SCFH

Weather Data

Barometric Pressure	29.89	in. Hg
Relative Humidity	53	%
Ambient Temperature	94	°F
Specific Humidity	0.018296	lb H ₂ O / lb air

Unit Data

Unit Load	2.8914	horsepower
Meas. Stack Moisture	13.9	%
Stack Exhaust Flow (M19)	310.849	SCFH

75% Load, Run - 2-1

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmw)	CO (ppmw)	THC (as C ₂ H ₆) (ppmw)	CO ₂ (%vvd)	N ₂ O (ppmw)	C ₂ H ₆ O (ppmw)	NO (ppmw)	NO ₂ (ppmw)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (ppmw)	C ₂ H ₆ (ppmw)	H ₂ O (%)
07/30/21 13:45:23	165720	8.94	5.59	2.67	149.97	5.60	1.40	0.37	5.59	0.00	15.45	-0.16	407.90	0.76	14.54
07/30/21 13:45:53	165750	8.93	5.69	2.63	149.97	5.62	1.44	0.54	5.69	0.00	15.26	-0.27	407.38	0.93	14.22
07/30/21 13:46:23	165780	8.94	5.80	2.79	150.51	5.65	1.42	0.03	5.80	0.00	14.83	-0.23	408.24	0.74	14.05
07/30/21 13:46:53	165810	8.94	5.78	2.72	150.09	5.61	1.43	0.80	5.78	0.00	14.78	-0.23	406.16	0.96	14.26
07/30/21 13:47:23	165840	8.95	5.79	2.65	150.57	5.61	1.41	0.51	5.79	0.00	15.18	-0.16	407.80	0.82	14.30
07/30/21 13:47:53	165870	8.94	5.73	2.78	152.51	5.64	1.43	0.24	5.73	0.00	15.41	-0.15	407.10	0.84	14.11
07/30/21 13:48:23	165900	8.94	6.01	2.73	150.28	5.62	1.43	0.60	6.01	0.00	15.24	-0.15	406.97	0.89	14.24
07/30/21 13:48:53	165930	8.93	5.79	2.71	148.46	5.57	1.42	0.67	5.79	0.00	15.98	-0.28	403.63	0.96	14.87
07/30/21 13:49:23	165960	8.94	5.69	2.70	152.44	5.59	1.41	0.58	5.69	0.00	16.27	-0.17	407.02	0.84	14.53
07/30/21 13:49:53	165990	8.94	5.69	2.68	150.92	5.59	1.46	0.58	5.69	0.00	16.09	-0.24	405.18	0.80	14.38
07/30/21 13:50:23	166020	8.94	5.87	2.83	149.52	5.63	1.47	0.39	5.87	0.00	15.75	-0.15	406.61	0.86	14.26
07/30/21 13:50:53	166050	8.95	5.87	2.82	151.94	5.63	1.43	0.48	5.87	0.00	15.40	-0.15	408.83	0.91	14.19
07/30/21 13:51:23	166080	8.95	5.96	2.86	149.85	5.63	1.44	0.35	5.96	0.00	15.33	-0.14	407.04	0.80	14.19
07/30/21 13:51:53	166110	8.97	6.04	2.84	150.42	5.63	1.47	0.38	6.04	0.00	15.39	-0.21	407.58	1.03	14.16
07/30/21 13:52:23	166140	8.97	5.99	2.72	149.87	5.61	1.52	0.60	5.99	0.00	15.35	-0.11	407.75	0.79	14.07
07/30/21 13:52:53	166170	9.00	5.92	2.73	150.51	5.60	1.49	0.49	5.92	0.00	15.19	-0.14	409.27	0.96	13.99
07/30/21 13:53:23	166200	8.98	5.58	2.79	150.71	5.62	1.44	0.29	5.58	0.00	15.04	-0.20	408.53	0.93	13.98
07/30/21 13:53:53	166230	8.95	5.73	2.83	150.82	5.66	1.41	0.67	5.73	0.00	14.75	-0.19	410.88	0.85	13.91
07/30/21 13:54:23	166260	8.97	5.46	2.80	151.19	5.65	1.40	0.61	5.46	0.00	14.33	-0.19	411.87	0.92	13.76
07/30/21 13:54:53	166290	8.97	5.68	2.67	153.46	5.67	1.45	0.71	5.68	0.00	13.91	-0.27	411.25	1.04	13.66
07/30/21 13:55:23	166320	8.96	5.52	2.79	151.54	5.66	1.42	0.59	5.52	0.00	13.72	-0.14	411.56	0.70	13.73
07/30/21 13:55:53	166350	8.96	5.38	2.66	151.37	5.64	1.41	0.75	5.38	0.00	13.94	-0.14	411.48	0.84	13.79
07/30/21 13:56:23	166380	8.97	5.82	2.75	152.50	5.64	1.42	0.36	5.82	0.00	14.23	-0.10	410.88	0.66	13.82
07/30/21 13:56:53	166410	8.98	6.10	2.68	150.29	5.65	1.46	0.99	6.10	0.00	14.63	-0.09	409.47	0.76	13.86
07/30/21 13:57:23	166440	8.97	5.96	2.67	150.64	5.64	1.44	0.45	5.96	0.00	14.80	-0.16	408.48	0.72	13.80
07/30/21 13:57:53	166470	8.96	5.37	2.83	150.92	5.66	1.43	0.93	5.37	0.00	14.66	-0.13	410.90	0.71	13.75
07/30/21 13:58:23	166500	8.97	5.53	2.72	151.61	5.67	1.43	0.46	5.53	0.00	14.19	-0.28	410.92	0.72	13.67
07/30/21 13:58:53	166530	8.97	5.37	2.83	153.19	5.63	1.44	0.58	5.37	0.00	14.14	-0.19	409.85	0.84	14.09
07/30/21 13:59:23	166560	8.96	5.36	2.78	150.89	5.65	1.43	0.23	5.36	0.00	13.96	-0.23	411.30	0.61	13.89
07/30/21 13:59:53	166590	8.96	5.35	2.81	151.49	5.64	1.43	0.29	5.35	0.00	13.69	-0.21	411.12	0.75	13.92
07/30/21 14:00:23	166620	8.96	5.36	2.77	152.13	5.67	1.41	0.66	5.36	0.00	13.36	-0.23	412.37	0.85	13.61
07/30/21 14:00:53	166650	8.96	5.53	2.68	152.22	5.70	1.42	0.49	5.53	0.00	13.05	-0.18	414.28	0.77	13.25
07/30/21 14:01:23	166680	8.96	5.73	2.73	152.80	5.72	1.45	0.42	5.73	0.00	12.83	-0.23	414.58	0.88	13.05
07/30/21 14:01:53	166710	8.94	5.63	2.82	152.68	5.75	1.44	0.76	5.63	0.00	12.60	-0.20	415.96	0.91	12.85
07/30/21 14:02:23	166740	8.94	5.75	2.85	152.33	5.76	1.41	0.84	5.75	0.00	12.43	-0.01	415.38	0.90	12.79
07/30/21 14:02:53	166770	8.96	5.79	2.87	152.72	5.75	1.44	0.99	5.79	0.00	12.30	-0.19	416.46	0.86	12.84
07/30/21 14:03:23	166800	8.95	5.83	2.87	152.76	5.75	1.43	0.63	5.83	0.00	12.38	-0.17	416.53	0.97	12.84
07/30/21 14:03:53	166830	8.95	5.78	2.80	152.87	5.75	1.48	0.16	5.78	0.00	12.58	-0.22	416.46	0.95	12.93
07/30/21 14:04:23	166860	8.95	6.02	2.73	153.08	5.77	1.46	0.35	6.02	0.00	12.74	-0.23	417.47	0.72	12.80
07/30/21 14:04:53	166890	8.97	6.26	2.75	152.62	5.76	1.57	0.22	6.26	0.00	12.89	-0.31	416.15	0.76	12.79
07/30/21 14:05:23	166920	8.97	6.13	2.76	154.06	5.75	1.52	0.47	6.13	0.00	13.16	-0.22	415.82	0.82	12.77
07/30/21 14:05:53	166950	8.97	6.03	2.80	151.98	5.75	1.50	0.88	6.03	0.00	13.43	-0.21	414.42	0.76	12.81
07/30/21 14:06:23	166980	8.97	5.72	2.72	153.39	5.61	1.44	0.76	5.72	0.00	14.26	-0.22	411.88	0.77	14.20
07/30/21 14:06:53	167010	8.98	5.59	2.78	151.06	5.62	1.40	0.56	5.59	0.00	14.60	-0.02	408.23	0.63	14.29
07/30/21 14:07:23	167040	8.97	6.05	2.74	153.83	5.71	1.50	0.65	6.05	0.00	14.62	-0.21	413.85	0.78	13.26
07/30/21 14:07:53	167070	8.98	6.02	2.78	151.59	5.74	1.49	0.55	6.02	0.00	14.53	-0.23	412.80	0.83	13.04
07/30/21 14:08:23	167100	8.97	5.59	2.74	151.39	5.59	1.43	0.42	5.59	0.00	15.29	-0.23	407.53	0.75	14.60
07/30/21 14:08:53	167130	8.96	5.84	2.77	150.86	5.68	1.50	0.49	5.84	0.00	15.30	-0.17	408.89	0.67	13.62
07/30/21 14:09:23	167160	8.96	5.88	2.77	150.77	5.69	1.45	0.86	5.88	0.00	15.35	-0.12	410.34	0.81	13.47
07/30/21 14:09:53	167190	8.97	5.86	2.86	150.95	5.67	1.49	0.88	5.86	0.00	15.45	-0.19	411.50	0.74	13.57
07/30/21 14:10:23	167220	8.96	5.37	2.77	150.82	5.58	1.44	0.70	5.37	0.00	16.26	-0.18	408.68	0.91	14.68
07/30/21 14:10:53	167250	8.97	5.46	2.68	150.73	5.58	1.45	0.71	5.46	0.00	16.65	-0.21	408.83	0.89	14.65
07/30/21 14:11:23	167280	8.96	5.68	2.78	150.28	5.65	1.51	0.90	5.68	0.00	16.98	-0.27	409.45	0.71	14.07
07/30/21 14:11:53	167310	8.97	5.41	2.87	151.28	5.65	1.47	1.08	5.41	0.00	16.77	-0.32	411.15	0.79	13.85
07/30/21 14:12:23	167340	8.97	5.82	2.71	151.71	5.67	1.46	0.95	5.82	0.00	16.65	-0.11	410.56	0.66	13.86
07/30/21 14:12:53	167370	8.96	5.64	2.78	151.38	5.68	1.48	0.38	5.64	0.00	16.27	-0.33	411.61	0.76	13.64
07/30/21 14:13:23	167400	8.97	5.57	2.72	151.56	5.66	1.49	0.41	5.57	0.00	16.18	-0.18	411.72	0.85	13.87
07/30/21 14:13:53	167430	8.97	5.44	2.86	150.30	5.65	1.46	0.92	5.44	0.00	16.44	-0.26	409.70	0.91	14.09
07/30/21 14:14:23	167460	8.98	5.32	2.71	150.51	5.61	1.48	0.97	5.32	0.00	16.70	-0.21	408.13	0.78	14.36
07/30/21 14:14:53	167490	8.97	5.29	2.78	151.40	5.60	1.40	1.01	5.29	0.00	16.91	-0.23	409.96	0.69	14.57
07/30/21 14:15:23	167520	8.95	5.33	2.78	151.65	5.60	1.44	0.68	5.33	0.00	16.89	-0.3			

Catalytic Combustion Corporation
July 30, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	20.603	SCFH

Weather Data

Barometric Pressure	29.89	in. Hg
Relative Humidity	53	%
Ambient Temperature	94	°F
Specific Humidity	0.018296	lb H ₂ O / lb air

Unit Data

Unit Load	2.6914	horsepower
Meas. Stack Moisture	13.9	%
Stack Exhaust Flow (M19)	310.849	SCFH

75% Load, Run - 2-1

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmvw)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%vvd)	N ₂ O (ppmvw)	C ₂ H ₂ O (ppmvw)	NO (ppmvw)	NO ₂ (ppmvw)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (ppmvw)	C ₂ H ₆ (ppmvw)	H ₂ O (%)
07/30/21 14:35:23	168720	8.97	5.15	2.77	152.90	5.61	1.44	1.70	5.15	0.00	17.43	-0.22	410.71	0.68	14.44
07/30/21 14:35:53	168750	8.98	5.40	2.85	151.24	5.63	1.43	1.41	5.40	0.00	17.47	-0.22	409.78	0.62	14.36
07/30/21 14:36:23	168780	8.98	5.53	2.83	152.34	5.65	1.43	1.65	5.53	0.00	17.28	-0.26	410.71	0.62	14.21
07/30/21 14:36:53	168810	8.99	5.38	2.91	154.17	5.64	1.42	1.54	5.38	0.00	17.27	-0.19	411.62	0.69	14.34
07/30/21 14:37:23	168840	9.00	5.24	2.91	153.21	5.64	1.45	1.13	5.24	0.00	17.28	-0.24	411.68	0.64	14.28
07/30/21 14:37:53	168870	8.97	5.47	2.81	152.42	5.65	1.45	1.78	5.47	0.00	17.10	-0.23	411.69	0.63	14.20
07/30/21 14:38:23	168900	8.98	5.42	2.80	152.65	5.66	1.43	1.48	5.42	0.00	16.90	-0.19	411.89	0.77	14.12
07/30/21 14:38:53	168930	8.99	5.44	2.91	152.73	5.67	1.44	1.58	5.44	0.00	16.52	-0.24	414.89	0.86	13.76
07/30/21 14:39:23	168960	8.98	5.79	2.93	152.87	5.72	1.50	1.54	5.79	0.00	15.56	-0.26	412.79	0.49	13.53
07/30/21 14:39:53	168990	8.99	5.89	2.98	152.32	5.73	1.48	1.86	5.89	0.00	14.95	-0.12	414.92	0.77	13.45
07/30/21 14:40:23	169020	8.98	5.65	2.83	154.63	5.74	1.52	1.71	5.65	0.00	14.64	-0.23	416.08	0.77	13.25
07/30/21 14:40:53	169050	8.98	5.95	2.86	152.01	5.76	1.49	1.69	5.95	0.00	14.33	-0.14	414.33	0.54	13.02
07/30/21 14:41:23	169080	8.99	5.76	2.87	153.24	5.75	1.46	2.06	5.76	0.00	14.00	-0.22	417.51	0.76	12.78
07/30/21 14:41:53	169110	8.98	5.81	2.91	152.70	5.76	1.44	1.49	5.81	0.00	13.88	-0.26	415.53	0.71	12.75
07/30/21 14:42:23	169140	8.98	5.69	2.88	154.77	5.77	1.50	1.65	5.69	0.00	13.94	-0.31	416.26	0.70	12.77
07/30/21 14:42:53	169170	8.99	4.94	2.93	155.75	5.73	1.52	1.27	4.94	0.00	14.04	-0.47	419.17	0.92	12.69
07/30/21 14:43:23	169200	9.00	4.85	2.81	155.30	5.73	1.53	1.90	4.85	0.00	14.03	-0.27	419.67	0.70	12.52
07/30/21 14:43:53	169230	9.01	5.06	3.03	155.34	5.74	1.47	1.67	5.06	0.00	13.98	-0.31	422.97	0.78	12.44
07/30/21 14:44:23	169260	9.02	5.04	2.93	157.03	5.75	1.47	1.92	5.04	0.00	13.99	-0.26	421.95	0.75	12.44
07/30/21 14:44:53	169290	9.01	4.92	2.93	155.37	5.75	1.47	1.73	4.92	0.00	14.09	-0.32	420.53	0.76	12.47
RAW AVERAGE		8.97	5.59	2.78	151.87	5.66	1.45	0.97	5.59	0.00	15.64	0.00	410.84	0.76	13.91

Bias	Serial Number:	INST-O2-0026	INST-IR-0005	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
		O ₂		NOx		CO		THC (as C ₃ H ₈)		CO ₂		N ₂ O		C ₂ H ₂ O	
		(%)						(ppmvw)							
	Initial Zero	0.07						0.13							
	Final Zero	0.06						0.27							
	Avg. Zero	0.07						0.20							
	Initial UpScale	12.01						304.51							
	Final UpScale	11.97						310.21							
	Avg. UpScale	11.99						307.36							
	Upscale Cal Gas	11.99						302.00							

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₂ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₃ H ₈)	C ₂ H ₆ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	8.95	6.49	3.23	176.40	6.57	1.68	1.12	6.49	0.00	18.17	0.00	174.98	0.59	0.83
Corrected Raw Average (ppm/% wet basis)	7.70	5.59	2.78	151.87	5.66	1.45	0.97	5.59	0.00	15.64	0.00	150.64	0.51	0.72
Concentration (ppm@ 15%O ₂)	N/A	3.20	1.60	74.99	3.24	0.83	0.55	3.20	0.00	8.97	0.00	86.41	0.29	0.35
Emission Rate (g/kw*hr)	N/A	0.0544	0.0165	1.2186	527	0.0135	0.0090	0.0355	0.0000	0.0564	0.0000	1.4073	0.0047	0.0058

Non-Bias Adjusted Averages Include:

Catalytic Combustion Corporation
July 30, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	20.591	SCFH

Weather Data

Barometric Pressure	29.87	in. Hg
Relative Humidity	47	%
Ambient Temperature	97	°F
Specific Humidity	0.017841	lb H ₂ O / lb air

Unit Data

Unit Load	2.698.1	horsepower
Meas. Stack Moisture	13.9	%
Stack Exhaust Flow (M19)	310.873	SCFH

75% Load, Run - 2-2

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmw)	CO (ppmw)	THC (as C ₃ H ₈) (ppmw)	CO ₂ (%vvd)	N ₂ O (ppmw)	C ₂ H ₄ O (ppmw)	NO (ppmw)	NO ₂ (ppmw)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (ppmw)	C ₂ H ₆ (ppmw)	H ₂ O (%)
07/30/21 15:00:23	170220	9.00	5.28	2.96	154.08	5.69	1.35	2.12	5.28	0.00	17.06	-0.04	414.63	0.44	13.70
07/30/21 15:00:53	170250	8.98	5.34	2.94	154.11	5.70	1.41	2.27	5.34	0.00	16.86	-0.22	412.25	0.31	13.74
07/30/21 15:01:23	170280	9.00	5.30	2.86	154.99	5.68	1.42	2.21	5.30	0.00	16.40	-0.15	415.77	0.50	13.68
07/30/21 15:01:53	170310	9.00	5.33	2.95	154.83	5.69	1.45	2.15	5.33	0.00	16.23	-0.09	412.74	0.82	13.66
07/30/21 15:02:23	170340	9.00	5.33	2.89	154.31	5.68	1.33	2.21	5.33	0.00	16.25	-0.25	410.69	0.72	13.66
07/30/21 15:02:53	170370	9.01	5.33	2.88	156.72	5.68	1.40	2.19	5.33	0.00	16.35	-0.19	416.89	0.74	13.69
07/30/21 15:03:23	170400	9.00	5.42	2.86	156.36	5.70	1.45	2.43	5.42	0.00	16.60	-0.20	415.69	0.58	13.71
07/30/21 15:03:53	170430	9.00	5.46	2.84	155.44	5.68	1.42	2.48	5.46	0.00	16.53	-0.23	415.13	0.41	13.69
07/30/21 15:04:23	170460	9.00	5.36	2.76	152.95	5.70	1.40	2.24	5.36	0.00	16.20	-0.17	413.52	0.61	13.66
07/30/21 15:04:53	170490	8.99	5.44	2.91	154.46	5.68	1.37	1.98	5.44	0.00	15.62	-0.27	410.42	0.79	13.67
07/30/21 15:05:23	170520	8.99	5.49	2.95	154.82	5.69	1.39	2.20	5.49	0.00	15.45	-0.19	410.93	0.67	13.67
07/30/21 15:05:53	170550	8.99	5.65	2.88	156.15	5.71	1.49	1.90	5.65	0.00	15.42	-0.56	413.05	0.45	13.65
07/30/21 15:06:23	170580	8.98	5.55	2.89	154.97	5.75	1.40	2.17	5.55	0.00	15.43	-0.38	411.31	0.41	13.49
07/30/21 15:06:53	170610	8.98	5.88	2.88	155.71	5.71	1.44	2.45	5.88	0.00	15.45	-0.16	413.83	0.54	13.58
07/30/21 15:07:23	170640	8.98	5.41	2.94	155.21	5.69	1.44	2.71	5.41	0.00	16.01	-0.22	410.80	0.40	13.77
07/30/21 15:07:53	170670	8.99	5.21	2.85	153.21	5.69	1.37	2.38	5.21	0.00	16.44	-0.19	412.71	0.48	13.73
07/30/21 15:08:23	170700	8.99	5.28	2.93	156.26	5.69	1.43	2.41	5.28	0.00	16.55	-0.21	413.90	0.79	13.75
07/30/21 15:08:53	170730	8.99	5.09	2.95	153.40	5.61	1.43	2.76	5.09	0.00	17.65	-0.20	408.10	0.53	14.82
07/30/21 15:09:23	170760	8.99	5.37	3.03	153.58	5.65	1.43	2.45	5.37	0.00	18.36	-0.20	409.03	0.45	14.45
07/30/21 15:09:53	170790	8.99	5.37	2.89	155.68	5.67	1.46	2.02	5.37	0.00	17.32	-0.27	411.40	0.40	13.96
07/30/21 15:10:23	170820	8.99	5.55	2.98	154.21	5.72	1.41	2.35	5.55	0.00	16.25	-0.17	412.97	0.45	13.56
07/30/21 15:10:53	170850	8.97	5.59	2.90	154.93	5.78	1.47	2.14	5.59	0.00	15.50	-0.42	411.69	0.66	13.33
07/30/21 15:11:23	170880	8.97	5.60	2.93	153.82	5.77	1.42	2.56	5.60	0.00	15.00	-0.29	413.84	0.61	13.14
07/30/21 15:11:53	170910	8.96	5.77	3.03	152.91	5.79	1.45	2.60	5.77	0.00	14.81	-0.30	411.83	0.28	13.16
07/30/21 15:12:23	170940	8.98	5.71	2.90	154.96	5.79	1.51	2.07	5.71	0.00	14.69	-0.19	413.08	0.68	12.87
07/30/21 15:12:53	170970	8.97	5.25	49.44	972.03	4.16	5.63	1.60	5.25	0.00	14.02	0.35	2,591.39	13.89	11.81
07/30/21 15:13:23	171000	8.96	4.53	35.32	615.49	0.45	16.68	1.57	4.16	0.37	14.81	1.32	1,673.96	0.66	10.89
07/30/21 15:13:53	171030	8.96	5.33	2.88	156.72	5.68	1.40	2.19	5.14	0.19	11.39	1.27	595.22	0.03	5.85
07/30/21 15:14:23	171060	8.96	5.42	2.86	156.36	5.70	1.45	2.43	5.42	0.00	11.41	1.83	554.73	-0.06	6.02
07/30/21 15:14:53	171090	8.97	5.46	2.84	155.44	5.68	1.42	2.48	5.46	0.00	13.64	0.19	231.15	0.08	12.48
07/30/21 15:15:23	171120	8.97	5.36	2.76	152.95	5.70	1.40	2.24	5.36	0.00	11.13	-0.01	289.72	-0.19	12.78
07/30/21 15:15:53	171150	8.97	5.44	2.91	154.46	5.68	1.37	1.98	5.44	0.00	16.35	-0.19	416.89	0.74	13.69
07/30/21 15:16:23	171180	8.97	5.49	2.95	154.82	5.69	1.39	2.20	5.49	0.00	16.60	-0.20	415.69	0.58	13.71
07/30/21 15:16:53	171210	8.98	5.65	2.88	156.15	5.71	1.49	1.90	5.65	0.00	16.53	-0.23	415.13	0.41	13.69
07/30/21 15:17:23	171240	8.97	5.55	2.89	154.97	5.75	1.40	2.17	5.55	0.00	16.20	-0.17	413.52	0.61	13.66
07/30/21 15:17:53	171270	8.95	5.88	2.88	155.71	5.71	1.44	2.45	5.88	0.00	15.62	-0.27	410.42	0.79	13.67
07/30/21 15:18:23	171300	8.95	5.41	2.94	155.21	5.69	1.44	2.71	5.41	0.00	15.45	-0.19	410.93	0.67	13.67
07/30/21 15:18:53	171330	8.95	5.21	2.85	153.21	5.69	1.37	2.38	5.21	0.00	15.42	-0.56	413.05	0.45	13.65
07/30/21 15:19:23	171360	8.95	6.23	2.93	153.34	5.80	1.55	2.28	6.23	0.00	15.43	-0.38	411.31	0.41	13.49
07/30/21 15:19:53	171390	8.93	5.82	2.84	159.23	5.78	1.52	2.45	5.82	0.00	15.45	-0.16	413.83	0.54	13.58
07/30/21 15:20:23	171420	8.93	6.13	2.78	162.43	5.81	1.51	2.58	6.13	0.00	15.42	-0.22	410.80	0.40	13.77
07/30/21 15:20:53	171450	8.93	6.34	2.79	162.71	5.82	1.47	2.94	6.34	0.00	15.43	-0.19	412.71	0.48	13.73
07/30/21 15:21:23	171480	8.94	6.00	2.83	163.18	5.81	1.52	2.14	6.00	0.00	15.45	-0.30	435.66	0.40	12.26
07/30/21 15:21:53	171510	8.93	5.81	2.90	162.58	5.78	1.52	2.30	5.81	0.00	16.01	-0.26	433.01	0.47	12.62
07/30/21 15:22:23	171540	8.92	5.81	2.79	158.77	5.68	1.45	2.65	5.81	0.00	16.44	-0.32	422.40	0.20	14.33
07/30/21 15:22:53	171570	8.94	5.88	2.86	158.19	5.68	1.44	2.56	5.88	0.00	16.55	-0.17	422.76	0.23	14.02
07/30/21 15:23:23	171600	8.94	6.26	2.79	160.29	5.80	1.50	2.40	6.26	0.00	17.65	-0.20	430.19	0.48	12.85
07/30/21 15:23:53	171630	8.94	5.89	2.92	160.26	5.69	1.44	2.52	5.89	0.00	18.36	-0.24	425.61	0.36	14.08
07/30/21 15:24:23	171660	8.94	6.01	2.74	161.11	5.76	1.48	2.67	6.01	0.00	17.32	-0.27	428.17	0.15	13.26
07/30/21 15:24:53	171690	8.94	5.69	2.75	161.33	5.73	1.48	2.37	5.69	0.00	16.25	-0.37	427.32	0.22	13.73
07/30/21 15:25:23	171720	8.94	6.32	2.84	160.38	5.77	1.46	3.06	6.32	0.00	12.05	-0.14	428.12	0.34	13.23
07/30/21 15:25:53	171750	8.94	5.52	2.96	159.66	5.64	1.41	2.81	5.52	0.00	13.02	-0.25	422.83	0.51	14.58
07/30/21 15:26:23	171780	8.94	5.20	2.89	158.70	5.62	1.42	3.04	5.20	0.00	13.55	-0.36	422.13	0.27	14.96
07/30/21 15:26:53	171810	8.94	5.61	2.80	157.68	5.58	1.39	2.98	5.61	0.00	14.30	-0.19	416.17	0.31	15.94
07/30/21 15:27:23	171840	8.94	4.85	2.97	159.58	5.58	1.39	3.26	4.85	0.00	14.48	-0.26	420.91	0.25	15.15
07/30/21 15:27:53	171870	8.92	4.86	2.82	158.95	5.60	1.40	3.06	4.86	0.00	15.07	-0.18	418.97	0.23	15.16
07/30/21 15:28:23	171900	8.94	4.97	2.89	158.70	5.61	1.40	2.78	4.97	0.00	15.27	-0.23	419.98	0.47	15.12
07/30/21 15:28:53	171930	8.94	5.09	3.03	158.28	5.58	1.36	3.15	5.09	0.00	15.48	-0.23	418.18	0.37	15.50
07/30/21 15:29:23	171960	8.94	5.19	2.87	155.45	5.49	1.32	3.61	5.19	0.00	16.64	-0.20	411.78	0.26	17.07
07/30/21 15:29:53	171990	8.94	5.10	3.01	156.35	5.53	1.38	3.48	5.10	0.00	16.92	-0.13	413.70	0.12	16.75
07/30/21 15:30:23	172020	8.94	5.22	2.94	157.11	5.57	1.36	3.84	5.22	0.00	16.76				

Stewart & Stevenson Integration Center

Catalytic Combustion Corporation
July 30, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	20.172	SCFH

Weather Data

Barometric Pressure	29.85	in. Hg
Relative Humidity	42	%
Ambient Temperature	97	°F
Specific Humidity	0.015856	lb H ₂ O / lb air

Unit Data

Unit Load	2.616.3	horsepower
Meas. Stack Moisture	13.6	%
Stack Exhaust Flow (M19)	303,928	SCFH

75% Load, Run - 2-3

Date/Time (mm/dd/yyyy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmw)	CO (ppmw)	THC (as C ₂ H ₆) (ppmw)	CO ₂ (%vvd)	N ₂ O (ppmw)	C ₂ H ₆ O (ppmw)	NO (ppmw)	NO ₂ (ppmw)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (ppmw)	C ₂ H ₆ (ppmw)	H ₂ O (%)
07/30/21 16:27:23	175440	8.96	5.20	3.09	162.24	5.68	1.52	4.26	5.20	0.00	13.65	-0.14	427.16	0.26	14.22
07/30/21 16:27:53	175470	8.96	5.51	3.11	161.66	5.68	1.55	4.06	5.51	0.00	13.76	-0.10	427.30	0.22	14.07
07/30/21 16:28:23	175500	8.97	5.37	3.07	162.33	5.70	1.57	4.19	5.37	0.00	13.70	-0.33	428.91	0.07	13.95
07/30/21 16:28:53	175530	8.98	5.45	3.14	161.73	5.70	1.52	3.78	5.45	0.00	13.56	-0.16	428.59	0.33	13.81
07/30/21 16:29:23	175560	8.98	5.37	3.16	163.32	5.69	1.46	3.41	5.37	0.00	13.58	-0.22	430.94	0.45	13.79
07/30/21 16:29:53	175590	8.96	5.32	3.18	162.36	5.70	1.51	4.28	5.32	0.00	13.59	-0.02	429.85	0.34	13.80
07/30/21 16:30:23	175620	8.96	5.28	3.15	162.84	5.71	1.49	3.61	5.28	0.00	13.58	-0.04	432.52	0.06	13.81
07/30/21 16:30:53	175650	8.97	5.19	3.02	164.45	5.71	1.51	3.37	5.19	0.00	13.74	-0.25	431.85	0.53	13.90
07/30/21 16:31:23	175680	8.98	5.32	3.01	163.06	5.71	1.56	3.86	5.32	0.00	13.86	-0.26	431.18	0.59	13.89
07/30/21 16:31:53	175710	8.98	5.37	3.06	163.49	5.70	1.54	4.16	5.37	0.00	13.87	-0.22	430.46	0.18	13.88
07/30/21 16:32:23	175740	8.97	5.23	3.12	161.58	5.71	1.50	3.96	5.23	0.00	13.73	-0.14	428.70	0.43	13.80
07/30/21 16:32:53	175770	8.97	5.20	3.09	161.94	5.71	1.48	3.71	5.20	0.00	13.67	-0.11	429.38	0.47	13.75
07/30/21 16:33:23	175800	8.97	5.26	3.09	161.52	5.71	1.48	3.36	5.26	0.00	13.54	-0.08	429.34	0.43	13.74
07/30/21 16:33:53	175830	8.96	5.21	3.09	162.99	5.71	1.53	3.70	5.21	0.00	13.48	-0.35	430.08	0.94	13.72
07/30/21 16:34:23	175860	8.97	5.15	3.05	162.67	5.70	1.46	3.61	5.15	0.00	13.42	-0.22	430.77	0.40	13.72
07/30/21 16:34:53	175890	8.97	5.11	3.09	161.73	5.69	1.52	3.26	5.11	0.00	13.41	-0.26	430.83	0.81	13.71
07/30/21 16:35:23	175920	8.97	5.29	3.02	163.62	5.71	1.48	3.99	5.29	0.00	13.35	-0.27	430.14	0.62	13.72
07/30/21 16:35:53	175950	8.97	5.16	3.16	165.32	5.70	1.51	3.04	5.16	0.00	13.34	-0.26	434.18	0.65	13.73
07/30/21 16:36:23	175980	8.96	5.23	3.00	163.44	5.72	1.51	3.74	5.23	0.00	13.35	-0.52	428.88	0.59	13.74
07/30/21 16:36:53	176010	8.96	5.45	2.93	163.48	5.70	1.52	4.05	5.45	0.00	13.30	-0.11	430.31	0.58	13.67
07/30/21 16:37:23	176040	8.96	5.37	2.92	164.02	5.70	1.49	3.34	5.37	0.00	13.36	-0.39	432.22	0.47	13.65
07/30/21 16:37:53	176070	8.95	5.34	2.94	164.51	5.72	1.52	3.73	5.34	0.00	13.47	-0.32	432.87	0.82	13.69
07/30/21 16:38:23	176100	8.95	5.38	3.20	164.50	5.72	1.53	3.24	5.38	0.00	13.48	-0.26	434.26	0.55	13.71
07/30/21 16:38:53	176130	8.95	5.59	3.11	166.19	5.73	1.57	4.16	5.59	0.00	13.54	-0.31	432.39	0.70	13.72
07/30/21 16:39:23	176160	8.95	5.41	3.16	165.30	5.72	1.49	3.55	5.41	0.00	13.64	-0.18	435.13	0.59	13.73
07/30/21 16:39:53	176190	8.94	5.41	3.17	163.86	5.73	1.53	3.69	5.41	0.00	13.72	-0.11	432.05	0.41	13.73
07/30/21 16:40:23	176220	8.94	5.31	3.04	165.67	5.72	1.53	4.04	5.31	0.00	13.74	0.02	433.43	0.32	13.73
07/30/21 16:40:53	176250	8.94	5.19	3.17	164.72	5.72	1.54	4.07	5.19	0.00	13.69	-0.12	433.49	0.53	13.74
07/30/21 16:41:23	176280	8.94	5.32	3.13	165.07	5.72	1.54	4.17	5.32	0.00	13.63	-0.12	433.90	0.26	13.74
07/30/21 16:41:53	176310	8.95	5.24	3.11	165.63	5.73	1.54	3.91	5.24	0.00	13.66	-0.20	432.97	0.71	13.73
07/30/21 16:42:23	176340	8.96	5.33	3.11	164.83	5.72	1.59	3.64	5.33	0.00	13.70	-0.32	433.01	0.41	13.74
07/30/21 16:42:53	176370	8.98	5.44	3.08	165.03	5.73	1.55	3.59	5.44	0.00	13.76	-0.08	434.03	0.53	13.74
07/30/21 16:43:23	176400	8.97	5.22	3.17	164.73	5.73	1.56	3.89	5.22	0.00	13.97	-0.28	432.25	0.71	13.72
07/30/21 16:43:53	176430	8.97	5.41	3.15	163.83	5.73	1.51	3.91	5.41	0.00	14.18	-0.26	431.82	0.60	13.74
07/30/21 16:44:23	176460	8.98	5.40	3.05	164.98	5.72	1.51	3.81	5.40	0.00	14.19	-0.29	433.20	0.61	13.75
07/30/21 16:44:53	176490	8.98	5.62	3.15	165.96	5.73	1.47	4.23	5.62	0.00	14.34	-0.07	432.68	0.28	13.73
07/30/21 16:45:23	176520	8.97	5.49	3.16	164.48	5.74	1.58	4.56	5.49	0.00	14.46	-0.21	432.58	0.58	13.73
07/30/21 16:45:53	176550	8.97	5.19	3.19	165.52	5.73	1.52	3.75	5.19	0.00	14.36	-0.17	434.05	0.33	13.76
07/30/21 16:46:23	176580	8.96	5.42	3.18	163.83	5.73	1.57	4.26	5.42	0.00	13.97	-0.21	431.62	0.46	13.76
07/30/21 16:46:53	176610	8.96	5.27	3.13	165.74	5.73	1.47	4.41	5.27	0.00	13.55	-0.28	432.33	0.33	13.76
07/30/21 16:47:23	176640	8.96	5.35	3.02	164.14	5.73	1.54	4.01	5.35	0.00	13.34	-0.27	432.18	0.30	13.76
07/30/21 16:47:53	176670	8.97	5.30	3.10	164.58	5.72	1.57	4.25	5.30	0.00	13.30	-0.21	431.82	0.48	13.77
07/30/21 16:48:23	176700	8.97	5.23	3.07	166.09	5.73	1.52	4.47	5.23	0.00	13.30	-0.14	433.25	0.59	13.79
07/30/21 16:48:53	176730	8.95	5.46	3.14	164.59	5.73	1.56	5.08	5.46	0.00	13.07	-0.29	433.13	0.24	13.75
07/30/21 16:49:23	176760	8.96	5.25	3.19	159.22	5.50	1.43	4.02	5.25	0.00	15.24	-0.25	414.50	0.38	16.82
07/30/21 16:49:53	176790	8.95	4.89	3.04	164.21	5.66	1.43	4.06	4.89	0.00	14.06	-0.22	429.74	0.34	14.43
07/30/21 16:50:23	176820	8.95	4.96	3.06	166.83	5.71	1.52	3.66	4.96	0.00	13.79	-0.18	431.24	0.32	13.95
07/30/21 16:50:53	176850	8.94	5.18	3.12	166.23	5.73	1.52	4.20	5.18	0.00	13.66	-0.29	434.25	0.69	13.79
07/30/21 16:51:23	176880	8.95	5.37	3.10	164.52	5.75	1.55	4.35	5.37	0.00	13.70	-0.28	432.03	0.29	13.76
07/30/21 16:51:53	176910	8.96	5.15	3.13	164.16	5.74	1.50	4.77	5.15	0.00	13.74	-0.05	432.73	0.29	13.65
07/30/21 16:52:23	176940	8.98	5.28	3.14	163.56	5.74	1.56	4.53	5.28	0.00	13.63	-0.06	431.91	0.57	13.48
07/30/21 16:52:53	176970	8.97	5.38	3.05	164.15	5.77	1.52	4.71	5.38	0.00	13.35	-0.12	433.33	0.53	13.29
07/30/21 16:53:23	177000	8.97	5.36	3.10	166.71	5.78	1.55	3.63	5.36	0.00	13.11	-0.36	435.10	0.46	13.15
07/30/21 16:53:53	177030	8.98	5.61	3.03	165.77	5.78	1.49	4.58	5.61	0.00	12.89	-0.08	437.33	0.21	13.09
07/30/21 16:54:23	177060	8.98	5.38	3.14	165.90	5.78	1.53	4.35	5.38	0.00	12.84	-0.24	436.28	0.56	13.04
07/30/21 16:54:53	177090	8.97	5.38	3.11	166.61	5.77	1.58	3.78	5.38	0.00	12.83	-0.28	436.12	0.34	12.92
07/30/21 16:55:23	177120	8.97	5.56	3.18	166.49	5.79	1.50	3.87	5.56	0.00	12.84	-0.22	438.02	0.45	12.91
07/30/21 16:55:53	177150	8.96	5.35	2.95	165.62	5.78	1.54	4.40	5.35	0.00	12.93	-0.23	438.22	0.58	12.94
07/30/21 16:56:23	177180	8.96	5.36	3.07	165.60	5.78	1.57	4.13	5.36	0.00	13.12	-0.29	436.74	0.55	12.95
07/30/21 16:56:53	177210	8.96	5.63	3.08	164.50	5.82	1.54	4.54	5.63	0.00	13.20	-0.27	435.95	0.44	12.83
07/30/21 16:57:23	177240	8.97	5.57	3.13	165.64	5.82	1.52	4.36	5.57	0.00	13.03	-0.26	435.31	0.75	12.78
07/30/21 16:5															

Catalytic Combustion Corporation
July 30, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	20.172	SCFH

Weather Data

Barometric Pressure	29.85	in. Hg
Relative Humidity	42	%
Ambient Temperature	97	°F
Specific Humidity	0.015856	lb H ₂ O / lb air

Unit Data

Unit Load	2.616.3	horsepower
Meas. Stack Moisture	13.6	%
Stack Exhaust Flow (M19)	303,928	SCFH

75% Load, Run - 2-3

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%vvd)	NOx (ppmvw)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%vw)	N ₂ O (ppmvw)	C ₂ H ₂ O (ppmvw)	NO (ppmvw)	NO ₂ (ppmvw)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (ppmvw)	C ₂ H ₆ (ppmvw)	H ₂ O (%)
07/30/21 17:17:23	178440	8.84	5.06	3.06	168.22	5.87	1.48	4.52	5.06	0.00	10.62	-0.27	444.05	0.73	12.33
07/30/21 17:17:53	178470	8.84	5.30	3.02	171.17	5.94	1.55	4.36	5.30	0.00	10.61	-0.28	447.17	0.31	11.65
07/30/21 17:18:23	178500	8.81	5.32	3.03	167.25	5.74	1.38	4.98	5.32	0.00	11.60	-0.13	434.22	0.22	14.18
07/30/21 17:18:53	178530	8.81	5.05	3.02	161.55	5.64	1.36	4.12	5.05	0.00	12.65	-0.12	423.40	0.04	16.10
07/30/21 17:19:23	178560	8.80	4.90	2.96	168.67	5.88	1.49	4.74	4.90	0.00	11.89	-0.21	443.32	0.42	12.45
07/30/21 17:19:53	178590	8.80	5.71	2.97	165.63	5.90	1.44	4.58	5.71	0.00	12.25	-0.32	437.62	0.22	12.82
07/30/21 17:20:23	178620	8.81	5.62	3.02	165.57	5.90	1.44	4.78	5.62	0.00	11.99	-0.36	437.27	0.63	12.83
07/30/21 17:20:53	178650	8.82	5.04	3.07	168.18	5.90	1.49	4.09	5.04	0.00	11.94	-0.29	442.26	0.29	12.23
07/30/21 17:21:23	178680	8.80	5.13	2.89	167.87	5.91	1.44	4.67	5.13	0.00	11.81	-0.22	443.18	0.14	12.13
07/30/21 17:21:53	178710	8.80	5.14	2.99	168.77	5.93	1.42	4.56	5.14	0.00	11.75	-0.17	445.98	0.37	11.95
07/30/21 17:22:23	178740	8.81	5.05	2.95	165.21	5.80	1.42	4.54	5.05	0.00	12.50	-0.16	432.28	0.24	13.83
07/30/21 17:22:53	178770	8.82	4.97	2.92	167.78	5.90	1.38	4.53	4.97	0.00	12.18	-0.19	442.61	0.30	12.28
07/30/21 17:23:23	178800	8.81	4.29	3.02	165.00	5.66	1.37	4.95	4.29	0.00	13.55	-0.21	430.24	0.68	15.27
07/30/21 17:23:53	178830	8.80	5.00	3.02	167.91	5.91	1.42	4.24	5.00	0.00	12.66	-0.44	444.46	0.53	12.03
07/30/21 17:24:23	178860	8.77	5.24	2.91	165.43	5.82	1.37	4.11	5.24	0.00	13.45	-0.35	433.08	-0.01	13.55
07/30/21 17:24:53	178890	8.78	5.14	2.98	163.19	5.82	1.43	4.20	5.14	0.00	13.33	-0.31	429.44	0.23	13.65
07/30/21 17:25:23	178920	8.78	5.15	2.94	164.70	5.89	1.45	4.45	5.15	0.00	13.14	-0.30	432.50	0.39	13.06
07/30/21 17:25:53	178950	8.76	5.27	3.04	166.33	5.89	1.39	4.44	5.27	0.00	13.25	-0.31	435.67	0.38	13.20
07/30/21 17:26:23	178980	8.75	4.69	2.97	166.88	5.91	1.41	4.39	4.69	0.00	13.03	-0.23	440.21	0.30	12.47
07/30/21 17:26:53	179010	8.76	4.62	3.00	167.04	5.91	1.42	4.54	4.62	0.00	13.10	-0.30	438.17	0.24	12.40
RAW AVERAGE		8.91	5.23	3.10	164.95	5.75	1.47	4.21	5.15	0.08	13.44	0.00	433.59	0.38	13.59

Bias	Serial Number:	INST-O2-0026	INST-IR-0005	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
		O ₂		NOx		CO		THC (as C ₃ H ₈)		CO ₂		N ₂ O		C ₂ H ₂ O	
		(%)						(ppmvw)							
	Initial Zero	0.04						0.44							
	Final Zero	0.06						1.21							
	Avg. Zero	0.05						0.83							
	Initial UpScale	11.95						303.21							
	Final UpScale	11.94						312.59							
	Avg. UpScale	11.95						307.90							
Upscale Cal Gas		11.99						302.00							

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₂ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₃ H ₈)	C ₂ H ₆ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	8.94	6.05	3.59	190.89	6.66	1.70	4.87	5.96	0.09	15.56	0.00	183.99	0.30	6.61
Corrected Raw Average (ppm/% wet basis)	7.71	5.23	3.10	164.95	5.75	1.47	4.21	5.15	0.08	13.44	0.00	158.98	0.26	5.71
Concentration (ppm@ 15%O ₂)	N/A	2.98	1.77	81.34	3.28	0.84	2.40	2.94	0.04	7.67	0.00	90.73	0.15	2.82
Emission Rate (g/kw*hr)	N/A	0.0511	0.0184	1.3313	538	0.0137	0.0393	0.0328	0.0008	0.0486	0.0000	1.4883	0.0024	0.0461

Non-Bias Adjusted Averages Include:

EMISSION DATA RECORDS

100% Load

NO_x, CO, THC, N₂O, C₂H₄O, NH₃, HCHO, CH₄, C₂H₆, and H₂O
Reference Method Data

Catalytic Combustion Corporation
September 1, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	26.278	SCFH

Weather Data

Barometric Pressure	29.73	in. Hg
Relative Humidity	70	%
Ambient Temperature	88	°F
Specific Humidity	0.020202	lb H ₂ O / lb air

Unit Data

Unit Load	3,598.0	horsepower
Meas. Stack Moisture	13.6	%
Stack Exhaust Flow (M19)	386,201	SCFH

100% Load, Run - 3-1

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%)	NOx (ppmv)	CO (ppmv)	THC (as C ₃ H ₈) (ppmv)	CO ₂ (%)	N ₂ O (ppmv)	C ₂ H ₂ O (ppmv)	NO (ppmv)	NO ₂ (ppmv)	NH ₃ (ppmv)	HCHO (ppmv)	CH ₄ (as C ₂ H ₆) (ppmv)	C ₂ H ₄ (as C ₃ H ₈) (ppmv)	H ₂ O (%)
09/01/21 9:23:57	12140	8.62	15.56	4.29	96.72	5.91	1.12	0.80	12.77	2.79	0.60	1.33	412.49	-0.42	13.13
09/01/21 9:24:27	12170	8.61	14.59	4.28	97.14	5.91	1.07	0.84	12.15	2.44	0.66	1.37	411.33	-0.37	13.10
09/01/21 9:24:57	12200	8.61	13.74	4.22	98.52	5.88	1.26	0.76	12.95	0.80	0.60	1.30	410.45	-0.20	13.48
09/01/21 9:25:27	12230	8.62	14.09	4.13	98.75	5.90	1.31	0.83	13.01	1.08	0.58	1.25	412.16	-0.35	13.30
09/01/21 9:25:57	12260	8.61	13.84	3.64	98.21	5.84	1.33	0.94	12.72	1.12	0.62	1.27	409.75	-0.42	14.07
09/01/21 9:26:27	12290	8.61	15.11	3.67	98.45	5.87	1.34	0.88	13.46	1.65	0.61	1.32	411.82	-0.48	13.88
09/01/21 9:26:57	12320	8.61	14.09	4.16	98.85	5.92	1.32	0.77	13.21	0.87	0.66	1.25	412.09	-0.34	13.09
09/01/21 9:27:27	12350	8.62	15.47	3.67	98.04	5.82	1.40	0.85	11.72	3.74	0.67	1.30	406.15	-0.76	14.56
09/01/21 9:27:57	12380	8.61	14.73	3.64	97.91	5.87	1.38	0.85	12.00	2.73	0.65	1.32	413.16	-0.48	13.88
09/01/21 9:28:27	12410	8.60	15.08	3.79	97.37	5.89	1.36	0.78	12.51	2.57	0.63	1.28	413.74	-0.61	13.54
09/01/21 9:28:57	12440	8.61	14.66	3.70	98.69	5.91	1.38	0.86	12.77	1.89	0.64	1.31	409.17	-0.54	13.54
09/01/21 9:29:27	12470	8.60	14.26	3.51	99.77	5.66	1.35	0.86	12.12	2.14	0.63	1.26	396.82	-0.63	16.52
09/01/21 9:29:57	12500	8.62	14.33	3.68	99.41	5.88	1.35	0.86	13.23	1.09	0.60	1.34	411.48	-0.49	13.77
09/01/21 9:30:27	12530	8.60	13.37	4.16	99.32	5.91	1.33	0.74	13.00	0.37	0.65	1.24	412.99	-0.27	13.24
09/01/21 9:30:57	12560	8.61	12.95	4.18	98.88	5.90	1.35	0.75	12.62	0.33	0.58	1.26	412.49	-0.35	13.31
09/01/21 9:31:27	12590	8.61	11.75	4.20	98.87	5.91	1.32	0.83	10.55	1.20	0.63	1.23	415.45	-0.33	13.05
09/01/21 9:31:57	12620	8.58	12.15	4.26	98.90	5.93	1.35	0.80	10.26	1.88	0.62	1.18	418.34	-0.37	12.81
09/01/21 9:32:27	12650	8.60	12.47	4.23	98.83	5.95	1.34	0.83	10.05	2.42	0.62	1.21	414.49	-0.43	12.70
09/01/21 9:32:57	12680	8.61	12.08	4.31	99.55	5.93	1.33	0.81	10.56	1.52	0.61	1.22	414.63	-0.40	12.78
09/01/21 9:33:27	12710	8.61	11.71	4.29	99.63	5.92	1.39	0.74	10.06	1.65	0.58	1.24	414.51	-0.34	12.89
09/01/21 9:33:57	12740	8.61	11.73	3.60	99.19	5.86	1.56	0.85	9.61	2.12	0.53	1.23	410.55	-0.56	13.96
09/01/21 9:34:27	12770	8.61	11.85	4.04	99.10	5.90	1.50	0.72	10.28	1.57	0.58	1.19	417.42	-0.32	13.33
09/01/21 9:34:57	12800	8.60	12.40	4.07	99.20	5.92	1.57	0.75	9.69	2.71	0.62	1.18	414.89	-0.39	13.18
09/01/21 9:35:27	12830	8.60	11.63	3.65	98.54	5.73	1.56	1.07	10.25	1.37	0.62	1.25	407.38	-0.61	15.56
09/01/21 9:35:57	12860	8.60	10.48	4.01	98.58	5.91	1.55	0.73	9.29	1.19	0.61	1.15	416.02	-0.29	13.26
09/01/21 9:36:27	12890	8.59	10.35	3.95	97.36	5.91	1.55	0.76	8.63	1.72	0.60	1.17	413.49	-0.30	13.22
09/01/21 9:36:57	12920	8.60	11.02	3.62	97.01	5.86	1.55	0.80	9.55	1.46	0.59	1.19	413.11	-0.45	13.83
09/01/21 9:37:27	12950	8.59	10.68	3.49	97.85	5.85	1.58	0.76	8.76	1.92	0.63	1.23	410.69	-0.46	14.23
09/01/21 9:37:57	12980	8.60	11.40	3.67	97.87	5.89	1.59	0.81	8.45	2.94	0.66	1.19	414.51	-0.60	13.51
09/01/21 9:38:27	13010	8.59	10.81	3.59	96.68	5.83	1.59	0.91	9.17	1.64	0.56	1.22	412.72	-0.41	14.31
09/01/21 9:38:57	13040	8.59	11.02	3.55	96.65	5.88	1.60	0.87	9.62	1.40	0.58	1.20	412.59	-0.48	13.85
09/01/21 9:39:27	13070	8.60	10.74	3.57	97.43	5.87	1.58	0.81	9.35	1.39	0.58	1.18	415.48	-0.50	13.78
09/01/21 9:39:57	13100	8.59	10.94	3.47	97.90	5.68	1.46	1.08	8.77	2.17	0.51	1.23	405.34	-0.33	15.78
09/01/21 9:40:27	13130	8.61	10.60	3.58	97.97	5.83	1.55	0.84	9.10	1.49	0.57	1.17	412.95	-0.36	14.28
09/01/21 9:40:57	13160	8.61	11.05	3.63	98.84	5.88	1.58	0.79	9.11	1.95	0.63	1.17	417.33	-0.53	13.56
09/01/21 9:41:27	13190	8.58	10.68	3.97	98.42	5.89	1.54	0.80	8.66	2.02	0.70	1.17	413.48	-0.27	13.36
09/01/21 9:41:57	13220	8.59	9.90	4.06	98.57	5.90	1.53	0.69	8.18	1.72	0.57	1.13	416.94	-0.35	13.16
09/01/21 9:42:27	13250	8.59	9.71	4.09	99.03	5.91	1.57	0.61	8.34	1.37	0.57	1.17	416.75	-0.36	13.10
09/01/21 9:42:57	13280	8.59	10.09	3.61	98.64	5.81	1.62	0.78	8.32	1.77	0.60	1.16	410.12	-0.79	14.49
09/01/21 9:43:27	13310	8.60	9.59	3.96	98.71	5.90	1.56	0.74	8.46	1.13	0.57	1.16	414.07	-0.25	13.28
09/01/21 9:43:57	13340	8.58	9.51	4.01	98.46	5.88	1.53	0.71	8.56	0.95	0.62	1.16	412.61	-0.29	13.46
09/01/21 9:44:27	13370	8.60	10.70	4.07	98.15	5.89	1.54	0.76	8.08	2.62	0.64	1.15	414.87	-0.31	13.25
09/01/21 9:44:57	13400	8.59	10.03	4.07	99.17	5.92	1.55	0.72	7.65	2.38	0.56	1.11	419.67	-0.32	13.01
09/01/21 9:45:27	13430	8.60	10.44	4.19	98.32	5.93	1.58	0.71	7.88	2.56	0.60	1.16	416.90	-0.33	12.88
09/01/21 9:45:57	13460	8.60	10.32	4.10	97.91	5.93	1.56	0.77	7.77	2.55	0.59	1.13	417.20	-0.41	12.87
09/01/21 9:46:27	13490	8.58	10.05	4.14	97.87	5.93	1.58	0.72	7.74	2.31	0.58	1.12	417.22	-0.37	12.82
09/01/21 9:46:57	13520	8.60	8.91	3.27	97.69	5.76	1.67	0.87	7.76	1.15	0.58	1.15	408.08	-0.45	15.13
09/01/21 9:47:27	13550	8.58	8.82	4.08	98.83	5.90	1.74	0.69	7.41	1.41	0.55	1.09	416.95	-0.34	13.18
09/01/21 9:47:57	13580	8.59	9.00	3.97	98.81	5.91	1.77	0.67	7.67	1.33	0.57	1.06	417.72	-0.33	13.10
09/01/21 9:48:27	13610	8.60	9.05	3.96	98.90	5.92	1.73	0.70	7.20	1.85	0.64	1.08	414.75	-0.36	13.06
09/01/21 9:48:57	13640	8.59	8.78	3.94	99.05	5.92	1.79	0.75	7.16	1.62	0.58	1.08	414.08	-0.29	13.08
09/01/21 9:49:27	13670	8.59	9.13	3.33	98.52	5.82	1.75	0.78	7.22	1.91	0.58	1.16	412.21	-0.38	14.35
09/01/21 9:49:57	13700	8.58	8.77	3.92	98.09	5.90	1.75	0.77	7.25	1.51	0.59	1.05	419.28	-0.26	13.22
09/01/21 9:50:27	13730	8.58	8.83	3.57	97.72	5.86	1.77	0.83	7.02	1.81	0.61	1.08	418.58	-0.47	13.80
09/01/21 9:50:57	13760	8.59	8.48	4.00	98.23	5.94	1.75	0.81	6.97	1.50	0.60	1.08	416.36	-0.35	13.06
09/01/21 9:51:27	13790	8.56	8.49	3.93	99.06	5.92	1.80	0.72	6.88	1.61	0.56	1.06	418.98	-0.32	13.05
09/01/21 9:51:57	13820	8.58	8.58	3.93	99.00	5.91	1.71	0.79	6.95	1.63	0.63	1.06	417.16	-0.36	13.24
09/01/21 9:52:27	13850	8.57	8.55	3.64	98.96	5.89	1.89	0.93	6.93	1.62	0.56	1.08	415.79	-0.57	13.52
09/01/21 9:52:57	13880	8.58	8.48	3.38	99.12	5.82	1.97	0.89	6.85	1.63	0.61	1.07	411.76	-0.75	14.55
09/01/21 9:53:27	13910	8.58	8.45	3.51	98.30	5.87	1.97	0.82	7.15	1.30	0.61	1.08	414.58	-0.50	13.83
09/01/21 9:53:57	13940	8.59	8.35	3.50	99.04	5.89	1.99	0.80	7.15	1.19	0.55	1.05	411.33	-0.53	13.71
09/01/21 9:54:27	13970	8.60	8.39	3.56	99.26	5.88	1.96	0.77	6.81	1.1					

Catalytic Combustion Corporation
September 1, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	26.278	SCFH

Weather Data

Barometric Pressure	29.73	in. Hg
Relative Humidity	70	%
Ambient Temperature	88	°F
Specific Humidity	0.020202	lb H ₂ O / lb air

Unit Data

Unit Load	3,598.0	horsepower
Meas. Stack Moisture	13.6	%
Stack Exhaust Flow (M19)	386,201	SCFH

100% Load, Run - 3-1

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%)	NOx (ppmvd)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%)	N ₂ O (ppmvw)	C ₂ H ₂ O (ppmvw)	NO (ppmvd)	NO ₂ (ppmvd)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (as C ₂ H ₆) (ppmvw)	C ₂ H ₆ (as C ₃ H ₈) (ppmvw)	H ₂ O (%)
09/01/21 10:16:27	15290	8.62	10.37	4.21	100.42	5.91	2.01	0.77	8.11	2.26	0.60	1.20	420.56	-0.31	13.11
09/01/21 10:16:57	15320	8.61	9.64	4.55	100.63	5.91	1.82	0.75	8.64	1.01	0.57	1.28	418.11	-0.34	13.07
09/01/21 10:17:27	15350	8.60	9.75	5.27	100.75	5.90	0.25	0.86	8.98	0.77	0.69	1.50	415.16	-0.34	13.01
09/01/21 10:17:57	15380	8.61	10.53	5.44	100.90	5.90	0.17	0.90	8.51	2.02	0.64	1.54	417.24	-0.32	13.00
09/01/21 10:18:27	15410	8.61	11.35	5.43	100.92	5.90	0.16	0.95	8.17	3.18	0.62	1.58	416.38	-0.36	12.99
09/01/21 10:18:57	15440	8.61	10.94	4.39	99.68	5.91	2.50	0.70	8.34	2.60	0.57	1.21	420.61	-0.30	13.04
09/01/21 10:19:27	15470	8.61	10.43	3.76	99.80	5.93	3.33	0.68	8.33	2.10	0.59	0.99	421.58	-0.36	13.05
09/01/21 10:19:57	15500	8.60	9.92	3.75	99.99	5.93	3.39	0.72	8.09	1.82	0.57	0.95	419.50	-0.37	12.93
09/01/21 10:20:27	15530	8.61	9.98	3.85	99.09	5.92	3.37	0.60	8.58	1.40	0.56	0.95	424.30	-0.38	12.90
09/01/21 10:20:57	15560	8.60	10.48	3.13	97.99	5.87	3.32	0.76	8.36	2.12	0.54	1.01	418.67	-0.40	13.80
09/01/21 10:21:27	15590	8.59	10.26	3.34	99.07	5.90	3.34	0.74	8.19	2.07	0.67	1.02	418.01	-0.58	13.64
09/01/21 10:21:57	15620	8.62	9.95	3.80	99.01	5.93	3.34	0.65	8.52	1.43	0.52	0.94	422.67	-0.32	13.06
09/01/21 10:22:27	15650	8.62	10.12	3.22	99.20	5.86	3.37	0.78	8.95	1.17	0.53	1.03	416.90	-0.44	14.05
09/01/21 10:22:57	15680	8.62	10.52	3.73	98.72	5.92	3.47	0.67	8.79	1.74	0.59	0.97	420.37	-0.27	13.29
09/01/21 10:23:27	15710	8.63	9.89	3.68	99.65	5.92	3.48	0.69	8.60	1.29	0.59	0.97	421.08	-0.28	13.22
09/01/21 10:23:57	15740	8.61	10.24	3.64	100.07	5.91	3.48	0.68	9.07	1.17	0.55	0.97	418.20	-0.25	13.39
09/01/21 10:24:27	15770	8.62	11.18	3.73	99.70	5.90	3.46	0.63	9.19	1.99	0.54	0.96	419.60	-0.29	13.48
09/01/21 10:24:57	15800	8.64	10.63	3.66	99.94	5.89	3.40	0.63	9.15	1.48	0.60	0.96	421.90	-0.19	13.48
09/01/21 10:25:27	15830	8.63	10.99	3.28	99.85	5.74	3.46	0.97	9.12	1.88	0.65	1.05	409.91	-0.58	15.43
09/01/21 10:25:57	15860	8.64	12.22	3.34	99.24	5.91	3.75	0.68	8.99	3.23	0.59	0.97	417.11	-0.51	13.56
RAW AVERAGE		8.60	10.21	3.76	99.12	5.88	2.08	0.79	8.60	1.61	0.59	1.12	414.75	0.00	13.64

Bias	Serial Number:	INST-O2-0026	INST-NX-0025	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-NX-0025	INST-NX-0025	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
		O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₂ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₂ H ₆)	C ₂ H ₆ (as C ₃ H ₈)
		(%)			(ppmvw)									
	Initial Zero	0.01			0.19									
	Final Zero	0.02			0.20									
	Avg. Zero	0.02			0.20									
	Initial UpScale	11.85			300.98									
	Final UpScale	11.94			300.31									
	Avg. UpScale	11.90			300.65									
Upscale Cal Gas		11.96			299.00									

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₂ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₂ H ₆)	C ₂ H ₆ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	8.64	10.21	4.36	114.77	6.81	2.40	0.91	8.60	1.61	0.68	1.29	176.10	0.00	0.00
Corrected Raw Average (ppm/% wet basis)	7.46	8.82	3.76	99.12	5.88	2.08	0.79	7.43	1.39	0.59	1.12	152.08	0.00	0.00
Concentration (ppm@ 15%O ₂)	N/A	4.92	2.10	47.70	3.28	1.16	0.44	4.14	0.78	0.33	0.62	84.74	0.00	0.00
Emission Rate (g/kw*hr)	N/A	0.0797	0.0207	0.7392	508	0.0179	0.0068	0.0437	0.0126	0.0020	0.0066	1.3162	0.0000	0.0000

Non-Bias Adjusted Averages Include:

Catalytic Combustion Corporation
September 1, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	26.278	SCFH

Weather Data

Barometric Pressure	29.73	in. Hg
Relative Humidity	57	%
Ambient Temperature	93	°F
Specific Humidity	0.019207	lb H ₂ O / lb air

Unit Data

Unit Load	3,598.0	horsepower
Meas. Stack Moisture	12.9	%
Stack Exhaust Flow (M19)	399,898	SCFH

100% Load, Run - 3-2

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%)	NOx (ppmv)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%)	N ₂ O (ppmvw)	C ₂ H ₂ O (ppmvw)	NO (ppmv)	NO ₂ (ppmv)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (as C ₂ H ₆) (ppmvw)	C ₂ H ₄ (as C ₃ H ₈) (ppmvw)	H ₂ O (%)
09/01/21 10:26:27	15890	8.63	10.93	3.24	99.31	5.91	3.81	0.76	9.15	1.78	0.63	0.97	417.84	-0.48	13.55
09/01/21 10:26:57	15920	8.62	10.77	3.37	99.38	5.91	3.80	0.70	9.23	1.54	0.64	0.94	417.36	-0.50	13.58
09/01/21 10:27:27	15950	8.62	11.03	3.20	99.52	5.90	3.80	0.75	9.08	1.95	0.58	0.97	418.06	-0.53	13.63
09/01/21 10:27:57	15980	8.64	11.41	3.23	99.55	5.90	3.80	0.72	9.23	2.18	0.54	0.97	418.20	-0.54	13.69
09/01/21 10:28:27	16010	8.63	10.75	3.16	100.19	5.76	3.83	0.75	9.29	1.47	0.60	0.96	411.88	-0.66	15.24
09/01/21 10:28:57	16040	8.62	11.56	3.16	100.40	5.86	3.77	0.67	9.07	2.49	0.65	0.97	419.57	-0.48	14.04
09/01/21 10:29:27	16070	8.64	10.82	3.21	100.54	5.87	3.82	0.74	9.16	1.66	0.60	1.01	417.74	-0.48	13.89
09/01/21 10:29:57	16100	8.63	11.67	3.30	100.76	5.90	3.81	0.72	8.47	3.20	0.68	1.03	417.82	-0.57	13.62
09/01/21 10:30:27	16130	8.63	11.55	3.24	101.14	5.88	3.79	0.65	8.51	3.04	0.61	0.94	416.35	-0.55	13.79
09/01/21 10:30:57	16160	8.62	11.02	3.18	100.86	5.86	3.81	0.76	9.11	1.91	0.73	0.99	417.79	-0.45	14.07
09/01/21 10:31:27	16190	8.64	10.62	3.60	100.74	5.91	3.80	0.72	9.30	1.32	0.78	0.90	417.79	-0.28	13.22
09/01/21 10:31:57	16220	8.63	10.90	3.63	100.52	5.93	3.79	0.54	8.61	2.29	0.69	0.91	418.91	-0.34	13.08
09/01/21 10:32:27	16250	8.62	10.51	3.66	100.73	5.94	3.85	0.59	8.86	1.65	0.72	0.92	423.48	-0.35	12.90
09/01/21 10:32:57	16280	8.63	11.03	3.76	100.97	5.95	3.85	0.59	9.04	2.00	0.73	0.96	422.53	-0.34	12.83
09/01/21 10:33:27	16310	8.63	11.24	3.72	101.35	5.96	3.82	0.64	8.07	3.17	0.72	0.95	423.24	-0.40	12.77
09/01/21 10:33:57	16340	8.62	11.70	3.79	101.21	5.94	2.89	0.66	8.48	3.22	0.76	0.95	421.14	-0.39	12.89
09/01/21 10:34:27	16370	8.63	11.19	4.01	100.92	5.95	2.11	0.75	9.39	1.80	0.72	1.03	419.17	-0.43	12.79
09/01/21 10:36:27	16490	9.10	12.43	3.44	94.25	5.82	2.06	0.76	11.49	0.94	0.76	1.08	418.85	-0.35	14.34
09/01/21 10:36:57	16520	9.10	11.91	3.53	92.81	5.90	2.05	0.85	11.10	0.80	0.72	1.01	417.41	-0.60	13.50
09/01/21 10:37:27	16550	9.11	11.35	3.52	92.70	5.86	2.11	0.80	10.63	0.72	0.79	1.05	416.14	-0.50	13.96
09/01/21 10:37:57	16580	9.10	10.93	3.93	92.36	5.91	2.05	0.72	10.22	0.71	0.82	1.01	420.27	-0.29	13.24
09/01/21 10:38:27	16610	9.12	10.18	3.96	92.36	5.92	2.08	0.70	9.89	0.29	0.76	1.01	419.51	-0.27	13.13
09/01/21 10:38:57	16640	9.12	9.99	3.98	92.28	5.92	2.09	0.65	9.07	0.92	0.76	1.01	421.75	-0.32	13.12
09/01/21 10:39:27	16670	9.12	9.84	4.04	92.08	5.94	2.06	0.65	9.75	0.09	0.68	1.04	419.46	-0.31	12.98
09/01/21 10:39:57	16700	9.13	10.03	4.04	92.56	5.95	2.06	0.68	9.38	0.65	0.73	1.02	419.79	-0.35	12.82
09/01/21 10:40:27	16730	9.13	10.20	4.11	92.74	5.95	2.05	0.76	9.55	0.65	0.80	1.02	421.15	-0.39	12.74
09/01/21 10:40:57	16760	9.13	9.77	4.10	92.69	5.93	2.11	0.74	9.42	0.35	0.79	0.99	420.08	-0.36	12.86
09/01/21 11:19:57	19100	9.13	9.83	1.47	92.40	5.64	0.19	0.91	9.06	0.77	1.06	0.72	386.10	0.58	12.92
09/01/21 11:20:27	19130	9.14	9.52	1.52	92.04	5.63	0.14	1.01	9.28	0.25	1.04	0.69	384.29	0.53	12.89
09/01/21 11:20:57	19160	9.16	9.84	1.57	91.43	5.64	0.17	0.98	9.41	0.43	1.08	0.68	382.45	0.46	12.83
09/01/21 11:21:27	19190	9.13	8.90	1.48	92.93	5.64	0.16	0.94	8.85	0.05	1.07	0.71	385.14	0.50	12.83
09/01/21 11:21:57	19220	9.12	8.91	1.47	94.59	5.64	0.18	0.96	8.43	0.48	1.03	0.73	386.35	0.56	12.83
09/01/21 11:22:27	19250	9.13	9.57	1.59	95.23	5.65	0.18	0.94	9.05	0.52	0.99	0.70	385.74	0.57	12.78
09/01/21 11:22:57	19280	9.13	9.12	1.51	96.70	5.66	0.16	0.86	8.55	0.57	0.99	0.71	386.92	0.53	12.74
09/01/21 11:23:27	19310	9.14	9.22	1.54	97.02	5.66	0.17	0.94	8.56	0.66	0.95	0.70	384.21	0.50	12.72
09/01/21 11:23:57	19340	9.13	9.05	1.53	94.70	5.67	0.18	0.91	8.31	0.73	0.97	0.69	385.10	0.47	12.71
09/01/21 11:24:27	19370	9.13	9.11	1.51	90.93	5.67	0.17	0.95	8.16	0.95	0.97	0.72	383.32	0.49	12.71
09/01/21 11:24:57	19400	9.12	8.84	1.62	90.99	5.67	0.19	0.94	7.96	0.89	0.96	0.67	385.77	0.54	12.68
09/01/21 11:25:27	19430	9.10	8.21	1.46	91.15	5.67	0.19	0.94	8.08	0.13	0.90	0.72	388.70	0.58	12.69
09/01/21 11:25:57	19460	9.10	9.17	1.50	91.11	5.65	0.19	1.04	8.46	0.70	0.89	0.70	387.60	0.53	12.69
09/01/21 11:26:27	19490	9.10	9.48	1.56	90.72	5.66	0.17	0.89	8.81	0.68	0.88	0.68	387.71	0.50	12.68
09/01/21 11:26:57	19520	9.11	8.98	1.48	91.72	5.66	0.18	0.93	8.60	0.38	0.96	0.71	385.46	0.48	12.67
09/01/21 11:27:27	19550	9.08	8.55	0.82	91.56	5.47	0.17	-0.28	8.32	0.24	1.49	0.64	366.29	1.65	15.26
09/01/21 11:27:57	19580	9.10	9.20	1.56	91.15	5.66	0.14	0.93	8.62	0.58	1.75	0.74	385.12	0.48	12.86
09/01/21 11:28:27	19610	9.10	9.17	1.37	91.47	5.65	0.15	1.01	8.32	0.85	1.19	0.71	386.86	0.68	12.47
09/01/21 11:28:57	19640	9.09	8.81	1.40	91.46	5.66	0.12	0.99	8.24	0.57	1.07	0.69	386.87	0.64	12.41
09/01/21 11:29:27	19670	9.08	8.29	1.33	90.05	5.67	0.16	1.00	7.93	0.36	0.95	0.71	380.96	0.62	12.39
09/01/21 11:29:57	19700	9.09	8.35	1.47	89.21	5.67	0.15	0.96	8.09	0.26	0.87	0.69	383.01	0.69	12.39
09/01/21 11:30:27	19730	9.07	8.22	1.46	89.57	5.66	0.17	1.01	7.70	0.51	0.89	0.71	394.32	0.76	12.32
09/01/21 11:30:57	19760	9.06	8.36	1.49	89.92	5.64	0.11	0.87	7.89	0.47	0.85	0.69	405.01	0.97	12.28
09/01/21 11:31:27	19790	9.05	8.46	1.45	89.80	5.65	0.18	1.00	8.02	0.44	0.86	0.69	401.42	0.85	12.19
09/01/21 11:31:57	19820	9.06	8.95	1.51	90.19	5.66	0.15	0.95	8.25	0.70	0.79	0.70	396.77	0.76	12.21
09/01/21 11:32:27	19850	9.06	8.67	1.48	90.23	5.67	0.15	1.07	8.98	-0.31	0.80	0.70	389.36	0.80	12.33
09/01/21 11:32:57	19880	9.07	9.01	1.54	90.66	5.65	0.14	0.93	8.87	0.14	0.80	0.67	387.85	0.73	12.45
09/01/21 11:33:27	19910	9.08	10.33	1.42	90.27	5.64	0.16	1.12	9.37	0.96	0.77	0.69	388.53	0.75	12.54
09/01/21 11:33:57	19940	9.08	8.74	1.42	91.42	5.66	0.17	0.95	8.16	0.59	0.92	0.68	388.58	0.55	12.60
09/01/21 11:34:27	19970	9.10	9.31	1.50	90.99	5.66	0.18	0.96	8.67	0.64	0.91	0.68	385.32	0.55	12.58
09/01/21 11:34:57	20000	9.08	9.12	1.63	90.81	5.67	0.16	0.93	8.58	0.54	0.88	0.66	387.04	0.48	12.59
09/01/21 11:35:27	20030	9.10	9.04	1.59	90.39	5.66	0.17	0.97	8.31	0.73	0.84	0.67	383.78	0.49	12.65
09/01/21 11:35:57	20060	9.09	9.00	1.50	89.96	5.66	0.18	0.97	8.40	0.60	0.80	0.66	382.67	0.51	12.64
09/01/21 11:36:27	20090	9.09	8.80	1.47	90.89	5.65	0.17	0.98	8.28	0.52	0.83	0.67	388.40	0.55	12.59
09/01/21 11:36:57	20120	9.06	8.73	1.40	9										

Catalytic Combustion Corporation
September 1, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	26.278	SCFH

Weather Data

Barometric Pressure	29.73	in. Hg
Relative Humidity	57	%
Ambient Temperature	93	°F
Specific Humidity	0.019207	lb H ₂ O / lb air

Unit Data

Unit Load	3,598.0	horsepower
Meas. Stack Moisture	12.9	%
Stack Exhaust Flow (M19)	399,898	SCFH

100% Load, Run - 3-2

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%)	NOx (ppmvd)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%)	N ₂ O (ppmvw)	C ₂ H ₆ O (ppmvw)	NO (ppmvd)	NO ₂ (ppmvd)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (as C ₂ H ₆) (ppmvw)	C ₂ H ₄ (as C ₃ H ₈) (ppmvw)	H ₂ O (%)
09/01/21 11:56:27	21290	9.19	8.39	1.39	94.33	5.66	0.71	0.86	7.90	0.49	7.12	0.53	384.79	0.66	13.46
09/01/21 11:56:57	21320	9.19	9.16	1.26	94.11	5.67	0.70	0.85	8.23	0.93	8.09	0.53	383.51	0.61	13.42
09/01/21 11:57:27	21350	9.20	8.84	1.34	94.21	5.70	0.71	0.85	8.56	0.28	8.45	0.53	380.88	0.52	13.17
09/01/21 11:57:57	21380	9.20	8.57	1.33	94.69	5.70	0.69	0.87	8.47	0.10	8.73	0.55	381.37	0.53	13.13
09/01/21 11:58:27	21410	9.20	8.53	1.49	95.06	5.71	0.71	0.85	8.32	0.21	8.69	0.53	384.53	0.53	12.94
09/01/21 11:58:57	21440	9.21	8.63	1.37	94.76	5.70	0.69	0.90	8.33	0.31	9.00	0.51	384.68	0.51	13.03
09/01/21 11:59:27	21470	9.21	8.33	1.29	95.18	5.72	0.69	0.87	8.05	0.28	9.28	0.52	382.22	0.53	13.05
09/01/21 11:59:57	21500	9.19	8.51	1.32	95.08	5.72	0.72	0.85	8.28	0.23	9.32	0.52	380.93	0.48	12.98
09/01/21 12:00:27	21530	9.21	8.51	0.75	95.15	5.50	0.70	-0.37	7.90	0.61	13.44	0.37	360.69	1.59	16.29
09/01/21 12:00:57	21560	9.19	8.54	1.33	94.65	5.70	0.71	0.81	8.15	0.38	11.42	0.53	381.65	0.59	13.46
09/01/21 12:01:27	21590	9.19	8.61	1.22	94.96	5.69	0.75	0.80	7.97	0.64	11.61	0.53	380.56	0.67	13.48
09/01/21 12:01:57	21620	9.16	8.79	0.86	94.88	5.61	0.79	-0.41	8.31	0.49	13.55	0.36	366.56	1.24	14.82
09/01/21 12:02:27	21650	9.18	9.53	1.00	93.89	5.71	0.79	0.93	9.08	0.45	12.76	0.55	380.90	0.30	13.50
09/01/21 12:02:57	21680	9.19	8.79	0.94	93.82	5.65	0.78	0.91	8.81	-0.02	13.04	0.53	368.61	0.42	14.38
RAW AVERAGE		9.05	9.38	1.90	93.36	5.73	1.01	0.83	8.67	0.71	2.31	0.71	392.98	0.37	12.89

Bias	Serial Number:	INST-O2-0026	INST-NX-0025	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-NX-0025	INST-NX-0025	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
		O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₆ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₂ H ₆)	C ₂ H ₄ (as C ₃ H ₈)	H ₂ O
		(%)			(ppmvw)										
	Initial Zero	0.02			0.20										
	Final Zero	0.02			0.20										
	Avg. Zero	0.02			0.20										
	Initial UpScale	11.94			300.31										
	Final UpScale	11.95			300.00										
	Avg. UpScale	11.95			300.16										
Upscale Cal Gas		11.96			299.00										

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₆ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₂ H ₆)	C ₂ H ₄ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	9.06	9.38	2.18	107.19	6.58	1.16	0.96	8.67	0.71	2.65	0.82	165.42	0.28	0.00
Corrected Raw Average (ppm/% wet basis)	7.89	8.17	1.90	93.36	5.73	1.01	0.83	7.55	0.61	2.31	0.71	144.09	0.24	0.00
Concentration (ppm@ 15%O ₂)	N/A	4.67	1.09	46.52	3.28	0.58	0.48	4.32	0.35	1.32	0.41	82.43	0.14	0.00
Emission Rate (g/kw*hr)	N/A	0.0757	0.0107	0.7210	508	0.0090	0.0074	0.0457	0.0057	0.0079	0.0043	1.2803	0.0022	0.0000

Non-Bias Adjusted Averages Include:

Catalytic Combustion Corporation
September 2, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	26.278	SCFH

Weather Data

Barometric Pressure	29.74	in. Hg
Relative Humidity	46	%
Ambient Temperature	95	°F
Specific Humidity	0.016410	lb H ₂ O / lb air

Unit Data

Unit Load	3,598.0	horsepower
Meas. Stack Moisture	13.0	%
Stack Exhaust Flow (M19)	406,400	SCFH

100% Load, Run - 3-3

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%)	NOx (ppmw)	CO (ppmw)	THC (as C ₃ H ₈) (ppmw)	CO ₂ (%)	N ₂ O (ppmw)	C ₂ H ₂ O (ppmw)	NO (ppmvd)	NO ₂ (ppmvd)	NH ₃ (ppmw)	HCHO (ppmw)	CH ₄ (as C ₂ H ₆) (ppmw)	C ₂ H ₄ (as C ₃ H ₈) (ppmw)	H ₂ O (%)
09/01/21 12:03:27	21710	9.20	8.82	1.25	94.00	5.72	0.75	0.76	8.39	0.43	12.99	0.51	379.09	0.56	13.46
09/01/21 12:03:57	21740	9.18	8.68	1.45	94.39	5.75	0.73	0.85	8.35	0.33	12.29	0.55	380.60	0.45	13.14
09/01/21 12:04:27	21770	9.19	8.42	0.90	95.02	5.68	0.74	0.98	7.81	0.60	12.27	0.57	369.55	0.34	14.12
09/01/21 12:04:57	21800	9.19	8.53	1.51	94.89	5.74	0.68	0.86	8.30	0.23	11.67	0.52	380.73	0.51	13.21
09/01/21 12:05:27	21830	9.19	8.80	1.39	94.85	5.75	0.72	0.79	8.20	0.60	10.89	0.53	370.24	0.40	12.86
09/01/21 12:05:57	21860	9.21	8.64	1.49	94.50	5.75	0.70	0.88	8.40	0.24	10.27	0.52	380.22	0.46	12.79
09/01/21 12:06:27	21890	9.21	8.76	1.49	94.15	5.74	0.72	0.92	8.17	0.60	10.28	0.54	384.31	0.47	12.84
09/01/21 12:06:57	21920	9.23	8.75	1.40	93.96	5.74	0.70	0.81	8.73	0.02	10.45	0.55	380.65	0.45	12.89
09/01/21 12:07:27	21950	9.23	9.33	0.90	93.20	5.63	0.71	0.90	8.92	0.41	11.19	0.55	369.54	0.54	14.31
09/01/21 12:07:57	21980	9.24	9.04	0.95	93.14	5.68	0.72	0.96	7.98	1.06	11.38	0.57	371.13	0.34	13.81
09/01/21 12:08:27	22010	9.24	8.81	0.91	92.33	5.70	0.72	0.99	8.20	0.61	11.19	0.53	371.09	0.27	13.56
09/01/21 12:08:57	22040	9.24	8.76	1.36	92.33	5.70	0.71	0.86	8.23	0.53	10.95	0.52	380.94	0.54	13.31
09/01/21 12:09:27	22070	9.26	9.03	1.48	92.91	5.71	0.71	0.82	8.59	0.45	10.71	0.55	380.08	0.51	13.20
09/01/21 12:09:57	22100	9.24	9.23	1.39	93.01	5.72	0.71	0.82	8.53	0.69	10.73	0.53	382.54	0.51	13.20
09/01/21 12:10:27	22130	9.24	8.66	1.38	93.57	5.72	0.72	0.85	8.19	0.47	10.83	0.54	380.95	0.55	13.20
09/01/21 12:10:57	22160	9.24	9.07	1.50	93.99	5.71	0.71	0.75	8.27	0.80	11.12	0.55	380.52	0.47	13.32
09/01/21 12:11:27	22190	9.24	8.76	1.06	94.38	5.54	0.69	-0.13	8.20	0.56	13.80	0.40	362.95	1.39	15.94
09/01/21 12:11:57	22220	9.24	8.59	1.10	94.46	5.68	0.73	0.85	8.12	0.47	12.22	0.53	369.62	0.22	13.74
09/01/21 12:12:27	22250	9.24	8.44	1.38	94.87	5.71	0.70	0.90	7.89	0.55	11.27	0.50	380.67	0.56	13.26
09/01/21 12:12:57	22280	9.24	8.48	1.41	95.22	5.70	0.70	0.80	7.90	0.58	10.95	0.56	371.17	0.47	13.13
09/01/21 12:13:27	22310	9.24	8.29	0.98	95.31	5.63	0.75	0.88	8.06	0.23	11.58	0.56	369.15	0.45	14.18
09/01/21 12:13:57	22340	9.21	8.34	1.38	95.52	5.71	0.69	0.93	7.90	0.44	11.56	0.54	381.76	0.55	13.24
09/01/21 12:14:27	22370	9.21	8.33	1.51	95.11	5.72	0.66	0.83	7.70	0.63	11.28	0.52	379.37	0.47	13.12
09/01/21 12:14:57	22400	9.22	8.71	1.43	94.66	5.72	0.74	0.86	8.37	0.34	10.70	0.55	378.82	0.53	12.98
09/01/21 12:15:27	22430	9.21	8.47	1.05	95.11	5.56	0.81	-0.30	8.03	0.44	11.59	0.37	363.41	1.33	14.84
09/01/21 12:15:57	22460	9.23	8.82	1.05	94.45	5.69	0.73	0.92	8.27	0.56	11.93	0.54	378.92	0.29	13.50
09/01/21 12:16:27	22490	9.22	8.61	1.43	94.01	5.70	0.76	0.82	8.53	0.08	11.65	0.53	382.00	0.53	13.13
09/01/21 12:16:57	22520	9.24	8.98	1.07	94.17	5.62	0.81	0.86	7.92	1.06	13.01	0.51	369.32	0.11	14.41
09/01/21 12:17:27	22550	9.24	8.35	1.41	95.01	5.68	0.71	0.77	8.04	0.32	12.81	0.53	383.23	0.60	13.41
09/01/21 12:17:57	22580	9.24	8.01	1.48	95.11	5.69	0.72	0.83	7.74	0.28	12.41	0.47	383.22	0.56	13.30
09/01/21 12:18:27	22610	9.22	7.83	1.42	94.98	5.69	0.73	0.85	7.30	0.53	11.92	0.54	386.66	0.60	13.30
09/01/21 12:18:57	22640	9.21	7.91	0.85	94.40	5.57	0.75	0.89	7.54	0.37	13.59	0.51	370.07	0.29	15.04
09/01/21 12:22:57	22880	9.22	10.09	1.41	94.04	5.71	0.68	0.90	9.52	0.56	10.74	0.52	383.50	0.68	12.52
09/01/21 12:23:27	22910	9.21	9.30	1.47	93.98	5.74	0.71	0.73	9.15	0.15	11.02	0.52	386.84	0.40	12.55
09/01/21 12:23:57	22940	9.22	9.11	1.64	93.69	5.74	0.72	0.86	8.58	0.54	11.10	0.49	385.22	0.46	12.56
09/01/21 12:24:27	22970	9.22	8.35	1.48	93.88	5.76	0.72	0.73	8.68	-0.32	10.90	0.53	383.27	0.44	12.57
09/01/21 12:24:57	23000	9.21	8.62	0.89	94.15	5.60	0.76	0.85	8.37	0.25	12.26	0.48	368.19	0.29	14.59
09/01/21 12:25:27	23030	9.21	8.65	1.43	94.41	5.69	0.70	0.87	7.78	0.87	12.32	0.51	369.70	0.54	13.39
09/01/21 12:25:57	23060	9.21	8.47	1.42	94.41	5.73	0.72	0.83	8.14	0.33	11.10	0.52	368.24	0.43	12.73
09/01/21 12:26:27	23090	9.21	8.49	1.56	94.65	5.72	0.75	0.82	8.11	0.38	11.02	0.51	382.43	0.48	12.69
09/01/21 12:26:57	23120	9.21	8.85	1.44	94.59	5.71	0.70	0.87	8.23	0.62	11.50	0.53	385.57	0.59	12.85
09/01/21 12:27:27	23150	9.21	8.77	1.03	94.43	5.65	0.76	0.95	8.25	0.52	12.45	0.54	379.50	0.37	13.74
09/01/21 12:27:57	23180	9.21	8.76	1.03	94.66	5.65	0.72	0.87	8.11	0.65	12.93	0.53	381.47	0.32	13.68
09/01/21 12:28:27	23210	9.22	8.50	1.41	94.45	5.69	0.72	0.82	8.31	0.19	11.85	0.53	383.29	0.59	13.04
09/01/21 12:28:57	23240	9.22	8.68	1.48	95.01	5.69	0.71	0.81	8.24	0.44	11.58	0.53	384.86	0.58	13.03
09/01/21 12:29:27	23270	9.22	8.19	1.35	94.77	5.70	0.72	0.91	8.44	-0.25	11.53	0.49	382.18	0.53	12.99
09/01/21 12:29:57	23300	9.23	8.80	1.04	95.08	5.58	0.77	-0.39	8.24	0.56	12.84	0.37	363.85	1.27	14.62
09/01/21 12:30:27	23330	9.22	8.20	1.38	95.59	5.68	0.68	0.83	7.80	0.40	11.63	0.54	380.69	0.46	12.96
09/01/21 12:30:57	23360	9.24	8.33	1.50	95.07	5.70	0.72	0.75	7.93	0.40	11.23	0.51	385.14	0.47	12.73
09/01/21 12:31:27	23390	9.22	8.62	1.48	94.91	5.70	0.73	0.83	7.84	0.78	11.05	0.53	384.18	0.44	12.64
09/01/21 12:31:57	23420	9.22	8.60	1.47	95.01	5.69	0.71	0.79	7.99	0.61	11.15	0.54	389.72	0.53	12.58
09/01/21 12:32:27	23450	9.22	8.66	1.33	95.13	5.68	0.67	0.88	7.99	0.67	11.14	0.53	386.42	0.67	12.46
09/01/21 12:32:57	23480	9.20	8.32	1.44	95.01	5.69	0.70	0.82	8.08	0.23	10.98	0.56	386.39	0.62	12.37
09/01/21 12:33:27	23510	9.22	8.55	1.43	94.97	5.68	0.71	0.92	7.56	0.99	11.03	0.57	389.28	0.65	12.34
09/01/21 12:33:57	23540	9.22	8.52	1.34	94.89	5.68	0.72	0.91	8.20	0.32	11.02	0.55	389.00	0.71	12.29
09/01/21 12:34:27	23570	9.22	8.37	1.34	95.20	5.69	0.66	0.84	7.98	0.39	10.97	0.53	388.62	0.61	12.22
09/01/21 12:34:57	23600	9.22	8.33	1.44	94.75	5.69	0.68	0.95	8.54	-0.20	10.97	0.54	389.14	0.68	12.19
09/01/21 12:35:27	23630	9.23	8.29	1.46	95.16	5.71	0.72	0.94	7.89	0.41	10.95	0.55	389.44	0.69	12.09
09/01/21 12:35:57	23660	9.21	8.14	1.44	95.65	5.72	0.68	0.93	7.85	0.29	10.82	0.51	389.83	0.60	11.99
09/01/21 12:36:27	23690	9.21	8.64	1.49	95.26	5.72	0.73	0.84	8.17	0.47	11.01	0.50	389.48	0.72	12.05
09/01/21 12:36:57	23720	9.21	8.73	1.37	95.23	5.71	0.69	0.89	7.84	0.89	11.15	0.53	388.48	0.67	12.11
09/01/21 12:37:27	23750	9.21	8.47	1.35	95.24	5.71	0.72	0.87	8.						

Catalytic Combustion Corporation
September 2, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Fuel Data

Fuel Fd factor	8.632	SCF exh/MMBtu
Fuel Heating Value (HHV)	999	Btu/SCF fuel
Engine Fuel Flow	26.278	SCFH

Weather Data

Barometric Pressure	29.74	in. Hg
Relative Humidity	46	%
Ambient Temperature	95	°F
Specific Humidity	0.016410	lb H ₂ O / lb air

Unit Data

Unit Load	3,598.0	horsepower
Meas. Stack Moisture	13.0	%
Stack Exhaust Flow (M19)	406,400	SCFH

100% Load, Run - 3-3

Date/Time (mm/dd/yy hh:mm:ss)	Elapsed Time (seconds)	O ₂ (%)	NOx (ppmvw)	CO (ppmvw)	THC (as C ₃ H ₈) (ppmvw)	CO ₂ (%)	N ₂ O (ppmvw)	C ₂ H ₂ O (ppmvw)	NO (ppmvw)	NO ₂ (ppmvw)	NH ₃ (ppmvw)	HCHO (ppmvw)	CH ₄ (as C ₂ H ₆) (ppmvw)	C ₂ H ₄ (as C ₃ H ₈) (ppmvw)	H ₂ O (%)
09/01/21 12:56:57	24920	9.27	8.90	1.02	92.98	5.58	0.72	0.91	8.60	0.29	14.90	0.55	384.09	0.61	14.16
09/01/21 12:57:27	24950	9.27	8.99	0.99	93.05	5.64	0.74	0.90	8.28	0.71	14.98	0.54	386.67	0.38	13.51
09/01/21 12:57:57	24980	9.25	8.38	1.38	93.31	5.64	0.51	0.85	8.01	0.38	14.34	0.53	386.40	0.61	13.24
09/01/21 12:58:27	25010	9.25	8.27	1.56	93.45	5.64	0.17	0.83	7.93	0.34	11.26	0.59	383.02	0.62	13.27
09/01/21 12:58:57	25040	9.26	8.72	1.66	93.61	5.62	0.17	0.91	8.15	0.58	8.75	0.66	383.84	0.67	13.27
09/01/21 12:59:27	25070	9.25	8.72	1.61	93.23	5.63	0.38	0.95	8.62	0.10	7.35	0.65	383.56	0.61	13.25
09/01/21 12:59:57	25100	9.26	9.57	1.49	93.36	5.63	0.62	0.84	8.17	1.40	6.80	0.58	384.97	0.59	13.21
09/01/21 13:00:27	25130	9.26	8.92	1.38	93.56	5.63	0.62	0.82	8.22	0.70	7.25	0.57	385.54	0.63	13.18
09/01/21 13:00:57	25160	9.26	8.64	1.45	93.69	5.63	0.65	0.82	8.14	0.50	7.80	0.56	387.60	0.59	13.14
09/01/21 13:01:27	25190	9.25	8.25	1.51	94.00	5.65	0.63	0.75	7.99	0.26	8.00	0.52	384.73	0.61	13.04
09/01/21 13:01:57	25220	9.26	8.21	1.47	94.11	5.65	0.66	0.81	7.99	0.22	8.36	0.55	386.38	0.68	13.01
09/01/21 13:02:27	25250	9.25	8.34	1.58	94.00	5.66	0.65	0.91	8.18	0.16	9.09	0.54	384.14	0.56	13.02
09/01/21 13:02:57	25280	9.24	8.36	1.46	94.18	5.66	0.68	0.84	7.62	0.74	9.96	0.50	385.19	0.67	13.02
09/01/21 13:03:27	25310	9.24	8.08	1.54	94.32	5.67	0.71	0.71	7.61	0.47	10.72	0.56	384.31	0.57	12.98
09/01/21 13:03:57	25340	9.25	7.91	1.55	94.48	5.66	0.71	0.83	8.06	-0.15	11.27	0.54	385.28	0.56	12.94
09/01/21 13:04:27	25370	9.23	7.66	1.47	95.32	5.67	0.73	0.83	7.43	0.22	11.55	0.50	385.02	0.59	12.92
09/01/21 13:04:57	25400	9.24	7.81	1.60	95.08	5.68	0.70	0.80	7.69	0.12	11.79	0.54	387.14	0.57	12.84
09/01/21 13:05:27	25430	9.23	8.14	1.56	94.16	5.69	0.70	0.81	8.03	0.12	11.93	0.52	386.98	0.58	12.77
09/01/21 13:05:57	25460	9.22	8.31	1.61	94.23	5.70	0.72	0.79	7.79	0.52	12.16	0.55	385.55	0.53	12.70
09/01/21 13:06:27	25490	9.23	8.50	1.17	94.16	5.60	0.77	0.93	8.05	0.45	13.16	0.57	379.72	0.50	13.81
RAW AVERAGE		9.23	8.57	1.38	94.52	5.68	0.69	0.82	8.13	0.44	11.60	0.53	382.57	0.59	13.03

Serial Number:	INST-O2-0026	INST-NX-0025	INST-IR-0005	INST-VC-0004	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-NX-0025	INST-NX-0025	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005	INST-IR-0005
Initial Zero	0.02			0.20										
Final Zero	0.02			0.21										
Avg. Zero	0.02			0.21										
Initial UpScale	11.95			300.00										
Final UpScale	11.90			299.31										
Avg. UpScale	11.93			299.66										
Upscale Cal Gas	11.96			299.00										

EMISSIONS DATA	O ₂	NOx	CO	THC (as C ₃ H ₈)	CO ₂	N ₂ O	C ₂ H ₂ O	NO	NO ₂	NH ₃	HCHO	CH ₄ (as C ₂ H ₆)	C ₂ H ₄ (as C ₃ H ₈)	VOC (as C ₃ H ₈)
Corrected Raw Average (ppm/% dry basis)	9.25	9.85	1.58	108.68	6.53	0.80	0.94	9.35	0.50	13.33	0.61	161.29	0.45	0.00
Corrected Raw Average (ppm/% wet basis)	8.04	8.57	1.38	94.52	5.68	0.69	0.82	8.13	0.44	11.60	0.53	140.27	0.39	0.00
Concentration (ppm@ 15%O ₂)	N/A	4.99	0.80	47.86	3.31	0.40	0.48	4.12	0.90	6.75	0.31	81.68	0.23	0.00
Emission Rate (g/hp*hr)	N/A	0.0808	0.0079	0.7417	512	0.0062	0.0074	0.0500	0.0041	0.0405	0.0033	1.2686	0.0036	0.0000

Non-Bias Adjusted Averages Include:

EMISSION DATA RECORDS

50% Load

PM

Reference Method Data

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE

Source Information	
Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Fuel Type	Gas, Natural

Test Information			
Project #		catc-21-houston.tx-start#1	
Operator		JLW	
Date for Preliminary Run	(mm/dd/yy)	07/28/21	
Standard Temperature		68	°F
Standard Pressure		29.92	in Hg
Run Duration	≥ 2 min/point	90	minutes
Unit Number		1	
Base Run Number		R-1 50%	
Number of Ports Available		2	
Number of Ports Used		2	
Port Inside Diameter		4.00	in
Stack Shape		Circular	

Test Equipment Information					
Run		1	2	3	
Test Date	(mm/dd/yy)	07/29/21	07/29/21	07/29/21	
Load		50%	50%	50%	% or w/DB
Fuel F-Factor		8631.70	8631.70	8631.70	dscf/MMBtu
Meter Box Number	from ACS	samp-cp-0022	samp-cp-0022	samp-cp-0022	
Meter Calibration Factor	(Y)	0.986	0.986	0.986	
Orifice Meter Coefficient	(ΔH _@)	1.831	1.831	1.831	in H ₂ O
Non-Console Manometer Used		No	No	No	
Pitot Identification	from ACS	A6223	A5708	A6223	
Pitot Tube Coefficient	(C _p)	0.8215	0.8230	0.8215	
Nozzle Number	from ACS	G-10	G-10	G-10	
Nozzle Diameter	(D _n)	0.311	0.311	0.311	in
Probe Number	from ACS	samp-hp-0014	samp-hp-0079	samp-hp-0014	
Probe Length		60.0	60.0	60.0	in
(SS, Glass) Liner Material	from list	glass	glass	glass	
Sample Case / Oven Number	from ACS	samp-BH-0018	samp-BH-0018	samp-BH-0018	
Impinger Case Number	from ACS	samp-cc-0011	samp-cc-0011	samp-cc-0011	

Testing Company Information	
Company Name	Air Hygiene International, Inc. (Tulsa, Oklahoma)
Address	1600 W Tacoma Street
City, State Zip	Broken Arrow, Oklahoma 74012
Project Manager	Pat McGovern, Jr.
Phone Number	(918) 307-8865
Fax Number	(918) 307-9131

Created with Isocalc-AHI v20210708

METHOD 1 - SAMPLE AND VELOCITY TRAVERSES FOR CIRCULAR SOURCES

Plant Name	Stewart and Stevenson Integration Center	Date	07/28/21
Sampling Location	Caterpillar G3520 TALE	Stack Type	Circular
Operator	JLW	Ports Available	2
Project #	catc-21-houston.tx-start#1	Ports Used	2
Stack Size	Large (>24 inch diameter)	Port ID (inches)	4.00

Circular Stack or Duct Diameter			
Distance to Far Wall of Stack	(L_{fw})	32.00	in
Distance to Near Wall of Stack	(L_{nw})	0.125	in
Diameter of Stack	(D)	31.88	in
Area of Stack	(A_s)	5.54	ft ²

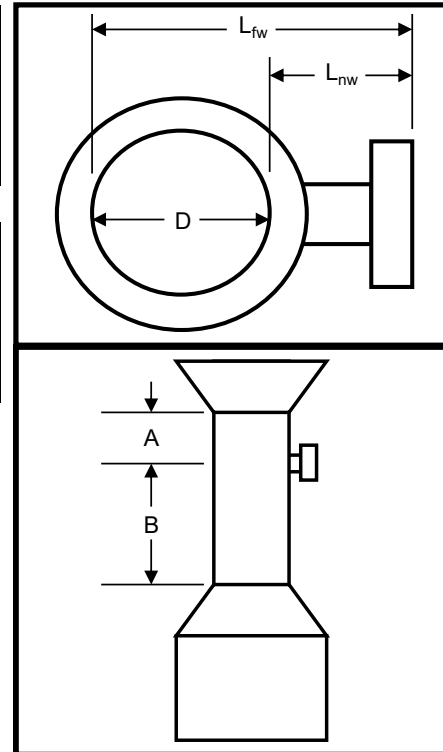
Distance from Port to Disturbances			
Distance Upstream	(A)	16.00	in
Diameters Upstream	(A_D)	0.50	diameters
Distance Downstream	(B)	64.00	in
Diameters Downstream	(B_D)	2.01	diameters

Number of Traverse Points Required			
Diameters to Flow Disturbance		Minimum Number of ¹ Traverse Points	
Down Stream	Up Stream	Particulate Points	Velocity Points
2.00-4.99	0.50-1.24	24	16
5.00-5.99	1.25-1.49	20	16
6.00-6.99	1.50-1.74	16	12
7.00-7.99	1.75-1.99	12	12
>= 8.00	>= 2.00	8 or 12 ²	8 or 12 ²
Upstream Spec		24	16
Downstream Spec		24	16
Traverse Pts Required		24	16

¹ Check Minimum Number of Points for the Upstream and Downstream conditions, then use the largest.

² 8 for Circular Stacks 12 to 24 inches
12 for Circular Stacks over 24 inches

Location of Traverse Points in Circular Stacks									
Traverse Point	(Fraction of Stack Dimension from Inside Wall to Traverse Point)								
Number	2	4	6	8	10	12	14	16	18
1	.146	.067	.044	.032	.026	.021	.018	.016	.014
2	.854	.250	.146	.105	.082	.067	.057	.049	.044
3		.750	.296	.194	.146	.118	.099	.085	.075
4		.933	.704	.323	.226	.177	.146	.125	.109
5			.854	.677	.342	.250	.201	.169	.146
6			.956	.806	.658	.356	.269	.220	.188
7				.895	.774	.644	.366	.283	.236
8				.968	.854	.750	.634	.375	.296
9					.918	.823	.731	.625	.382
10					.974	.882	.799	.717	.618
11						.933	.854	.780	.704
12						.979	.901	.831	.764



Number of Traverse Points Used			
2	Ports by	12	Across
24	Pts Used	24	Required

Adjust Sample Points Out of Boundary Layer

Traverse Point Locations			
Traverse Point Number	Fraction of Stack Diameter	Distance from Inside Wall	Distance Including Reference Length
		in	in
1	0.021	5/8	6/8
2	0.067	2 1/8	2 2/8
3	0.118	3 6/8	3 7/8
4	0.177	5 5/8	5 6/8
5	0.250	8	8 1/8
6	0.356	11 3/8	11 4/8
7	0.644	20 4/8	20 5/8
8	0.750	23 7/8	24
9	0.823	26 2/8	26 3/8
10	0.882	28 1/8	28 2/8
11	0.933	29 6/8	29 7/8
12	0.979	31 2/8	31 3/8

- ☒ Method 1 Trav
- ☐ 12 Point PM Trav (M201a ONLY)
- ☐ Velocity

METHOD 2 - DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

Preliminary Run Date	07/28/21		
Stack Type	Circular		
Ports Available	2		
Thermocouple ID	samp-hp-0014		
Pitot Coefficient	0.8300	Pitot Identification	A6904

Velocity Traverse Data	
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Run Number	R-1 50%-V1
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Run Time	08:46	Start	08:59	End
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Traverse	Velocity	Null	Zero Deg	Stack	Local
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Point	Head	Angle	Pressure	Temp	Velocity
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	(Δp)	(N_a)	(0^0_a)	(t_s)	$(v_{s(l)})$
	1.110	1	1.110	25	5%

	in H ₂ O	deg	in H ₂ O	°F	ft/sec
$\Delta 1$	0.15	0	0.00	872	34.80

A-1	0.15	0	0.00	873	34.80
A-2	0.17	5	0.03	896	37.36

A-2	0.17	9	0.00	930	37.50
A-3	0.17	0	0.00	923	37.73

A-4	0.15	0	0.00	929	35.52
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A-5	0.17	5	0.03	930	37.83
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A-6	0.18	5	0.02	932	38.95
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A-7	0.19	0	0.00	928	39.96
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A-8	0.18	0	0.00	930	38.92
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A-9	0.19	0	0.00	933	40.03
A-10	0.19	0	0.00	933	40.03

A-10	0.18	5	0.04	933	38.97
A-11	0.18	6	0.03	888	38.97

A-11	0.18	0	0.00	933	38.97
A-12	0.17	0	0.00	933	37.87

A-12	0.17	0	0.00	933	37.87
B-1	0.15	0	0.00	933	35.57

B-2	0.15	0	0.00	933	35.57
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B-3	0.16	5	0.03	933	36.74
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B-4	0.17	5	0.03	933	37.87
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B-5	0.18	0	0.00	933	38.97
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B-6	0.18	0	0.00	933	38.97
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B-7	0.18	0	0.00	933	38.97
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B-8	0.17	0	0.00	933	37.87
B-9	0.17	0	0.00	933	37.87

B-9	0.17	0	0.00	933	37.87
B-10	0.17	0	0.00	933	37.87

B-10	0.17	0	0.00	933	37.87
B-11	0.16	0	0.00	933	36.74

B-11	0.10	0	0.00	933	36.74
B-12	0.16	0	0.00	933	36.74

DATE	DATE	DATE	DATE	DATE	DATE

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Average	0.17	1	928
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0.41	= Square roots of Δp
Standard deviation of null angles =	2.2

METHOD 3a - DETERMINATION OF DRY MOLECULAR WEIGHT BY ANALYZER

Plant Name	Stewart and Stevenson Integration Center	Preliminary Run Date	07/28/21		
Sampling Location	Caterpillar G3520 TALE	Operator	JLW		
Project #	catc-21-houston.tx-start#1	# of Ports Used	1 (gas probe)		
Fuel Type	Gas, Natural	Min. Fuel Factor	1.600	Max. Fuel Factor	1.836

Gas Analysis Data								
Run Number	R-1 50%-1		Date	07/29/21	Run Start Time	09:34	Run Stop Time	11:24
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:50	6.71	8.67	6.03	84.6	29.42	1.822	63.4	YES

Gas Analysis Data								
Run Number	R-1 50%-2		Date	07/29/21	Run Start Time	12:05	Run Stop Time	13:59
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:54	6.69	8.74	5.97	84.6	29.42	1.817	64.4	YES

Gas Analysis Data								
Run Number	R-1 50%-3		Date	07/29/21	Run Start Time	14:23	Run Stop Time	15:58
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:35	6.75	8.79	6.40	84.5	29.43	1.793	65.1	YES

METHOD 4 - DETERMINATION OF MOISTURE CONTENT IN STACK GASES

Plant Name	Stewart and Stevenson Integration Center	Preliminary Run Date	07/28/21
Sampling Location	Caterpillar G3520 TALE	Operator	JLW
Project #	catc-21-houston.tx-start#1	Ports Used	2

Scale Daily Calibration					
Scale Number	Extra	Standard	Result	Difference	Pass/Fail
Date		(g)	(g)	(g)	(± 0.5 g)
Preliminary Date	07/28/21	500	499.5	-0.5	Pass
Test Day 1	07/29/21	500	500.5	0.5	Pass

Moisture Content Data								
Run Number	R-1 50%-1		Date	07/29/21	Start Time	09:34	Stop Time	11:24
Meter Box Number	samp-cp-0022				Meter Cal Factor	(Y)	0.986	
Total Meter Volume	(V _m)	36.989	dcf		Barometric Pressure	(P _b)	29.87	in Hg
Average Stack Temp	(t _s) _{avg}	906	°F		Stack Static Pressure	(P _{static})	0.07	in H ₂ O
Average Meter Temp	(t _m) _{avg}	87	°F		Avg Orifice Pressure	(ΔH) _{avg}	0.52	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	456.80	612.90	720.10	856.20			
Initial Value	(V _i),(W _i)	350.70	612.50	708.90	847.80			
Net Value	(V _n),(W _n)	106.1	0.4	11.2	8.4			
Results								
Total Weight	(W _t)	126.10	g	Water Vol Weighed	(V _{wsg(std)})	5.946	scf	
Std Meter Volume	(V _{m(std)})	35.190	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	14.45	%	Final Moisture Content	(B _{ws})	14.45	%	

Moisture Content Data								
Run Number	R-1 50%-2		Date	07/29/21	Start Time	12:05	Stop Time	13:59
Meter Box Number	samp-cp-0022				Meter Cal Factor	(Y)	0.986	
Total Meter Volume	(V _m)	37.647	dcf		Barometric Pressure	(P _b)	29.90	in Hg
Average Stack Temp	(t _s) _{avg}	905	°F		Stack Static Pressure	(P _{static})	0.07	in H ₂ O
Average Meter Temp	(t _m) _{avg}	95	°F		Avg Orifice Pressure	(ΔH) _{avg}	0.53	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	473.40	601.90	721.10	823.40			
Initial Value	(V _i),(W _i)	357.60	600.50	720.50	816.50			
Net Value	(V _n),(W _n)	115.8	1.4	0.6	6.9			
Results								
Total Weight	(W _t)	124.70	g	Water Vol Weighed	(V _{wsg(std)})	5.880	scf	
Std Meter Volume	(V _{m(std)})	35.360	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	14.26	%	Final Moisture Content	(B _{ws})	14.26	%	

Moisture Content Data								
Run Number	R-1 50%-3		Date	07/29/21	Start Time	14:23	Stop Time	15:58
Meter Box Number	samp-cp-0022				Meter Cal Factor	(Y)	0.986	
Total Meter Volume	(V _m)	37.385	dcf		Barometric Pressure	(P _b)	29.85	in Hg
Average Stack Temp	(t _s) _{avg}	923	°F		Stack Static Pressure	(P _{static})	0.07	in H ₂ O
Average Meter Temp	(t _m) _{avg}	94	°F		Avg Orifice Pressure	(ΔH) _{avg}	0.53	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	463.70	614.80	722.80	863.20			
Initial Value	(V _i),(W _i)	351.30	614.60	720.10	856.20			
Net Value	(V _n),(W _n)	112.4	0.2	2.7	7.0			
Results								
Total Weight	(W _t)	122.30	g	Water Vol Weighed	(V _{wsg(std)})	5.766	scf	
Std Meter Volume	(V _{m(std)})	35.098	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	14.11	%	Final Moisture Content	(B _{ws})	14.11	%	

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Date	07/29/21
Operator	JLW
Run Number	R-1 50%-1

Filter #
00713
R-1 50%-1-CPM

Pressures			
Barometric Pressure	(P_b)	29.87	in Hg
Stack Static Pressure	(P_{static})	0.07	in H ₂ O
Absolute Stack Pressure	(P_a)	29.88	in Hg
Absolute Meter Pressure	(P_m)	30.00	in Hg

Wash Volumes					ml
					ml

Sampling Equipment			
Meter Box Number	samp-cp-0022		
Meter Cal Factor	(Y)	0.986	
Nozzle Number	G-10		
Average Nozzle Diameter	(D _{no})	0.3113	in
Suggested Nozzle Diameter	(D _n)	0.3148	in
Probe Number	samp-hp-0014		in
Probe Length	60		in
Liner Material	glass		
Sample Case / Oven Number	samp-BH-0018		
Impinging Case Number	samp-cc-0011		

Barometer ID
SAMP-WE-0014
Scale ID
Extra

Weights	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre	350.7	612.5	708.9	847.8				
Post	456.8	612.9	720.1	856.2				

Notes:

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Date	07/29/21
Operator	JLW
Run Number	R-1 50%-2

Filter #	0652
	R-1 50%-2-CPM

Leak Checks			[change]	[level]	[time]
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for 60.0 sec [≥60]
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for 60.0 sec [≥60]
PASS	Pitot	Pre (+)	0.00	in H ₂ O	7.0 in H ₂ O for 15.0 sec [≥15]
		Pre (-)	0.00	in H ₂ O	5.0 in H ₂ O for 15.0 sec [≥15]
		Post (+)	0.00	in H ₂ O	6.0 in H ₂ O for 15.0 sec [≥15]
		Post (-)	0.00	in H ₂ O	4.0 in H ₂ O for 15.0 sec [≥15]

Sampling Equipment		
Meter Box Number	samp-cp-0022	
Meter Cal Factor	(Y)	0.986
Nozzle Number	G-10	
Average Nozzle Diameter	(D _{na})	0.3113 in
Suggested Nozzle Diameter	(D _m)	0.2255 in
Probe Number	samp-hp-0079	in
Probe Length	60	in
Liner Material	glass	
Sample Case / Oven Number	samp-BH-0018	
Impinger Case Number	samp-cc-0011	

Nozzle Measurements		ID: G-10		
Pre	0.311	0.312	0.311	PASS
Post	0.311	0.312	0.311	PASS

Barometer ID
SAMP-WE-0014
Scale ID
Extra

Run Time		
Start	12:05	End 13:59

Weights	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre	357.6	600.5	720.5	816.5				
Post	473.4	601.9	721.1	823.4				

Ideal Nozzle Diameter and IsoKinetic Factor Setup			
Pitot Coefficient / ID	(C _p)	0.8230	A5708
Average Stack Temp	(t _s)	904.8	°F
Average Meter Temp	(t _m)	94.6	
Orifice Meter Coefficient	(ΔH@)	1.831	in H ₂ O
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.42	in H ₂ O
Stack Moisture Content	(B _{ws})	14.26	%
Stack Dry Molecular Weight	(M _d)	29.42	lb/lb-mole
Estimated Orifice Flow Rate	(Q _m)	0.39	acfm
ΔP to ΔH Isokinetic Factor	(K)	3.12	

Pressures		
Barometric Pressure	(P _b)	29.90 in Hg
Stack Static Pressure	(P _{static})	0.07 in H ₂ O
Absolute Stack Pressure	(P _a)	29.91 in Hg
Absolute Meter Pressure	(P _m)	30.03 in Hg

Wash Volumes					ml
					ml

Identification Nos.		samp-cp-0022	samp-cp-0022	samp-cp-0022			samp-hp-0079	samp-hp-0079	samp-BH-0018	samp-cc-0011			samp-cp-0022		samp-cp-0022							
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (Δp ^{1/2}) √(in H ₂ O)	Local Stack Velocity (V _s) _i	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}		
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg		f/sec	dscf	%	dscf		
A-1	0.0	00:00:00	96.035	0.17	0.530	0.52	910	248	250	53	50	70	92	92	2.0	0.41	37.24	1.430	97.8	34.313		
A-2	3.8	00:03:45	97.550	0.16	0.499	0.49	908	250	249	53	51	70	92	92	2.0	0.40	36.11	2.845	98.7	34.142		
A-3	7.5	00:07:30	99.050	0.16	0.499	0.49	908	251	250	55	49	71	92	92	2.0	0.40	36.11	4.261	99.0	34.085		
A-4	11.3	00:11:15	100.550	0.17	0.530	0.53	910	250	250	55	50	71	93	93	2.0	0.41	37.24	5.730	99.4	34.381		
A-5	15.0	00:15:00	102.110	0.18	0.561	0.56	909	249	251	56	52	73	93	93	2.0	0.42	38.31	7.256	99.8	34.831		
A-6	18.8	00:18:45	103.730	0.19	0.592	0.60	912	250	251	56	52	73	93	93	2.0	0.44	39.40	8.830	100.2	35.319		
A-7	22.5	00:22:30	105.400	0.18	0.561	0.56	908	249	249	57	52	73	94	94	2.0	0.42	38.30	10.316	100.0	35.368		
A-8	26.3	00:26:15	106.980	0.17	0.530	0.52	905	250	249	57	53	74	94	94	2.0	0.41	37.18	11.773	99.9	35.319		
A-9	30.0	00:30:00	108.530	0.17	0.530	0.52	903	251	250	57	53	74	94	94	2.0	0.41	37.15	13.221	99.8	35.256		
A-10	33.8	00:33:45	110.070	0.16	0.499	0.49	903	250	249	58	55	75	95	95	2.0	0.40	36.04	14.620	99.6	35.087		
A-11	37.5	00:37:30	111.560	0.16	0.499	0.49	903	249	252	57	56	75	95	95	2.0	0.40	36.04	16.065	99.8	35.051		
A-12	41.3	00:41:15	113.100	0.16	0.499	0.49	903	250	250	57	56	75	95	95	2.0	0.40	36.04	17.465	99.7	34.930		
B-1	45.0	00:45:00	114.592	0.16	0.499	0.49	903	249	249	65	52	73	95	95	2.0	0.40	36.04	18.862	99.6	34.822		
B-2	48.8	00:48:45	116.080	0.17	0.530	0.52	899	250	251	56	53	73	95	95	2.0	0.41	37.10	20.326	99.6	34.845		
B-3	52.5	00:52:30	117.640	0.17	0.530	0.52	900	251	250	56	53	73	95	95	2.0	0.41	37.11	21.753	99.4	34.804		
B-4	56.3	00:56:15	119.160	0.16	0.499	0.49	902	251	250	56	53	74	96	96	2.0	0.40	36.03	23.214	99.7	34.821		
B-5	60.0	01:00:00	120.720	0.17	0.530	0.52	904	250	252	56	53	74	96	96	2.0	0.41	37.16	24.666	99.6	34.823		
B-6	63.8	01:03:45	122.270	0.19	0.592	0.58	904	250	250	56	54	75	96	96	2.0	0.44	39.29	26.212	99.6	34.950		
B-7	67.5	01:07:30	123.920	0.18	0.561	0.55	902	251	251	56	54	75	96	96	2.0	0.42	38.21	27.740	99.7	35.040		
B-8	71.3	01:11:15	125.550	0.18	0.561	0.55	904	250	249	57	56	76	96	96	2.0	0.42	38.24	29.276	99.8	35.132		
B-9	75.0	01:15:00	127.190	0.19	0.592	0.58	906	250	250	57	56	76	96	96	2.0	0.44	39.32	30.851	99.9	35.258		
B-10	78.8	01:18:45	128.870	0.19	0.592	0.58	906	249	250	57	56	76	96	96	2.0	0.44	39.32	32.425	100.0	35.373		
B-11	82.5	01:22:30	130.550	0.18	0.561	0.55	904	251	250	57	56	76	96	96	2.0	0.42	38.24	33.933	100.0	35.409		
B-12	86.3	01:26:15	132.160	0.17	0.530	0.52	900	250	250	57	56	76	96	96	2.0	0.41	37.11	35.359	99.9	35.359		
Last Pt	90.0	01:30:00	133.682																			
Final Val	90.0	01:30:00	133.682																			
Average Values				0.17		0.53	905	250	250	57	53	74	95	95	Max Vac 2.0	Final Values 0.42 37.43		35.359	99.9			
													95									

Notes: PAUSED 14:39 in

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Date	07/29/21
Operator	JLW
Run Number	R-1 50%-3

Filter #	0722
	R-1 50%-3-CPM

Leak Checks		[change]		[level]		[time]	
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]
Pitot	Pre (+)	0.00	in H ₂ O	6.0	in H ₂ O for	15.0	sec [≥15]
	Pre (-)	0.00	in H ₂ O	6.0	in H ₂ O for	15.0	sec [≥15]
	Post (+)	0.00	in H ₂ O	7.0	in H ₂ O for	15.0	sec [≥15]
	Post (-)	0.00	in H ₂ O	5.0	in H ₂ O for	15.0	sec [≥15]

Sampling Equipment		
Meter Box Number	samp-cp-0022	
Meter Cal Factor	(Y)	0.986
Nozzle Number	G-10	
Average Nozzle Diameter	(D _{na})	0.3113 in
Suggested Nozzle Diameter	(D _m)	0.2273 in
Probe Number	samp-hp-0014	in
Probe Length	60	in
Liner Material	glass	
Sample Case / Oven Number	samp-BH-0018	
Impinger Case Number	samp-cc-0011	

Nozzle Measurements		ID: G-10	
Pre	0.312	0.311	PASS
Post	0.312	0.311	PASS

Barometer ID	
SAMP-WE-0014	
Scale ID	
Extra	

Run Time	
Start	14:23
End	15:58

Weights	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre	351.3	614.6	720.1	856.2				
Post	463.7	614.8	722.8	863.2				

Ideal Nozzle Diameter and IsoKinetic Factor Setup			
Pitot Coefficient / ID	(C _p)	0.8215	A6223
Average Stack Temp	(t _s)	922.7	°F
Average Meter Temp	(t _m)	94.0	
Orifice Meter Coefficient	(ΔH@)	1.831	in H ₂ O
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.41	in H ₂ O
Stack Moisture Content	(B _{ws})	14.11	%
Stack Dry Molecular Weight	(M _d)	29.43	lb/lb-mole
Estimated Orifice Flow Rate	(Q _m)	0.39	acfm
ΔP to ΔH Isokinetic Factor	(K)	3.07	

Pressures			
Barometric Pressure	(P _b)	29.85	in Hg
Stack Static Pressure	(P _{static})	0.07	in H ₂ O
Absolute Stack Pressure	(P _a)	29.86	in Hg
Absolute Meter Pressure	(P _m)	29.98	in Hg

Wash Volumes					ml
					ml

Identification Nos.		samp-cp-0022	samp-cp-0022	samp-cp-0022			samp-hp-0014	samp-hp-0014	samp-BH-0018	samp-cc-0011			samp-cp-0022		samp-cp-0022					
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (ΔP ^{1/2})	Local Stack Velocity (V _s)	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg	√(in H ₂ O)	ft/sec	dscf	%	dscf
A-1	0.0	00:00:00	133.977	0.15	0.461	0.47	926	248	250	59	53	79	92	92	2.0	0.39	35.14	1.406	103.1	33.754
A-2	3.8	00:03:45	135.470	0.16	0.491	0.50	928	250	249	59	53	79	92	92	2.0	0.40	36.32	2.801	101.1	33.609
A-3	7.5	00:07:30	136.950	0.16	0.491	0.50	925	251	250	59	53	79	92	92	2.0	0.40	36.28	4.261	102.0	34.087
A-4	11.3	00:11:15	138.500	0.17	0.522	0.53	927	250	250	57	56	80	92	92	2.0	0.41	37.42	5.655	100.5	33.932
A-5	15.0	00:15:00	139.980	0.18	0.553	0.56	925	251	249	58	57	80	92	92	2.0	0.42	38.48	7.172	100.7	34.427
A-6	18.8	00:18:45	141.590	0.18	0.553	0.56	923	250	250	58	57	80	92	92	2.0	0.42	38.45	8.708	101.1	34.832
A-7	22.5	00:22:30	143.220	0.18	0.553	0.56	922	251	249	57	55	81	93	93	2.0	0.42	38.44	10.194	100.8	34.951
A-8	26.3	00:26:15	144.800	0.17	0.522	0.53	923	250	250	57	55	81	93	93	2.0	0.41	37.37	11.680	101.0	35.040
A-9	30.0	00:30:00	146.380	0.17	0.522	0.53	925	249	251	57	55	81	93	93	2.0	0.41	37.39	13.138	100.9	35.034
A-10	33.8	00:33:45	147.930	0.17	0.522	0.53	922	250	250	58	56	80	94	94	2.0	0.41	37.35	14.612	101.0	35.068
A-11	37.5	00:37:30	149.500	0.15	0.461	0.47	924	251	249	58	57	80	94	94	2.0	0.39	35.11	15.963	100.8	34.829
A-12	41.3	00:41:15	150.940	0.16	0.491	0.50	922	250	250	58	57	79	94	94	2.0	0.40	36.24	17.409	100.9	34.818
B-1	45.0	00:45:00	152.480	0.16	0.491	0.50	918	249	252	60	59	81	94	94	2.0	0.40	36.18	18.845	101.0	34.791
B-2	48.8	00:48:45	154.010	0.16	0.491	0.50	924	249	250	59	58	81	94	94	2.0	0.40	36.26	20.262	101.0	34.735
B-3	52.5	00:52:30	155.520	0.17	0.522	0.53	922	250	249	58	57	80	94	94	2.0	0.41	37.35	21.727	101.0	34.763
B-4	56.3	00:56:15	157.080	0.17	0.522	0.53	919	248	249	58	57	80	95	95	2.0	0.41	37.31	23.161	100.8	34.741
B-5	60.0	01:00:00	158.610	0.18	0.553	0.56	922	249	251	56	55	78	95	95	2.0	0.42	38.44	24.697	100.9	34.867
B-6	63.8	01:03:45	160.250	0.19	0.584	0.59	922	250	250	56	55	78	95	95	2.0	0.44	39.49	26.244	100.9	34.992
B-7	67.5	01:07:30	161.900	0.18	0.553	0.56	924	251	253	56	56	78	95	95	2.0	0.42	38.46	27.724	100.8	35.020
B-8	71.3	01:11:15	163.480	0.18	0.553	0.56	923	249	247	56	58	79	96	96	2.0	0.42	38.45	29.193	100.7	35.032
B-9	75.0	01:15:00	165.050	0.19	0.584	0.59	922	248	248	56	58	79	96	96	2.0	0.44	39.49	30.709	100.6	35.096
B-10	78.8	01:18:45	166.670	0.18	0.553	0.56	922	250	249	57	60	80	96	96	2.0	0.42	38.44	32.168	100.4	35.092
B-11	82.5	01:22:30	168.230	0.18	0.553	0.56	920	249	250	57	60	80	96	96	2.0	0.42	38.41	33.665	100.4	35.128
B-12	86.3	01:26:15	169.830	0.17	0.522	0.53	915	251	250	57	60	80	96	96	2.0	0.41	37.26	35.098	100.3	35.098
Last Pt	90.0	01:30:00	171.362																	
Final Val	90.0	01:30:00	171.362																	
Average Values				0.17		0.53	923	250	250	58	57	80	94	94			0.41	37.48		
													94							

Notes:

AIR HYGIENE



PM (EPA METHOD 5) DATA SHEET

Project Code: catc-21-houston.tx-start#1

Site Info.

Plant Name: _____

Sampling Location: _____

Unit #: _____

Date: 7.29.21

Console Info.

Console: _____ samp-cp-0022

Meter Calibration Factor 0.986

Orifice Meter Coefficient 1.831

PM RUNS

Run#: <u>1</u>	Load: <u>50%</u> normal	Box#: <u>5310</u>						
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)	<u>456.8</u>	<u>612.9</u>	<u>720.1</u>	<u>856.2</u>			
Initial Value	(V _i), (W _i)	<u>350.7</u>	<u>700.9</u>	<u>700.9</u>	<u>847.8</u>			
Filter #	<u>00713</u>	Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

CPM - 5736

EXIT - 8471

COND. - 3006

Run#: <u>2</u>	Load: <u>50%</u> normal	Box#: <u>samp-cp-0011</u>						
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)	<u>473.4</u>	<u>601.9</u>	<u>721.1</u>	<u>823.4</u>			
Initial Value	(V _i), (W _i)	<u>357.6</u>	<u>600.5</u>	<u>720.5</u>	<u>816.5</u>			
Filter #	<u>0652</u>	Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

CPM - 1004

EXIT - 8609

COND. - 2917

Run#: <u>3</u>	Load: <u>50%</u> normal	Box#: _____						
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)	<u>463.7</u>	<u>614.8</u>	<u>722.8</u>	<u>863.2</u>			
Initial Value	(V _i), (W _i)	<u>351.3</u>	<u>614.6</u>	<u>720.1</u>	<u>856.2</u>			
Filter #	<u>0722</u>	Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

Run#: _____	Load: _____ normal	Box#: _____						
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)							
Initial Value	(V _i), (W _i)							
Filter #		Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

Signature

[Handwritten Signature]

EMISSION DATA RECORDS

75% Load

PM

Reference Method Data

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE

Source Information	
Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Fuel Type	Gas, Natural

Test Information			
Project #		catc-21-houston.tx-start#1	
Operator		JLW	
Date for Preliminary Run	(mm/dd/yy)	07/28/21	
Standard Temperature		68	°F
Standard Pressure		29.92	in Hg
Run Duration	≥ 2 min/point	90	minutes
Unit Number		1	
Base Run Number		R-1 75%	
Number of Ports Available		2	
Number of Ports Used		2	
Port Inside Diameter		4.00	in
Stack Shape		Circular	

Test Equipment Information					
Run		1	2	3	
Test Date	(mm/dd/yy)	07/30/21	07/30/21	07/30/21	
Load		75%	75%	75%	% or w/DB
Fuel F-Factor		8632.09	8632.09	8632.09	dscf/MMBtu
Meter Box Number	from ACS	samp-cp-0022	samp-cp-0022	samp-cp-0022	
Meter Calibration Factor	(Y)	0.986	0.986	0.986	
Orifice Meter Coefficient	(ΔH _@)	1.831	1.831	1.831	in H ₂ O
Non-Console Manometer Used		No	No	No	
Pitot Identification	from ACS	A5708	A5708	A5708	
Pitot Tube Coefficient	(C _p)	0.8230	0.8230	0.8230	
Nozzle Number	from ACS	G-10	G-10	G-10	
Nozzle Diameter	(D _n)	0.311	0.311	0.311	in
Probe Number	from ACS	samp-hp-0079	samp-hp-0079	samp-hp-0079	
Probe Length		60.0	60.0	60.0	in
(SS, Glass) Liner Material	from list	glass	glass	glass	
Sample Case / Oven Number	from ACS	samp-BH-0018	samp-BH-0018	samp-BH-0018	
Impinger Case Number	from ACS	samp-cc-0011	samp-cc-0011	samp-cc-0011	

Testing Company Information	
Company Name	Air Hygiene International, Inc. (Tulsa, Oklahoma)
Address	1600 W Tacoma Street
City, State Zip	Broken Arrow, Oklahoma 74012
Project Manager	Pat McGovern, Jr.
Phone Number	(918) 307-8865
Fax Number	(918) 307-9131

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METHOD 1 - SAMPLE AND VELOCITY TRAVERSES FOR CIRCULAR SOURCES

Plant Name	Stewart and Stevenson Integration Center	Date	07/28/21
Sampling Location	Caterpillar G3520 TALE	Stack Type	Circular
Operator	JLW	Ports Available	2
Project #	catc-21-houston.tx-start#1	Ports Used	2
Stack Size	Large (>24 inch diameter)	Port ID (inches)	4.00

Circular Stack or Duct Diameter			
Distance to Far Wall of Stack	(L_{fw})	32.00	in
Distance to Near Wall of Stack	(L_{nw})	0.13	in
Diameter of Stack	(D)	31.88	in
Area of Stack	(A_s)	5.54	ft ²

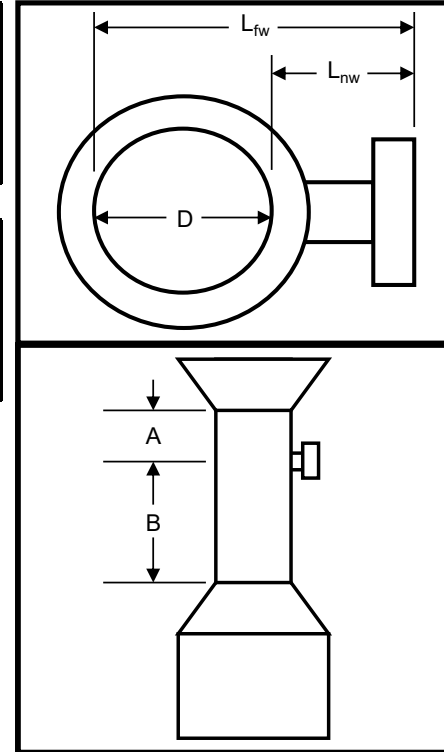
Distance from Port to Disturbances			
Distance Upstream	(A)	16.00	in
Diameters Upstream	(A_D)	0.50	diameters
Distance Downstream	(B)	64.00	in
Diameters Downstream	(B_D)	2.01	diameters

Number of Traverse Points Required			
Diameters to Flow Disturbance		Minimum Number of ¹ Traverse Points	
Down Stream	Up Stream	Particulate Points	Velocity Points
2.00-4.99	0.50-1.24	24	16
5.00-5.99	1.25-1.49	20	16
6.00-6.99	1.50-1.74	16	12
7.00-7.99	1.75-1.99	12	12
≥ 8.00	≥ 2.00	8 or 12 ²	8 or 12 ²
Upstream Spec		24	16
Downstream Spec		24	16
Traverse Pts Required		24	16

¹ Check Minimum Number of Points for the Upstream and Downstream conditions, then use the largest.

² 8 for Circular Stacks 12 to 24 inches
12 for Circular Stacks over 24 inches

Location of Traverse Points in Circular Stacks									
Traverse Point	(Fraction of Stack Dimension from Inside Wall to Traverse Point)								
Number	2	4	6	8	10	12	14	16	18
1	.146	.067	.044	.032	.026	.021	.018	.016	.014
2	.854	.250	.146	.105	.082	.067	.057	.049	.044
3		.750	.296	.194	.146	.118	.099	.085	.075
4		.933	.704	.323	.226	.177	.146	.125	.109
5			.854	.677	.342	.250	.201	.169	.146
6			.956	.806	.658	.356	.269	.220	.188
7				.895	.774	.644	.366	.283	.236
8				.968	.854	.750	.634	.375	.296
9					.918	.823	.731	.625	.382
10					.974	.882	.799	.717	.618
11						.933	.854	.780	.704
12						.979	.901	.831	.764



Number of Traverse Points Used			
2	Ports by	12	Across
24	Pts Used	24	Required

Adjust Sample Points Out of Boundary Layer

Traverse Point Locations			
Traverse Point Number	Fraction of Stack Diameter	Distance from Inside Wall	Distance Including Reference Length
		in	in
1	0.021	5/8	6/8
2	0.067	2 1/8	2 2/8
3	0.118	3 6/8	3 7/8
4	0.177	5 5/8	5 6/8
5	0.250	8	8 1/8
6	0.356	11 3/8	11 4/8
7	0.644	20 4/8	20 5/8
8	0.750	23 7/8	24
9	0.823	26 2/8	26 3/8
10	0.882	28 1/8	28 2/8
11	0.933	29 6/8	29 7/8
12	0.979	31 2/8	31 3/8

METHOD 2 - DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant Name	Stewart and Stevenson Integration Center			
Sampling Location	Caterpillar G3520 TALE			
Operator	JLW			
Project #	catc-21-houston.tx-start#1			
Pitot Leak Check	x	PreTest	x	PostTest

Stack Dimensions			
Area of Stack	(A _s)	5.54	ft ²
Diameter of Stack	(D)	31.88	in

Pressures			
Barometric Pressure	(P_b)	29.89	in Hg
Static Pressure	(P_{static})	0.21	in H ₂ O
Absolute Stack Pressure	(P_s)	29.91	in Hg

Stack Gas Composition			
Composition Data:	Estimated Composition		
Carbon Dioxide Concentration	(%CO ₂)	5.80	%vd
Oxygen Concentration	(%O ₂)	8.80	%vd
Carbon Monoxide Concentration	(ppmCO)	5.00	ppmvd
Nitrogen Concentration	(%N ₂)	85.40	%vd
Stack Moisture Content	(B _{WS})	14.00	%
Stack Dry Molecular Weight	(M _d)	29.28	lb/lb-mole
Stack Wet Molecular Weight	(M _w)	27.70	lb/lb-mole

Results			
Avg Stack Gas Velocity	(V_s)	52.84	ft/sec
Avg Stack Dry Std Flow Rate	(Q_{sd})	363,978	dscf/hr
Avg Stack Dry Std Flow Rate	(Q_{sd})	6,066	dscf/min
Avg Stack Wet Flow Rate	(Q_{sw})	17,569	acf/min
Avg Stack Wet Std Flow Rate	(Q_{sw})	423,231	ascf/hr

40 CFR 60, Method 2G, Section 8.11.1 (but applies to all Method 2 type static pressure measurements):

If a Type S probe is used for this measurement, position the probe at or between any traverse point(s) and rotate the probe until a null differential pressure reading is obtained. Disconnect the tubing from one of the pressure ports; read and record the ΔP . For pressure devices with one-directional scales, if a deflection in the positive direction is noted with the negative side disconnected, then the static pressure is positive. Likewise, if a deflection in the positive direction is noted with the positive side disconnected, then the static pressure is negative.

Stack Cross Section Schematic

Preliminary Run Date	07/28/21		
Stack Type	Circular		
Ports Available	2		
Thermocouple ID	samp-hp-0079		
Pitot Coefficient	0.8215	Pitot Identification	A6223

[illegible]

METHOD 3a - DETERMINATION OF DRY MOLECULAR WEIGHT BY ANALYZER

Plant Name	Stewart and Stevenson Integration Center	Preliminary Run Date	07/28/21		
Sampling Location	Caterpillar G3520 TALE	Operator	JLW		
Project #	catc-21-houston.tx-start#1	# of Ports Used	1 (gas probe)		
Fuel Type	Gas, Natural	Min. Fuel Factor	1.600	Max. Fuel Factor	1.836

Gas Analysis Data								
Run Number	R-1 75%-1		Date	07/30/21	Run Start Time	08:08	Run Stop Time	09:42
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:34	6.57	8.95	3.23	84.5	29.41	1.819	67.1	YES

Gas Analysis Data								
Run Number	R-1 75%-2		Date	07/30/21	Run Start Time	13:17	Run Stop Time	14:56
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:39	6.55	8.96	4.20	84.5	29.41	1.823	67.1	YES

Gas Analysis Data								
Run Number	R-1 75%-3		Date	07/30/21	Run Start Time	15:25	Run Stop Time	17:01
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:36	6.66	8.94	3.59	84.4	29.42	1.796	66.9	YES

METHOD 4 - DETERMINATION OF MOISTURE CONTENT IN STACK GASES

Plant Name	Stewart and Stevenson Integration Center	Preliminary Run Date	07/28/21
Sampling Location	Caterpillar G3520 TALE	Operator	JLW
Project #	catc-21-houston.tx-start#1	Ports Used	2

Scale Daily Calibration					
Scale Number	Extra	Standard	Result	Difference	Pass/Fail
Date		(g)	(g)	(g)	(± 0.5 g)
Preliminary Date	07/28/21	500	499.5	-0.5	Pass
Test Day 1	07/30/21	500	499.5	-0.5	Pass

Moisture Content Data								
Run Number	R-1 75%-1		Date	07/30/21	Start Time	08:08	Stop Time	09:42
Meter Box Number	samp-cp-0022				Meter Cal Factor	(Y)	0.986	
Total Meter Volume	(V _m)	52.714	dcf		Barometric Pressure	(P _b)	29.89	in Hg
Average Stack Temp	(t _s) _{avg}	912	°F		Stack Static Pressure	(P _{static})	0.21	in H ₂ O
Average Meter Temp	(t _m) _{avg}	82	°F		Avg Orifice Pressure	(ΔH) _{avg}	1.14	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	524.30	605.50	724.50	832.60			
Initial Value	(V _i),(W _i)	360.00	604.30	721.10	823.40			
Net Value	(V _n),(W _n)	164.3	1.2	3.4	9.2			
Results								
Total Weight	(W _t)	178.10	g	Water Vol Weighed	(V _{wsg(std)})	8.397	scf	
Std Meter Volume	(V _{m(std)})	50.693	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	14.21	%	Final Moisture Content	(B _{ws})	14.21	%	

Moisture Content Data								
Run Number	R-1 75%-2		Date	07/30/21	Start Time	13:17	Stop Time	14:56
Meter Box Number	samp-cp-0022				Meter Cal Factor	(Y)	0.986	
Total Meter Volume	(V _m)	53.576	dcf		Barometric Pressure	(P _b)	29.90	in Hg
Average Stack Temp	(t _s) _{avg}	909	°F		Stack Static Pressure	(P _{static})	0.21	in H ₂ O
Average Meter Temp	(t _m) _{avg}	92	°F		Avg Orifice Pressure	(ΔH) _{avg}	1.09	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	505.30	615.70	730.50	872.90			
Initial Value	(V _i),(W _i)	351.70	615.10	722.80	863.20			
Net Value	(V _n),(W _n)	153.6	0.6	7.7	9.7			
Results								
Total Weight	(W _t)	171.60	g	Water Vol Weighed	(V _{wsg(std)})	8.091	scf	
Std Meter Volume	(V _{m(std)})	50.619	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	13.78	%	Final Moisture Content	(B _{ws})	13.78	%	

Moisture Content Data								
Run Number	R-1 75%-3		Date	07/30/21	Start Time	15:25	Stop Time	17:01
Meter Box Number	samp-cp-0022				Meter Cal Factor	(Y)	0.986	
Total Meter Volume	(V _m)	53.946	dcf		Barometric Pressure	(P _b)	29.86	in Hg
Average Stack Temp	(t _s) _{avg}	910	°F		Stack Static Pressure	(P _{static})	0.21	in H ₂ O
Average Meter Temp	(t _m) _{avg}	95	°F		Avg Orifice Pressure	(ΔH) _{avg}	1.12	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	516.00	603.50	726.60	834.40			
Initial Value	(V _i),(W _i)	359.80	604.60	724.50	823.30			
Net Value	(V _n),(W _n)	156.2	-1.1	2.1	11.1			
Results								
Total Weight	(W _t)	168.30	g	Water Vol Weighed	(V _{wsg(std)})	7.935	scf	
Std Meter Volume	(V _{m(std)})	50.659	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	13.54	%	Final Moisture Content	(B _{ws})	13.54	%	

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Date	07/30/21
Operator	JLW
Run Number	R-1 75%-1

Filter #	0523
	R-1 75%-1-CPM

Leak Checks		[change]		[level]		[time]	
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]
Pitot	Pre (+)	0.00	in H ₂ O	6.0	in H ₂ O for	15.0	sec [≥15]
	Pre (-)	0.00	in H ₂ O	7.0	in H ₂ O for	15.0	sec [≥15]
	Post (+)	0.00	in H ₂ O	5.0	in H ₂ O for	15.0	sec [≥15]
	Post (-)	0.00	in H ₂ O	6.0	in H ₂ O for	15.0	sec [≥15]

Sampling Equipment		
Meter Box Number	samp-cp-0022	
Meter Cal Factor	(Y)	0.986
Nozzle Number	G-10	
Average Nozzle Diameter	(D _{na})	0.3113 in
Suggested Nozzle Diameter	(D _m)	0.2888 in
Probe Number	samp-hp-0079	in
Probe Length	60	in
Liner Material	glass	
Sample Case / Oven Number	samp-BH-0018	
Impinger Case Number	samp-cc-0011	

Nozzle Measurements		ID: G-10			
Pre	0.312	0.311	0.311	PASS	
Post	0.312	0.311	0.311	PASS	

Barometer ID	
SAMP-WE-0014	
Scale ID	
Extra	

Run Time	
Start	08:08
End	09:42

Weights	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre	360.0	604.3	721.1	823.4				
Post	524.3	605.5	724.5	832.6				

Ideal Nozzle Diameter and IsoKinetic Factor Setup			
Pitot Coefficient / ID	(C _p)	0.8230	A5708
Average Stack Temp	(t _s)	911.5	°F
Average Meter Temp	(t _m)	82.3	
Orifice Meter Coefficient	(ΔH@)	1.831	in H ₂ O
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.60	in H ₂ O
Stack Moisture Content	(B _{ws})	14.21	%
Stack Dry Molecular Weight	(M _d)	29.41	lb/lb-mole
Estimated Orifice Flow Rate	(Q _m)	0.75	acfm
ΔP to ΔH Isokinetic Factor	(K)	3.04	

Pressures		
Barometric Pressure	(P _b)	29.89 in Hg
Stack Static Pressure	(P _{static})	0.21 in H ₂ O
Absolute Stack Pressure	(P _a)	29.91 in Hg
Absolute Meter Pressure	(P _m)	30.02 in Hg

Wash Volumes					ml
					ml

Identification Nos.		samp-cp-0022	samp-cp-0022	samp-cp-0022			samp-hp-0079	samp-hp-0079	samp-BH-0018	samp-cc-0011	2917	1004	samp-cp-0022	samp-cp-0022						
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (ΔP ^{1/2})	Local Stack Velocity (V _s)	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg	√(in H ₂ O)	ft/sec	dscf	%	dscf
A-1	0.0	00:00:00	171.591	0.40	1.215	1.30	884	250	250	60	64	83	74	74	3.0	0.63	56.59	2.324	102.6	55.786
A-2	3.8	00:03:45	173.970	0.39	1.185	1.20	911	248	248	60	66	82	74	74	3.0	0.62	56.44	4.542	101.4	54.502
A-3	7.5	00:07:30	176.240	0.39	1.185	1.20	912	248	247	62	65	81	74	74	3.0	0.62	56.46	6.769	101.1	54.152
A-4	11.3	00:11:15	178.520	0.41	1.245	1.30	912	250	249	63	66	81	75	75	3.0	0.64	57.89	9.070	101.2	54.423
A-5	15.0	00:15:00	180.880	0.41	1.245	1.30	914	250	250	63	68	81	76	76	3.0	0.64	57.93	11.397	101.4	54.705
A-6	18.8	00:18:45	183.270	0.40	1.215	1.30	911	250	250	64	71	82	77	77	3.0	0.63	57.16	13.651	101.3	54.604
A-7	22.5	00:22:30	185.590	0.40	1.215	1.30	911	250	250	62	72	83	78	78	3.0	0.63	57.16	15.940	101.4	54.651
A-8	26.3	00:26:15	187.950	0.39	1.185	1.20	912	248	250	62	53	80	79	79	3.0	0.62	56.46	18.146	101.2	54.439
A-9	30.0	00:30:00	190.230	0.37	1.124	1.20	910	249	249	62	50	79	80	80	3.0	0.61	54.95	20.349	101.3	54.263
A-10	33.8	00:33:45	192.510	0.37	1.124	1.20	912	250	250	62	50	78	81	81	3.0	0.61	54.99	22.537	101.3	54.090
A-11	37.5	00:37:30	194.780	0.36	1.094	1.20	910	249	249	63	51	79	82	82	3.0	0.60	54.20	24.684	101.2	53.855
A-12	41.3	00:41:15	197.010	0.35	1.063	1.10	909	250	250	63	53	79	83	83	3.0	0.59	53.43	26.756	101.0	53.512
B-1	45.0	00:45:00	199.168	0.30	0.911	0.96	915	250	251	59	42	84	84	84	3.0	0.55	49.57	28.751	101.2	53.079
B-2	48.8	00:48:45	201.250	0.27	0.820	0.86	917	248	250	60	42	83	84	84	3.0	0.52	47.06	30.591	101.1	52.441
B-3	52.5	00:52:30	203.170	0.28	0.851	0.90	915	250	249	61	43	82	85	85	3.0	0.53	47.89	32.494	101.1	51.990
B-4	56.3	00:56:15	205.160	0.29	0.881	0.93	915	249	251	61	44	82	85	85	3.0	0.54	48.74	34.426	101.1	51.639
B-5	60.0	01:00:00	207.180	0.32	0.972	1.00	914	250	250	61	46	82	86	86	3.0	0.57	51.18	36.431	101.1	51.432
B-6	63.8	01:03:45	209.280	0.33	1.002	1.10	913	250	251	61	48	82	87	87	3.0	0.57	51.95	38.462	101.0	51.283
B-7	67.5	01:07:30	211.410	0.35	1.063	1.10	913	250	249	60	47	82	87	87	3.0	0.59	53.50	40.493	100.8	51.149
B-8	71.3	01:11:15	213.540	0.35	1.063	1.10	916	249	251	61	49	82	88	88	3.0	0.59	53.56	42.520	100.6	51.023
B-9	75.0	01:15:00	215.670	0.35	1.063	1.10	917	249	250	61	50	83	89	89	3.0	0.59	53.58	44.533	100.4	50.895
B-10	78.8	01:18:45	217.790	0.37	1.124	1.20	915	250	250	61	51	83	89	89	3.0	0.61	55.05	46.614	100.2	50.852
B-11	82.5	01:22:30	219.980	0.36	1.094	1.20	911	248	251	61	53	83	89	89	3.0	0.60	54.22	48.676	100.1	50.792
B-12	86.3	01:26:15	222.150	0.34	1.033	1.10	908	250	250	61	54	83	90	90	3.0	0.58	52.64	50.719	100.0	50.719
Last Pt	90.0	01:30:00	224.305																	
Final Val	90.0	01:30:00	224.305												Max Vac	3.0	Final Values	50.719	100.0	
Average Values				0.36		1.14	912	249	250	61	54	82	82	82		0.60	53.86			
														82						

Notes:

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name		Stewart and Stevenson Integration Center						Date		07/30/21		Filter #	
Sampling Location		Caterpillar G3520 TALE						Operator		JLW		0916	
Project #		catc-21-houston.tx-start#1						Run Number		R-1 75%-2		R-1 75%-2-CPM	

Leak Checks										Sampling Equipment									
[change]					[level]					[time]									
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]	Meter Box Number			samp-cp-0022								
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]	Meter Cal Factor			(Y)	0.986							
Pitot	Pre (+)	0.00	in H ₂ O	6.0	in H ₂ O for	15.0	sec [≥15]	Nozzle Number			G-10								
PASS	Pre (-)	0.00	in H ₂ O	5.0	in H ₂ O for	15.0	sec [≥15]	Average Nozzle Diameter			(D _{na})	0.3113		in					
	Post (+)	0.00	in H ₂ O	7.0	in H ₂ O for	15.0	sec [≥15]	Suggested Nozzle Diameter			(D _m)	0.2482		in					
	Post (-)	0.00	in H ₂ O	6.0	in H ₂ O for	15.0	sec [≥15]	Probe Number			samp-hp-0079		in						
								Probe Length			60		in						
								Liner Material			glass								
								Sample Case / Oven Number			samp-BH-0018								
								Impinger Case Number			samp-cc-0011								

Nozzle Measurements					ID: G-10					Barometer ID				
Pre	0.311	0.312	0.311	PASS	SAMP-WE-0014									
Post	0.311	0.312	0.311	PASS	Scale ID									
					Extra									

Run Time					Weights					Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Start	13:17	End	14:56		Pre	351.7	615.1	722.8	863.2								
					Post	505.3	615.7	730.5	872.9								

Ideal Nozzle Diameter and IsoKinetic Factor Setup			
Pitot Coefficient / ID	(C _p)	0.8230	A5708
Average Stack Temp	(t _s)	908.8	°F
Average Meter Temp	(t _m)	92.1	
Orifice Meter Coefficient	(ΔH@)	1.831	in H ₂ O
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.59	in H ₂ O
Stack Moisture Content	(B _{ws})	13.78	%
Stack Dry Molecular Weight	(M _d)	29.41	lb/lb-mole
Estimated Orifice Flow Rate	(Q _m)	0.56	acfm
ΔP to ΔH Isokinetic Factor	(K)	3.12	

Pressures			
Barometric Pressure	(P _b)	29.90	in Hg
Stack Static Pressure	(P _{static})	0.21	in H ₂ O
Absolute Stack Pressure	(P _a)	29.92	in Hg
Absolute Meter Pressure	(P _m)	30.03	in Hg

Wash Volumes					ml
					ml

Identification Nos.		samp-cp-0022	samp-cp-0022	samp-cp-0022			samp-hp-0079	samp-hp-0079	samp-BH-0018	samp-cc-0011	3006	8471	samp-cp-0022	samp-cp-0022	samp-cp-0022					
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (ΔP ^{1/2})	Local Stack Velocity (V _s)	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg	√(in H ₂ O)	ft/sec	dscf	%	dscf
A-1	0.0	00:00:00	224.575	0.28	0.875	0.86	896	250	249	66	65	72	85	85	2.0	0.53	47.51	1.822	96.1	43.737
A-2	3.8	00:03:45	226.480	0.27	0.844	0.82	904	247	250	65	56	74	86	86	2.0	0.52	46.79	3.636	96.9	43.637
A-3	7.5	00:07:30	228.380	0.28	0.875	0.86	908	249	251	65	55	74	86	86	2.0	0.53	47.72	5.508	97.7	44.064
A-4	11.3	00:11:15	230.340	0.29	0.906	0.89	911	249	252	64	55	74	87	87	2.0	0.54	48.62	7.405	98.0	44.429
A-5	15.0	00:15:00	232.330	0.31	0.969	0.95	911	249	250	64	57	74	88	88	2.0	0.56	50.27	9.384	98.4	45.044
A-6	18.8	00:18:45	234.410	0.32	1.000	0.98	914	250	250	65	60	73	88	88	2.0	0.57	51.13	11.354	98.3	45.417
A-7	22.5	00:22:30	236.480	0.35	1.093	1.10	912	251	249	65	62	74	89	89	2.0	0.59	53.43	13.445	98.4	46.096
A-8	26.3	00:26:15	238.680	0.35	1.093	1.10	912	250	250	64	63	74	90	90	2.0	0.59	53.43	15.541	98.6	46.622
A-9	30.0	00:30:00	240.890	0.36	1.125	1.10	912	250	251	64	60	75	91	91	2.0	0.60	54.19	17.624	98.4	46.996
A-10	33.8	00:33:45	243.090	0.37	1.156	1.10	911	250	249	63	60	75	92	92	2.0	0.61	54.92	19.712	98.2	47.309
A-11	37.5	00:37:30	245.300	0.36	1.125	1.10	911	250	250	63	60	75	92	92	2.0	0.60	54.17	21.857	98.4	47.689
A-12	41.3	00:41:15	247.570	0.34	1.062	1.00	910	250	251	63	60	75	93	93	2.0	0.58	52.62	23.891	98.4	47.782
B-1	45.0	00:45:00	249.726	0.40	1.250	1.20	893	248	250	55	63	78	93	93	2.0	0.63	56.72	26.103	98.3	48.189
B-2	48.8	00:48:45	252.070	0.40	1.250	1.20	899	251	250	59	63	78	93	93	2.0	0.63	56.85	28.320	98.3	48.548
B-3	52.5	00:52:30	254.420	0.39	1.218	1.20	905	250	249	59	65	79	94	94	2.0	0.62	56.26	30.552	98.4	48.883
B-4	56.3	00:56:15	256.790	0.40	1.250	1.20	909	250	250	60	65	79	94	94	2.0	0.63	57.06	32.831	98.6	49.247
B-5	60.0	01:00:00	259.210	0.41	1.281	1.30	911	249	249	60	66	78	95	95	2.0	0.64	57.81	35.201	98.9	49.696
B-6	63.8	01:03:45	261.730	0.40	1.250	1.20	912	251	250	60	66	78	95	95	2.0	0.63	57.12	37.505	99.1	50.006
B-7	67.5	01:07:30	264.180	0.39	1.218	1.20	912	249	249	58	66	78	96	96	2.0	0.62	56.40	39.804	99.4	50.279
B-8	71.3	01:11:15	266.630	0.39	1.218	1.20	915	249	250	58	65	77	96	96	2.0	0.62	56.46	42.085	99.6	50.501
B-9	75.0	01:15:00	269.060	0.38	1.187	1.20	912	249	251	58	66	78	97	97	2.0	0.62	55.67	44.352	99.8	50.687
B-10	78.8	01:18:45	271.480	0.37	1.156	1.10	911	250	251	58	67	78	97	97	2.0	0.61	54.92	46.468	99.7	50.693
B-11	82.5	01:22:30	273.740	0.35	1.093	1.10	911	250	249	58	67	78	97	97	2.0	0.59	53.41	48.519	99.6	50.629
B-12	86.3	01:26:15	275.930	0.35	1.093	1.10	909	250	251	58	67	78	97	97	2.0	0.59	53.37	50.599	99.5	50.599
Last Pt	90.0	01:30:00	278.151																	
Final Val	90.0	01:30:00	278.151												Max Vac	2.0	Final Values	50.599	99.5	
Average Values				0.35		1.09	909	250	250	61	62	76	92	92		0.59	53.62			
													92							

Notes:

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name		Stewart and Stevenson Integration Center						Date		07/30/21		Filter #		Ideal Nozzle Diameter and IsoKinetic Factor Setup									
Sampling Location		Caterpillar G3520 TALE						Operator		JLW		0917		Pitot Coefficient / ID		(C _p)		0.8230		A5708			
Project #		catc-21-houston.tx-start#1						Run Number		R-1 75%-3		R-1 75%-3-CPM		Average Stack Temp		(t _s)		910.2		°F			
Leak Checks		[change]		[level]		[time]		Sampling Equipment						Average Meter Temp				(t _m)		94.8			
Train		Pre		0.000		ft³/min@ 15.0		in Hg for		60.0		sec [≥60]		Meter Box Number		samp-cp-0022							
PASS		Post		0.000		ft³/min@ 15.0		in Hg for		60.0		sec [≥60]		Meter Cal Factor		(Y)		0.986					
Pitot		Pre (+)		0.00		in H ₂ O		6.0		in H ₂ O for		15.0		Nozzle Number		G-10							
PASS		Pre (-)		0.00		in H ₂ O		7.0		in H ₂ O for		15.0		Average Nozzle Diameter		(D _{na})		0.3113		in			
		Post (+)		0.00		in H ₂ O		5.0		in H ₂ O for		15.0		Suggested Nozzle Diameter		(D _m)		0.2474		in			
		Post (-)		0.00		in H ₂ O		6.0		in H ₂ O for		15.0		Probe Number		samp-hp-0079		in					
														Probe Length		60		in					
														Liner Material		glass							
														Sample Case / Oven Number		samp-BH-0018							
														Impinger Case Number		samp-cc-0011							
Nozzle Measurements				ID: G-10				Barometer ID															
Pre		0.311		0.312		0.311		PASS															
Post		0.311		0.312		0.311		PASS															
Run Time																							
Start		15:25		End		17:01																	

Notes:

AIR HYGIENE

PM (EPA METHOD 5) DATA SHEET



Project Code: catc-21-houston.tx-start#1

Site Info.

Plant Name: _____
 Sampling Location: _____
 Unit #: _____
 Date: 7.30.21

Console Info.

Console: _____ samp-cp-0022
 Meter Calibration Factor 0.986
 Orifice Meter Coefficient 1.831

PM RUNS

Run#: <u>1</u>		Load: <u>75%</u> normal				Box#: <u>Samp-cp-0011</u>		
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)	<u>524.3</u>	<u>605.5</u>	<u>724.5</u>	<u>823.4</u>	<u>832.6</u>		
Initial Value	(V _i), (W _i)	<u>360.0</u>	<u>604.3</u>	<u>721.1</u>	<u>823.4</u>			
Filter #	<u>0523</u>	Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

Run#: <u>2</u>		Load: <u>75%</u> normal				Box#:		
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)	<u>505.3</u>	<u>615.7</u>	<u>730.5</u>	<u>872.9</u>			
Initial Value	(V _i), (W _i)	<u>351.7</u>	<u>615.1</u>	<u>722.8</u>	<u>863.2</u>			
Filter #	<u>0916</u>	Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

Run#: <u>3</u>		Load: normal				Box#:		
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)	<u>516.0</u>	<u>603.5</u>	<u>726.6</u>	<u>834.4</u>			
Initial Value	(V _i), (W _i)	<u>359.8</u>	<u>604.6</u>	<u>724.5</u>	<u>823.3</u>			
Filter #	<u>0917</u>	Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

Run#:		Load: normal				Box#:		
		Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7
		(g)	(g)	(g)	(g)			
Contents		Dry	Di Water	Dry	Sil Gel			
Final Value	(V _f), (W _f)							
Initial Value	(V _i), (W _i)							
Filter #		Probe #		Probe (in.)				
Pitot #		Nozzle #		Nozzle Meas				

Signature

EMISSION DATA RECORDS

100% Load

PM

Reference Method Data

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE

Source Information	
Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Fuel Type	Gas, Natural

Test Information			
Project #		catc-21-houston.tx-start#1	
Operator		TP	
Date for Preliminary Run	(mm/dd/yy)	08/31/21	
Standard Temperature		68	°F
Standard Pressure		29.92	in Hg
Run Duration	≥ 2 min/point	90	minutes
Unit Number		1	
Base Run Number		R-1 100%	
Number of Ports Available		2	
Number of Ports Used		2	
Port Inside Diameter		4.00	in
Stack Shape		Circular	

Test Equipment Information					
Run		1	2	3	
Test Date	(mm/dd/yy)	08/31/21	08/31/21	08/31/21	
Load		100%	100%	100%	% or w/DB
Fuel F-Factor		8631.42	8631.42	8631.42	dscf/MMBtu
Meter Box Number	from ACS	samp-cp-0021	samp-cp-0021	samp-cp-0021	
Meter Calibration Factor	(Y)	0.970	0.970	0.970	
Orifice Meter Coefficient	(ΔH _@)	1.812	1.812	1.812	in H ₂ O
Non-Console Manometer Used		No	No	No	
Pitot Identification	from ACS	A5708	A5708	A5708	
Pitot Tube Coefficient	(C _p)	0.8230	0.8230	0.8230	
Nozzle Number	from ACS	H-10	H-10	H-10	
Nozzle Diameter	(D _n)	0.293	0.293	0.293	in
Probe Number	from ACS	samp-hp-0079	samp-hp-0079	samp-hp-0079	
Probe Length		60.0	60.0	60.0	in
(SS, Glass) Liner Material	from list	glass	glass	glass	
Sample Case / Oven Number	from ACS	samp-BH-0036	samp-BH-0036	samp-BH-0036	
Impinger Case Number	from ACS	samp-cc-0009	samp-cc-0009	samp-cc-0009	

Testing Company Information	
Company Name	Air Hygiene International, Inc. (Tulsa, Oklahoma)
Address	1600 W Tacoma Street
City, State Zip	Broken Arrow, Oklahoma 74012
Project Manager	Matt McBride
Phone Number	(918) 307-8865
Fax Number	(918) 307-9131

Created with Isocalc-AHI v20210708

METHOD 1 - SAMPLE AND VELOCITY TRAVERSES FOR CIRCULAR SOURCES

Plant Name	Stewart and Stevenson Integration Center	Date	08/31/21
Sampling Location	Caterpillar G3520 TALE	Stack Type	Circular
Operator	TP	Ports Available	2
Project #	catc-21-houston.tx-start#1	Ports Used	2
Stack Size	Large (>24 inch diameter)	Port ID (inches)	4.00

Circular Stack or Duct Diameter			
Distance to Far Wall of Stack	(L _{fw})	32.00	in
Distance to Near Wall of Stack	(L _{nw})	0.125	in
Diameter of Stack	(D)	31.88	in
Area of Stack	(A _s)	5.54	ft ²

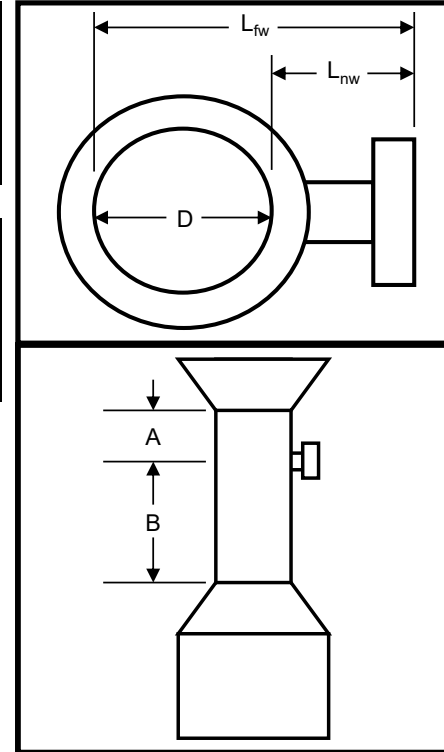
Distance from Port to Disturbances			
Distance Upstream	(A)	16.00	in
Diameters Upstream	(A _D)	0.50	diameters
Distance Downstream	(B)	64.00	in
Diameters Downstream	(B _D)	2.01	diameters

Number of Traverse Points Required			
Diameters to Flow Disturbance		Minimum Number of ¹ Traverse Points	
Down Stream	Up Stream	Particulate Points	Velocity Points
2.00-4.99	0.50-1.24	24	16
5.00-5.99	1.25-1.49	20	16
6.00-6.99	1.50-1.74	16	12
7.00-7.99	1.75-1.99	12	12
>= 8.00	>= 2.00	8 or 12 ²	8 or 12 ²
Upstream Spec		24	16
Downstream Spec		24	16
Traverse Pts Required		24	16

¹ Check Minimum Number of Points for the Upstream and Downstream conditions, then use the largest.

² 8 for Circular Stacks 12 to 24 inches
12 for Circular Stacks over 24 inches

Location of Traverse Points in Circular Stacks									
Traverse Point	(Fraction of Stack Dimension from Inside Wall to Traverse Point)								
Number	2	4	6	8	10	12	14	16	18
1	.146	.067	.044	.032	.026	.021	.018	.016	.014
2	.854	.250	.146	.105	.082	.067	.057	.049	.044
3		.750	.296	.194	.146	.118	.099	.085	.075
4		.933	.704	.323	.226	.177	.146	.125	.109
5			.854	.677	.342	.250	.201	.169	.146
6			.956	.806	.658	.356	.269	.220	.188
7				.895	.774	.644	.366	.283	.236
8				.968	.854	.750	.634	.375	.296
9					.918	.823	.731	.625	.382
10					.974	.882	.799	.717	.618
11						.933	.854	.780	.704
12						.979	.901	.831	.764



Number of Traverse Points Used			
2	Ports by	12	Across
24	Pts Used	24	Required

Adjust Sample Points Out of Boundary Layer

Traverse Point Locations			
Traverse Point Number	Fraction of Stack Diameter	Distance from Inside Wall	Distance Including Reference Length
		in	in
1	0.021	5/8	6/8
2	0.067	2 1/8	2 2/8
3	0.118	3 6/8	3 7/8
4	0.177	5 5/8	5 6/8
5	0.250	8	8 1/8
6	0.356	11 3/8	11 4/8
7	0.644	20 4/8	20 5/8
8	0.750	23 7/8	24
9	0.823	26 2/8	26 3/8
10	0.882	28 1/8	28 2/8
11	0.933	29 6/8	29 7/8
12	0.979	31 2/8	31 3/8

- ☒ Method 1 Trav
- ☐ 12 Point PM Trav (M201a ONLY)
- ☐ Velocity

METHOD 2 - DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

Preliminary Run Date	08/31/21		
Stack Type	Circular		
Ports Available	2		
Thermocouple ID	samp-hp-0079		
Pitot Coefficient	0.8300	Pitot Identification	A6904

Velocity Traverse Data	
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Run Number	R-1 100%-V1
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Run Time	07:14	Start	07:38	End
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Traverse	Velocity	Null	Zero Deg	Stack	Local
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Point	Head	Angle	Pressure	Temp	Velocity
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	(Δp)	(N_a)	(O_a^0)	(t_s)	$(v_{s(l)})$
	1.110	1	1.110	25	5.4

	in H ₂ O	deg	in H ₂ O	°F	ft/sec
A 1	0.53	5	0.20	878	65.77

A-1	0.33	-3	0.20	878	65.77
A-2	0.53	-5	0.20	879	65.80

A-2	0.55	-5	0.20	979	55.50
A-3	0.53	5	-0.05	878	65.77

A-4	0.56	10	-0.10	879	67.63
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A-5	0.58	15	-0.10	882	68.91
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A-6	0.60	-5	0.20	882	70.08
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A-7	0.50	15	-0.05	873	63.76
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A-8	0.43	0	0.00	866	58.98
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A-9	0.39	5	-0.03	867	56.19
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A-10	0.37	0	0.00	866	54.71
A-11	0.33	0	0.00	885	53.94

A-11	0.36	0	0.00	865	53.94
A-12	0.36	0	0.00	865	53.94

A-12	0.50	0	0.00	865	55.94
B-1	0.50	-5	0.04	877	63.86

B-2	0.50	-5	0.04	878	63.88
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B-3	0.51	5	-0.04	878	64.52
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B-4	0.53	10	-0.05	879	65.80
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B-5	0.61	5	-0.10	880	70.61
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B-6	0.63	5	-0.06	881	71.79
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B-7	0.52	-5	0.05	874	65.05
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B-8	0.44	5	-0.03	873	59.82
B-9	0.46	5	0.04	876	57.88

B-9	0.40	5	-0.04	873	57.03
B-10	0.30	5	0.04	873	56.20

B-10	0.39	-3	0.04	872	56.29
B-11	0.36	0	0.00	872	54.08

B-11	0.50	0	0.00	872	54.08
B-12	0.36	0	0.00	871	54.06

DATE	STATE	CITY	STATE	CITY	STATE

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Average	0.48	5		875
	0.22	= 2 more roots of 10		

0.69	= Square roots of Δp
Standard deviation of null angles =	4.2

METHOD 3a - DETERMINATION OF DRY MOLECULAR WEIGHT BY ANALYZER

Plant Name	Stewart and Stevenson Integration Center	Preliminary Run Date	08/31/21		
Sampling Location	Caterpillar G3520 TALE	Operator	TP		
Project #	catc-21-houston.tx-start#1	# of Ports Used	1 (gas probe)		
Fuel Type	Gas, Natural	Min. Fuel Factor	1.600	Max. Fuel Factor	1.836

Gas Analysis Data								
Run Number	R-1 100%-1		Date	08/31/21	Run Start Time	09:36	Run Stop Time	11:17
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:41	6.81	8.64	4.36	84.6	29.44	1.800	63.1	YES

Gas Analysis Data								
Run Number	R-1 100%-2		Date	08/31/21	Run Start Time	12:05	Run Stop Time	13:44
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:39	6.58	9.06	2.18	84.4	29.41	1.800	68.6	YES

Gas Analysis Data								
Run Number	R-1 100%-3		Date	08/31/21	Run Start Time	14:24	Run Stop Time	16:05
Sample Analysis Time	CO₂ Conc.	O₂ Conc.	CO Conc.	N₂ Conc.	Dry Molecular Weight	Calculated Fuel Factor	Excess Air	Fuel Factor in Range
	(%CO ₂)	(%O ₂)	(ppmCO)	(%N ₂)	(M _d)	(Fo)avg	(%EA)avg	
hh:mm	%	%	ppm	%	lb/lb-mole		%	
01:41	6.58	9.06	2.18	84.4	29.41	1.800	68.6	YES

METHOD 4 - DETERMINATION OF MOISTURE CONTENT IN STACK GASES

Plant Name	Stewart and Stevenson Integration Center	Preliminary Run Date	08/31/21
Sampling Location	Caterpillar G3520 TALE	Operator	TP
Project #	catc-21-houston.tx-start#1	Ports Used	2

Scale Daily Calibration					
Scale Number	SAMP-SC-0025	Standard	Result	Difference	Pass/Fail
Date		(g)	(g)	(g)	(± 0.5 g)
Test Day 1	08/31/21	500	499.5	-0.5	Pass

Moisture Content Data								
Run Number	R-1 100%-1		Date	08/31/21	Start Time	09:36	Stop Time	11:17
Meter Box Number	samp-cp-0021				Meter Cal Factor	(Y)	0.970	
Total Meter Volume	(V _m)	62.495	dcf		Barometric Pressure	(P _b)	29.72	in Hg
Average Stack Temp	(t _s) _{avg}	878	°F		Stack Static Pressure	(P _{static})	-0.36	in H ₂ O
Average Meter Temp	(t _m) _{avg}	84	°F		Avg Orifice Pressure	(ΔH) _{avg}	1.41	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	540.00	641.60	676.30	874.30			
Initial Value	(V _i),(W _i)	360.60	635.70	672.50	859.20			
Net Value	(V _n),(W _n)	179.4	5.9	3.8	15.1			
Results								
Total Weight	(W _t)	204.20	g	Water Vol Weighed	(V _{wsg(std)})	9.628	scf	
Std Meter Volume	(V _{m(std)})	58.697	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	14.09	%	Final Moisture Content	(B _{ws})	14.09	%	

Moisture Content Data								
Run Number	R-1 100%-2		Date	08/31/21	Start Time	12:05	Stop Time	13:44
Meter Box Number	samp-cp-0021				Meter Cal Factor	(Y)	0.970	
Total Meter Volume	(V _m)	62.465	dcf		Barometric Pressure	(P _b)	29.71	in Hg
Average Stack Temp	(t _s) _{avg}	878	°F		Stack Static Pressure	(P _{static})	-0.36	in H ₂ O
Average Meter Temp	(t _m) _{avg}	91	°F		Avg Orifice Pressure	(ΔH) _{avg}	1.43	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	521.40	609.40	723.30	860.10			
Initial Value	(V _i),(W _i)	346.10	604.10	719.20	844.50			
Net Value	(V _n),(W _n)	175.3	5.3	4.1	15.6			
Results								
Total Weight	(W _t)	200.30	g	Water Vol Weighed	(V _{wsg(std)})	9.444	scf	
Std Meter Volume	(V _{m(std)})	57.810	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	14.04	%	Final Moisture Content	(B _{ws})	14.04	%	

Moisture Content Data								
Run Number	R-1 100%-3		Date	08/31/21	Start Time	14:24	Stop Time	16:05
Meter Box Number	samp-cp-0021				Meter Cal Factor	(Y)	0.970	
Total Meter Volume	(V _m)	62.265	dcf		Barometric Pressure	(P _b)	29.66	in Hg
Average Stack Temp	(t _s) _{avg}	877	°F		Stack Static Pressure	(P _{static})	-0.36	in H ₂ O
Average Meter Temp	(t _m) _{avg}	77	°F		Avg Orifice Pressure	(ΔH) _{avg}	1.47	in H ₂ O
	Impinger 1	Impinger 2	Impinger 3	Impinger 4	Impinger 5	Impinger 6	Impinger 7	Impinger 8
	(g)	(g)	(g)	(g)				
Contents	Dry		DI Water	Sil Gel				
Final Value	(V _f),(W _f)	573.90	618.50	758.30	870.70			
Initial Value	(V _i),(W _i)	347.60	615.30	754.70	855.40			
Net Value	(V _n),(W _n)	226.3	3.2	3.6	15.3			
Results								
Total Weight	(W _t)	248.40	g	Water Vol Weighed	(V _{wsg(std)})	11.712	scf	
Std Meter Volume	(V _{m(std)})	59.138	dscf	Sat. Moisture Content	(B _{ws(svp)})	100.00	%	
Calc Moisture Content	(B _{ws(calc)})	16.53	%	Final Moisture Content	(B _{ws})	16.53	%	

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name		Stewart and Stevenson Integration Center				Date		08/31/21		Filter #			
Sampling Location		Caterpillar G3520 TALE				Operator		TP		0523			
Project #		catc-21-houston.tx-start#1				Run Number		R-1 100%-1		R-1 100%-1-CPM			

Leak Checks								Sampling Equipment								
[change]				[level]				[time]								
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec ≥60]	Meter Box Number	samp-cp-0021							
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec ≥60]	Meter Cal Factor	(Y)	0.970						
Pitot	Pre (+)	0.00	in H ₂ O	4.5	in H ₂ O for	15.0	sec ≥15]	Nozzle Number	H-10							
PASS	Pre (-)	0.00	in H ₂ O	5.1	in H ₂ O for	15.0	sec ≥15]	Average Nozzle Diameter	(D _{na})	0.2930	in					
	Post (+)	0.00	in H ₂ O	5.0	in H ₂ O for	15.0	sec ≥15]	Suggested Nozzle Diameter	(D _m)	0.2696	in					
	Post (-)	0.00	in H ₂ O	5.2	in H ₂ O for	15.0	sec ≥15]	Probe Number	samp-hp-0079		in					
								Probe Length	60		in					
								Liner Material	glass							
								Sample Case / Oven Number	samp-BH-0036							
								Impinger Case Number	samp-cc-0009							

Nozzle Measurements				ID: H-10		Barometer ID	
Pre	0.293	0.292	0.294	PASS		SAMP-WE-0014	
Post	0.293	0.292	0.294	PASS		Scale ID	
						SAMP-SC-0025	

Run Time				Weights							
Start	09:36	End	11:17	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre				360.6	635.7	672.5	859.2				
Post				540.0	641.6	676.3	874.3				

Ideal Nozzle Diameter and IsoKinetic Factor Setup				Pressures			
Pitot Coefficient / ID	(C _p)	0.8230	A5708	Barometric Pressure	(P _b)	29.72	in Hg
Average Stack Temp	(t _s)	877.8	°F	Stack Static Pressure	(P _{static})	-0.36	in H ₂ O
Average Meter Temp	(t _m)	83.5		Absolute Stack Pressure	(P _a)	29.69	in Hg
Orifice Meter Coefficient	(ΔH@)	1.812	in H ₂ O	Absolute Meter Pressure	(P _m)	29.85	in Hg
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.76	in H ₂ O				
Stack Moisture Content	(B _{wt})	14.09	%				
Stack Dry Molecular Weight	(M _d)	29.44	lb/lb-mole				
Estimated Orifice Flow Rate	(Q _m)	0.75	acfm				
ΔP to ΔH Isokinetic Factor	(K)	2.43					

Wash Volumes						ml
						ml

Identification Nos.		samp-cp-0021	samp-cp-0021	samp-cp-0021			samp-hp-0079	samp-hp-0079	samp-BH-0036	samp-cc-0009	2917	1004	samp-cp-0021	samp-cp-0021						
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (ΔP ^{1/2})	Local Stack Velocity (V _{sl})	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg	√(in H ₂ O)	ft/sec	dscf	%	dscf
A-1	0.0	00:00:00	921.610	0.65	1.577	1.60	888	888	252	53	73	84	77	77	4.5	0.81	72.46	2.402	94.3	57.638
A-2	3.8	00:03:45	924.135	0.66	1.601	1.60	890	890	253	56	77	85	79	79	5.0	0.81	73.07	5.097	100.0	61.170
A-3	7.5	00:07:30	926.980	0.65	1.577	1.60	888	888	249	56	85	84	79	79	5.0	0.81	72.46	7.817	102.3	62.536
A-4	11.3	00:11:15	929.850	0.71	1.722	1.70	887	887	249	54	83	82	79	79	5.0	0.84	75.70	10.566	102.6	63.394
A-5	15.0	00:15:00	932.750	0.72	1.746	1.80	885	885	250	58	85	81	81	81	5.0	0.85	76.17	13.584	104.8	65.201
A-6	18.8	00:18:45	935.945	0.75	1.819	1.80	882	882	253	55	82	79	80	80	5.0	0.87	77.66	15.836	101.5	63.343
A-7	22.5	00:22:30	938.325	0.65	1.577	1.60	875	875	252	57	81	81	81	81	5.0	0.81	72.11	18.607	102.5	63.794
A-8	26.3	00:26:15	941.260	0.56	1.358	1.30	874	874	248	61	82	83	83	83	3.5	0.75	66.90	21.079	102.7	63.236
A-9	30.0	00:30:00	943.890	0.49	1.188	1.20	862	862	256	63	73	83	82	82	3.5	0.70	62.30	23.437	103.0	62.498
A-10	33.8	00:33:45	946.395	0.40	0.970	0.98	863	863	246	60	74	83	84	84	3.5	0.63	56.31	25.762	104.1	61.828
A-11	37.5	00:37:30	948.875	0.39	0.946	0.95	855	855	248	61	69	83	84	84	3.0	0.62	55.43	27.754	103.8	60.553
A-12	41.3	00:41:15	951.000	0.39	0.946	0.95	855	855	256	66	74	85	84	84	3.0	0.62	55.43	29.628	103.2	59.257
B-1	45.0	00:45:00	953.000	0.51	1.237	1.20	882	882	256	66	73	85	85	85	3.5	0.71	64.04	31.805	102.7	58.717
B-2	48.8	00:48:45	955.325	0.53	1.286	1.30	884	884	246	52	77	82	84	84	4.0	0.73	65.33	34.198	102.8	58.624
B-3	52.5	00:52:30	957.875	0.57	1.383	1.40	884	884	251	50	75	78	85	85	4.0	0.75	67.75	36.600	102.6	58.560
B-4	56.3	00:56:15	960.440	0.61	1.480	1.50	885	885	250	54	55	78	84	84	4.0	0.78	70.11	39.003	102.3	58.505
B-5	60.0	01:00:00	963.000	0.63	1.528	1.50	886	886	254	55	55	79	85	85	4.0	0.79	71.28	41.486	102.1	58.568
B-6	63.8	01:03:45	965.650	0.66	1.601	1.60	886	886	250	57	57	80	86	86	4.5	0.81	72.96	44.077	102.0	58.769
B-7	67.5	01:07:30	968.420	0.71	1.722	1.70	882	882	253	58	60	79	86	86	4.5	0.84	75.56	46.631	101.7	58.903
B-8	71.3	01:11:15	971.150	0.65	1.577	1.60	878	878	253	58	66	84	86	86	4.5	0.81	72.19	49.297	101.8	59.157
B-9	75.0	01:15:00	974.000	0.58	1.407	1.40	876	876	249	59	62	85	87	87	4.5	0.76	68.14	51.836	102.0	59.241
B-10	78.8	01:18:45	976.720	0.56	1.358	1.40	875	875	251	60	59	85	87	87	4.5	0.75	66.93	54.286	102.0	59.221
B-11	82.5	01:22:30	979.345	0.47	1.140	1.10	870	870	251	56	57	85	88	88	3.5	0.69	61.20	56.515	102.0	58.972
B-12	86.3	01:26:15	981.740	0.46	1.116	1.10	874	874	255	63	61	85	89	89	3.5	0.68	60.64	58.713	102.0	58.713
Last Pt	90.0	01:30:00	984.105																	
Final Val	90.0	01:30:00	984.105												Max Vac	5.0	Final Values	58.713	102.0	
Average Values				0.58		1.41	878	878	251	58	71	82	84	84		0.76	68.00			
												84								

Notes:

Probe temp out of specification due to: stack temp

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Date	08/31/21
Operator	TP
Run Number	R-1 100%-2

Filter #	0916
	R-1 100%-2-CPM

Leak Checks		[change]		[level]		[time]	
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for	60.0	sec [≥60]
Pitot	Pre (+)	0.00	in H ₂ O	4.6	in H ₂ O for	15.0	sec [≥15]
	Pre (-)	0.00	in H ₂ O	4.3	in H ₂ O for	15.0	sec [≥15]
	Post (+)	0.00	in H ₂ O	5.1	in H ₂ O for	15.0	sec [≥15]
	Post (-)	0.00	in H ₂ O	4.3	in H ₂ O for	15.0	sec [≥15]

Sampling Equipment		
Meter Box Number	samp-cp-0021	
Meter Cal Factor	(Y)	0.970
Nozzle Number	H-10	
Average Nozzle Diameter	(D _{na})	0.2930 in
Suggested Nozzle Diameter	(D _m)	0.2494 in
Probe Number	samp-hp-0079	in
Probe Length	60	in
Liner Material	glass	
Sample Case / Oven Number	samp-BH-0036	
Impinger Case Number	samp-cc-0009	

Nozzle Measurements		ID: H-10	
Pre	0.293	0.292	PASS
Post	0.293	0.292	PASS

Barometer ID	
SAMP-WE-0014	
Scale ID	
SAMP-SC-0025	

Run Time	
Start	12:05
End	13:44

Weights	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre	346.1	604.1	719.2	844.5				
Post	521.4	609.4	723.3	860.1				

Ideal Nozzle Diameter and IsoKinetic Factor Setup			
Pitot Coefficient / ID	(C _p)	0.8230	A5708
Average Stack Temp	(t _s)	878.1	°F
Average Meter Temp	(t _m)	91.5	
Orifice Meter Coefficient	(ΔH@)	1.812	in H ₂ O
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.76	in H ₂ O
Stack Moisture Content	(B _{ws})	14.04	%
Stack Dry Molecular Weight	(M _d)	29.41	lb/lb-mole
Estimated Orifice Flow Rate	(Q _m)	0.65	acfm
ΔP to ΔH Isokinetic Factor	(K)	2.46	

Pressures		
Barometric Pressure	(P _b)	29.71 in Hg
Stack Static Pressure	(P _{static})	-0.36 in H ₂ O
Absolute Stack Pressure	(P _a)	29.68 in Hg
Absolute Meter Pressure	(P _m)	29.84 in Hg

Wash Volumes					ml
					ml

Identification Nos.		samp-cp-0021	samp-cp-0021	samp-cp-0021			samp-hp-0079	samp-hp-0079	samp-BH-0036	samp-cc-0009	3006	8471	samp-cp-0021	samp-cp-0021						
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (ΔP ^{1/2})	Local Stack Velocity (V _s)	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg	√(in H ₂ O)	ft/sec	dscf	%	dscf
A-1	0.0	00:00:00	984.410	0.60	1.477	1.50	883	883	255	64	46	84	88	88	4.5	0.77	69.51	2.534	103.3	60.807
A-2	3.8	00:03:45	987.130	0.60	1.477	1.50	881	881	251	59	47	84	87	87	4.5	0.77	69.46	5.025	102.4	60.303
A-3	7.5	00:07:30	989.800	0.64	1.576	1.60	883	883	247	56	50	76	88	88	4.5	0.80	71.79	7.541	101.3	60.327
A-4	11.3	00:11:15	992.500	0.63	1.551	1.50	883	883	254	56	51	73	88	88	4.5	0.79	71.23	10.009	100.6	60.056
A-5	15.0	00:15:00	995.150	0.64	1.576	1.60	882	882	250	56	57	73	89	89	4.5	0.80	71.76	12.627	101.1	60.611
A-6	18.8	00:18:45	997.965	0.68	1.674	1.70	882	882	247	56	63	77	90	90	4.5	0.82	73.97	15.074	99.9	60.296
A-7	22.5	00:22:30	1000.600	0.62	1.527	1.50	878	878	251	57	49	76	92	92	4.5	0.79	70.53	17.686	100.6	60.639
A-8	26.3	00:26:15	1003.425	0.56	1.379	1.40	874	874	250	56	49	72	91	91	4.5	0.75	66.93	20.104	100.7	60.311
A-9	30.0	00:30:00	1006.035	0.53	1.305	1.30	873	873	253	55	47	71	92	92	4.0	0.73	65.09	22.414	100.6	59.772
A-10	33.8	00:33:45	1008.535	0.47	1.157	1.10	872	872	253	56	48	70	93	93	3.5	0.69	61.27	24.637	100.7	59.128
A-11	37.5	00:37:30	1010.945	0.44	1.083	1.10	867	867	256	57	50	71	93	93	3.5	0.66	59.17	26.785	100.8	58.441
A-12	41.3	00:41:15	1013.275	0.44	1.083	1.10	862	862	251	56	52	71	94	94	3.5	0.66	59.06	28.880	100.7	57.759
B-1	45.0	00:45:00	1015.550	0.63	1.551	1.50	884	884	254	68	59	85	94	94	4.0	0.79	71.25	31.321	100.4	57.824
B-2	48.8	00:48:45	1018.200	0.63	1.551	1.50	886	886	252	56	64	84	94	94	4.0	0.79	71.31	33.781	100.2	57.911
B-3	52.5	00:52:30	1020.870	0.64	1.576	1.60	889	889	247	57	69	83	94	94	4.5	0.80	71.95	36.279	100.1	58.046
B-4	56.3	00:56:15	1023.580	0.67	1.650	1.60	884	884	248	61	52	80	96	96	4.5	0.82	73.48	38.915	100.2	58.372
B-5	60.0	01:00:00	1026.450	0.67	1.650	1.60	883	883	247	64	55	69	97	97	4.5	0.82	73.45	41.344	99.8	58.368
B-6	63.8	01:03:45	1029.100	0.69	1.699	1.70	882	882	249	63	55	70	96	96	4.5	0.83	74.51	44.145	100.3	58.860
B-7	67.5	01:07:30	1032.150	0.69	1.699	1.70	882	882	256	64	61	71	95	95	4.5	0.83	74.51	46.519	99.7	58.761
B-8	71.3	01:11:15	1034.730	0.70	1.724	1.70	887	887	254	64	66	73	93	93	4.5	0.84	75.19	49.124	99.7	58.948
B-9	75.0	01:15:00	1037.550	0.55	1.354	1.30	879	879	249	67	71	74	90	90	4.0	0.74	66.45	51.526	99.8	58.887
B-10	78.8	01:18:45	1040.140	0.45	1.108	1.10	878	878	254	64	52	74	88	88	3.5	0.67	60.09	53.764	100.0	58.652
B-11	82.5	01:22:30	1042.545	0.41	1.010	1.00	860	860	255	63	50	72	87	87	3.0	0.64	56.97	55.801	100.0	58.227
B-12	86.3	01:26:15	1044.730	0.42	1.034	1.00	860	860	248	67	48	73	86	86	3.0	0.65	57.66	57.804	99.9	57.804
Last Pt	90.0	01:30:00	1046.875																	
Final Val	90.0	01:30:00	1046.875												Max Vac	4.5	Final Values	57.804	99.9	
Average Values					0.58	1.43	878	878	251	60	55	75	91	91		0.76	68.19			
													91							

Notes:

Probe temp out of specification due to: stack temp

METHOD 5 (FRONT) AND 202 (BACK) SOURCE SAMPLING TITLE PAGE ISOKINETIC SAMPLING DATA

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Date	08/31/21
Operator	TP
Run Number	R-1 100%-3

Filter #	0917
	R-1 100%-3-CPM

Leak Checks			[change]	[level]	[time]
Train	Pre	0.000	ft ³ /min@	15.0	in Hg for 60.0 sec [≥60]
PASS	Post	0.000	ft ³ /min@	15.0	in Hg for 60.0 sec [≥60]
PASS	Pitot	Pre (+)	0.00	in H ₂ O	5.0 in H ₂ O for 15.0 sec [≥15]
		Pre (-)	0.00	in H ₂ O	6.0 in H ₂ O for 15.0 sec [≥15]
		Post (+)	0.00	in H ₂ O	5.8 in H ₂ O for 15.0 sec [≥15]
		Post (-)	0.00	in H ₂ O	5.2 in H ₂ O for 15.0 sec [≥15]

Sampling Equipment		
Meter Box Number	samp-cp-0021	
Meter Cal Factor	(Y)	0.970
Nozzle Number	H-10	
Average Nozzle Diameter	(D _{na})	0.2930 in
Suggested Nozzle Diameter	(D _m)	0.2501 in
Probe Number	samp-hp-0079	in
Probe Length	60	in
Liner Material	glass	
Sample Case / Oven Number	samp-BH-0036	
Impinger Case Number	samp-cc-0009	

Nozzle Measurements				ID: H-10
Pre	0.293	0.292	0.294	PASS
Post	0.293	0.292	0.294	PASS

Barometer ID
SAMP-WE-0014
Scale ID
SAMP-SC-0025

Run Time		
Start	14:24	End 16:05

Weights	Imp 1	Imp 2	Imp 3	Imp 4	Imp 5	Imp 6	Imp 7	Imp 8
Pre	347.6	615.3	754.7	855.4				
Post	573.9	618.5	758.3	870.7				

Ideal Nozzle Diameter and IsoKinetic Factor Setup			
Pitot Coefficient / ID	(C _p)	0.8230	A5708
Average Stack Temp	(t _s)	876.7	°F
Average Meter Temp	(t _m)	76.5	
Orifice Meter Coefficient	(ΔH@)	1.812	in H ₂ O
Square Root ΔP	(ΔP ^{1/2} _{avg})	0.76	in H ₂ O
Stack Moisture Content	(B _{ws})	16.53	%
Stack Dry Molecular Weight	(M _d)	29.41	lb/lb-mole
Estimated Orifice Flow Rate	(Q _m)	0.64	acfm
ΔP to ΔH Isokinetic Factor	(K)	2.28	

Pressures		
Barometric Pressure	(P _b)	29.66 in Hg
Stack Static Pressure	(P _{static})	-0.36 in H ₂ O
Absolute Stack Pressure	(P _a)	29.63 in Hg
Absolute Meter Pressure	(P _m)	29.79 in Hg

Wash Volumes					ml
					ml

Identification Nos.		samp-cp-0021	samp-cp-0021	samp-cp-0021			samp-hp-0079	samp-hp-0079	samp-BH-0036	samp-cc-0009	2917	1004	samp-cp-0021	samp-cp-0021						
Traverse Point #	Sampling Time (Θ)	Timer Time	Dry Gas Meter Reading (V _m)	Velocity Head (Δp)	Desired Orifice ΔH (ΔH _d)	Actual Orifice ΔH (ΔH _a)	Stack Temp (t _s)	Probe Temp (248±25°F)	Filter Temp (248±25°F)	Impinger Exit Temp (≤68°F)	Cond. Temp (≤85°F)	CPM Filter Temp (76.5±8.5°F)	Meter Inlet Temp (t _{mi})	Meter Outlet Temp (t _{mo})	Pump Vacuum	Square Root ΔP (ΔP ^{1/2})	Local Stack Velocity (v _s)	Cumul. Meter Volume (V _m) _{std}	Cumul. Percent IsoKinetic (I)	Est-Run Meter Volume (V _m) _{std}
	min	hh:mm:ss	ft ³	in H ₂ O	in H ₂ O	in H ₂ O	°F	°F	°F	°F	°F	°F	°F	°F	in Hg	√(in H ₂ O)	ft/sec	dscf	%	dscf
A-1	0.0	00:00:00	48.125	0.63	1.439	1.60	885	885	251	67	38	84	72	72	3.5	0.79	71.71	2.597	106.0	62.317
A-2	3.8	00:03:45	50.835	0.63	1.439	1.60	888	888	252	58	41	76	73	73	3.5	0.79	71.79	5.140	105.0	61.684
A-3	7.5	00:07:30	53.495	0.72	1.645	1.80	890	890	249	55	43	71	75	75	3.5	0.85	76.80	7.843	104.4	62.742
A-4	11.3	00:11:15	56.330	0.75	1.713	1.90	886	886	255	55	43	68	75	75	3.5	0.87	78.27	10.675	104.8	64.047
A-5	15.0	00:15:00	59.300	0.75	1.713	1.90	885	885	254	55	43	68	75	75	3.5	0.87	78.24	13.487	104.9	64.739
A-6	18.8	00:18:45	62.250	0.72	1.645	1.80	881	881	254	54	44	68	76	76	3.5	0.85	76.55	16.246	104.9	64.986
A-7	22.5	00:22:30	65.150	0.66	1.508	1.60	880	880	255	52	44	68	76	76	3.5	0.81	73.26	18.862	104.8	64.668
A-8	26.3	00:26:15	67.900	0.60	1.371	1.50	877	877	255	52	46	69	76	76	3.5	0.77	69.77	21.476	105.3	64.428
A-9	30.0	00:30:00	70.650	0.48	1.097	1.20	877	877	253	52	43	68	76	76	3.0	0.69	62.41	23.937	106.3	63.831
A-10	33.8	00:33:45	73.240	0.40	0.914	1.00	865	865	257	52	41	69	77	77	2.5	0.63	56.71	26.060	106.4	62.544
A-11	37.5	00:37:30	75.480	0.37	0.845	0.91	862	862	249	51	42	69	77	77	2.5	0.61	54.48	28.040	106.3	61.179
A-12	41.3	00:41:15	77.570	0.36	0.822	0.90	854	854	254	54	44	70	77	77	2.5	0.60	53.58	29.954	106.0	59.909
B-1	45.0	00:45:00	79.590	0.65	1.485	1.60	882	882	248	63	38	74	75	75	3.0	0.81	72.76	32.489	105.7	59.979
B-2	48.8	00:48:45	82.250	0.65	1.485	1.60	882	882	250	50	38	68	75	75	3.0	0.81	72.76	35.061	105.5	60.105
B-3	52.5	00:52:30	84.950	0.71	1.622	1.80	883	883	251	49	38	68	75	75	3.5	0.84	76.07	37.635	105.1	60.216
B-4	56.3	00:56:15	87.650	0.74	1.691	1.80	884	884	248	52	41	68	77	77	3.5	0.86	77.69	40.484	105.2	60.726
B-5	60.0	01:00:00	90.650	0.75	1.713	1.85	881	881	251	51	39	68	78	78	3.5	0.87	78.12	43.186	104.9	60.968
B-6	63.8	01:03:45	93.500	0.75	1.713	1.85	882	882	249	51	40	69	78	78	3.5	0.87	78.15	45.982	104.9	61.310
B-7	67.5	01:07:30	96.450	0.55	1.257	1.40	874	874	252	51	39	69	78	78	3.0	0.74	66.73	48.416	105.0	61.157
B-8	71.3	01:11:15	99.020	0.53	1.211	1.30	875	875	248	51	40	70	79	79	3.0	0.73	65.53	50.797	105.0	60.957
B-9	75.0	01:15:00	101.540	0.46	1.051	1.10	870	870	255	50	39	70	79	79	2.5	0.68	60.93	52.932	104.8	60.494
B-10	78.8	01:18:45	103.800	0.39	0.891	1.00	862	862	251	51	40	70	79	79	2.0	0.62	55.94	54.986	104.9	59.985
B-11	82.5	01:22:30	105.975	0.44	1.005	1.10	868	868	255	52	39	69	79	79	2.5	0.66	59.55	57.064	104.7	59.545
B-12	86.3	01:26:15	108.175	0.44	1.005	1.10	867	867	249	53	39	70	79	79	2.5	0.66	59.52	59.156	104.6	59.156
Last Pt	90.0	01:30:00	110.390																	
Final Val	90.0	01:30:00	110.390												Max Vac	3.5	Final Values	59.156	104.6	
Average Values				0.59		1.47	877	877	252	53	41	70	77	77		0.76	68.64			
													77							

Notes:

Probe temp out of specification due to: stack temp

APPENDIX C

CALIBRATION GAS CERTIFICATIONS



Assay Laboratory: Red Ball TGS
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150

CERTIFICATE OF ANALYSIS (Zero Ambient Nitrogen)

Cylinder Number:	CC727745	Certification Date:	03/16/2021
Product ID Number:	121026	Expiration Date:	03/14/2029
Cylinder Pressure:	1900 PSIG	MFG Facility:	RBTGS-Shreveport-LA
COA #	CC727745.20210316-0	Lot Number:	CC727745.20210316
Customer PO. NO.:		Tracking Number:	098853339
Customer:		Previous Certification Dates:	

This mixture is for laboratory use only, not for drug, household or other use.	
This mixture is certified in Mole % to be within $\pm 2\%$ of the actual number reported with a confidence of 95%.	
This mixture was manufactured by scale; weights traceable to N.I.S.T. Certificate #822/266926-02.	
Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).	

Composing Material: Zero Ambient Nitrogen, Cert., Sz152

Component	Specification	Concentration
Nitrogen	Balance	Balance
Oxygen as Impurity	<1.0 PPM	<1.0 PPM
Carbon Dioxide as Impurity	<0.5 PPM	<0.5 PPM
Carbon Monoxide as Impurity	<0.5 PPM	<0.5 PPM
Total Oxides of Nitrogen as Impurity	<0.1 PPM	<0.1 PPM
Sulfur Dioxide as Impurity	<0.1 PPM	<0.1 PPM
Total Hydrocarbons as Impurity	<0.1 PPM	<0.1 PPM

Red Ball Technical Gas Service
PGVP Vendor ID # G12021
Information and Ordering
800-551-8150
Fax (318-425-6309)



Brandon Theus
Laboratory Supervisor

Version 02-B, Revised on 2015-05-27



Red Ball Technical Gas Service
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150
PGVP Vendor ID # G12018

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	EB0059402	Certification Date:	06/06/2018
Product ID Number:	124605	Expiration Date:	06/04/2026
Cylinder Pressure:	1900 PSIG	MFG Facility:	- Shreveport - LA
COA #	EB0059402.20180530-0	Lot Number:	EB0059402.20180530
Customer PO. NO.:		Tracking Number:	074332991
Customer:		Previous Certification Dates:	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G2.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Carbon Dioxide	19.0 %	±0.19 %	NDIR	06/06/2018
Oxygen	21.0 %	±0.11 %	MPA	06/05/2018
Nitrogen	Balance			

Analytical Measurement Data Available Online.

Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
CC237204	CC237204.071001a	04/05/2023	NTRM	N2	O2	24.31 %	0.49	071001
EB0034340	EB0034340.20170209	05/09/2026	GMIS	N2	O2	20 %	0.5	071001
EB0072967	EB0072967.20170424	11/25/2025	GMIS	N2	CO2	9.52 %	0.753	C1309410.01

Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
O2	MPA	Thermo	410i	1162980025	05/11/2018
CO2	NDIR	Thermo	410i	1162980025	06/06/2018

SMART-CERT



This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

B. Theus

Brandon Theus
Analytical Chemist
Assay Laboratory: Red Ball TGS
Version 02-1, Revised on 2017-09-07



Red Ball Technical Gas Service
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150
PGVP Vendor ID # G12021

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	CC712952	Certification Date:	04/16/2021
Product ID Number:	124606	Expiration Date:	04/14/2029
Cylinder Pressure:	1900 PSIG	MFG Facility:	- Shreveport - LA
COA #	CC712952.20210412-0	Lot Number:	CC712952.20210412
Customer PO. NO.:		Tracking Number:	097024578
Customer:		Previous Certification Dates:	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Carbon Dioxide	8.95 %	±0.08 %	NDIR	04/16/2021
Oxygen	11.99 %	±0.03 %	MPA	04/16/2021
Nitrogen	Balance			

Analytical Measurement Data Available Online.

Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
FF61011	71-F-34	02/27/2026	SRM	N2	O2	20.753 %	0.101	SRM 2659a
EB0007615	EB0007615.20190610	11/24/2027	GMIS	N2	CO2	24.71 %	0.274	C1579010.02
EB0059422	EB0059422.20191017	01/07/2028	GMIS	N2	O2	12.02 %	0.139	SRM 2659a
EB0087520	EB0087520.20191025	03/08/2029	GMIS	N2	CO2	9.48 %	0.331	C1847810.03

Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
CO2	NDIR	Thermo	410i	1162980025	04/09/2021
O2	MPA	Thermo	410i	1162980025	04/08/2021

SMART-CERT



This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

Amisha Jewitt

Amisha Jewitt
Analytical Chemist
Assay Laboratory: Red Ball TGS
Version 02-J, Revised on 2018-09-17



Assay Laboratory: Red Ball TGS
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	EB0034654	Certification Date:	03/10/2014
Product ID Number:	125021	Expiration Date:	03/08/2022
Cylinder Pressure:	1900 PSIG	MFG Facility:	RBTGS-Shreveport-LA
COA #	EB0034654.20140306-0	Lot Number:	EB0034654.20140306
Customer PO. NO.:		Tracking Number:	056563667
Customer:		Previous Certification Dates:	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle
Propane	802 PPM	±2 PPM	FTIR
Nitrogen	Balance		

Analytical Measurement Data Available Online.

Reference Standard(s)

Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
GC1302210752	06/14/2021	GMIS	N2	C3H8	1003 PPM	0.587	2647a

Analytical Instrumentation

Component	Analytical Principle	Make	Model	Serial	MPC Date
C3H8	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	3/10/2014 10:30:00 AM

Red Ball Technical Gas Service
PGVP Vendor ID # G12014
Information and Ordering
800-551-8150
Fax (318-425-6309)

Fred Holt
Analyst



Cylinder Number:	EB0093622	Certification Date:	05/16/2017
Product ID Number:	125267	Expiration Date:	05/14/2025
Cylinder Pressure:	1900 PSIG	MFG Facility:	RBTGS-Shreveport-LA
COA #	EB0093622.20170427-0	Lot Number:	EB0093622.20170427
Customer PO. NO.:		Tracking Number:	095483935
Customer:		Previous Certification Dates:	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Propane	456 PPM	±1.5 PPM	FTIR	05/16/2017
Nitrogen	Balance			

Analytical Measurement Data Available Online.

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
EB0031829	EB0031829.20160114g	05/17/2024	GMIS	N2	C3H8	2461 PPM	0.57	2647a

Component	Analytical Principle	Make	Model	Serial	MPC Date
C3H8	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	05/16/2017



Brandon Theus
Analytical Chemis

This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of $k=2$ to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

Version 02-E, Revised on 2016-04-27



Assay Laboratory: Red Ball TGS
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	EB0032453	Certification Date:	03/10/2014
Product ID Number:	125020	Expiration Date:	03/08/2022
Cylinder Pressure:	1900 PSIG	MFG Facility:	RBTGS-Shreveport-LA
COA #	EB0032453.20140306-0	Lot Number:	EB0032453.20140306
Customer PO. NO.:		Tracking Number:	056560484
Customer:		Previous Certification Dates:	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle
Propane	302 PPM	±2 PPM	FTIR
Nitrogen	Balance		

Analytical Measurement Data Available Online.

Reference Standard(s)

Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
GC1302210752	06/14/2021	GMIS	N2	C3H8	1003 PPM	0.587	2647a

Analytical Instrumentation

Component	Analytical Principle	Make	Model	Serial	MPC Date
C3H8	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	3/10/2014 10:30:00 AM

Red Ball Technical Gas Service
PGVP Vendor ID # G12014
Information and Ordering
800-551-8150
Fax (318-425-6309)

Fred Holt
Analyst

APPENDIX D

QUALITY ASSURANCE AND QUALITY CONTROL DATA

QA/QC PROGRAM

AIR HYGIENE ensures the quality and validity of its emission measurement and reporting procedures through a rigorous quality assurance (QA) program. The program is developed and administered by an internal QA team and encompasses six major areas:

1. Field Qualifications
2. QA reviews of reports, laboratory work, and field testing;
3. Equipment calibration and maintenance;
4. Chain-of-custody;
5. Training; and
6. Knowledge of current test methods

Field Qualifications

Air Hygiene personnel are required to gain and maintain competence with testing methods and techniques according to their job titles and the roles they play during field testing events. Qualifications for each job description include:

Staff Technician - An entry level position with responsibility to test on the stack by performing duties that include: keep trucks and trailers stocked and clean, travel to and from job site, be the “hands of the test” on the stack; stay on a stack during the sample test, set up and tear down equipment on-site, perform maintenance on equipment in the shop and on-site.

Test Technician or Specialist - Acts as the “hands of the test” on the stack by performing duties that include: stay on a stack during the sample test, migrate to the testing trailer and learn the different analyzers and testing methods used on site, set up and tear down testing equipment on site, learn the system for testing from Testing Managers and Project Managers, travel to and from job site; including driving responsibilities under DOT requirements, follow directions of Testing Managers and Project Managers, learn the proper way to conduct on-site test of stationary stacks

Test Manager or Engineer - Directs and coordinates all aspects of a successful test by performing the following duties personally or through subordinate supervisors including: operating analyzers and consoles during testing along with QA/QC procedures, supervise set up and tear down of equipment on site, writing, reviewing, and revising final test reports, working with the client or state personnel while on the job site, managing pre-test checklists and onsite testing procedures, diagnose and repair any problems that may arise with the equipment, safely operate a man lift and drive a truck with or without a trailer, act as crew leader in the field, write protocols and reports, maintain project log of services performed on the job, verify all equipment needed for a job was loaded on the trailer. Test Managers must hold at least one QSTI certificate.

Project Manager - Directs and coordinates all aspects of a successful test by performing the following duties personally or through subordinate supervisors including: operating analyzers and consoles during testing along with QA/QC procedures, supervise set up and tear down of equipment on site, writing, reviewing, and revising final test reports, working with the client or state personnel while on the job site, managing pre-test checklists and onsite testing procedures, diagnose and repair any problems that may arise with the equipment, safely operate a man lift and drive a truck with or without a trailer, act as crew leader in the field, write protocols and reports, maintain project log of services performed on the job, verify all equipment needed for a job was loaded on the trailer. Project Managers typically hold QSTI certificates in Groups 1 through 4.

QA Reviews

Air Hygiene’s review procedure includes review of each source test report, along with laboratory and fieldwork, by the QA Team. The most important review is the one that takes place before a test program begins. The QA Team works closely with technical division personnel to prepare and review test protocols. Test protocol review includes selection of appropriate test procedures, evaluation of interferences or other restrictions that might preclude use of standard test procedures, and evaluation and/or development of alternate procedures.

Equipment Calibration and Maintenance

The equipment used to conduct the emission measurements is maintained according to the manufacturer’s instructions to ensure proper operation. In addition to the maintenance program, calibrations are carried out on each measurement device according to the schedule outlined by the Environmental Protection Agency. Quality control checks are also conducted in the field for each test program. In conformance with ASTM D7036 Section 15.3.15, all metering and monitoring equipment meets or exceeds the uncertainty criteria contained in the method language that pertains to that equipment.

Chain-of-Custody

Air Hygiene maintains full chain-of-custody documentation on all samples and data sheets. In addition to normal documentation of changes between field sample custodians, laboratory personnel, and field test personnel, Air Hygiene documents every individual who handles any test component in the field (e.g., probe wash, impinger loading and recovery, filter loading and recovery, etc.). Samples are stored in a locked area to which only Air Hygiene personnel have access. Field data sheets are secured at Air Hygiene's offices upon return from the field.

Training

Personnel's training is essential to ensure quality testing. Air Hygiene has formal and informal training programs, which include:

1. Attendance at EPA-sponsored training courses
2. Enrollment in EPA correspondence courses
3. A requirement for all technicians to read and understand Air Hygiene's QA manual
4. In-house training and QA meetings on a regular basis
5. Maintenance of training records

Knowledge of Current Test Methods

With the constant updating of standard test methods and the wide variety of emerging test procedures, it is essential that any qualified source tester keep abreast of new developments. Air Hygiene subscribes to services, which provide updates on EPA reference methods, rules, and regulations. Additionally, source test personnel regularly attend and present papers at testing and emission-related seminars and conferences. Air Hygiene personnel maintain membership in the Air and Waste Management Association and the American Industrial Hygiene Association.

Reproduction and Distribution Policy

Reproducing portions of this test report may omit critical or substantial documentation or be taken out of context and due care must be exercised in this regard. Furthermore, this test report and its associated data shall not be reproduced in full or in part without the written consent of the customer.

Data Provided by Client

Data provided by the Client is clearly identified in the report. Air Hygiene accepts data provided by the Client as accurate.

COMBUSTION TESTING QUALITY ASSURANCE ACTIVITIES

In conformance with ASTM D7036 Section 15.3.11 and 13, all testing was performed without any real or apparent errors, with the exception of those that would be listed in Section 2.0 of this report. In addition, all testing was conducted according to the approved testing protocol, test methods, Air Hygiene Quality Manual, or ASTM D7036, with the exception of specifics noted in Section 2.0 of this report. A number of quality assurance activities were undertaken before, during, and after this testing project. This section of the report combined with the documentation in Appendix C describes each of those activities.

Each instrument's response was checked and adjusted in the field prior to the collection of data via multi-point calibration. The instrument's linearity was checked by adjusting its zero and span responses to zero nitrogen and an upscale calibration gas in the range of the expected concentrations. The instrument response was then challenged with other calibration gases of known concentration and accepted as being linear if the response of the other calibration gases agreed within plus or minus two percent of the range of predicted values. NO₂ to NO conversion was checked via direct connect with an EPA Protocol certified concentration of NO₂ in a balance of air or nitrogen. Conversion was verified to be between 90 and 110 percent.

After each test run, the analyzers were checked for zero and span drift. This allowed each test run to be bracketed by calibrations and documents the precision of the data just collected. The criterion for acceptable data is that the instrument drift is no more than three percent of the full-scale response. The quality assurance worksheets in the following pages summarize all multipoint calibration checks and zero to span checks performed during the tests. These worksheets (as prepared from the data records of Appendix A) show that no drifts in excess of three percent occurred in the zero to span checks following each test run.

The sampling systems were leak checked by demonstrating that a vacuum greater than 10 in Hg could be held for at least one minute with a decline of less than one inch of Hg. A leak test was conducted after the sample system was set up and before the system was dismantled. This test was conducted to ensure that ambient air had not diluted the sample. Any leakage detected prior to the tests would be repaired and another leak check conducted before testing commenced. No leaks were found during the pre or post-test leak checks.

The absence of leaks in the sampling system was also verified by a sampling system bias check. The sampling system's integrity was tested by comparing the responses of the analyzers to the calibration gases introduced via two paths. The first path was directly into the analyzer and the second path via the sample system at the sample probe. Any difference in the instrument responses by these two methods was attributed to sampling system bias or leakage. The criterion for acceptance is agreement within five percent of the span of the analyzer.

The control gases used to calibrate the instruments were analyzed and certified by the compressed gas vendors to plus or minus one percent accuracy for all gases. EPA Protocol No. 1 was used, where applicable to assign the concentration values traceable to the National Institute of Standards and Technology (NIST), Standard Reference Materials (SRM's). The gas calibration sheets as prepared by the vendor are contained in Appendix C.

Air Hygiene collected and reported the enclosed test data in accordance with the procedures and quality assurance activities described in this test report. Air Hygiene makes no warranty as to the suitability of the test methods. Air Hygiene also assumes no liability relating to the interpretation and use of the test data.

INSTRUMENTAL ANALYSIS QUALITY ASSURANCE DATA

Date: July 29-30, 2021
Company: Catalytic Combustion Corporation
Location: Houston, Texas
Techs: PM / CK / WN

Sample System Leak Check

Date	Sample System	Leak Rate (l/min)
July 29-30, 2021	1	0



Accredited Laboratory

AIR HYGIENE INTERNATIONAL, INC.

A2LA has accredited

Broken Arrow, OK

for technical competence in the field of

Environmental Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This laboratory also meets the A2LA R219 – Specific Requirements – TNI Field Sampling and Measurement Organization Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 18th day of December 2019

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3796.01
Valid to August 31, 2021

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.



American Association for Laboratory Accreditation

Accredited Air Emission Testing Body

A2LA has accredited

AIR HYGIENE INTERNATIONAL, INC.

In recognition of the successful completion of the joint A2LA and Stack Testing Accreditation Council (STAC) evaluation process, this laboratory is accredited to perform testing activities in compliance with ASTM D7036:2004 - Standard Practice for Competence of Air Emission Testing Bodies.

Presented this 18th day of December 2019.



Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3796.02
Valid to August 31, 2021

This accreditation program is not included under the A2LA ILAC Mutual Recognition Arrangement.



Texas Commission on Environmental Quality



NELAP-Recognized Laboratory Accreditation is hereby awarded to

Air Hygiene International, Inc.

1600 West Tacoma

Broken Arrow, OK 74102-1483

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current location(s) and accreditation status for particular methods and analyses (www.tceq.texas.gov/goto/lab). Accreditation does not imply that a product, process, system or person is approved by the Texas Commission on Environmental Quality.

A handwritten signature in black ink, appearing to read "T. Beh", located below the main text of the certificate.

Certificate Number: T104704523-21-9

Effective Date: 3/1/2021

Expiration Date: 2/28/2022

**Executive Director Texas Commission on
Environmental Quality**



Texas Commission on Environmental Quality



NELAP-Recognized Laboratory Accreditation is hereby awarded to

Air Hygiene International, Inc. - Mobile Lab (OK 6782JZ)

1600 West Tacoma
Broken Arrow, OK 74102-1483

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current location(s) and accreditation status for particular methods and analyses (www.tceq.texas.gov/goto/lab). Accreditation does not imply that a product, process, system or person is approved by the Texas Commission on Environmental Quality.

A handwritten signature in black ink, appearing to read "T. B. Baker", is placed over the signature line.

Certificate Number: 1M104704523-21-9
Effective Date: 3/1/2021
Expiration Date: 2/28/2022

Executive Director Texas Commission on
Environmental Quality

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

PATRICK K. McGOVERN, Jr.

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

**MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE
SAMPLING METHODS**

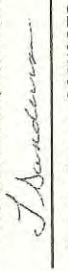
ISSUED THIS 4TH DAY OF SEPTEMBER 2020 AND EFFECTIVE UNTIL SEPTEMBER 3RD, 2025



Peter R. Westlin, QSTI/QSTO Review Board



Peter S. Pakalnis, QSTI/QSTO Review Board



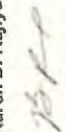
Tina Sanderson, QSTI/QSTO Review Board



J. Wade Bice, QSTI/QSTO Review Board



Karen D. Kajiye-Mills, QSTI/QSTO Review Board



Bruce Randall, QSTI/QSTO Review Board



CERTIFICATE
NO.

2008-133

SOURCE EVALUATION SOCIETY



Qualified Source Testing Individual

LET IT BE KNOWN THAT

PATRICK K. MCGOVERN, Jr.

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED
EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES
ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

ISSUED THIS 10TH DAY OF NOVEMBER 2017 AND EFFECTIVE UNTIL NOVEMBER 9TH, 2022



CERTIFICATE
NO.
2008-133

J. Wade Bice
J. Wade Bice, QSTI/QSTO Review Board

Karen D. Kajiya-Mills
Karen D. Kajiya-Mills, QSTI/QSTO Review Board

Bruce Randall
Bruce Randall QSTI/QSTO Review Board

Peter R. Westlin
Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis
Peter S. Pakalnis, QSTI/QSTO Review Board

Theresa M. Lowe
Theresa Lowe, QSTI/QSTO Review Board

QUALITY ASSURANCE AND QUALITY CONTROL DATA

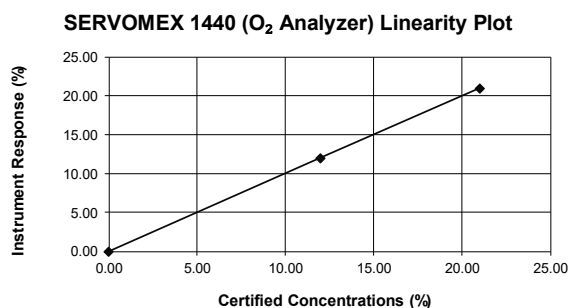
Reference Method Analyzer Daily Calibration Data

Calibration Date: July 29, 2021
Client: Catalytic Combustion Corporation

Location: Stewart & Stevenson Integration Center -

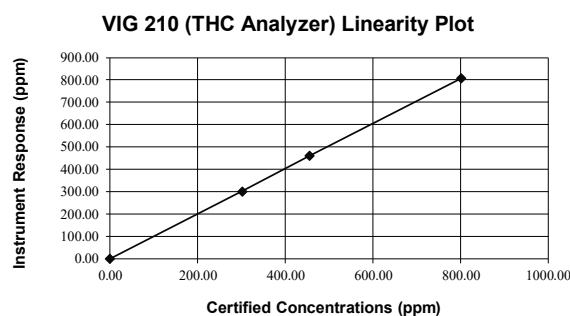
O₂ Span (%) = 21.00

SERVOMEX 1440 (O ₂ Analyzer)				
Certified Concentration (%)	Instrument Response (%)	Calibration Error (%)	Absolute Conc. (%)	Pass (±2%, ≤0.5%)
0.00	0.05	0.24	0.05	YES (%)
11.99	12.02	0.14	0.03	YES (%)
21.00	21.01	0.05	0.01	YES (%)
Linearity = 1.002				



THC (as C₃H₈) Range (ppm) = 1000

VIG 210 (THC Analyzer)				
Certified Concentration (ppm)	Instrument Response (ppm)	Calibration Error (%)	Estimated Point (ppm)	Pass (±2,5%) ¹
0.00	1.42	0.14	N/A	YES
302.00	304.24	-0.36	305.31	YES
456.00	461.70	0.31	460.28	YES
802.00	808.45	0.65	N/A	YES
Linearity = 0.993				



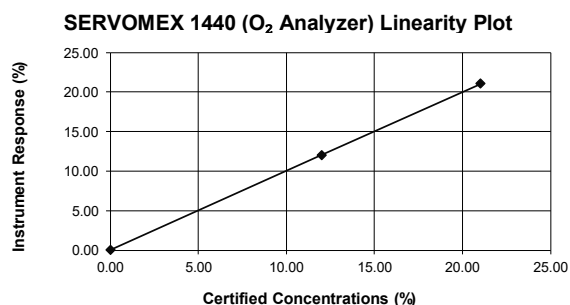
¹ zero/high based on 2% of span, low/mid based on 5% of concentration

Calibration Date: July 30, 2021
Client: Catalytic Combustion Corporation

Location: Stewart & Stevenson Integration Center -

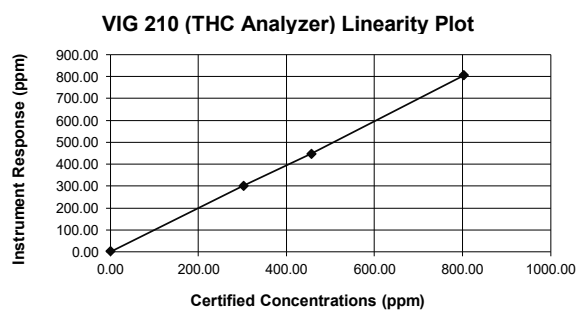
O₂ Span (%) = 21.00

SERVOMEX 1440 (O ₂ Analyzer)				
Certified Concentration (%)	Instrument Response (%)	Calibration Error (%)	Absolute Conc. (%)	Pass (±2%, ≤0.5%)
0.00	0.06	0.29	0.06	YES (%)
11.99	12.03	0.19	0.04	YES (%)
21.00	21.06	0.29	0.06	YES (%)
Linearity = 1.000				



THC (as C₃H₈) Range (ppm) = 1000

VIG 210 (THC Analyzer)				
Certified Concentration (ppm)	Instrument Response (ppm)	Calibration Error (%)	Estimated Point (ppm)	Pass (±2,5%) ¹
0.00	1.86	0.19	N/A	YES
302.00	301.28	-1.04	304.43	YES
456.00	446.31	-2.72	458.72	YES
802.00	805.37	0.34	N/A	YES
Linearity = 0.987				



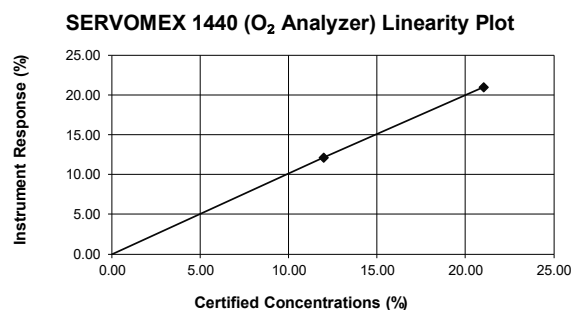
¹-zero/high based on 2% of span, low/mid based on 5% of concentration

Calibration Date: September 1, 2021
Client: Catalytic Combustion Corporation

Location: Stewart & Stevenson Integration Center

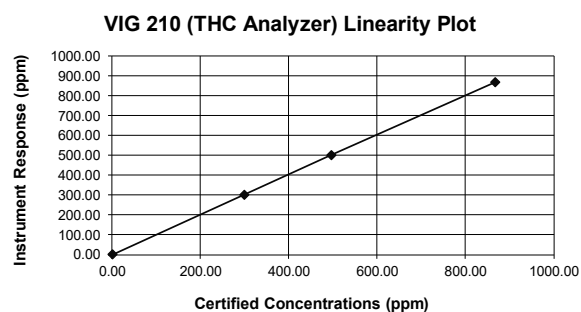
O₂ Span (%) = 21.00

SERVOMEX 1440 (O ₂ Analyzer)				
Certified Concentration (%)	Instrument Response (%)	Calibration Error (%)	Absolute Conc. (%)	Pass (±2%, ≤0.5%)
0.00	0.00	-0.01	0.00	YES (%)
11.96	12.09	0.62	0.13	YES (%)
21.00	20.97	-0.14	0.03	YES (%)
Linearity = 1.001				



THC (as C₃H₈) Range (ppm) = 1000

VIG 210 (THC Analyzer)				
Certified Concentration (ppm)	Instrument Response (ppm)	Calibration Error (%)	Estimated Point (ppm)	Pass (±2.5%) ¹
0.00	0.19	0.02	N/A	YES
299.00	300.99	0.50	299.51	YES
495.00	500.30	0.93	495.71	YES
867.00	868.10	0.11	N/A	YES
Linearity = 1.003				



¹ zero/high based on 2% of span, low/mid based on 5% of concentration

DRIFT AND BIAS CHECK AND RESPONSE TIME CALCULATOR		
Strat Test Pre and Post QA/QC Check	O ₂	NO _x
Initial Zero	0.03	0.66
Final Zero	0.05	0.21
Avg. Zero	0.04	0.44
Initial UpScale	11.98	10.99
Final UpScale	11.97	10.97
Avg. UpScale	11.98	10.98
Sys Resp (Zero)	0.05	0.00
Sys Resp (Upscale)	12.02	11.00
Upscale Cal Gas	11.99	10.80
Initial Zero Bias	-0.10%	3.03%
Final Zero Bias	0.00%	0.96%
Zero Drift	0.10%	2.06%
Initial Upscale Bias	-0.19%	-0.05%
Final Upscale Bias	-0.24%	-0.14%
Upscale Drift	0.05%	0.09%
Alternative Specification n Abs Diff	Initial Zero	0.02
	Final Zero	0.00
	Initial Upscale	0.04
	Final Upscale	0.05
Calibration Span	21.00	21.80
3% of Cal. Span (drift)	0.63	0.65
5% of Cal. Span (bias)	1.05	1.09

Response Time (min)	0.8	1.2
Sys. Response (min)	1.2	

Date/Time mm/dd/yy hh:mm:ss	z	O ₂ %-10	s	z	NO _x ppm-10	s
07/30/21 10:20:43		8.92			6.51	
07/30/21 10:20:53		8.92			6.51	
07/30/21 10:21:03		8.91			6.56	
07/30/21 10:21:13		8.79			6.62	
07/30/21 10:21:23		10.25			6.73	
07/30/21 10:21:33		11.72	x		6.63	
07/30/21 10:21:43		11.94			3.53	
07/30/21 10:21:53		11.96		x	0.70	
07/30/21 10:22:03		11.97			0.64	
07/30/21 10:22:13		11.97			0.56	
07/30/21 10:22:23		11.97			0.66	
07/30/21 10:22:33		11.98			0.77	
07/30/21 10:22:43		11.98			0.52	
07/30/21 10:22:53		11.79			0.39	
07/30/21 10:23:03		8.98			0.88	
07/30/21 10:23:13		2.37			1.65	
07/30/21 10:23:23	x	0.38			6.15	
07/30/21 10:23:33		0.16			10.27	
07/30/21 10:23:43		0.04			10.59	x
07/30/21 10:23:53		0.04			10.95	
07/30/21 10:24:03		0.03			10.95	
07/30/21 10:24:13		0.03			10.99	

INJECTIONS

x

x

x

DRIFT AND BIAS CHECK		
50% Load, Run - 1-1	O ₂	THC (as C ₃ H ₈)
Raw Average	8.69	157.35
Corrected Average	8.67	183.85
Initial Zero	0.03	2.53
Final Zero	0.07	0.12
Avg. Zero	0.05	1.33
Initial UpScale	12.03	306.71
Final UpScale	11.98	307.25
Avg. UpScale	12.01	306.98
Sys Resp (Zero)	0.05	1.42
Sys Resp (Upscale)	12.02	304.24
Upscale Cal Gas	11.99	302.00
Initial Zero Bias	-0.10%	0.11%
Final Zero Bias	0.10%	-0.13%
Zero Drift	0.19%	0.24%
Initial Upscale Bias	0.05%	0.25%
Final Upscale Bias	-0.19%	0.30%
Upscale Drift	0.24%	0.05%
Alternative Specification Abs Diff	Initial Zero	0.02
	Final Zero	0.02
	Initial Upscale	0.01
	Final Upscale	0.04
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
50% Load, Run - 1-2	O ₂	THC (as C ₃ H ₈)
Raw Average	8.75	163.11
Corrected Average	8.74	190.60
Initial Zero	0.07	0.12
Final Zero	0.08	0.21
Avg. Zero	0.08	0.17
Initial UpScale	11.98	307.25
Final UpScale	11.97	317.42
Avg. UpScale	11.98	312.34
Sys Resp (Zero)	0.05	1.42
Sys Resp (Upscale)	12.02	304.24
Upscale Cal Gas	11.99	302.00
Initial Zero Bias	0.10%	-0.13%
Final Zero Bias	0.14%	-0.12%
Zero Drift	0.05%	0.01%
Initial Upscale Bias	-0.19%	0.30%
Final Upscale Bias	-0.24%	1.32%
Upscale Drift	0.05%	1.02%
Alternative Specification Abs Diff	Initial Zero	0.02
	Final Zero	0.03
	Initial Upscale	0.04
	Final Upscale	0.05
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
50% Load, Run - 1-3	O ₂	THC (as C ₃ H ₈)
Raw Average	8.80	168.64
Corrected Average	8.79	197.00
Initial Zero	0.08	0.21
Final Zero	0.09	0.17
Avg. Zero	0.09	0.19
Initial UpScale	11.97	317.42
Final UpScale	11.98	314.03
Avg. UpScale	11.98	315.73
Sys Resp (Zero)	0.05	1.42
Sys Resp (Upscale)	12.02	304.24
Upscale Cal Gas	11.99	302.00
Initial Zero Bias	0.14%	-0.12%
Final Zero Bias	0.19%	-0.13%
Zero Drift	0.05%	0.00%
Initial Upscale Bias	-0.24%	1.32%
Final Upscale Bias	-0.19%	0.98%
Upscale Drift	0.05%	0.34%
Alternative Specification Abs Diff	Initial Zero	0.03
	Final Zero	0.04
	Initial Upscale	0.05
	Final Upscale	0.04
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
75% Load, Run - 2-1	O ₂	THC (as C ₃ H ₈)
Raw Average	8.97	151.87
Corrected Average	8.95	176.40
Initial Zero	0.07	0.13
Final Zero	0.06	0.27
Avg. Zero	0.07	0.20
Initial UpScale	12.01	304.51
Final UpScale	11.97	310.21
Avg. UpScale	11.99	307.36
Sys Resp (Zero)	0.06	1.86
Sys Resp (Upscale)	12.03	301.28
Upscale Cal Gas	11.99	302.00
Initial Zero Bias	0.05%	-0.17%
Final Zero Bias	0.00%	-0.16%
Zero Drift	0.05%	0.01%
Initial Upscale Bias	-0.10%	0.32%
Final Upscale Bias	-0.29%	0.89%
Upscale Drift	0.19%	0.57%
Alternative Specification Abs Diff	Initial Zero	0.01
	Final Zero	0.00
	Initial Upscale	0.02
	Final Upscale	0.06
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
75% Load, Run - 2-2	O ₂	THC (as C ₃ H ₈)
Raw Average	8.95	169.71
Corrected Average	8.96	197.01
Initial Zero	0.06	0.27
Final Zero	0.04	0.44
Avg. Zero	0.05	0.36
Initial UpScale	11.97	310.21
Final UpScale	11.95	303.21
Avg. UpScale	11.96	306.71
Sys Resp (Zero)	0.06	1.86
Sys Resp (Upscale)	12.03	301.28
Upscale Cal Gas	11.99	302.00
Initial Zero Bias	0.00%	-0.16%
Final Zero Bias	-0.10%	-0.14%
Zero Drift	0.10%	0.02%
Initial Upscale Bias	-0.29%	0.89%
Final Upscale Bias	-0.38%	0.19%
Upscale Drift	0.10%	0.70%
Alternative Specification Abs Diff	Initial Zero	0.00
	Final Zero	0.02
	Initial Upscale	0.06
	Final Upscale	0.08
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
75% Load, Run - 2-3	O ₂	THC (as C ₃ H ₈)
Raw Average	8.91	164.95
Corrected Average	8.94	190.89
Initial Zero	0.04	0.44
Final Zero	0.06	1.21
Avg. Zero	0.05	0.83
Initial UpScale	11.95	303.21
Final UpScale	11.94	312.59
Avg. UpScale	11.95	307.90
Sys Resp (Zero)	0.06	1.86
Sys Resp (Upscale)	12.03	301.28
Upscale Cal Gas	11.99	302.00
Initial Zero Bias	-0.10%	-0.14%
Final Zero Bias	0.00%	-0.07%
Zero Drift	0.10%	0.08%
Initial Upscale Bias	-0.38%	0.19%
Final Upscale Bias	-0.43%	1.13%
Upscale Drift	0.05%	0.94%
Alternative Specification Abs Diff	Initial Zero	0.02
	Final Zero	0.00
	Initial Upscale	0.08
	Final Upscale	0.09
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
100% Load, Run - 3-1	O ₂	THC (as C ₃ H ₈)
Raw Average	8.60	99.12
Corrected Average	8.64	114.77
Initial Zero	0.01	0.19
Final Zero	0.02	0.20
Avg. Zero	0.02	0.20
Initial UpScale	11.85	300.98
Final UpScale	11.94	300.31
Avg. UpScale	11.90	300.65
Sys Resp (Zero)	0.00	0.19
Sys Resp (Upscale)	12.09	300.99
Upscale Cal Gas	11.96	299.00
Initial Zero Bias	0.08%	0.00%
Final Zero Bias	0.11%	0.00%
Zero Drift	0.03%	0.00%
Initial Upscale Bias	-1.14%	0.00%
Final Upscale Bias	-0.71%	-0.07%
Upscale Drift	0.43%	0.07%
Alternative Specification Abs Diff	Initial Zero	--
	Final Zero	--
	Initial Upscale	--
	Final Upscale	--
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
100% Load, Run - 3-2	O ₂	THC (as C ₃ H ₈)
Raw Average	9.05	93.36
Corrected Average	9.06	107.19
Initial Zero	0.02	0.20
Final Zero	0.02	0.20
Avg. Zero	0.02	0.20
Initial UpScale	11.94	300.31
Final UpScale	11.95	300.00
Avg. UpScale	11.95	300.16
Sys Resp (Zero)	0.00	0.19
Sys Resp (Upscale)	12.09	300.99
Upscale Cal Gas	11.96	299.00
Initial Zero Bias	0.11%	0.00%
Final Zero Bias	0.11%	0.00%
Zero Drift	0.00%	0.00%
Initial Upscale Bias	-0.71%	-0.07%
Final Upscale Bias	-0.67%	-0.10%
Upscale Drift	0.05%	0.03%
Alternative Specification Abs Diff	Initial Zero	--
	Final Zero	--
	Initial Upscale	--
	Final Upscale	--
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

DRIFT AND BIAS CHECK		
100% Load, Run - 3-3	O ₂	THC (as C ₃ H ₈)
Raw Average	9.23	94.52
Corrected Average	9.25	108.68
Initial Zero	0.02	0.20
Final Zero	0.02	0.21
Avg. Zero	0.02	0.21
Initial UpScale	11.95	300.00
Final UpScale	11.90	299.31
Avg. UpScale	11.93	299.66
Sys Resp (Zero)	0.00	0.19
Sys Resp (Upscale)	12.09	300.99
Upscale Cal Gas	11.96	299.00
Initial Zero Bias	0.11%	0.00%
Final Zero Bias	0.11%	0.00%
Zero Drift	0.00%	0.00%
Initial Upscale Bias	-0.67%	-0.10%
Final Upscale Bias	-0.90%	-0.17%
Upscale Drift	0.24%	0.07%
Alternative Specification Abs Diff	Initial Zero	--
	Final Zero	--
	Initial Upscale	--
	Final Upscale	--
Calibration Span	21.00	1,000.00
3% of Cal. Span (drift)	0.63	30.00
5% of Cal. Span (bias)	1.05	50.00

ENGINE TEST - FIELD DATA SHEET

Company:		Catalytic Combustion Corporation	
Facility Name:		Stewart & Stevenson Intergration Center	
Location (county & state):		Houston, Texas	
Physical Address or GPS Coordinates:		10750 Telge Road Houston, Texas	
Project Code:		catc-21-houston.tx-start#1	
Date:		7/29/2021	
Unit Make and Model:			
Unit Number:			
Serial Number:			
Data Recorded By:		CK	
Tested With AHI Unit(s):		Truck(s):	173
LDEQ Warmup/Cal Req:		On (Day/Time):	Cal (Day/Time):
RUN INFORMATION		Run #1	Run #2
Time Start (hh:mm:ss)		01:34:23	12:05:23
Time Stop (hh:mm:ss)		10:33:53	13:04:53
Barometric Pressure (in. Hg)		29.9	29.9
Ambient Temperature (°F)		96	96
Relative Humidity (%)		53	49
Stack Temperature (°F)			
Fuel Usage (btu/hp*hr or SCFM)			
Rated Horsepower (hp)			
Rated Engine RPM		502	502
Load % or BHP from panel		1799	1799
Engine Speed RPM		25.2	25.3
Air Manifold Pressure (psia/in. Hg)		12.2	12.4
Air Manifold Temperature (°F)		1350	1350
Kilowatts (KW)		56	56
Ampere (A)		23	23
Engine Operating Hours			
Engine Timing (degrees)			

CYLINDER SERIAL NUMBERS	N2/Low	O2	VOC
	Mid	CC727745	EB0032453
	High	CC712952	EB0093622
		EB0059402	EB0034654
	N2/Low	NOx	CO
	Mid		
High			

NO2 CONVERSION	
NO2 Gas (ppm)	
NO Reading (ppm)	
NOx Reading (ppm)	
Cylinder Num	
Time	

Probe Used:	Multi Point Rake Pre-Hung Shepherd's hook Ports where used
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REPORT INFORMATION	
INSTRUMENT	SERIAL #
O2	
NOx	
CO	
Dilutor	
VOC	
FTIR	

Customer Number:	
Regulated Entity Number:	
Permit ID:	

CALIBRATION	O2		NOx		CO		VOC	
	Conc.	Actual	Conc.	Actual	Conc.	Actual	Conc.	Actual
	Zero Gas	0			0	1.42		
	Low Gas					302	304.34	
	Mid Gas	12.0	12.02			456	461.70	
High Gas	21	21.01			802	808.45		

BIAS	O2		NOx		CO		VOC	
	Zero	Mid	Zero	Mid	Zero	Mid	Zero	Mid
	.03	12.03			2.53	306.71		
	.07	11.96			.12	307.25		
	.08	11.97			.21	317.92		
Run #1/Run #2								
Run #2/Run #3								
Run #3/Run #4								
Run #4/Final								

Bias Gas Actual Conc.



AIR HYGIENE

Signature: *[Signature]*

ENGINE TEST - FIELD DATA SHEET									
Company:		Catalytic Combustion Corporation							
Facility Name:		Stewart & Stevenson Intergration Center							
Location (county & state):		Houston, Texas							
Physical Address or GPS Coordinates:		10750 Teige Road Houston, Texas							
Project Code:		catc-21-houston.tx-start#1							
Date:		7/30/2021							
Unit Make and Model:									
Unit Number:									
Serial Number:		CK							
Data Recorded By:		CK							
Tested With AHI Unit(s):		Truck(s):		173		Trailer(s):		217	
LDEQ Warmup/Cal Req:		On (Day/Time):		Cal (Day/Time):					
RUN INFORMATION									
Time Start (hh:mm:ss)		Run #1		Run #2		Run #3			
Time Stop (hh:mm:ss)		13:45:53		15:00:23		16:28:33			
Barometric Pressure (in. Hg)		14:44:53		15:59:53		17:26:53			
Ambient Temperature (°F)		29.89		29.87		29.46			
Relative Humidity (%)		44		47		47			
Stack Temperature (°F)		53		47		42			
Fuel Usage (btu/hp·hr or SCFM)									
Rated Horsepower (hp)									
Rated Engine RPM									
Load % or BHP from panel		75		75		75			
Engine Speed RPM		1500		1500		1500			
Air Manifold Pressure (psig or in. Hg)		36.4		36.7		35.6			
Air Manifold Temperature (°F)		131		131		129			
Kilowatts (KW)		2007		2012		1951			
Ampere (A)		89		90		97			
Engine Operating Hours									
Engine Timing (degrees)		23		23		23			

CALIBRATION	O ₂		NOx		CO		VOC	
	Conc.	Actual	Conc.	Actual	Conc.	Actual	Conc.	Actual
Zero Gas	0	1.06			0	1.86		
Low Gas					302	301.29		
Mid Gas	12.0	12.03			458	446.31		
High Gas	21	21.06			802	805.37		

BIAS	O ₂		NOx		CO		VOC	
	Zero	Mid	Zero	Mid	Zero	Mid	Zero	Mid
Initial/Run #1	.07	12.01			.13	304.51		
Run #1/Run #2	.06	11.97			.27	310.21		
Run #2/Run #3	.04	11.95			.44	307.2		
Run #3/Run #4								
Run #4/Final								

Bias Gas Actual Conc.



AIR HYGIENE

Signature: *Chad R.*

QUALITY ASSURANCE AND QUALITY CONTROL DATA

Fourier Transform Infrared Analyzer Daily QA Data

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Sampling System Leak Check	Flow (LPM)	Date (dd/mm/yy)	Time (hh:mm)
	≤0.2	07/29/21	6:00

FTIR No: 509/ INST-IR-0005
 Make Model: MKS 2030

Analytical System Leak Checks

Vacuum Leak Check

Spectrum	Date (dd/mm/yy)	Time (hh:mm:ss)	Vacuum (atm)
0729-PRE_000015.LAB	07/29/21	6:11:04	0.99216
0729-PRE_000016.LAB	07/29/21	6:11:34	0.99222
0729-PRE_000017.LAB	07/29/21	6:12:04	0.99226
0729-PRE_000018.LAB	07/29/21	6:12:34	0.99232
0729-PRE_000019.LAB	07/29/21	6:13:04	0.99235
0729-PRE_000020.LAB	07/29/21	6:13:34	0.99241
0729-PRE_000021.LAB	07/29/21	6:14:04	0.99239
0729-PRE_000022.LAB	07/29/21	6:14:34	0.99237
0729-PRE_000023.LAB	07/29/21	6:15:04	0.99289

Pressure Elements	Vacuum (atm)
Average, P_s	0.99237
Maximum	0.99289
Minimum	0.99216
Difference, ΔP_v	0.00073

Time Elements	Results (min)
Signal Integration, t_{ss}	0.50
Test Duration, t_d	4.00

Analytical System Leak Checks

Pressure Leak Check

Spectrum	Date (dd/mm/yy)	Time (hh:mm:ss)	Pressure (atm)
0729-PRE_000002.LAB	07/29/21	6:04:33	1.10579
0729-PRE_000003.LAB	07/29/21	6:05:03	1.10579
0729-PRE_000004.LAB	07/29/21	6:05:33	1.10579
0729-PRE_000005.LAB	07/29/21	6:06:03	1.10579
0729-PRE_000006.LAB	07/29/21	6:06:33	1.10579
0729-PRE_000007.LAB	07/29/21	6:07:03	1.10579
0729-PRE_000008.LAB	07/29/21	6:07:33	1.10579
0729-PRE_000009.LAB	07/29/21	6:08:03	1.10579
0729-PRE_000010.LAB	07/29/21	6:08:33	1.10579
0729-PRE_000011.LAB	07/29/21	6:09:03	1.10579

Pressure Elements	Pressure (atm)
Average, P_s	1.10579
Maximum	1.10579
Minimum	1.10579
Difference, ΔP_p	0.00000

Station Pressure (in. Hg)	29.90
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Time Elements	Results (min)
Signal Integration, t_{ss}	0.50
Test Duration, t_d	4.50

Parameter	Vacuum	Pressure	Max ΔP
Test Duration, t_d	4.00	4.50	4.00
Signal Integ., t_{ss}	0.50	0.50	0.50
Difference, ΔP	0.00073	0.00000	0.00073
Average, P_s	0.99237	1.10579	0.99237
Leak Volume, %V _L	0.009	0.000	0.009
Pass, ≤4%	yes	yes	yes

$$\%V_L = \frac{100\%}{t_d} t_{ss} \frac{\Delta P_{max}}{P_s}$$

Method 320, Section 8.2.2.4, Equation 2
 expanded to account for sample duration

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Protocol No. 1, CO ₂ Cylinder Concentration:	8.95 %vd
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Pre-Test Background						FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/29/21	6:21:13	0729-PRE_000032BKG.LAB	191.3	0.99	0.0000	0.0000

Pre-Test Direct Zero						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/29/21	6:18:04	0729-PRE_000029.LAB	191.3	0.99	0.0060	0.0092
07/29/21	6:18:35	0729-PRE_000030.LAB	191.3	0.99	-0.0087	0.0085
07/29/21	6:19:04	0729-PRE_000031.LAB	191.3	0.99	-0.0089	0.0019

Pre-Test Direct Calibration Transfer Spectra						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/29/21	6:22:49	0729-PRE_000035.LAB	191.3	0.99	8.9948	0.0225
07/29/21	6:23:19	0729-PRE_000036.LAB	191.3	0.99	9.0258	0.0065
07/29/21	6:23:49	0729-PRE_000037.LAB	191.3	0.99	9.0322	-0.0002
07/29/21	6:24:19	0729-PRE_000038.LAB	191.3	0.99	9.0356	0.0066
07/29/21	6:24:49	0729-PRE_000039.LAB	191.3	0.99	9.0464	0.0034
Average			191.3	0.99	9.0270	0.0078

Post-Test Direct Calibration Transfer Spectra						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/29/21	17:07:51	0729-R3_000460.LAB	191.4	0.99	9.1068	0.8887
07/29/21	17:08:21	0729-R3_000461.LAB	191.4	0.99	9.1768	0.2897
07/29/21	17:09:51	0729-R3_000464.LAB	191.4	0.99	9.2146	0.1001
07/29/21	17:10:21	0729-R3_000465.LAB	191.3	0.99	9.2266	0.1005
07/29/21	17:10:51	0729-R3_000466.LAB	191.4	0.99	9.2030	0.0946
Average			191.4	0.99	9.1856	0.2947

Post-Test Direct Zero						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/29/21	17:45:10	0729-R3_000534.LAB	191.4	0.99	0.0618	-0.0234
07/29/21	17:45:40	0729-R3_000535.LAB	191.5	0.99	0.0086	-0.0113
07/29/21	17:46:10	0729-R3_000536.LAB	191.4	0.99	0.0130	-0.0153

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Post-Test Background						
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)		(%)
07/29/21	17:48:27	0729-R3_000537BKG.LAB	191.4	0.99	0.0000	0.0000

CTS Results	Protocol No. 1 Concentration	FTIR CO ₂ Average	Error (%)	Pass (≤5%)
Pre-Test Direct	8.95	9.03	0.86	YES
Post-Test Direct	8.95	9.19	2.63	YES

Pre / Post Comparison	FTIR CO ₂ Maximum	FTIR CO ₂ Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	9.05	9.11	0.66	YES
Post-Test Direct	9.23		1.30	YES

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Certified, NH ₃ Cylinder Concentration:	49 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/29/21	6:21:13	0729-PRE_000032BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/29/21	6:18:04	0729-PRE_000029.LAB	191.3	0.99	0.0060	0.0092	0.0729
07/29/21	6:18:35	0729-PRE_000030.LAB	191.3	0.99	-0.0087	0.0085	0.0730
07/29/21	6:19:04	0729-PRE_000031.LAB	191.3	0.99	-0.0089	0.0019	0.0763

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/29/21	7:26:34	0729-PRE_000163.LAB	191.3	0.99	0.0016	0.0092	46.2851
07/29/21	7:28:34	0729-PRE_000167.LAB	191.3	0.99	-0.0024	0.0120	47.2974
07/29/21	7:29:04	0729-PRE_000168.LAB	191.3	0.99	0.0013	0.0064	46.2767
07/29/21	7:29:34	0729-PRE_000169.LAB	191.3	0.99	0.0097	0.0036	47.1397
07/29/21	7:30:04	0729-PRE_000170.LAB	191.3	0.99	0.0069	0.0053	46.8958
Average			191.3	0.99	0.0034	0.0073	46.7789

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/29/21	17:31:53	0729-R3_000508.LAB	191.4	0.99	0.0023	-0.0039	46.6088
07/29/21	17:32:24	0729-R3_000509.LAB	191.4	0.99	0.0178	0.0033	46.7044
07/29/21	17:32:54	0729-R3_000510.LAB	191.4	0.99	0.0233	-0.0043	46.6023
07/29/21	17:33:24	0729-R3_000511.LAB	191.4	0.99	0.0205	-0.0039	46.8212
07/29/21	17:33:54	0729-R3_000512.LAB	191.4	0.99	0.0073	0.0111	46.7872
Average			191.4	0.99	0.0142	0.0005	46.7048

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/29/21	17:45:10	0729-R3_000534.LAB	191.4	0.99	0.0618	-0.0234	0.7380
07/29/21	17:45:40	0729-R3_000535.LAB	191.5	0.99	0.0086	-0.0113	0.7408
07/29/21	17:46:10	0729-R3_000536.LAB	191.4	0.99	0.0130	-0.0153	0.7300

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	NH₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/29/21	17:48:27	0729-R3_000537BKG.LAB	191.4	0.99	0.0000	0.0000	0.0000

CTS Results	Certified Concentration	FTIR NH ₃ Average	Error (%)	Pass (≤5%)
Pre-Test Direct	49.00	46.78	4.53	YES
Post-Test Direct	49.00	46.70	4.68	YES

Pre / Post Comparison	FTIR NH ₃ Maximum	FTIR NH ₃ Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	47.30	46.74	1.17	YES
Post-Test Direct	46.82		0.17	YES

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Certified, C ₂ H ₆ Cylinder Concentration:	100 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	6:21:13	0729-PRE_000032BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	6:18:04	0729-PRE_000029.LAB	191.3	0.99	0.0060	0.0092	-0.0143
07/29/21	6:18:35	0729-PRE_000030.LAB	191.3	0.99	-0.0087	0.0085	-0.2806
07/29/21	6:19:04	0729-PRE_000031.LAB	191.3	0.99	-0.0089	0.0019	-0.1091

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	6:26:19	0729-PRE_000042.LAB	191.3	0.99	0.0046	0.0038	101.0654
07/29/21	6:26:49	0729-PRE_000043.LAB	191.3	0.99	0.0091	-0.0046	101.3680
07/29/21	6:27:19	0729-PRE_000044.LAB	191.3	0.99	-0.0013	0.0043	101.0983
07/29/21	6:27:50	0729-PRE_000045.LAB	191.3	0.99	0.0055	-0.0011	101.4527
07/29/21	6:28:20	0729-PRE_000046.LAB	191.3	0.99	0.0024	-0.0025	101.4251
Average			191.3	0.99	0.0040	0.0000	101.2819

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	17:15:52	0729-R3_000476.LAB	191.4	0.99	0.0099	0.0079	99.9658
07/29/21	17:16:22	0729-R3_000477.LAB	191.4	0.99	0.0164	0.0016	99.3676
07/29/21	17:16:52	0729-R3_000478.LAB	191.4	0.99	0.0052	0.0063	99.9686
07/29/21	17:17:22	0729-R3_000479.LAB	191.4	0.99	0.0139	0.0039	99.3839
07/29/21	17:17:52	0729-R3_000480.LAB	191.4	0.99	0.0141	-0.0024	99.2374
Average			191.4	0.99	0.0119	0.0035	99.5847

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	17:45:10	0729-R3_000534.LAB	191.4	0.99	0.0618	-0.0234	-0.4644
07/29/21	17:45:40	0729-R3_000535.LAB	191.5	0.99	0.0086	-0.0113	-0.3360
07/29/21	17:46:10	0729-R3_000536.LAB	191.4	0.99	0.0130	-0.0153	-0.7831

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	C₂H₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/29/21	17:48:27	0729-R3_000537BKG.LAB	191.4	0.99	0.0000	0.0000	0.0000

CTS Results	Certified Concentration	FTIR C ₂ H ₆ Average	Error (%)	Pass (≤5%)
Pre-Test Direct	100.00	101.28	1.28	YES
Post-Test Direct	100.00	99.58	0.42	YES

Pre / Post Comparison	FTIR C ₂ H ₆ Maximum	FTIR C ₂ H ₆ Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	101.45	100.43	1.00	YES
Post-Test Direct	99.97		0.46	YES

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Protocol No. 1, NOx Cylinder Concentration:	116.1 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	6:21:13	0729-PRE_000032BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	6:18:04	0729-PRE_000029.LAB	191.3	0.99	0.0060	0.0092	-0.1679
07/29/21	6:18:35	0729-PRE_000030.LAB	191.3	0.99	-0.0087	0.0085	-0.0946
07/29/21	6:19:04	0729-PRE_000031.LAB	191.3	0.99	-0.0089	0.0019	-0.1183

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	118.4758
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	118.2633
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	117.9127
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	118.9113
07/29/21	6:31:20	0729-PRE_000052.LAB	191.3	0.99	-0.0412	0.0002	119.3122
Average			191.3	0.99	-0.0342	0.0028	118.5751

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	17:12:22	0729-R3_000469.LAB	191.4	0.99	-0.0204	0.0499	120.3651
07/29/21	17:12:52	0729-R3_000470.LAB	191.4	0.99	-0.0230	0.0303	120.2399
07/29/21	17:13:22	0729-R3_000471.LAB	191.4	0.99	-0.0332	0.0140	120.4058
07/29/21	17:13:52	0729-R3_000472.LAB	191.4	0.99	-0.0284	0.0138	120.5176
07/29/21	17:14:22	0729-R3_000473.LAB	191.4	0.99	-0.0239	0.0099	120.2993
Average			191.4	0.99	-0.0258	0.0236	120.3655

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	17:45:10	0729-R3_000534.LAB	191.4	0.99	0.0618	-0.0234	-0.7746
07/29/21	17:45:40	0729-R3_000535.LAB	191.5	0.99	0.0086	-0.0113	-0.2312
07/29/21	17:46:10	0729-R3_000536.LAB	191.4	0.99	0.0130	-0.0153	-0.1751

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Post-Test Background							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO₂ (ppmvw)	H₂O (%)	NOx (ppmvw)
07/29/21	17:48:27	0729-R3_000537BKG.LAB	191.4	0.99	0.0000	0.0000	0.0000

CTS Results	Protocol No. 1 Concentration	FTIR NOx Average	Error (%)	Pass (≤5%)
Pre-Test Direct	116.10	118.58	2.13	YES
Post-Test Direct	116.10	120.37	3.67	YES

Pre / Post Comparison	FTIR NOx Maximum	FTIR NOx Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	119.31	119.47	0.13	YES
Post-Test Direct	120.52		0.87	YES

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Protocol No. 1, CO Cylinder Concentration:	122 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/29/21	6:21:13	0729-PRE_000032BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/29/21	6:18:04	0729-PRE_000029.LAB	191.3	0.99	0.0060	0.0092	-0.0233
07/29/21	6:18:35	0729-PRE_000030.LAB	191.3	0.99	-0.0087	0.0085	-0.0104
07/29/21	6:19:04	0729-PRE_000031.LAB	191.3	0.99	-0.0089	0.0019	0.0645

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	121.3862
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	120.7858
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	120.6875
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	121.4610
07/29/21	6:31:20	0729-PRE_000052.LAB	191.3	0.99	-0.0412	0.0002	121.9527
Average			191.3	0.99	-0.0342	0.0028	121.2546

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/29/21	17:12:22	0729-R3_000469.LAB	191.4	0.99	-0.0204	0.0499	122.9462
07/29/21	17:12:52	0729-R3_000470.LAB	191.4	0.99	-0.0230	0.0303	122.7267
07/29/21	17:13:22	0729-R3_000471.LAB	191.4	0.99	-0.0332	0.0140	123.2405
07/29/21	17:13:52	0729-R3_000472.LAB	191.4	0.99	-0.0284	0.0138	122.9788
07/29/21	17:14:22	0729-R3_000473.LAB	191.4	0.99	-0.0239	0.0099	122.6847
Average			191.4	0.99	-0.0258	0.0236	122.9154

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/29/21	17:45:10	0729-R3_000534.LAB	191.4	0.99	0.0618	-0.0234	0.1207
07/29/21	17:45:40	0729-R3_000535.LAB	191.5	0.99	0.0086	-0.0113	0.2300
07/29/21	17:46:10	0729-R3_000536.LAB	191.4	0.99	0.0130	-0.0153	0.0047

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/29/21	17:48:27	0729-R3_000537BKG.LAB	191.4	0.99	0.0000	0.0000	0.0000

CTS Results	Protocol No. 1 Concentration	FTIR CO Average	Error (%)	Pass (≤5%)
Pre-Test Direct	122.00	121.25	0.61	YES
Post-Test Direct	122.00	122.92	0.75	YES

Pre / Post Comparison	FTIR CO Maximum	FTIR CO Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	121.95	122.09	0.11	YES
Post-Test Direct	123.24		0.94	YES

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Certified, C ₂ H ₄ O Cylinder Concentration:	47.4 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/29/21	6:21:13	0729-PRE_000032BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/29/21	6:18:04	0729-PRE_000029.LAB	191.3	0.99	0.0060	0.0092	-0.3305
07/29/21	6:18:35	0729-PRE_000030.LAB	191.3	0.99	-0.0087	0.0085	-0.1519
07/29/21	6:19:04	0729-PRE_000031.LAB	191.3	0.99	-0.0089	0.0019	-0.4129

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/29/21	6:32:20	0729-PRE_000054.LAB	191.3	0.99	0.0102	-0.0025	46.1720
07/29/21	6:32:50	0729-PRE_000055.LAB	191.3	0.99	0.0016	-0.0038	47.2898
07/29/21	6:33:20	0729-PRE_000056.LAB	191.3	0.99	0.0070	-0.0048	47.6549
07/29/21	6:33:50	0729-PRE_000057.LAB	191.3	0.99	0.0126	-0.0068	47.3384
07/29/21	6:34:20	0729-PRE_000058.LAB	191.3	0.99	0.0030	-0.0075	47.8559
Average			191.3	0.99	0.0069	-0.0051	47.2622

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/29/21	17:18:52	0729-R3_000482.LAB	191.4	0.99	0.0101	0.0408	49.2208
07/29/21	17:19:22	0729-R3_000483.LAB	191.4	0.99	0.0057	-0.0063	49.2790
07/29/21	17:19:52	0729-R3_000484.LAB	191.4	0.99	0.0063	-0.0058	48.3237
07/29/21	17:20:22	0729-R3_000485.LAB	191.4	0.99	0.0040	-0.0059	49.9271
07/29/21	17:20:52	0729-R3_000486.LAB	191.4	0.99	0.0152	-0.0042	49.7117
Average			191.4	0.99	0.0083	0.0037	49.2925

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/29/21	17:45:10	0729-R3_000534.LAB	191.4	0.99	0.0618	-0.0234	0.6676
07/29/21	17:45:40	0729-R3_000535.LAB	191.5	0.99	0.0086	-0.0113	0.4959
07/29/21	17:46:10	0729-R3_000536.LAB	191.4	0.99	0.0130	-0.0153	0.3050

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	C₂H₄O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/29/21	17:48:27	0729-R3_000537BKG.LAB	191.4	0.99	0.0000	0.0000	0.0000

CTS Results	Certified Concentration	FTIR C ₂ H ₄ O Average	Error (%)	Pass (≤5%)
Pre-Test Direct	47.40	47.26	0.29	YES
Post-Test Direct	47.40	49.29	3.99	YES

Pre / Post Comparison	FTIR C ₂ H ₄ O Maximum	FTIR C ₂ H ₄ O Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	47.86	48.28	0.88	YES
Post-Test Direct	49.93		3.30	YES

Catalytic Combustion Corporation
July 29, 2021
Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005			
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	7:26:34	0729-PRE_000163.LAB	191.3	0.99	0.0016	0.0092	11.0529	46.2851	
07/29/21	7:28:34	0729-PRE_000167.LAB	191.3	0.99	-0.0024	0.0120	11.0578	47.2974	
07/29/21	7:29:04	0729-PRE_000168.LAB	191.3	0.99	0.0013	0.0064	11.0505	46.2767	
07/29/21	7:29:34	0729-PRE_000169.LAB	191.3	0.99	0.0097	0.0036	11.0187	47.1397	
Average			191.3	0.99	0.0026	0.0078	11.0450	46.7497	

Trial #1		Pre-Spike - Native Samples							
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	13:27:28	0729-R3_000020.LAB	191.4	1.03	5.7788	13.7763	-0.0029	0.2584	
07/29/21	13:27:58	0729-R3_000021.LAB	191.4	1.03	5.7773	13.8252	-0.0016	0.2776	
07/29/21	13:28:28	0729-R3_000022.LAB	191.4	1.03	5.8095	13.3030	-0.0010	0.2552	
07/29/21	13:28:59	0729-R3_000023.LAB	191.4	1.03	5.8209	13.3611	0.0007	0.2444	
Average			191.4	1.03	5.7966	13.5664	-0.0012	0.2589	

Trial #1		Spiked Samples							
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	13:50:01	0729-R3_000065.LAB	191.4	1.02	5.2051	16.0779	0.7052	2.5695	
07/29/21	13:50:31	0729-R3_000066.LAB	191.4	1.02	5.2154	16.1184	0.7046	2.2878	
07/29/21	13:51:01	0729-R3_000067.LAB	191.4	1.02	5.1984	15.5626	0.6996	2.3897	
07/29/21	13:51:31	0729-R3_000068.LAB	191.4	1.03	5.1159	17.0782	0.7039	2.0829	
Average			191.4	1.03	5.1837	16.2093	0.7033	2.3325	

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005			
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	7:26:34	0729-PRE_000163.LAB	191.3	0.99	0.0016	0.0092	11.0529	46.2851	
07/29/21	7:28:34	0729-PRE_000167.LAB	191.3	0.99	-0.0024	0.0120	11.0578	47.2974	
07/29/21	7:29:04	0729-PRE_000168.LAB	191.3	0.99	0.0013	0.0064	11.0505	46.2767	
07/29/21	7:29:34	0729-PRE_000169.LAB	191.3	0.99	0.0097	0.0036	11.0187	47.1397	
Average			191.3	0.99	0.0026	0.0078	11.0450	46.7497	

Trial #2 Pre-Spike - Native Samples								
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	SF ₆ (ppmvw)	NH ₃ (ppmvw)
07/29/21	15:29:41	0729-R3_000264.LAB	191.4	1.03	6.0871	10.4932	0.0086	0.3996
07/29/21	15:30:11	0729-R3_000265.LAB	191.4	1.03	6.0964	10.4971	0.0088	0.4470
07/29/21	15:30:41	0729-R3_000266.LAB	191.4	1.03	6.0418	10.9671	0.0082	0.4291
07/29/21	15:31:11	0729-R3_000267.LAB	191.4	1.03	6.0821	10.6008	0.0035	0.4249
Average			191.4	1.03	6.0768	10.6396	0.0073	0.4251

Trial #2 Spiked Samples								
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	SF ₆ (ppmvw)	NH ₃ (ppmvw)
07/29/21	15:36:42	0729-R3_000278.LAB	191.4	1.02	5.0614	16.8342	0.8971	3.3038
07/29/21	15:37:12	0729-R3_000279.LAB	191.4	1.02	5.2201	14.6879	0.8932	2.9650
07/29/21	15:37:42	0729-R3_000280.LAB	191.4	1.02	5.2446	14.2924	0.9011	2.9494
07/29/21	15:38:12	0729-R3_000281.LAB	191.4	1.03	5.3618	12.4385	0.9063	2.8430
Average			191.4	1.02	5.2220	14.5633	0.8995	3.0153

Trial #3 Spike Gas Direct Verification						FTIR: 509/ INST-IR-0005		
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	SF ₆ (ppmvw)	NH ₃ (ppmvw)
07/29/21	7:26:34	0729-PRE_000163.LAB	191.3	0.99	0.0016	0.0092	11.0529	46.2851
07/29/21	7:28:34	0729-PRE_000167.LAB	191.3	0.99	-0.0024	0.0120	11.0578	47.2974
07/29/21	7:29:04	0729-PRE_000168.LAB	191.3	0.99	0.0013	0.0064	11.0505	46.2767
07/29/21	7:29:34	0729-PRE_000169.LAB	191.3	0.99	0.0097	0.0036	11.0187	47.1397
Average			191.3	0.99	0.0026	0.0078	11.0450	46.7497

Trial #3 Pre-Spike - Native Samples								
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	SF ₆ (ppmvw)	NH ₃ (ppmvw)
07/29/21	15:53:14	0729-R3_000311.LAB	191.4	1.03	5.8236	13.9644	0.0020	0.7851
07/29/21	15:53:43	0729-R3_000312.LAB	191.4	1.03	5.8299	13.9946	0.0003	0.7793
07/29/21	15:54:14	0729-R3_000313.LAB	191.4	1.03	5.8400	13.9150	0.0015	0.7948
07/29/21	15:54:44	0729-R3_000314.LAB	191.4	1.03	5.8328	13.9310	-0.0022	0.7720
Average			191.4	1.03	5.8316	13.9513	0.0004	0.7828

Trial #3 Spiked Samples								
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	SF ₆ (ppmvw)	NH ₃ (ppmvw)
07/29/21	16:08:15	0729-R3_000341.LAB	191.4	1.03	5.4136	13.4491	0.7531	3.9385
07/29/21	16:08:45	0729-R3_000342.LAB	191.4	1.03	5.4074	13.4088	0.7539	3.8026
07/29/21	16:09:15	0729-R3_000343.LAB	191.4	1.03	5.4029	13.3926	0.7544	3.7165
07/29/21	16:09:45	0729-R3_000344.LAB	191.4	1.03	5.4003	13.3926	0.7529	3.6759
Average			191.4	1.03	5.4061	13.4108	0.7536	3.7834

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Sulfur Hexafluoride (SF ₆)	(ppmvw)	11.04	11.04	11.04
Direct Verified Concentration of Ammonia (NH ₃)	(ppmvw)	46.75	46.75	46.75
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.797	6.077	5.832
Stack (Native, Unspiked) H ₂ O Concentration	(%)	13.566	10.640	13.951
Stack (Native, Unspiked) SF ₆ Concentration	(ppmvw)	-0.001	0.007	0.000
Stack (Native, Unspiked) NH ₃ Concentration	(ppmvw)	0.259	0.425	0.783
Stack + Spike CO ₂ Concentration	(%vw)	5.184	5.222	5.406
Stack + Spike H ₂ O Concentration	(%)	16.209	14.563	13.411
Stack + Spike SF ₆ Concentration	(ppmvw)	0.703	0.899	0.754
Stack + Spike NH ₃ Concentration	(ppmvw)	2.332	3.015	3.783
Dilution Factor, calc. from SF ₆ (ppmvw)		0.064	0.081	0.068
Dilution Factor, as the ratio of dir to spk	(ratio)	15.7 : 1	12.4 : 1	14.7 : 1
Expected Concentration of the SF ₆ Spike+Native, CS	(ppmvw)	0.703	0.899	0.754
Expected Concentration of the NH ₃ Spike+Native, CS	(ppmvw)	3.225	4.167	3.917
Method 320 Spiked / Expected SF ₆	%	99.99	100.07	100.00
Method 320 Spiked / Expected NH ₃	%	72.33	72.36	96.58
Method 320 Passing SF ₆ (70-130%)		YES	YES	YES
Method 320 Passing NH ₃ (70-130%)		YES	YES	YES

Catalytic Combustion Corporation
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Trial #1		Spike Gas Direct Verification				FTIR: 509/INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	6:26:19	0729-PRE_000042.LAB	191.3	0.99	0.0046	0.0038	101.0654
07/29/21	6:26:49	0729-PRE_000043.LAB	191.3	0.99	0.0091	-0.0046	101.3680
07/29/21	6:27:19	0729-PRE_000044.LAB	191.3	0.99	-0.0013	0.0043	101.0983
07/29/21	6:27:50	0729-PRE_000045.LAB	191.3	0.99	0.0055	-0.0011	101.4527
Average			191.3	0.99	0.0045	0.0006	101.2461

Trial #1		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	7:54:07	0729-PRE_000218.LAB	191.4	1.03	5.9875	11.5338	0.6056
07/29/21	7:54:37	0729-PRE_000219.LAB	191.4	1.03	5.9302	12.1485	0.4878
07/29/21	7:55:07	0729-PRE_000220.LAB	191.4	1.03	5.9536	11.8260	0.6502
07/29/21	7:55:37	0729-PRE_000221.LAB	191.4	1.03	5.7779	12.4808	0.5425
Average			191.4	1.03	5.9123	11.9973	0.5715

Trial #1		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	7:57:37	0729-PRE_000225.LAB	191.4	1.03	5.4423	13.3304	6.8719
07/29/21	7:58:07	0729-PRE_000226.LAB	191.4	1.03	5.4336	13.4652	6.6892
07/29/21	7:58:37	0729-PRE_000227.LAB	191.3	1.03	5.4348	13.3763	6.6564
07/29/21	7:59:07	0729-PRE_000228.LAB	191.4	1.03	5.4500	13.4160	6.8767
Average			191.4	1.03	5.4402	13.3970	6.7735

Trial #2		Spike Gas Direct Verification				FTIR: 509/INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	6:26:19	0729-PRE_000042.LAB	191.3	0.99	0.0046	0.0038	101.0654
07/29/21	6:26:49	0729-PRE_000043.LAB	191.3	0.99	0.0091	-0.0046	101.3680
07/29/21	6:27:19	0729-PRE_000044.LAB	191.3	0.99	-0.0013	0.0043	101.0983
07/29/21	6:27:50	0729-PRE_000045.LAB	191.3	0.99	0.0055	-0.0011	101.4527
Average			191.3	0.99	0.0045	0.0006	101.2461

Trial #2 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	9:07:29	0729-R1_000016.LAB	191.4	1.03	5.6801	15.1958	0.4539
07/29/21	9:07:59	0729-R1_000017.LAB	191.4	1.03	5.7495	14.5253	0.4642
07/29/21	9:08:29	0729-R1_000018.LAB	191.4	1.03	5.7714	14.4530	0.6337
07/29/21	9:08:59	0729-R1_000019.LAB	191.4	1.03	5.7488	14.5817	0.6257
Average			191.4	1.03	5.7375	14.6889	0.5444

Trial #2 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	9:11:29	0729-R1_000024.LAB	191.4	1.03	5.3331	13.9803	7.4505
07/29/21	9:11:59	0729-R1_000025.LAB	191.4	1.03	5.3881	13.5880	7.4152
07/29/21	9:12:29	0729-R1_000026.LAB	191.4	1.03	5.3839	13.3244	7.6570
07/29/21	9:12:59	0729-R1_000027.LAB	191.4	1.03	5.4045	12.8692	7.9010
Average			191.4	1.03	5.3774	13.4405	7.6059

Trial #3 Spike Gas Direct Verification						FTIR: 509/ INST-IR-0005	
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	6:26:19	0729-PRE_000042.LAB	191.3	0.99	0.0046	0.0038	101.0654
07/29/21	6:26:49	0729-PRE_000043.LAB	191.3	0.99	0.0091	-0.0046	101.3680
07/29/21	6:27:19	0729-PRE_000044.LAB	191.3	0.99	-0.0013	0.0043	101.0983
07/29/21	6:27:50	0729-PRE_000045.LAB	191.3	0.99	0.0055	-0.0011	101.4527
Average			191.3	0.99	0.0045	0.0006	101.2461

Trial #3 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	9:14:30	0729-R1_000030.LAB	191.4	1.03	5.8943	12.9276	0.5478
07/29/21	9:15:00	0729-R1_000031.LAB	191.4	1.03	5.8058	13.9653	0.5314
07/29/21	9:15:30	0729-R1_000032.LAB	191.4	1.03	5.7807	14.0679	0.6174
07/29/21	9:16:00	0729-R1_000033.LAB	191.4	1.02	5.5559	16.7870	0.5112
Average			191.4	1.03	5.7592	14.4370	0.5519

Trial #3 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/29/21	9:17:30	0729-R1_000036.LAB	191.4	1.03	5.3371	13.5885	7.9238
07/29/21	9:18:00	0729-R1_000037.LAB	191.4	1.03	5.4023	12.9546	8.1480
07/29/21	9:18:30	0729-R1_000038.LAB	191.4	1.03	5.3772	13.1870	8.0203
07/29/21	9:19:00	0729-R1_000039.LAB	191.4	1.03	5.4150	12.7563	8.1687
Average			191.4	1.03	5.3829	13.1216	8.0652

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Ethane (C ₂ H ₆)	(ppmvw)	101.25	101.25	101.25
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.912	5.737	5.759
Stack (Native, Unspiked) H ₂ O Concentration	(%)	11.997	14.689	14.437
Stack (Native, Unspiked) C ₂ H ₆ Concentration	(ppmvw)	0.572	0.544	0.552
Stack + Spike CO ₂ Concentration	(%vw)	5.440	5.377	5.383
Stack + Spike H ₂ O Concentration	(%)	13.397	13.440	13.122
Stack + Spike C ₂ H ₆ Concentration	(ppmvw)	6.774	7.606	8.065
Dilution Factor, calc. from CO ₂ (%vw)		0.080	0.063	0.065
Dilution Factor, as the ratio of dir to spk	(ratio)	12.5 : 1	15.9 : 1	15.3 : 1
Expected Concentration of the C ₂ H ₆ Spike+Native, CS	(ppmvw)	8.611	6.864	7.131
Method 320 Spiked / Expected C ₂ H ₆	%	78.66	110.81	113.10
Method 320 Passing C ₂ H ₆ (70-130%)		YES	YES	YES

Catalytic Combustion Corporation
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Trial #1		Spike Gas Direct Verification				FTIR: 509/INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	118.4758
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	118.2633
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	117.9127
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	118.9113
Average			191.3	0.99	-0.0325	0.0034	118.3908

Trial #1		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	8:03:08	0729-PRE_000236.LAB	191.3	1.03	5.3847	13.9361	18.9449
07/29/21	8:03:38	0729-PRE_000237.LAB	191.3	1.03	5.5921	14.3319	19.4786
07/29/21	8:04:08	0729-PRE_000238.LAB	191.4	1.03	5.7245	14.8875	19.1555
07/29/21	8:04:38	0729-PRE_000239.LAB	191.4	1.02	5.4752	18.0467	19.5173
Average			191.3	1.02	5.5441	15.3006	19.2741

Trial #1		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	8:09:08	0729-PRE_000248.LAB	191.2	1.03	5.1639	14.2613	28.2136
07/29/21	8:09:38	0729-PRE_000249.LAB	191.1	1.03	5.2596	13.4329	29.8942
07/29/21	8:10:08	0729-PRE_000250.LAB	191.1	1.03	5.2123	13.9439	29.3501
07/29/21	8:10:39	0729-PRE_000251.LAB	191.2	1.03	5.2120	13.9711	28.4101
Average			191.2	1.03	5.2119	13.9023	28.9670

Trial #2		Spike Gas Direct Verification				FTIR: 509/INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	118.4758
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	118.2633
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	117.9127
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	118.9113
Average			191.3	0.99	-0.0325	0.0034	118.3908

Trial #2 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	10:41:16	0729-R1_000203.LAB	191.4	1.04	6.0667	9.8749	6.6883
07/29/21	10:41:46	0729-R1_000204.LAB	191.4	1.04	6.0394	10.4201	7.0146
07/29/21	10:42:17	0729-R1_000205.LAB	191.4	1.04	6.0349	10.5369	7.0232
07/29/21	10:42:47	0729-R1_000206.LAB	191.4	1.04	5.9472	10.1020	7.0688
Average			191.4	1.04	6.0221	10.2335	6.9487

Trial #2 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	10:44:16	0729-R1_000209.LAB	191.4	1.04	5.5818	9.2504	15.0471
07/29/21	10:44:47	0729-R1_000210.LAB	191.4	1.03	5.3310	12.2215	14.6741
07/29/21	10:45:17	0729-R1_000211.LAB	191.4	1.03	5.2587	13.6691	14.9002
07/29/21	10:45:47	0729-R1_000212.LAB	191.4	1.03	5.2719	13.6722	15.1687
Average			191.4	1.03	5.3609	12.2033	14.9475

Trial #3 Spike Gas Direct Verification							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	118.4758
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	118.2633
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	117.9127
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	118.9113
Average			191.3	0.99	-0.0325	0.0034	118.3908

Trial #3 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	10:46:47	0729-R1_000214.LAB	191.4	1.03	5.6735	14.9820	6.0733
07/29/21	10:47:17	0729-R1_000215.LAB	191.4	1.02	5.4686	17.7606	5.7500
07/29/21	10:47:47	0729-R1_000216.LAB	191.4	1.02	5.5923	16.5758	6.2012
07/29/21	10:48:17	0729-R1_000217.LAB	191.4	1.03	5.6718	15.1855	5.8747
Average			191.4	1.03	5.6015	16.1260	5.9748

Trial #3 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/29/21	10:51:47	0729-R1_000224.LAB	191.4	1.03	5.1912	14.5061	14.5892
07/29/21	10:52:17	0729-R1_000225.LAB	191.4	1.03	5.1831	14.6822	14.4297
07/29/21	10:52:47	0729-R1_000226.LAB	191.4	1.03	5.1944	14.6065	14.5221
07/29/21	10:53:17	0729-R1_000227.LAB	191.3	1.03	5.2487	13.9940	14.6695
Average			191.4	1.03	5.2044	14.4472	14.5526

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Nitrogen Oxides (NOx)	(ppmvw)	118.39	118.39	118.39
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.544	6.022	5.602
Stack (Native, Unspiked) H ₂ O Concentration	(%)	15.301	10.233	16.126
Stack (Native, Unspiked) NOx Concentration	(ppmvw)	19.274	6.949	5.975
Stack + Spike CO ₂ Concentration	(%vw)	5.212	5.361	5.204
Stack + Spike H ₂ O Concentration	(%)	13.902	12.203	14.447
Stack + Spike NOx Concentration	(ppmvw)	28.967	14.948	14.553
Dilution Factor, calc. from CO ₂ (%vw)		0.060	0.110	0.071
Dilution Factor, as the ratio of dir to spk	(ratio)	16.7 : 1	9.1 : 1	14.1 : 1
Expected Concentration of the NOx Spike+Native, CS	(ppmvw)	25.213	19.185	13.946
Method 320 Spiked / Expected NOx	%	114.89	77.91	104.35
Method 320 Passing NOx (70-130%)		YES	YES	YES

Catalytic Combustion Corporation
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Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	121.3862
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	120.7858
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	120.6875
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	121.4610
Average			191.3	0.99	-0.0325	0.0034	121.0801

Trial #1		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	8:03:08	0729-PRE_000236.LAB	191.3	1.03	5.3847	13.9361	3.9106
07/29/21	8:03:38	0729-PRE_000237.LAB	191.3	1.03	5.5921	14.3319	4.0740
07/29/21	8:04:08	0729-PRE_000238.LAB	191.4	1.03	5.7245	14.8875	4.3006
07/29/21	8:04:38	0729-PRE_000239.LAB	191.4	1.02	5.4752	18.0467	4.1830
Average			191.3	1.02	5.5441	15.3006	4.1170

Trial #1		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	8:08:38	0729-PRE_000247.LAB	191.3	1.03	5.1809	14.2651	14.3805
07/29/21	8:09:08	0729-PRE_000248.LAB	191.2	1.03	5.1639	14.2613	14.4930
07/29/21	8:09:38	0729-PRE_000249.LAB	191.1	1.03	5.2596	13.4329	14.6522
07/29/21	8:10:08	0729-PRE_000250.LAB	191.1	1.03	5.2123	13.9439	14.5963
Average			191.2	1.03	5.2042	13.9758	14.5305

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	121.3862
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	120.7858
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	120.6875
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	121.4610
Average			191.3	0.99	-0.0325	0.0034	121.0801

Trial #2 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	CO (ppmvw)
07/29/21	10:41:46	0729-R1_000204.LAB	191.4	1.04	6.0394	10.4201	5.1958
07/29/21	10:42:17	0729-R1_000205.LAB	191.4	1.04	6.0349	10.5369	5.1412
07/29/21	10:42:47	0729-R1_000206.LAB	191.4	1.04	5.9472	10.1020	5.0784
07/29/21	10:43:17	0729-R1_000207.LAB	191.4	1.04	5.5778	9.5137	4.7623
Average			191.4	1.04	5.8998	10.1432	5.0444

Trial #2 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	CO (ppmvw)
07/29/21	10:44:16	0729-R1_000209.LAB	191.4	1.04	5.5818	9.2504	13.6473
07/29/21	10:44:47	0729-R1_000210.LAB	191.4	1.03	5.3310	12.2215	14.0312
07/29/21	10:45:17	0729-R1_000211.LAB	191.4	1.03	5.2587	13.6691	13.9973
07/29/21	10:45:47	0729-R1_000212.LAB	191.4	1.03	5.2719	13.6722	14.0508
Average			191.4	1.03	5.3609	12.2033	13.9317

Trial #3 Spike Gas Direct Verification							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	CO (ppmvw)
07/29/21	6:29:20	0729-PRE_000048.LAB	191.3	0.99	-0.0356	0.0132	121.3862
07/29/21	6:29:50	0729-PRE_000049.LAB	191.3	0.99	-0.0345	0.0001	120.7858
07/29/21	6:30:20	0729-PRE_000050.LAB	191.3	0.99	-0.0255	-0.0019	120.6875
07/29/21	6:30:50	0729-PRE_000051.LAB	191.3	0.99	-0.0344	0.0022	121.4610
Average			191.3	0.99	-0.0325	0.0034	121.0801

Trial #3 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	CO (ppmvw)
07/29/21	10:47:17	0729-R1_000215.LAB	191.4	1.02	5.4686	17.7606	4.9024
07/29/21	10:47:47	0729-R1_000216.LAB	191.4	1.02	5.5923	16.5758	4.8346
07/29/21	10:48:17	0729-R1_000217.LAB	191.4	1.03	5.6718	15.1855	5.0380
07/29/21	10:48:47	0729-R1_000218.LAB	191.4	1.03	5.7312	14.3712	5.0990
Average			191.4	1.03	5.6160	15.9733	4.9685

Trial #3 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	CO (ppmvw)
07/29/21	10:50:17	0729-R1_000221.LAB	191.4	1.03	5.3414	12.8845	14.0327
07/29/21	10:50:47	0729-R1_000222.LAB	191.3	1.03	5.2080	14.3284	13.9683
07/29/21	10:51:17	0729-R1_000223.LAB	191.3	1.03	5.1211	15.2920	13.8946
07/29/21	10:51:47	0729-R1_000224.LAB	191.4	1.03	5.1912	14.5061	13.8609
Average			191.4	1.03	5.2154	14.2527	13.9391

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Carbon Monoxide (CO)	(ppmvw)	121.08	121.08	121.08
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.544	5.900	5.616
Stack (Native, Unspiked) H ₂ O Concentration	(%)	15.301	10.143	15.973
Stack (Native, Unspiked) CO Concentration	(ppmvw)	4.117	5.044	4.968
Stack + Spike CO ₂ Concentration	(%vw)	5.204	5.361	5.215
Stack + Spike H ₂ O Concentration	(%)	13.976	12.203	14.253
Stack + Spike CO Concentration	(ppmvw)	14.530	13.932	13.939
Dilution Factor, calc. from CO ₂ (%vw)		0.061	0.091	0.071
Dilution Factor, as the ratio of dir to spk	(ratio)	16.3 : 1	10.9 : 1	14 : 1
Expected Concentration of the CO Spike+Native, CS	(ppmvw)	11.289	15.645	13.250
Method 320 Spiked / Expected CO	%	128.71	89.05	105.20
Method 320 Passing CO (70-130%)		YES	YES	YES

Catalytic Combustion Corporation
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 Caterpillar, G3520 TALE
 Stewart & Stevenson Integration Center

Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005			
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	6:32:20	0729-PRE_000054.LAB	191.3	0.99	0.0102	-0.0025	5.6174	46.1720	
07/29/21	6:32:50	0729-PRE_000055.LAB	191.3	0.99	0.0016	-0.0038	5.6081	47.2898	
07/29/21	6:33:20	0729-PRE_000056.LAB	191.3	0.99	0.0070	-0.0048	5.6041	47.6549	
07/29/21	6:33:50	0729-PRE_000057.LAB	191.3	0.99	0.0126	-0.0068	5.6117	47.3384	
Average			191.3	0.99	0.0078	-0.0045	5.6103	47.1138	

Trial #1		Pre-Spike - Native Samples							
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	8:13:09	0729-PRE_000256.LAB	191.3	1.03	5.8412	13.6062	-0.0029	0.1604	
07/29/21	8:13:39	0729-PRE_000257.LAB	191.4	1.03	5.7654	14.4985	-0.0054	0.4411	
07/29/21	8:14:09	0729-PRE_000258.LAB	191.4	1.03	5.7930	14.2263	-0.0039	0.8452	
07/29/21	8:14:39	0729-PRE_000259.LAB	191.4	1.03	5.4426	14.6566	-0.0013	0.3062	
Average			191.4	1.03	5.7106	14.2469	-0.0034	0.4382	

Trial #1		Spiked Samples							
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	8:17:09	0729-PRE_000264.LAB	191.4	1.03	5.4266	12.7225	0.4138	3.7061	
07/29/21	8:17:39	0729-PRE_000265.LAB	191.4	1.03	5.2023	15.0338	0.4087	3.6254	
07/29/21	8:18:09	0729-PRE_000266.LAB	191.4	1.03	5.3755	13.2563	0.4079	3.6457	
07/29/21	8:18:39	0729-PRE_000267.LAB	191.4	1.03	5.3797	13.4089	0.4026	3.5155	
Average			191.4	1.03	5.3460	13.6054	0.4082	3.6232	

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005			
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/29/21	6:32:20	0729-PRE_000054.LAB	191.3	0.99	0.0102	-0.0025	5.6174	46.1720	
07/29/21	6:32:50	0729-PRE_000055.LAB	191.3	0.99	0.0016	-0.0038	5.6081	47.2898	
07/29/21	6:33:20	0729-PRE_000056.LAB	191.3	0.99	0.0070	-0.0048	5.6041	47.6549	
07/29/21	6:33:50	0729-PRE_000057.LAB	191.3	0.99	0.0126	-0.0068	5.6117	47.3384	
Average			191.3	0.99	0.0078	-0.0045	5.6103	47.1138	

Trial #2		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/29/21	10:58:18	0729-R1_000237.LAB	191.4	1.03	5.8150	13.6099	0.0006	0.3406
07/29/21	10:58:48	0729-R1_000238.LAB	191.4	1.03	5.8728	12.9194	-0.0025	0.5241
07/29/21	10:59:18	0729-R1_000239.LAB	191.4	1.03	5.8676	12.9379	-0.0025	0.6039
07/29/21	10:59:48	0729-R1_000240.LAB	191.4	1.03	5.4829	12.5593	0.0002	0.3223
Average			191.4	1.03	5.7596	13.0067	-0.0011	0.4477

Trial #2		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/29/21	11:01:49	0729-R1_000244.LAB	191.5	1.03	5.2712	13.8200	0.4242	3.7331
07/29/21	11:02:19	0729-R1_000245.LAB	191.5	1.03	5.3219	13.2850	0.4282	4.2742
07/29/21	11:02:49	0729-R1_000246.LAB	191.5	1.03	5.3687	12.7560	0.4313	4.0858
07/29/21	11:03:18	0729-R1_000247.LAB	191.5	1.03	5.3000	13.5442	0.4326	4.3084
Average			191.5	1.03	5.3154	13.3513	0.4291	4.1004

Trial #3		Spike Gas Direct Verification					FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/29/21	6:32:20	0729-PRE_000054.LAB	191.3	0.99	0.0102	-0.0025	5.6174	46.1720
07/29/21	6:32:50	0729-PRE_000055.LAB	191.3	0.99	0.0016	-0.0038	5.6081	47.2898
07/29/21	6:33:20	0729-PRE_000056.LAB	191.3	0.99	0.0070	-0.0048	5.6041	47.6549
07/29/21	6:33:50	0729-PRE_000057.LAB	191.3	0.99	0.0126	-0.0068	5.6117	47.3384
Average			191.3	0.99	0.0078	-0.0045	5.6103	47.1138

Trial #3		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/29/21	11:04:19	0729-R1_000249.LAB	191.5	1.03	5.8610	12.4156	0.0084	0.5578
07/29/21	11:04:49	0729-R1_000250.LAB	191.4	1.03	5.7812	13.8925	-0.0013	0.2429
07/29/21	11:05:19	0729-R1_000251.LAB	191.4	1.03	5.8004	13.6536	0.0004	0.3584
07/29/21	11:05:49	0729-R1_000252.LAB	191.5	1.03	5.7415	14.2661	-0.0004	0.2898
Average			191.5	1.03	5.7960	13.5570	0.0018	0.3622

Trial #3		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/29/21	11:08:19	0729-R1_000257.LAB	191.5	1.03	5.3438	13.0895	0.4337	4.2009
07/29/21	11:08:49	0729-R1_000258.LAB	191.4	1.03	5.3372	12.6090	0.4378	4.1634
07/29/21	11:09:19	0729-R1_000259.LAB	191.5	1.03	5.3282	12.4337	0.4382	4.3737
07/29/21	11:09:49	0729-R1_000260.LAB	191.4	1.04	5.3419	13.0188	0.4436	4.5190
Average			191.5	1.03	5.3378	12.7877	0.4383	4.3142

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Sulfur Hexafluoride (SF ₆)	(ppmvw)	5.61	5.61	5.61
Direct Verified Concentration of Acetaldehyde (C ₂ H ₄ O)	(ppmvw)	47.11	47.11	47.11
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.711	5.760	5.796
Stack (Native, Unspiked) H ₂ O Concentration	(%)	14.247	13.007	13.557
Stack (Native, Unspiked) SF ₆ Concentration	(ppmvw)	-0.003	-0.001	0.002
Stack (Native, Unspiked) C ₂ H ₄ O Concentration	(ppmvw)	0.438	0.448	0.362
Stack + Spike CO ₂ Concentration	(%vw)	5.346	5.315	5.338
Stack + Spike H ₂ O Concentration	(%)	13.605	13.351	12.788
Stack + Spike SF ₆ Concentration	(ppmvw)	0.408	0.429	0.438
Stack + Spike C ₂ H ₄ O Concentration	(ppmvw)	3.623	4.100	4.314
Dilution Factor, calc. from SF ₆ (ppmvw)		0.073	0.077	0.078
Dilution Factor, as the ratio of dir to spk	(ratio)	13.6 : 1	13 : 1	12.9 : 1
Expected Concentration of the SF ₆ Spike+Native, CS	(ppmvw)	0.408	0.429	0.438
Expected Concentration of the C ₂ H ₄ O Spike+Native, CS	(ppmvw)	3.863	4.026	4.000
Method 320 Spiked / Expected SF ₆	%	99.94	99.98	100.03
Method 320 Spiked / Expected C ₂ H ₄ O	%	93.80	101.86	107.85
Method 320 Passing SF ₆ (70-130%)		YES	YES	YES
Method 320 Passing C ₂ H ₄ O (70-130%)		YES	YES	YES

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Sampling System Leak Check	Flow (LPM)	Date (dd/mm/yy)	Time (hh:mm)
	≤0.2	07/30/21	5:30

FTIR No: 509/ INST-IR-0005
Make Model: MKS 2030

Analytical System Leak Checks	Vacuum Leak Check
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Spectrum	Date (dd/mm/yy)	Time (hh:mm:ss)	Vacuum (atm)
0730-PRE_000014.LAB	07/30/21	6:03:12	0.99459
0730-PRE_000015.LAB	07/30/21	6:03:42	0.99447
0730-PRE_000016.LAB	07/30/21	6:04:12	0.99512
0730-PRE_000017.LAB	07/30/21	6:04:42	0.99520
0730-PRE_000018.LAB	07/30/21	6:05:12	0.99500
0730-PRE_000019.LAB	07/30/21	6:05:42	0.99504
0730-PRE_000020.LAB	07/30/21	6:06:12	0.99529
0730-PRE_000021.LAB	07/30/21	6:06:42	0.99537
0730-PRE_000022.LAB	07/30/21	6:07:12	0.99551

Pressure Elements	Vacuum (atm)
Average, P_s	0.99507
Maximum	0.99551
Minimum	0.99447
Difference, ΔP_v	0.00104

Time Elements	Results (min)
Signal Integration, t_{ss}	0.50
Test Duration, t_d	4.00

Analytical System Leak Checks	Pressure Leak Check
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Spectrum	Date (dd/mm/yy)	Time (hh:mm:ss)	Pressure (atm)
0730-PRE_000002.LAB	07/30/21	5:57:11	1.10579
0730-PRE_000003.LAB	07/30/21	5:57:41	1.10579
0730-PRE_000004.LAB	07/30/21	5:58:11	1.10579
0730-PRE_000005.LAB	07/30/21	5:58:41	1.10579
0730-PRE_000006.LAB	07/30/21	5:59:11	1.10579
0730-PRE_000007.LAB	07/30/21	5:59:42	1.10579
0730-PRE_000008.LAB	07/30/21	6:00:12	1.10579
0730-PRE_000009.LAB	07/30/21	6:00:42	1.10579
0730-PRE_000010.LAB	07/30/21	6:01:12	1.10579
0730-PRE_000011.LAB	07/30/21	6:01:42	1.10579

Pressure Elements	Pressure (atm)
Average, P_s	1.10579
Maximum	1.10579
Minimum	1.10579
Difference, ΔP_p	0.00000

Station Pressure (in. Hg)	29.89
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Time Elements	Results (min)
Signal Integration, t_{ss}	0.50
Test Duration, t_d	4.50

Parameter	Vacuum	Pressure	Max ΔP
Test Duration, t_d	4.00	4.50	4.00
Signal Integ., t_{ss}	0.50	0.50	0.50
Difference, ΔP	0.00104	0.00000	0.00104
Average, P_s	0.99507	1.10579	0.99507
Leak Volume, %V _L	0.013	0.000	0.013
Pass, ≤4%	yes	yes	yes

$$\%V_L = \frac{100\%}{t_d} t_{ss} \frac{\Delta P_{max}}{P_s}$$

Method 320, Section 8.2.2.4, Equation 2
expanded to account for sample duration

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Protocol No. 1, CO ₂ Cylinder Concentration:	8.95 %vd
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Pre-Test Background						FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/30/21	6:13:32	0730-PRE_000031BKG.LAB	191.4	1.00	0.0000	0.0000

Pre-Test Direct Zero						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/30/21	6:14:09	0730-PRE_000032.LAB	191.3	1.00	-0.0033	0.0042
07/30/21	6:14:38	0730-PRE_000033.LAB	191.4	1.00	0.0086	-0.0009
07/30/21	6:15:08	0730-PRE_000034.LAB	191.3	1.00	-0.0026	0.0014

Pre-Test Direct Calibration Transfer Spectra						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/30/21	6:16:09	0730-PRE_000036.LAB	191.3	1.00	8.9894	0.0085
07/30/21	6:16:39	0730-PRE_000037.LAB	191.3	1.00	9.0392	0.0043
07/30/21	6:17:09	0730-PRE_000038.LAB	191.4	1.00	9.0308	0.0029
07/30/21	6:17:39	0730-PRE_000039.LAB	191.4	1.00	8.9392	-0.0020
07/30/21	6:18:09	0730-PRE_000040.LAB	191.4	1.00	8.9547	0.0015
Average			191.4	1.00	8.9907	0.0030

Post-Test Direct Calibration Transfer Spectra						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/30/21	20:08:00	0730-R3_000443.LAB	191.4	0.99	9.0504	0.0024
07/30/21	20:08:30	0730-R3_000444.LAB	191.4	0.99	9.0830	-0.0011
07/30/21	20:09:00	0730-R3_000445.LAB	191.4	0.99	9.0399	0.0029
07/30/21	20:09:30	0730-R3_000446.LAB	191.4	0.99	9.0417	-0.0021
07/30/21	20:10:00	0730-R3_000447.LAB	191.4	0.99	9.0313	-0.0045
Average			191.4	0.99	9.0492	-0.0005

Post-Test Direct Zero						
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂	H ₂ O (%)
07/30/21	20:15:00	0730-R3_000457.LAB	191.4	0.99	0.0107	-0.0023
07/30/21	20:15:30	0730-R3_000458.LAB	191.4	0.99	0.0023	-0.0021
07/30/21	20:16:00	0730-R3_000459.LAB	191.4	0.99	0.0115	-0.0060

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Post-Test Background						
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)		(%)
07/30/21	20:18:25	0730-R3_000460BKG.LAB	191.3	0.99	0.0000	0.0000

CTS Results	Protocol No. 1 Concentration	FTIR CO ₂ Average	Error (%)	Pass (≤5%)
Pre-Test Direct	8.95	8.99	0.45	YES
Post-Test Direct	8.95	9.05	1.11	YES

Pre / Post Comparison	FTIR CO ₂ Maximum	FTIR CO ₂ Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	9.04	9.02	0.21	YES
Post-Test Direct	9.08		0.69	YES

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Certified, NH ₃ Cylinder Concentration:	49 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/30/21	6:13:32	0730-PRE_000031BKG.LAB	191.4	1.00	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/30/21	6:14:09	0730-PRE_000032.LAB	191.3	1.00	-0.0033	0.0042	0.0083
07/30/21	6:14:38	0730-PRE_000033.LAB	191.4	1.00	0.0086	-0.0009	-0.0388
07/30/21	6:15:08	0730-PRE_000034.LAB	191.3	1.00	-0.0026	0.0014	-0.0227

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/30/21	6:38:41	0730-PRE_000081.LAB	191.4	1.00	0.0045	0.0037	46.4683
07/30/21	6:39:11	0730-PRE_000082.LAB	191.4	1.00	0.0114	0.0074	46.4068
07/30/21	6:39:41	0730-PRE_000083.LAB	191.4	1.00	0.0126	0.0106	47.4780
07/30/21	6:40:11	0730-PRE_000084.LAB	191.4	1.00	0.0086	0.0062	47.5915
07/30/21	6:41:11	0730-PRE_000086.LAB	191.4	1.00	0.0281	0.7565	48.0381
Average			191.4	1.00	0.0130	0.1569	47.1965

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/30/21	19:53:28	0730-R3_000414.LAB	191.3	1.00	-0.0003	0.0082	47.5248
07/30/21	19:53:58	0730-R3_000415.LAB	191.3	1.00	0.0067	0.0095	46.4149
07/30/21	19:54:28	0730-R3_000416.LAB	191.3	1.00	0.0161	0.0061	45.7153
07/30/21	19:54:58	0730-R3_000417.LAB	191.2	1.00	0.0057	0.0043	45.8208
07/30/21	19:55:28	0730-R3_000418.LAB	191.2	1.00	0.0145	0.0039	47.3945
Average			191.3	1.00	0.0085	0.0064	46.5741

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NH ₃ (ppmvw)
07/30/21	20:15:00	0730-R3_000457.LAB	191.4	0.99	0.0107	-0.0023	1.0692
07/30/21	20:15:30	0730-R3_000458.LAB	191.4	0.99	0.0023	-0.0021	0.9469
07/30/21	20:16:00	0730-R3_000459.LAB	191.4	0.99	0.0115	-0.0060	0.8690

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	NH₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/30/21	20:18:25	0730-R3_000460BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

CTS Results	Certified Concentration	FTIR NH ₃ Average	Error (%)	Pass (≤5%)
Pre-Test Direct	49.00	47.20	3.68	YES
Post-Test Direct	49.00	46.57	4.95	YES

Pre / Post Comparison	FTIR NH ₃ Maximum	FTIR NH ₃ Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	48.04	46.89	2.40	YES
Post-Test Direct	47.52		1.35	YES

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Certified, C ₂ H ₆ Cylinder Concentration:	100 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	6:13:32	0730-PRE_000031BKG.LAB	191.4	1.00	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	6:14:09	0730-PRE_000032.LAB	191.3	1.00	-0.0033	0.0042	-0.0546
07/30/21	6:14:38	0730-PRE_000033.LAB	191.4	1.00	0.0086	-0.0009	0.0040
07/30/21	6:15:08	0730-PRE_000034.LAB	191.3	1.00	-0.0026	0.0014	-0.0639

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	6:19:39	0730-PRE_000043.LAB	191.3	1.00	0.0072	0.0011	100.6868
07/30/21	6:20:09	0730-PRE_000044.LAB	191.4	1.00	0.0030	-0.0006	100.9227
07/30/21	6:20:39	0730-PRE_000045.LAB	191.4	1.00	0.0058	-0.0020	100.6889
07/30/21	6:21:09	0730-PRE_000046.LAB	191.4	1.00	-0.0050	-0.0002	101.1251
07/30/21	6:21:39	0730-PRE_000047.LAB	191.4	1.00	0.0032	0.0017	101.2393
Average			191.4	1.00	0.0028	0.0000	100.9326

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	20:04:59	0730-R3_000437.LAB	191.5	0.99	0.0128	0.0883	94.9111
07/30/21	20:05:29	0730-R3_000438.LAB	191.4	0.99	0.0051	0.0921	96.0914
07/30/21	20:05:59	0730-R3_000439.LAB	191.4	0.99	-0.0016	0.1057	95.6295
07/30/21	20:06:29	0730-R3_000440.LAB	191.4	0.99	0.0089	0.1073	95.1082
07/30/21	20:06:59	0730-R3_000441.LAB	191.4	0.99	0.0170	0.0381	99.3170
Average			191.4	0.99	0.0084	0.0863	96.2115

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	20:15:00	0730-R3_000457.LAB	191.4	0.99	0.0107	-0.0023	-0.2236
07/30/21	20:15:30	0730-R3_000458.LAB	191.4	0.99	0.0023	-0.0021	-0.1017
07/30/21	20:16:00	0730-R3_000459.LAB	191.4	0.99	0.0115	-0.0060	-0.3388

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	C₂H₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/30/21	20:18:25	0730-R3_000460BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

CTS Results	Certified Concentration	FTIR C ₂ H ₆ Average	Error (%)	Pass (≤5%)
Pre-Test Direct	100.00	100.93	0.93	YES
Post-Test Direct	100.00	96.21	3.79	YES

Pre / Post Comparison	FTIR C ₂ H ₆ Maximum	FTIR C ₂ H ₆ Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	101.24	98.57	2.63	YES
Post-Test Direct	99.32		0.75	YES

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Protocol No. 1, NOx Cylinder Concentration:	116.1 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	6:13:32	0730-PRE_000031BKG.LAB	191.4	1.00	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	6:14:09	0730-PRE_000032.LAB	191.3	1.00	-0.0033	0.0042	0.0301
07/30/21	6:14:38	0730-PRE_000033.LAB	191.4	1.00	0.0086	-0.0009	-0.0634
07/30/21	6:15:08	0730-PRE_000034.LAB	191.3	1.00	-0.0026	0.0014	0.0144

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	118.1741
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	118.8564
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	118.6155
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	117.8215
07/30/21	6:24:39	0730-PRE_000053.LAB	191.4	1.00	-0.0356	-0.0027	118.2811
Average			191.4	1.00	-0.0372	0.0030	118.3497

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	20:01:59	0730-R3_000431.LAB	191.4	0.99	-0.0372	0.0002	119.2568
07/30/21	20:02:29	0730-R3_000432.LAB	191.4	0.99	-0.0273	-0.0001	118.8093
07/30/21	20:02:59	0730-R3_000433.LAB	191.4	0.99	-0.0241	0.0010	118.7938
07/30/21	20:03:29	0730-R3_000434.LAB	191.4	0.99	-0.0204	-0.0029	118.3085
07/30/21	20:03:59	0730-R3_000435.LAB	191.4	0.99	-0.0253	-0.0007	118.3400
Average			191.4	0.99	-0.0268	-0.0005	118.7017

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	20:15:00	0730-R3_000457.LAB	191.4	0.99	0.0107	-0.0023	-0.0462
07/30/21	20:15:30	0730-R3_000458.LAB	191.4	0.99	0.0023	-0.0021	-0.1749
07/30/21	20:16:00	0730-R3_000459.LAB	191.4	0.99	0.0115	-0.0060	-0.0298

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/30/21	20:18:25	0730-R3_000460BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

CTS Results	Protocol No. 1 Concentration	FTIR NOx Average	Error (%)	Pass (≤5%)
Pre-Test Direct	116.10	118.35	1.94	YES
Post-Test Direct	116.10	118.70	2.24	YES

Pre / Post Comparison	FTIR NOx Maximum	FTIR NOx Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	118.86	118.53	0.28	YES
Post-Test Direct	119.26		0.61	YES

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Protocol No. 1, CO Cylinder Concentration:	122 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/30/21	6:13:32	0730-PRE_000031BKG.LAB	191.4	1.00	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/30/21	6:14:09	0730-PRE_000032.LAB	191.3	1.00	-0.0033	0.0042	0.0440
07/30/21	6:14:38	0730-PRE_000033.LAB	191.4	1.00	0.0086	-0.0009	-0.0435
07/30/21	6:15:08	0730-PRE_000034.LAB	191.3	1.00	-0.0026	0.0014	0.0030

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	120.7373
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	121.4913
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	121.2086
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	120.4047
07/30/21	6:24:39	0730-PRE_000053.LAB	191.4	1.00	-0.0356	-0.0027	120.4995
Average			191.4	1.00	-0.0372	0.0030	120.8683

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/30/21	20:01:59	0730-R3_000431.LAB	191.4	0.99	-0.0372	0.0002	122.2379
07/30/21	20:02:29	0730-R3_000432.LAB	191.4	0.99	-0.0273	-0.0001	121.5142
07/30/21	20:02:59	0730-R3_000433.LAB	191.4	0.99	-0.0241	0.0010	121.3072
07/30/21	20:03:29	0730-R3_000434.LAB	191.4	0.99	-0.0204	-0.0029	120.9053
07/30/21	20:03:59	0730-R3_000435.LAB	191.4	0.99	-0.0253	-0.0007	120.6371
Average			191.4	0.99	-0.0268	-0.0005	121.3203

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	CO (ppmvw)
07/30/21	20:15:00	0730-R3_000457.LAB	191.4	0.99	0.0107	-0.0023	-0.0600
07/30/21	20:15:30	0730-R3_000458.LAB	191.4	0.99	0.0023	-0.0021	-0.1378
07/30/21	20:16:00	0730-R3_000459.LAB	191.4	0.99	0.0115	-0.0060	-0.0268

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/30/21	20:18:25	0730-R3_000460BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

CTS Results	Protocol No. 1 Concentration	FTIR CO Average	Error (%)	Pass (≤5%)
Pre-Test Direct	122.00	120.87	0.93	YES
Post-Test Direct	122.00	121.32	0.56	YES

Pre / Post Comparison	FTIR CO Maximum	FTIR CO Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	121.49	121.09	0.33	YES
Post-Test Direct	122.24		0.94	YES

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Certified, C ₂ H ₄ O Cylinder Concentration:	47.4 ppmvd
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Pre-Test Background							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/30/21	6:13:32	0730-PRE_000031BKG.LAB	191.4	1.00	0.0000	0.0000	0.0000

Pre-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/30/21	6:14:09	0730-PRE_000032.LAB	191.3	1.00	-0.0033	0.0042	0.2031
07/30/21	6:14:38	0730-PRE_000033.LAB	191.4	1.00	0.0086	-0.0009	0.0650
07/30/21	6:15:08	0730-PRE_000034.LAB	191.3	1.00	-0.0026	0.0014	0.1599

Pre-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/30/21	6:25:40	0730-PRE_000055.LAB	191.4	1.00	0.0066	0.0047	46.2794
07/30/21	6:26:10	0730-PRE_000056.LAB	191.4	1.00	0.0073	-0.0029	47.4824
07/30/21	6:26:40	0730-PRE_000057.LAB	191.4	1.00	-0.0018	0.0002	48.0103
07/30/21	6:27:10	0730-PRE_000058.LAB	191.4	1.00	-0.0025	-0.0030	48.0884
07/30/21	6:27:40	0730-PRE_000059.LAB	191.4	1.00	0.0059	-0.0068	48.1908
Average			191.4	1.00	0.0031	-0.0015	47.6103

Post-Test Direct Calibration Transfer Spectra							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/30/21	19:58:59	0730-R3_000425.LAB	191.4	0.99	0.0109	-0.0057	44.9843
07/30/21	19:59:29	0730-R3_000426.LAB	191.4	0.99	0.0138	-0.0121	45.1049
07/30/21	19:59:59	0730-R3_000427.LAB	191.4	0.99	0.0118	-0.0089	45.3844
07/30/21	20:00:29	0730-R3_000428.LAB	191.4	0.99	0.0115	-0.0111	45.3527
07/30/21	20:00:59	0730-R3_000429.LAB	191.4	0.99	0.0119	-0.0026	45.4163
Average			191.4	0.99	0.0120	-0.0081	45.2485

Post-Test Direct Zero							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (ppmvw)	H ₂ O (%)	C ₂ H ₄ O (ppmvw)
07/30/21	20:15:00	0730-R3_000457.LAB	191.4	0.99	0.0107	-0.0023	-0.0450
07/30/21	20:15:30	0730-R3_000458.LAB	191.4	0.99	0.0023	-0.0021	0.2411
07/30/21	20:16:00	0730-R3_000459.LAB	191.4	0.99	0.0115	-0.0060	0.3815

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Post-Test Background							
Date	Time	Spectrum	Cell Temp	Cell Press	CO₂	H₂O	C₂H₄O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(ppmvw)	(%)	(ppmvw)
07/30/21	20:18:25	0730-R3_000460BKG.LAB	191.3	0.99	0.0000	0.0000	0.0000

CTS Results	Certified Concentration	FTIR C ₂ H ₄ O Average	Error (%)	Pass (≤5%)
Pre-Test Direct	47.40	47.61	0.44	YES
Post-Test Direct	47.40	45.25	4.54	YES

Pre / Post Comparison	FTIR C ₂ H ₄ O Maximum	FTIR C ₂ H ₄ O Pre/Post Mean	Error (%)	Pass (≤5%)
Pre-Test Direct	48.19	46.43	3.66	YES
Post-Test Direct	45.42		2.23	YES

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Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005			
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/30/21	6:38:41	0730-PRE_000081.LAB	191.4	1.00	0.0045	0.0037	11.0592	46.4683	
07/30/21	6:39:11	0730-PRE_000082.LAB	191.4	1.00	0.0114	0.0074	11.0565	46.4068	
07/30/21	6:39:41	0730-PRE_000083.LAB	191.4	1.00	0.0126	0.0106	11.0569	47.4780	
07/30/21	6:40:11	0730-PRE_000084.LAB	191.4	1.00	0.0086	0.0062	11.0642	47.5915	
Average			191.4	1.00	0.0093	0.0070	11.0592	46.9861	

Trial #1		Pre-Spike - Native Samples							
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/30/21	17:29:43	0730-R3_000127.LAB	191.4	1.03	5.8899	13.0638	-0.0051	13.1427	
07/30/21	17:30:13	0730-R3_000128.LAB	191.4	1.02	5.8880	13.1952	-0.0051	13.2455	
07/30/21	17:30:43	0730-R3_000129.LAB	191.5	1.03	5.9085	12.4733	-0.0025	13.0278	
07/30/21	17:31:13	0730-R3_000130.LAB	191.5	1.03	5.9130	12.4050	-0.0035	13.1000	
Average			191.5	1.03	5.8999	12.7843	-0.0041	13.1290	

Trial #1		Spiked Samples							
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/30/21	17:41:44	0730-R3_000151.LAB	191.4	1.01	5.1125	16.8425	4.0957	21.6241	
07/30/21	17:42:14	0730-R3_000152.LAB	191.4	1.03	4.5930	11.9125	4.0952	21.1914	
07/30/21	17:42:44	0730-R3_000153.LAB	191.4	1.03	4.7731	13.8540	4.0957	22.1734	
07/30/21	17:43:14	0730-R3_000154.LAB	191.3	1.02	5.1449	13.8670	4.0952	22.5789	
Average			191.4	1.02	4.9059	14.1190	4.0954	21.8920	

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005			
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃	
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)	
07/30/21	6:38:41	0730-PRE_000081.LAB	191.4	1.00	0.0045	0.0037	11.0592	46.4683	
07/30/21	6:39:11	0730-PRE_000082.LAB	191.4	1.00	0.0114	0.0074	11.0565	46.4068	
07/30/21	6:39:41	0730-PRE_000083.LAB	191.4	1.00	0.0126	0.0106	11.0569	47.4780	
07/30/21	6:40:11	0730-PRE_000084.LAB	191.4	1.00	0.0086	0.0062	11.0642	47.5915	
Average			191.4	1.00	0.0093	0.0070	11.0592	46.9861	

Trial #2		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	18:52:21	0730-R3_000292.LAB	191.3	1.04	5.5552	14.4346	-0.0093	1.8100
07/30/21	18:52:51	0730-R3_000293.LAB	191.3	1.03	5.5539	14.6010	-0.0090	1.5328
07/30/21	18:53:22	0730-R3_000294.LAB	191.3	1.03	5.5866	14.1337	-0.0094	1.3203
07/30/21	18:53:52	0730-R3_000295.LAB	191.3	1.03	5.6429	13.7381	-0.0080	1.1878
Average			191.3	1.03	5.5847	14.2269	-0.0089	1.4628

Trial #2		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	19:15:54	0730-R3_000339.LAB	191.3	1.03	4.6391	13.2155	0.8064	4.0219
07/30/21	19:16:24	0730-R3_000340.LAB	191.2	1.03	4.9884	11.5188	0.8079	4.1450
07/30/21	19:16:54	0730-R3_000341.LAB	191.3	1.03	4.5691	11.4957	0.8030	3.3466
07/30/21	19:17:24	0730-R3_000342.LAB	191.3	1.03	4.3604	10.6202	0.7988	3.0584
Average			191.3	1.03	4.6393	11.7125	0.8040	3.6430

Trial #3		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005		
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	6:38:41	0730-PRE_000081.LAB	191.4	1.00	0.0045	0.0037	11.0592	46.4683
07/30/21	6:39:11	0730-PRE_000082.LAB	191.4	1.00	0.0114	0.0074	11.0565	46.4068
07/30/21	6:39:41	0730-PRE_000083.LAB	191.4	1.00	0.0126	0.0106	11.0569	47.4780
07/30/21	6:40:11	0730-PRE_000084.LAB	191.4	1.00	0.0086	0.0062	11.0642	47.5915
Average			191.4	1.00	0.0093	0.0070	11.0592	46.9861

Trial #3		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	19:20:24	0730-R3_000348.LAB	191.3	1.02	5.4440	16.3774	-0.0033	1.9032
07/30/21	19:20:55	0730-R3_000349.LAB	191.3	1.02	5.5524	14.7458	-0.0042	1.7367
07/30/21	19:21:24	0730-R3_000350.LAB	191.4	1.02	5.6631	13.6230	-0.0057	1.6003
07/30/21	19:21:55	0730-R3_000351.LAB	191.3	1.03	5.6113	14.0821	-0.0035	1.5597
Average			191.3	1.02	5.5677	14.7071	-0.0042	1.7000

Trial #3		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	NH ₃
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	19:28:55	0730-R3_000365.LAB	191.3	1.03	5.1457	13.9195	0.8066	4.5177
07/30/21	19:29:25	0730-R3_000366.LAB	191.3	1.02	5.1848	13.5242	0.8021	3.9342
07/30/21	19:29:55	0730-R3_000367.LAB	191.3	1.03	5.2114	13.0419	0.8058	3.4876
07/30/21	19:30:25	0730-R3_000368.LAB	191.3	1.03	5.2138	12.5100	0.8088	3.5619
Average			191.3	1.03	5.1889	13.2489	0.8058	3.8754

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Sulfur Hexafluoride (SF ₆)	(ppmvw)	11.06	11.06	11.06
Direct Verified Concentration of Ammonia (NH ₃)	(ppmvw)	46.99	46.99	46.99
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.900	5.585	5.568
Stack (Native, Unspiked) H ₂ O Concentration	(%)	12.784	14.227	14.707
Stack (Native, Unspiked) SF ₆ Concentration	(ppmvw)	-0.004	-0.009	-0.004
Stack (Native, Unspiked) NH ₃ Concentration	(ppmvw)	13.129	1.463	1.700
Stack + Spike CO ₂ Concentration	(%vw)	4.906	4.639	5.189
Stack + Spike H ₂ O Concentration	(%)	14.119	11.713	13.249
Stack + Spike SF ₆ Concentration	(ppmvw)	4.095	0.804	0.806
Stack + Spike NH ₃ Concentration	(ppmvw)	21.892	3.643	3.875
Dilution Factor, calc. from SF ₆ (ppmvw)		0.371	0.074	0.073
Dilution Factor, as the ratio of dir to spk	(ratio)	2.7 : 1	13.6 : 1	13.7 : 1
Expected Concentration of the SF ₆ Spike+Native, CS	(ppmvw)	4.097	0.805	0.806
Expected Concentration of the NH ₃ Spike+Native, CS	(ppmvw)	25.679	4.809	5.017
Method 320 Spiked / Expected SF ₆	%	99.96	99.92	99.96
Method 320 Spiked / Expected NH ₃	%	85.25	75.75	77.25
Method 320 Passing SF ₆ (70-130%)		YES	YES	YES
Method 320 Passing NH ₃ (70-130%)		YES	YES	YES

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Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:19:39	0730-PRE_000043.LAB	191.3	1.00	0.0072	0.0011	100.6868
07/30/21	6:20:09	0730-PRE_000044.LAB	191.4	1.00	0.0030	-0.0006	100.9227
07/30/21	6:20:39	0730-PRE_000045.LAB	191.4	1.00	0.0058	-0.0020	100.6889
07/30/21	6:21:09	0730-PRE_000046.LAB	191.4	1.00	-0.0050	-0.0002	101.1251
Average			191.4	1.00	0.0027	-0.0004	100.8559

Trial #1		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	7:07:14	0730-PRE_000138.LAB	191.4	1.04	6.0532	8.9759	0.7175
07/30/21	7:07:44	0730-PRE_000139.LAB	191.4	1.04	6.0684	8.6764	1.0738
07/30/21	7:08:14	0730-PRE_000140.LAB	191.4	1.04	5.4819	8.8570	0.7126
07/30/21	7:08:44	0730-PRE_000141.LAB	191.4	1.03	5.4148	11.0471	0.4528
Average			191.4	1.03	5.7546	9.3891	0.7392

Trial #1		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	7:10:14	0730-PRE_000144.LAB	191.4	1.03	5.4320	10.5697	8.4013
07/30/21	7:10:44	0730-PRE_000145.LAB	191.4	1.03	5.2716	13.0538	8.3076
07/30/21	7:11:14	0730-PRE_000146.LAB	191.4	1.03	5.2550	12.5253	8.4825
07/30/21	7:11:44	0730-PRE_000147.LAB	191.4	1.03	5.3563	11.4675	8.3991
Average			191.4	1.03	5.3287	11.9041	8.3976

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	C ₂ H ₆
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:19:39	0730-PRE_000043.LAB	191.3	1.00	0.0072	0.0011	100.6868
07/30/21	6:20:09	0730-PRE_000044.LAB	191.4	1.00	0.0030	-0.0006	100.9227
07/30/21	6:20:39	0730-PRE_000045.LAB	191.4	1.00	0.0058	-0.0020	100.6889
07/30/21	6:21:09	0730-PRE_000046.LAB	191.4	1.00	-0.0050	-0.0002	101.1251
Average			191.4	1.00	0.0027	-0.0004	100.8559

Trial #2 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	7:12:45	0730-PRE_000149.LAB	191.4	1.03	5.8000	12.8597	0.7345
07/30/21	7:13:15	0730-PRE_000150.LAB	191.4	1.03	5.8314	11.8100	0.7608
07/30/21	7:13:45	0730-PRE_000151.LAB	191.4	1.03	5.6332	14.6153	0.7099
07/30/21	7:14:15	0730-PRE_000152.LAB	191.4	1.02	5.5540	16.2007	0.7127
Average			191.4	1.03	5.7047	13.8714	0.7295

Trial #2 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	7:15:45	0730-PRE_000155.LAB	191.4	1.02	5.1139	14.9382	8.2753
07/30/21	7:16:15	0730-PRE_000156.LAB	191.4	1.03	5.1541	14.3975	8.4375
07/30/21	7:16:45	0730-PRE_000157.LAB	191.4	1.03	5.2980	12.8197	8.5701
07/30/21	7:17:15	0730-PRE_000158.LAB	191.4	1.03	5.2867	12.7394	8.4587
Average			191.4	1.03	5.2132	13.7237	8.4354

Trial #3 Spike Gas Direct Verification							FTIR: 509/ INST-IR-0005
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	6:19:39	0730-PRE_000043.LAB	191.3	1.00	0.0072	0.0011	100.6868
07/30/21	6:20:09	0730-PRE_000044.LAB	191.4	1.00	0.0030	-0.0006	100.9227
07/30/21	6:20:39	0730-PRE_000045.LAB	191.4	1.00	0.0058	-0.0020	100.6889
07/30/21	6:21:09	0730-PRE_000046.LAB	191.4	1.00	-0.0050	-0.0002	101.1251
Average			191.4	1.00	0.0027	-0.0004	100.8559

Trial #3 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	7:18:15	0730-PRE_000160.LAB	191.4	1.03	5.7401	13.4425	0.7732
07/30/21	7:18:45	0730-PRE_000161.LAB	191.4	1.02	5.5498	15.5749	0.5713
07/30/21	7:19:15	0730-PRE_000162.LAB	191.4	1.03	5.6786	14.0766	0.7417
07/30/21	7:19:45	0730-PRE_000163.LAB	191.4	1.03	5.5581	15.0022	0.8356
Average			191.4	1.03	5.6316	14.5241	0.7304

Trial #3 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	C ₂ H ₆ (ppmvw)
07/30/21	7:21:15	0730-PRE_000166.LAB	191.4	1.03	5.2190	13.6704	8.3180
07/30/21	7:21:46	0730-PRE_000167.LAB	191.4	1.03	5.2700	13.0154	8.5543
07/30/21	7:22:16	0730-PRE_000168.LAB	191.5	1.03	5.2269	13.5371	8.5568
07/30/21	7:22:46	0730-PRE_000169.LAB	191.4	1.03	5.2680	13.1603	8.5293
Average			191.4	1.03	5.2460	13.3458	8.4896

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Ethane (C ₂ H ₆)	(ppmvw)	100.86	100.86	100.86
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.755	5.705	5.632
Stack (Native, Unspiked) H ₂ O Concentration	(%)	9.389	13.871	14.524
Stack (Native, Unspiked) C ₂ H ₆ Concentration	(ppmvw)	0.739	0.729	0.730
Stack + Spike CO ₂ Concentration	(%vw)	5.329	5.213	5.246
Stack + Spike H ₂ O Concentration	(%)	11.904	13.724	13.346
Stack + Spike C ₂ H ₆ Concentration	(ppmvw)	8.398	8.435	8.490
Dilution Factor, calc. from CO ₂ (%vw)		0.074	0.086	0.068
Dilution Factor, as the ratio of dir to spk	(ratio)	13.5 : 1	11.6 : 1	14.6 : 1
Expected Concentration of the C ₂ H ₆ Spike+Native, CS	(ppmvw)	8.148	9.356	7.587
Method 320 Spiked / Expected C ₂ H ₆	%	103.06	90.16	111.89
Method 320 Passing C ₂ H ₆ (70-130%)		YES	YES	YES

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Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	118.1741
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	118.8564
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	118.6155
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	117.8215
Average			191.4	1.00	-0.0376	0.0044	118.3669

Trial #1		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	7:23:46	0730-PRE_000171.LAB	191.4	1.03	5.6918	13.9245	16.6396
07/30/21	7:24:16	0730-PRE_000172.LAB	191.4	1.03	5.7387	13.4806	16.3643
07/30/21	7:24:46	0730-PRE_000173.LAB	191.4	1.03	5.6194	14.7534	16.1108
07/30/21	7:25:16	0730-PRE_000174.LAB	191.4	1.02	5.5866	15.0709	15.4793
Average			191.4	1.03	5.6591	14.3073	16.1485

Trial #1		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	7:27:16	0730-PRE_000178.LAB	191.4	1.03	5.1608	13.8424	24.2100
07/30/21	7:27:46	0730-PRE_000179.LAB	191.4	1.03	5.2530	12.8052	25.1630
07/30/21	7:28:16	0730-PRE_000180.LAB	191.4	1.03	5.2479	12.9054	25.2521
07/30/21	7:28:46	0730-PRE_000181.LAB	191.4	1.03	5.2082	13.2288	24.2115
Average			191.4	1.03	5.2175	13.1954	24.7091

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	118.1741
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	118.8564
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	118.6155
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	117.8215
Average			191.4	1.00	-0.0376	0.0044	118.3669

Trial #2		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	14:44:02	0730-PRE_001049.LAB	191.4	1.03	5.7369	12.4441	5.0561
07/30/21	14:44:32	0730-PRE_001050.LAB	191.4	1.03	5.7460	12.4431	5.0416
07/30/21	14:45:02	0730-PRE_001051.LAB	191.4	1.03	5.7463	12.4741	4.9203
07/30/21	14:45:32	0730-PRE_001052.LAB	191.4	1.03	5.7250	12.5610	4.9086
Average			191.4	1.03	5.7386	12.4806	4.9816

Trial #2		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	14:47:32	0730-PRE_001056.LAB	191.5	1.03	5.2360	13.3371	13.5438
07/30/21	14:48:02	0730-PRE_001057.LAB	191.5	1.02	5.1899	13.6994	13.3789
07/30/21	14:48:32	0730-PRE_001058.LAB	191.4	1.02	5.1590	13.9761	13.0878
07/30/21	14:49:02	0730-PRE_001059.LAB	191.5	1.02	5.1399	14.2498	13.1142
Average			191.5	1.02	5.1812	13.8156	13.2812

Trial #3		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	NOx
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	118.1741
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	118.8564
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	118.6155
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	117.8215
Average			191.4	1.00	-0.0376	0.0044	118.3669

Trial #3 Pre-Spike - Native Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	14:50:03	0730-PRE_001061.LAB	191.5	1.02	5.5992	14.9701	5.0871
07/30/21	14:50:32	0730-PRE_001062.LAB	191.5	1.02	5.5984	14.7950	5.0964
07/30/21	14:51:02	0730-PRE_001063.LAB	191.4	1.02	5.6097	14.6418	5.1337
07/30/21	14:51:32	0730-PRE_001064.LAB	191.4	1.02	5.5973	14.7381	5.1409
Average			191.4	1.02	5.6012	14.7862	5.1145

Trial #3 Spiked Samples							
Date (mm/dd/yy)	Time (hh:mm:ss)	Spectrum (File Name)	Cell Temp (°C)	Cell Press (atm)	CO ₂ (%vw)	H ₂ O (%)	NOx (ppmvw)
07/30/21	14:53:03	0730-PRE_001067.LAB	191.4	1.02	5.1934	13.8151	13.2145
07/30/21	14:53:33	0730-PRE_001068.LAB	191.4	1.03	5.2220	13.6576	13.4804
07/30/21	14:54:03	0730-PRE_001069.LAB	191.4	1.02	5.2084	13.5414	13.4392
07/30/21	14:54:33	0730-PRE_001070.LAB	191.4	1.03	5.2343	13.4546	13.7276
Average			191.4	1.03	5.2145	13.6172	13.4654

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Nitrogen Oxides (NOx)	(ppmvw)	118.37	118.37	118.37
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.659	5.739	5.601
Stack (Native, Unspiked) H ₂ O Concentration	(%)	14.307	12.481	14.786
Stack (Native, Unspiked) NOx Concentration	(ppmvw)	16.149	4.982	5.115
Stack + Spike CO ₂ Concentration	(%vw)	5.217	5.181	5.215
Stack + Spike H ₂ O Concentration	(%)	13.195	13.816	13.617
Stack + Spike NOx Concentration	(ppmvw)	24.709	13.281	13.465
Dilution Factor, calc. from CO ₂ (%vw)		0.078	0.097	0.069
Dilution Factor, as the ratio of dir to spk	(ratio)	12.8 : 1	10.3 : 1	14.5 : 1
Expected Concentration of the NOx Spike+Native, CS	(ppmvw)	24.125	15.995	12.932
Method 320 Spiked / Expected NOx	%	102.42	83.03	104.12
Method 320 Passing NOx (70-130%)		YES	YES	YES

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Trial #1		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	120.7373
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	121.4913
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	121.2086
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	120.4047
Average			191.4	1.00	-0.0376	0.0044	120.9605

Trial #1		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	7:23:46	0730-PRE_000171.LAB	191.4	1.03	5.6918	13.9245	2.4183
07/30/21	7:24:16	0730-PRE_000172.LAB	191.4	1.03	5.7387	13.4806	2.4016
07/30/21	7:24:46	0730-PRE_000173.LAB	191.4	1.03	5.6194	14.7534	2.4795
07/30/21	7:25:16	0730-PRE_000174.LAB	191.4	1.02	5.5866	15.0709	2.5247
Average			191.4	1.03	5.6591	14.3073	2.4560

Trial #1		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	7:27:16	0730-PRE_000178.LAB	191.4	1.03	5.1608	13.8424	11.6753
07/30/21	7:27:46	0730-PRE_000179.LAB	191.4	1.03	5.2530	12.8052	11.8689
07/30/21	7:28:16	0730-PRE_000180.LAB	191.4	1.03	5.2479	12.9054	12.0123
07/30/21	7:28:46	0730-PRE_000181.LAB	191.4	1.03	5.2082	13.2288	12.0099
Average			191.4	1.03	5.2175	13.1954	11.8916

Trial #2		Spike Gas Direct Verification				FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	120.7373
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	121.4913
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	121.2086
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	120.4047
Average			191.4	1.00	-0.0376	0.0044	120.9605

Trial #2		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	14:43:02	0730-PRE_001047.LAB	191.4	1.03	5.7266	12.6880	2.9336
07/30/21	14:43:32	0730-PRE_001048.LAB	191.4	1.03	5.7343	12.5239	2.8088
07/30/21	14:44:02	0730-PRE_001049.LAB	191.4	1.03	5.7369	12.4441	3.0307
07/30/21	14:44:32	0730-PRE_001050.LAB	191.4	1.03	5.7460	12.4431	2.9345
Average			191.4	1.03	5.7360	12.5248	2.9269

Trial #2		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	14:47:32	0730-PRE_001056.LAB	191.5	1.03	5.2360	13.3371	11.4735
07/30/21	14:48:02	0730-PRE_001057.LAB	191.5	1.02	5.1899	13.6994	11.3942
07/30/21	14:48:32	0730-PRE_001058.LAB	191.4	1.02	5.1590	13.9761	11.3660
07/30/21	14:49:02	0730-PRE_001059.LAB	191.5	1.02	5.1399	14.2498	11.5300
Average			191.5	1.02	5.1812	13.8156	11.4409

Trial #3		Spike Gas Direct Verification					FTIR: 509/ INST-IR-0005
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	6:22:39	0730-PRE_000049.LAB	191.4	1.00	-0.0302	0.0182	120.7373
07/30/21	6:23:09	0730-PRE_000050.LAB	191.4	1.00	-0.0389	0.0025	121.4913
07/30/21	6:23:39	0730-PRE_000051.LAB	191.4	1.00	-0.0431	-0.0001	121.2086
07/30/21	6:24:09	0730-PRE_000052.LAB	191.4	1.00	-0.0383	-0.0029	120.4047
Average			191.4	1.00	-0.0376	0.0044	120.9605

Trial #3		Pre-Spike - Native Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	14:50:03	0730-PRE_001061.LAB	191.5	1.02	5.5992	14.9701	2.9415
07/30/21	14:50:32	0730-PRE_001062.LAB	191.5	1.02	5.5984	14.7950	2.9191
07/30/21	14:51:02	0730-PRE_001063.LAB	191.4	1.02	5.6097	14.6418	2.8402
07/30/21	14:51:32	0730-PRE_001064.LAB	191.4	1.02	5.5973	14.7381	2.8936
Average			191.4	1.02	5.6012	14.7862	2.8986

Trial #3		Spiked Samples					
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	CO
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)
07/30/21	14:53:03	0730-PRE_001067.LAB	191.4	1.02	5.1934	13.8151	11.4955
07/30/21	14:53:33	0730-PRE_001068.LAB	191.4	1.03	5.2220	13.6576	11.5884
07/30/21	14:54:03	0730-PRE_001069.LAB	191.4	1.02	5.2084	13.5414	11.5316
07/30/21	14:54:33	0730-PRE_001070.LAB	191.4	1.03	5.2343	13.4546	11.4985
Average			191.4	1.03	5.2145	13.6172	11.5285

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Carbon Monoxide (CO)	(ppmvw)	120.96	120.96	120.96
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.659	5.736	5.601
Stack (Native, Unspiked) H ₂ O Concentration	(%)	14.307	12.525	14.786
Stack (Native, Unspiked) CO Concentration	(ppmvw)	2.456	2.927	2.899
Stack + Spike CO ₂ Concentration	(%vw)	5.217	5.181	5.215
Stack + Spike H ₂ O Concentration	(%)	13.195	13.816	13.617
Stack + Spike CO Concentration	(ppmvw)	11.892	11.441	11.529
Dilution Factor, calc. from CO ₂ (%vw)		0.078	0.097	0.069
Dilution Factor, as the ratio of dir to spk	(ratio)	12.8 : 1	10.3 : 1	14.5 : 1
Expected Concentration of the CO Spike+Native, CS	(ppmvw)	11.704	14.343	11.048
Method 320 Spiked / Expected CO	%	101.60	79.77	104.35
Method 320 Passing CO (70-130%)		YES	YES	YES

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Caterpillar, G3520 TALE
Stewart & Stevenson Integration Center

Trial #1		Spike Gas Direct Verification				FTIR: 509/INST-IR-0005		
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	6:25:40	0730-PRE_000055.LAB	191.4	1.00	0.0066	0.0047	5.6053	46.2794
07/30/21	6:26:10	0730-PRE_000056.LAB	191.4	1.00	0.0073	-0.0029	5.6165	47.4824
07/30/21	6:26:40	0730-PRE_000057.LAB	191.4	1.00	-0.0018	0.0002	5.6054	48.0103
07/30/21	6:27:10	0730-PRE_000058.LAB	191.4	1.00	-0.0025	-0.0030	5.6293	48.0884
Average			191.4	1.00	0.0024	-0.0002	5.6141	47.4651

Trial #1		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	16:08:24	0730-R2_000146.LAB	191.4	1.02	5.7713	13.7720	-0.0059	3.6044
07/30/21	16:08:54	0730-R2_000147.LAB	191.4	1.02	5.7267	13.9990	-0.0055	3.7065
07/30/21	16:09:24	0730-R2_000148.LAB	191.4	1.02	5.7083	14.1170	-0.0069	3.7018
07/30/21	16:09:54	0730-R2_000149.LAB	191.4	1.02	5.7255	14.1603	-0.0066	4.5399
Average			191.4	1.02	5.7330	14.0121	-0.0062	3.8881

Trial #1		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	16:12:54	0730-R2_000155.LAB	191.4	1.02	5.2999	13.0120	0.4156	7.8255
07/30/21	16:13:24	0730-R2_000156.LAB	191.4	1.02	5.3080	12.8405	0.4238	7.8915
07/30/21	16:13:54	0730-R2_000157.LAB	191.4	1.03	5.3199	12.7503	0.4258	7.8579
07/30/21	16:14:25	0730-R2_000158.LAB	191.5	1.03	5.3166	12.7834	0.4263	7.4489
Average			191.4	1.03	5.3111	12.8465	0.4229	7.7559

Trial #2		Spike Gas Direct Verification				FTIR: 509/INST-IR-0005		
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	6:25:40	0730-PRE_000055.LAB	191.4	1.00	0.0066	0.0047	5.6053	46.2794
07/30/21	6:26:10	0730-PRE_000056.LAB	191.4	1.00	0.0073	-0.0029	5.6165	47.4824
07/30/21	6:26:40	0730-PRE_000057.LAB	191.4	1.00	-0.0018	0.0002	5.6054	48.0103
07/30/21	6:27:10	0730-PRE_000058.LAB	191.4	1.00	-0.0025	-0.0030	5.6293	48.0884
Average			191.4	1.00	0.0024	-0.0002	5.6141	47.4651

Trial #2		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	16:15:55	0730-R2_000161.LAB	191.4	1.02	5.7123	14.0511	-0.0053	4.6214
07/30/21	16:16:25	0730-R2_000162.LAB	191.4	1.02	5.7120	14.1027	-0.0031	3.8296
07/30/21	16:16:55	0730-R2_000163.LAB	191.5	1.02	5.4558	17.3753	-0.0039	4.3182
07/30/21	16:17:25	0730-R2_000164.LAB	191.5	1.02	5.6095	15.7793	-0.0044	3.8522
Average			191.4	1.02	5.6224	15.3271	-0.0042	4.1554

Trial #2		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	16:18:55	0730-R2_000167.LAB	191.4	1.03	5.2392	13.7149	0.4266	7.5391
07/30/21	16:19:25	0730-R2_000168.LAB	191.5	1.02	5.2282	13.8275	0.4253	7.4193
07/30/21	16:19:55	0730-R2_000169.LAB	191.5	1.03	5.2383	13.7240	0.4255	7.7933
07/30/21	16:20:25	0730-R2_000170.LAB	191.5	1.03	5.2524	13.6092	0.4256	7.9073
Average			191.5	1.03	5.2395	13.7189	0.4257	7.6648

Trial #3		Spike Gas Direct Verification					FTIR: 509/ INST-IR-0005	
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	6:25:40	0730-PRE_000055.LAB	191.4	1.00	0.0066	0.0047	5.6053	46.2794
07/30/21	6:26:10	0730-PRE_000056.LAB	191.4	1.00	0.0073	-0.0029	5.6165	47.4824
07/30/21	6:26:40	0730-PRE_000057.LAB	191.4	1.00	-0.0018	0.0002	5.6054	48.0103
07/30/21	6:27:10	0730-PRE_000058.LAB	191.4	1.00	-0.0025	-0.0030	5.6293	48.0884
Average			191.4	1.00	0.0024	-0.0002	5.6141	47.4651

Trial #3		Pre-Spike - Native Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	16:21:25	0730-R2_000172.LAB	191.5	1.02	5.7333	13.6223	-0.0018	3.9788
07/30/21	16:21:55	0730-R2_000173.LAB	191.5	1.02	5.7138	14.0067	-0.0041	3.9006
07/30/21	16:22:25	0730-R2_000174.LAB	191.4	1.02	5.7115	14.1215	-0.0078	3.8331
07/30/21	16:22:56	0730-R2_000175.LAB	191.5	1.02	5.6979	14.2024	-0.0028	4.1707
Average			191.5	1.02	5.7142	13.9882	-0.0041	3.9708

Trial #3		Spiked Samples						
Date	Time	Spectrum	Cell Temp	Cell Press	CO ₂	H ₂ O	SF ₆	C ₂ H ₄ O
(mm/dd/yy)	(hh:mm:ss)	(File Name)	(°C)	(atm)	(%vw)	(%)	(ppmvw)	(ppmvw)
07/30/21	16:23:56	0730-R2_000177.LAB	191.4	1.02	5.1967	14.0712	0.4185	7.4727
07/30/21	16:24:26	0730-R2_000178.LAB	191.4	1.03	5.2160	13.7566	0.4194	7.6900
07/30/21	16:24:56	0730-R2_000179.LAB	191.5	1.03	5.2569	13.4089	0.4242	7.6490
07/30/21	16:25:26	0730-R2_000180.LAB	191.4	1.03	5.2622	13.4270	0.4228	7.9476
Average			191.4	1.03	5.2329	13.6659	0.4212	7.6898

Parameter	Units	Trial #1	Trial #2	Trial #3
Direct Verified Concentration of Sulfur Hexafluoride (SF ₆)	(ppmvw)	5.61	5.61	5.61
Direct Verified Concentration of Acetaldehyde (C ₂ H ₄ O)	(ppmvw)	47.47	47.47	47.47
Stack (Native, Unspiked) CO ₂ Concentration	(%vw)	5.733	5.622	5.714
Stack (Native, Unspiked) H ₂ O Concentration	(%)	14.012	15.327	13.988
Stack (Native, Unspiked) SF ₆ Concentration	(ppmvw)	-0.006	-0.004	-0.004
Stack (Native, Unspiked) C ₂ H ₄ O Concentration	(ppmvw)	3.888	4.155	3.971
Stack + Spike CO ₂ Concentration	(%vw)	5.311	5.240	5.233
Stack + Spike H ₂ O Concentration	(%)	12.847	13.719	13.666
Stack + Spike SF ₆ Concentration	(ppmvw)	0.423	0.426	0.421
Stack + Spike C ₂ H ₄ O Concentration	(ppmvw)	7.756	7.665	7.690
Dilution Factor, calc. from SF ₆ (ppmvw)		0.076	0.077	0.076
Dilution Factor, as the ratio of dir to spk	(ratio)	13.1 : 1	13.1 : 1	13.2 : 1
Expected Concentration of the SF ₆ Spike+Native, CS	(ppmvw)	0.423	0.426	0.422
Expected Concentration of the C ₂ H ₄ O Spike+Native, CS	(ppmvw)	7.219	7.472	7.266
Method 320 Spiked / Expected SF ₆	%	99.89	99.93	99.93
Method 320 Spiked / Expected C ₂ H ₄ O	%	107.44	102.58	105.83
Method 320 Passing SF ₆ (70-130%)		YES	YES	YES
Method 320 Passing C ₂ H ₄ O (70-130%)		YES	YES	YES

QUALITY ASSURANCE AND QUALITY CONTROL DATA

**50% Load
PM Laboratory Data**

SAMPLE RECOVERY AND INTEGRITY DATA SHEET

Plant Name	Stewart and Stevenson Integration Center	Date	07/28/21
Sampling Location	Caterpillar G3520 TALE	Operator	JLW
Project #	catc-21-houston.tx-start#1		

Run History Data				
Run Number	R-1 50%-1	R-1 50%-2	R-1 50%-3	
Run Start Time	09:34	12:05	14:23	(hh:mm)
Run Stop Time	11:24	13:59	15:58	(hh:mm)
Train Prepared By	PKM	PKM	PKM	
Train Recovered By	PKM	PKM	PKM	
Recovery Date	07/29/21	07/29/21	07/29/21	(mm/dd/yy)
Relinquished By	PKM	PKM	PKM	
Relinquished Date	08/02/21	08/02/21	08/02/21	(mm/dd/yy)

Equipment Identification Numbers			
Impinger Case	samp-BH-0018	samp-BH-0018	samp-BH-0018
Sample Box	samp-cc-0011	samp-cc-0011	samp-cc-0011
PM Filter	00713	0652	0722
CPM Filter	R-1 50%-1-CPM	R-1 50%-2-CPM	R-1 50%-3-CPM

Sample Blank Taken ☒ YES

Moisture Content Data					
Impingers 1, 2, and 3 - Liquid Weight					
Final Weight	(W _f)	1789.8	1796.4	1801.3	g
Initial Weight	(W _i)	1672.1	1678.6	1686.0	g
Net Weight	(W _n)	117.7	117.8	115.3	g
Comments					
Impinger 4 - Silica Gel Weight					
Final Weight	(W _f)	856.2	823.4	863.2	g
Initial Weight	(W _i)	847.8	816.5	856.2	g
Net Weight	(W _n)	8.4	6.9	7.0	g
Comments					
Total Water Collected					
Total Weight	(W _{lc})	126.1	124.7	122.3	g
Total Volume	(V _{lc})	126.3	124.9	122.5	ml

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 50%-1
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Filter	0652	08/11/21	14:10
Probe Wash	250-747	08/11/21	14:10
Inorganic Impinger Contents	250-302	08/11/21	14:10
Organic Impinger Contents	439	08/11/21	14:10

Weight Data			Run		1	Start Time	09:34
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	48.7912	08/17/21	07:43	45%	66.6		
Measurement 2	48.7914	08/17/21	14:14	43%	68.9		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	125.9982	08/17/21	07:43	45%	66.6		
Measurement 2	125.9986	08/17/21	14:14	43%	68.9		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	118.6959	08/17/21	07:43	45%	66.6		
Measurement 2	118.6962	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7596	08/17/21	07:43	45%	66.6		
Measurement 2	1.7597	08/17/21	14:14	43%	68.9		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0004	137.0000	0.002555	--
DI Water Blank Weight of Solids	0.0002	224.0000	0.000759	--
Hexane Blank Weight of Solids	0.0000	123.0000	0.000000	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		1	Start Time	09:34
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	48.7913	0.3503	2.7000	--	--	2.7000	
Filter Beaker		48.4383		--	--		
Probe Wash	125.9984	125.9889	9.5000	200.0000	0.5109	8.9891	
Inorganic Impinger Contents	118.6961	118.6933	2.7500	333.3080	1.2703	1.4797	
Organic Impinger Contents	1.7597	1.7540	5.6500	66.0000	0.7297	4.9203	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 50%-2		
Sample Leakage Evident	NO	Estimated Leak Volume		0.00	(mg)

Sample Type	Sample Number	Date	Time
Filter	0713	08/11/21	14:10
Probe Wash	250-494	08/11/21	14:10
Inorganic Impinger Contents	250-685	08/11/21	14:10
Organic Impinger Contents	430	08/11/21	14:10

Weight Data			Run		2	Start Time	12:05
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	68.0982	08/17/21	07:43	45%	66.6		
Measurement 2	68.0984	08/17/21	14:14	43%	68.9		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	120.7377	08/17/21	07:43	45%	66.6		
Measurement 2	120.7381	08/17/21	14:14	43%	68.9		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	122.7244	08/17/21	07:43	45%	66.6		
Measurement 2	122.7249	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7682	08/17/21	07:43	45%	66.6		
Measurement 2	1.7683	08/17/21	14:14	43%	68.9		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0004	137.0000	0.002555	--
DI Water Blank Weight of Solids	0.0002	224.0000	0.000759	--
Hexane Blank Weight of Solids	0.0000	123.0000	0.000000	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		2	Start Time	12:05
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	68.0983	0.3468	5.2000	--	--	5.2000	
Filter Beaker		67.7464		--	--		
Probe Wash	120.7379	120.7318	6.1000	162.0000	0.4139	5.6861	
Inorganic Impinger Contents	122.7247	122.7208	3.8500	342.5887	1.2703	2.5797	
Organic Impinger Contents	1.7683	1.7665	1.8000	60.0000	0.7297	1.0703	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 50%-3
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Filter	0722	08/11/21	14:10
Probe Wash	250-665	08/11/21	14:10
Inorganic Impinger Contents	250-741	08/11/21	14:10
Organic Impinger Contents	446	08/11/21	14:10

Weight Data			Run		3	Start Time	14:23
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	48.2665	08/17/21	07:43	45%	66.6		
Measurement 2	48.2668	08/17/21	14:14	43%	68.9		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	123.1212	08/17/21	07:43	45%	66.6		
Measurement 2	123.1211	08/17/21	14:14	43%	68.9		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	127.5165	08/17/21	07:43	45%	66.6		
Measurement 2	127.5170	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7761	08/17/21	07:43	45%	66.6		
Measurement 2	1.7763	08/17/21	14:14	43%	68.9		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0004	137.0000	0.002555	--
DI Water Blank Weight of Solids	0.0002	224.0000	0.000759	--
Hexane Blank Weight of Solids	0.0000	123.0000	0.000000	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		3	Start Time	14:23
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	48.2667	0.3583	2.3500	--	--	2.3500	
Filter Beaker		47.9060		--	--		
Probe Wash	123.1212	123.1152	5.9500	124.0000	0.3168	5.6332	
Inorganic Impinger Contents	127.5168	127.5147	2.1000	407.1970	1.2703	0.8297	
Organic Impinger Contents	1.7762	1.7746	1.6000	72.0000	0.7297	0.8703	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 50%-FB
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Inorganic Impinger Contents	250-478	08/11/21	14:10
Organic Impinger Contents	464	08/11/21	14:10

Weight Data			Run		R-1 50%-FB	Start Time	
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	121.8241	08/17/21	07:43	45%	66.6		
Measurement 2	121.8246	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7720	08/17/21	07:43	45%	66.6		
Measurement 2	1.7721	08/17/21	14:14	43%	68.9		

Gravimetric Concentrations					Actual Gain
Sample Portion	Final	Tare	Gain		(mg)
	(g)	(g)	(mg)		
Inorganic Impinger Contents	121.8244	121.8220	1.2703	max 2 mg total blank adjustment, proportioned	2.3500
Organic Impinger Contents	1.7721	1.7707	0.7297		1.3500

EQUIPMENT / INSTRUMENTATION IDENTIFICATION

Equipment / Instrumentation	Identification No.
Acetone Lot	20120533
Hexane Lot	21030109
Filterable Particulate Matter Oven ID	SAMP-OV-0007
Condensable Particulate Matter Oven ID	SAMP-OV-0008
Sonic Bath ID	SAMP-UB-0001
SAMP-SC-0003 Scale Weight Set ID (1st weights)	LABS-WT-0001
SAMP-SC-0003 Scale Weight Set ID (2nd weights)	
SAMP-SC-0003 Scale Weight Set ID (3rd weights)	
SAMP-SC-0003 Scale Weight Set ID (4th weights)	

Requested Standard Analysis - 5-10 business days after receipt at lab										Contact Information (deliver results to)									
Name: (918) 307-8865										Air Hygiene International, Inc. 1600 W Tacoma Street Broken Arrow, Oklahoma 74012 (888) 461-8778 www.airhygiene.com									
Email:										Laboratory Analysis Requested:									
Project Number: catc-21-houston.tx-start#1										Gravimetric									
Person Taking Samples: JLV										Analysis Method									
Sample Number	Location	Date	Volume	RM 5	RM 202	RM 5	RM 202	RM 5	RM 202	RM 5	RM 202	RM 5	RM 202	RM 5	RM 202				
R-1 50%-1-F	Unit R-1 50% - Run 1 - Filter	07/29/21	N/A	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-1-PW	Unit R-1 50% - Run 1 - Probe Wash	07/29/21	54cc	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-1-IC	Unit R-1 50% - Run 1 - Inorganic Impinger Contents	07/29/21																	
R-1 50%-1-Hex	Unit R-1 50% - Run 1 - Organic Impinger Contents	07/29/21																	
R-1 50%-1-CPM	Unit R-1 50% - Run 1 - CPM Filter	07/29/21	N/A																
R-1 50%-2-F	Unit R-1 50% - Run 2 - Filter	07/29/21	N/A	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-2-PW	Unit R-1 50% - Run 2 - Probe Wash	07/29/21	54cc	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-2-IC	Unit R-1 50% - Run 2 - Inorganic Impinger Contents	07/29/21																	
R-1 50%-2-Hex	Unit R-1 50% - Run 2 - Organic Impinger Contents	07/29/21																	
R-1 50%-2-CPM	Unit R-1 50% - Run 2 - CPM Filter	07/29/21	N/A																
R-1 50%-3-F	Unit R-1 50% - Run 3 - Filter	07/29/21	N/A	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-3-PW	Unit R-1 50% - Run 3 - Probe Wash	07/29/21	54cc	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-3-IC	Unit R-1 50% - Run 3 - Inorganic Impinger Contents	07/29/21																	
R-1 50%-3-Hex	Unit R-1 50% - Run 3 - Organic Impinger Contents	07/29/21																	
R-1 50%-3-CPM	Unit R-1 50% - Run 3 - CPM Filter	07/29/21	N/A																
R-1 50%-FB-IC	Unit R-1 50% - Run FB - Inorganic Impinger Contents	FB																	
R-1 50%-FB-Hex	Unit R-1 50% - Run FB - Organic Impinger Contents	FB																	
R-1 50%-FB-CPM	Unit R-1 50% - Run FB - CPM Filter	FB	N/A																
R-1 50%-B1-Acetone	Unit R-1 50% - Blank - Acetone	07/30/21	200																
R-1 50%-B2-DI Water	Unit R-1 50% - Blank - DI Water	07/30/21	200	X	---	X	---	X	---	X	---	X	---	X	---				
R-1 50%-B3-Hexane	Unit R-1 50% - Blank - Hexane	07/30/21	200																

SD&L

Isocalc-AHI v20210708 CATC 50%

QUALITY ASSURANCE AND QUALITY CONTROL DATA

**75% Load
PM Laboratory Data**

SAMPLE RECOVERY AND INTEGRITY DATA SHEET

Plant Name	Stewart and Stevenson Integration Center	Date	07/28/21
Sampling Location	Caterpillar G3520 TALE	Operator	JLW
Project #	catc-21-houston.tx-start#1		

Run History Data				
Run Number	R-1 75%-1	R-1 75%-2	R-1 75%-3	
Run Start Time	08:08	13:17	15:25	(hh:mm)
Run Stop Time	09:42	14:56	17:01	(hh:mm)
Train Prepared By	PKM	PKM	PKM	
Train Recovered By	PKM	PKM	PKM	
Recovery Date	07/30/21	07/30/21	07/30/21	(mm/dd/yy)
Relinquished By	PKM	PKM	PKM	
Relinquished Date	08/02/21	08/02/21	08/02/21	(mm/dd/yy)

Equipment Identification Numbers			
Impinger Case	samp-BH-0018	samp-BH-0018	samp-BH-0018
Sample Box	samp-cc-0011	samp-cc-0011	samp-cc-0011
PM Filter	0523	0916	0917
CPM Filter	R-1 75%-1-CPM	R-1 75%-2-CPM	R-1 75%-3-CPM

Sample Blank Taken ☒ YES

Moisture Content Data					
Impingers 1, 2, and 3 - Liquid Weight					
Final Weight	(W _f)	1854.3	1851.5	1846.1	g
Initial Weight	(W _i)	1685.4	1689.6	1688.9	g
Net Weight	(W _n)	168.9	161.9	157.2	g
Comments					
Impinger 4 - Silica Gel Weight					
Final Weight	(W _f)	832.6	872.9	834.4	g
Initial Weight	(W _i)	823.4	863.2	823.3	g
Net Weight	(W _n)	9.2	9.7	11.1	g
Comments					
Total Water Collected					
Total Weight	(W _{lc})	178.1	171.6	168.3	g
Total Volume	(V _{lc})	178.4	171.9	168.6	ml

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 75%-1
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Filter	0523	08/11/21	14:10
Probe Wash	250-853	08/11/21	14:10
Inorganic Impinger Contents	250-338	08/11/21	14:10
Organic Impinger Contents	438	08/11/21	14:10

Weight Data			Run		1	Start Time	08:08
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	69.3936	08/17/21	07:43	45%	66.6		
Measurement 2	69.3938	08/17/21	14:14	43%	68.9		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	121.8107	08/17/21	07:43	45%	66.6		
Measurement 2	121.8110	08/17/21	14:14	43%	68.9		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	112.7466	08/17/21	07:43	45%	66.6		
Measurement 2	112.7470	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7471	08/17/21	07:43	45%	66.6		
Measurement 2	1.7473	08/17/21	14:14	43%	68.9		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0004	137.0000	0.002555	--
DI Water Blank Weight of Solids	0.0002	224.0000	0.000759	--
Hexane Blank Weight of Solids	0.0000	123.0000	0.000000	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		1	Start Time	08:08
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	69.3937	0.3451	1.2500	--	--	1.2500	
Filter Beaker		69.0474		--	--		
Probe Wash	121.8109	121.8075	3.4000	134.0000	0.3423	3.0577	
Inorganic Impinger Contents	112.7468	112.7446	2.2000	279.2016	1.2703	0.9297	
Organic Impinger Contents	1.7472	1.7456	1.6000	118.0000	0.7297	0.8703	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 75%-2		
Sample Leakage Evident	NO	Estimated Leak Volume		0.00	(mg)

Sample Type	Sample Number	Date	Time
Filter	0916	08/11/21	14:10
Probe Wash	250-506	08/11/21	14:10
Inorganic Impinger Contents	250-510	08/11/21	14:10
Organic Impinger Contents	463	08/11/21	14:10

Weight Data			Run		2	Start Time	13:17
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	66.5723	08/17/21	07:43	45%	66.6		
Measurement 2	66.5724	08/17/21	14:14	43%	68.9		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	119.5037	08/17/21	07:43	45%	66.6		
Measurement 2	119.5042	08/17/21	14:14	43%	68.9		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	115.4424	08/17/21	07:43	45%	66.6		
Measurement 2	115.4429	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7476	08/17/21	07:43	45%	66.6		
Measurement 2	1.7478	08/17/21	14:14	43%	68.9		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0004	137.0000	0.002555	--
DI Water Blank Weight of Solids	0.0002	224.0000	0.000759	--
Hexane Blank Weight of Solids	0.0000	123.0000	0.000000	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		2	Start Time	13:17
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	66.5724	0.3617	0.9000	--	--	0.9000	
Filter Beaker		66.2098		--	--		
Probe Wash	119.5040	119.4984	5.5500	210.0000	0.5365	5.0135	
Inorganic Impinger Contents	115.4427	115.4407	2.0000	320.5219	1.2703	0.7297	
Organic Impinger Contents	1.7477	1.7463	1.4500	102.0000	0.7297	0.7203	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 75%-3		
Sample Leakage Evident	NO	Estimated Leak Volume		0.00	(mg)

Sample Type	Sample Number	Date	Time
Filter	0917	08/11/21	14:10
Probe Wash	250-497	08/11/21	14:10
Inorganic Impinger Contents	250-748	08/11/21	14:10
Organic Impinger Contents	455	08/11/21	14:10

Weight Data			Run		3	Start Time	15:25
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	49.3830	08/17/21	07:43	45%	66.6		
Measurement 2	49.3833	08/17/21	14:14	43%	68.9		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	119.3830	08/17/21	07:43	45%	66.6		
Measurement 2	119.3834	08/17/21	14:14	43%	68.9		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	125.3623	08/17/21	07:43	45%	66.6		
Measurement 2	125.3624	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7394	08/17/21	07:43	45%	66.6		
Measurement 2	1.7395	08/17/21	14:14	43%	68.9		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0004	137.0000	0.002555	--
DI Water Blank Weight of Solids	0.0002	224.0000	0.000759	--
Hexane Blank Weight of Solids	0.0000	123.0000	0.000000	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		3	Start Time	15:25
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	49.3832	0.3598	1.0000	--	--	1.0000	
Filter Beaker		49.0224		--	--		
Probe Wash	119.3832	119.3800	3.2500	140.0000	0.3577	2.8923	
Inorganic Impinger Contents	125.3624	125.3607	1.7000	319.6203	1.2703	0.4297	
Organic Impinger Contents	1.7395	1.7377	1.7500	96.0000	0.7297	1.0203	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 75%-FB
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Inorganic Impinger Contents	250-478	08/11/21	14:10
Organic Impinger Contents	464	08/11/21	14:10

Weight Data			Run		R-1 75%-FB	Start Time	
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	121.8241	08/17/21	07:43	45%	66.6		
Measurement 2	121.8246	08/17/21	14:14	43%	68.9		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7720	08/17/21	07:43	45%	66.6		
Measurement 2	1.7721	08/17/21	14:14	43%	68.9		

Gravimetric Concentrations					Actual Gain
Sample Portion	Final	Tare	Gain		(mg)
	(g)	(g)	(mg)		
Inorganic Impinger Contents	121.8244	121.8220	1.2703	max 2 mg total blank adjustment, proportioned	2.3500
Organic Impinger Contents	1.7721	1.7707	0.7297		1.3500

Requested Standard Analysis - 5-10 business days after receipt at lab

SAMPLE DESCRIPTION AND LABELING RECORD

Contact Information (deliver results to)

Name: Pat McGovern, Jr.

Phone: (918) 307-8865

Email:



Air Hygiene International, Inc.
1600 W Tacoma Street
Broken Arrow, Oklahoma 74012
(888) 461-8778
www.airhygiene.com

Project Number:	catc-21-houston.tx-start#1	Laboratory Analysis Requested:
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Person Taking Samples:	JLW	Gravimetric
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Analysis Method	
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Sample Number	Location	Date	Volume
			RM 5
			RM 202
			RM 202

R-1 75%-1-E					
	Init R-1 75% - Run 1 - Filter	07/30/21	N/A	X	10-746 853

Run	Probe	Run Date	Run Time	Run Status	Run Notes
1	R-1 75%-1-PW	07/30/21	11:00	Success	Initial R-1 75% - Run 1 - Probe Wash
2	R-1 75%-1-PW	07/30/21	11:05	Success	Initial R-1 75% - Run 1 - Probe Wash

11-11-2020-11-20	Init 1A - 100% - Run 1 - 100% water	07/30/21	X	17
11-11-2020-11-20	Init B-1 75% - Run 1 - Inorganic Imminger Contents	07/30/21	X	17-32X
11-11-2020-11-20	B-1 75% - 1 IC			17

Run	Time	Temp	Pressure	Flow	Detector	Response	Area	Conc	Yield
1	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
21	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
22	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
23	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
24	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
26	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
27	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
28	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
29	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
31	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
32	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
33	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
34	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
35	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
36	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
37	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
38	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
39	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
40	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
41	10.0	100	1.0	1.0	1.0	1.0	1.0	1.0	1.0
42	10.0	100	1						

Run	Monomer	Initiator	Temperature (°C)	Time (h)	Yield (%)	Characterization
1	Styrene	AIBN	60	24	95	FTIR, ¹ H NMR
2	Methyl Methacrylate	AIBN	60	24	85	FTIR, ¹ H NMR
3	Acrylonitrile	AIBN	60	24	75	FTIR, ¹ H NMR
4	Butyl Acrylate	AIBN	60	24	90	FTIR, ¹ H NMR
5	Styrene	BPO	80	24	92	FTIR, ¹ H NMR
6	Methyl Methacrylate	BPO	80	24	88	FTIR, ¹ H NMR
7	Acrylonitrile	BPO	80	24	78	FTIR, ¹ H NMR
8	Butyl Acrylate	BPO	80	24	91	FTIR, ¹ H NMR

Unit	Filter	Unit	Filter
K-1 1/5%-1-CPM	Unit R-1 1/5% - Run 1 - CPM Filter	U130/Z1	N/A
D 1 75% - CPM	Unit D 1 75% - Run 1 - CPM Filter	U7100/Z4	N/A

R-1 15%-Z-F	Unit R-1 15% - Run Z - Filter	U/130/Z-1	N/A	X	10-633	04/16
R-1 15%-Z-F	Unit R-1 15% - Run Z - Filter	U/130/Z-1	N/A	X		

Unit	Probe	Wash	Run	2	75%-	1	R-1	2-PW
Q1	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q2	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q3	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q4	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q5	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q6	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q7	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q8	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q9	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q10	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q11	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q12	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q13	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q14	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q15	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q16	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q17	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q18	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q19	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q20	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q21	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q22	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q23	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q24	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q25	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q26	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q27	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q28	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q29	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q30	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q31	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q32	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q33	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q34	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q35	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q36	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q37	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q38	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q39	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q40	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q41	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q42	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q43	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q44	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q45	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q46	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q47	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q48	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q49	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q50	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q51	Unit	R-1	75%-	Run	2	75%-	1	R-1
Q52	Unit	R-1	75%-					

R-1 75%-2-IC	Unit R-1 75% - Run 2 - Inorganic Impinger Contents	07/30/21	X	250-510	915
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R-1 75%-2-Hex	Unit R-1 75% - Run 2 - Organic Impinger Contents	07/30/21	X	463	102
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R-1 75%-2-CPM	64	Unit R-1 75% - Run 2 - CPM Filter	07/30/21	N/A	X

R-1 75%-3-F	Unit R-1 75% - Run 3 - Filter	07/30/21	N/A	X	10/1-083	09/17
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R-1 75%-3-PW	66	Unit R-1 75% - Run 3 - Probe Wash	07/30/21	X	250-497	140
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R-1 75%-3-IC	Unit R-1 75% - Run 3 - Inorganic Impinger Contents	07/30/21	X	250-748	475
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R-1 75%-3-Hex	68	Unit R-1 75% - Run 3 - Organic Impinger Contents	07/30/21	X	455	96
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R-1 75%-3-CPM	Unit R-1 75% - Run 3 - CPM Filter	07/30/21	N/A		X
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8/2/21 13:36 @/cs San Ben 8/3/21 10:00

Signature _____ Date _____ Time _____

Signature _____ Date _____ Time _____

1

Signature	Date	Time

A: 2020533

iston.tx-start#1-EG1-75-PM

QUALITY ASSURANCE AND QUALITY CONTROL DATA

**100% Load
PM Laboratory Data**

SAMPLE RECOVERY AND INTEGRITY DATA SHEET

Plant Name	Stewart and Stevenson Integration Center	Date	08/31/21
Sampling Location	Caterpillar G3520 TALE	Operator	TP
Project #	catc-21-houston.tx-start#1		

Run History Data				
Run Number	R-1 100%-1	R-1 100%-2	R-1 100%-3	
Run Start Time	09:36	12:05	14:24	(hh:mm)
Run Stop Time	11:17	13:44	16:05	(hh:mm)
Train Prepared By	PKM	PKM	PKM	
Train Recovered By	PKM	PKM	PKM	
Recovery Date	07/30/21	07/30/21	07/30/21	(mm/dd/yy)
Relinquished By	PKM	PKM	PKM	
Relinquished Date	08/02/21	08/02/21	08/02/21	(mm/dd/yy)

Equipment Identification Numbers			
Impinger Case	samp-BH-0036	samp-BH-0036	samp-BH-0036
Sample Box	samp-cc-0009	samp-cc-0009	samp-cc-0009
PM Filter	0523	0916	0917
CPM Filter	R-1 100%-1-CPM	R-1 100%-2-CPM	R-1 100%-3-CPM

Sample Blank Taken ☒ YES

Moisture Content Data					
Impingers 1, 2, and 3 - Liquid Weight					
Final Weight	(W _f)	1857.9	1854.1	1950.7	g
Initial Weight	(W _i)	1668.8	1669.4	1717.6	g
Net Weight	(W _n)	189.1	184.7	233.1	g
Comments					
Impinger 4 - Silica Gel Weight					
Final Weight	(W _f)	874.3	860.1	870.7	g
Initial Weight	(W _i)	859.2	844.5	855.4	g
Net Weight	(W _n)	15.1	15.6	15.3	g
Comments					
Total Water Collected					
Total Weight	(W _{lc})	204.2	200.3	248.4	g
Total Volume	(V _{lc})	204.6	200.7	248.8	ml

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 100%-1
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Filter	1023	09/10/21	15:42
Probe Wash	250-726	09/10/21	15:42
Inorganic Impinger Contents	250-802	09/10/21	15:42
Organic Impinger Contents	0597	09/10/21	15:42

Weight Data			Run		1	Start Time	09:36
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	48.0276	09/14/21	11:15	45%	68		
Measurement 2	48.0279	09/15/21	13:55	45%	68		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	122.1851	09/14/21	11:15	45%	68		
Measurement 2	122.1854	09/15/21	13:55	45%	68		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	126.0307	09/14/21	11:15	45%	68		
Measurement 2	126.0310	09/15/21	13:55	45%	68		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7512	09/14/21	11:15	45%	68		
Measurement 2	1.7513	09/15/21	13:55	45%	68		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0000	420.0000	0.000000	--
DI Water Blank Weight of Solids	0.0001	240.0000	0.000417	--
Hexane Blank Weight of Solids	0.0002	430.0000	0.000349	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		1	Start Time	09:36
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	48.0278	0.3602	-0.4000	--	--	0.0000	
Filter Beaker		47.6680		--	--		
Probe Wash	122.1853	122.1817	3.6000	140.0000	0.0000	3.6000	
Inorganic Impinger Contents	126.0309	126.0276	3.2500	484.3659	1.5904	1.6596	
Organic Impinger Contents	1.7513	1.7501	1.2000	80.0000	0.4096	0.7904	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 100%-2
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Filter	0806	09/10/21	15:42
Probe Wash	250-846	09/10/21	15:42
Inorganic Impinger Contents	250-857	09/10/21	15:42
Organic Impinger Contents	0594	09/10/21	15:42

Weight Data			Run		2	Start Time	12:05
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	67.0374	09/14/21	11:15	45%	68		
Measurement 2	67.0376	09/15/21	13:55	45%	68		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	123.8782	09/14/21	11:15	45%	68		
Measurement 2	123.8785	09/15/21	13:55	45%	68		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	123.3015	09/14/21	11:15	45%	68		
Measurement 2	123.3018	09/15/21	13:55	45%	68		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7514	09/14/21	11:15	45%	68		
Measurement 2	1.7515	09/15/21	13:55	45%	68		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0000	420.0000	0.000000	--
DI Water Blank Weight of Solids	0.0001	240.0000	0.000417	--
Hexane Blank Weight of Solids	0.0002	430.0000	0.000349	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		2	Start Time	12:05
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	67.0375	0.3586	-0.6500	--	--	0.0000	
Filter Beaker		66.6796		--	--		
Probe Wash	123.8784	123.8773	1.0500	235.0000	0.0000	1.0500	
Inorganic Impinger Contents	123.3017	123.3002	1.5000	509.0743	1.5904	0.0000	
Organic Impinger Contents	1.7515	1.7505	1.0000	66.0000	0.4096	0.5904	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 100%-3
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Filter	0852	09/10/21	15:42
Probe Wash	250-357	09/10/21	15:42
Inorganic Impinger Contents	250-083	09/10/21	15:42
Organic Impinger Contents	0584	09/10/21	15:42

Weight Data			Run		3	Start Time	14:24
Filter and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	68.7259	09/14/21	11:15	45%	68		
Measurement 2	68.7262	09/15/21	13:55	45%	68		
Probe Wash and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	113.7084	09/14/21	11:15	45%	68		
Measurement 2	113.7087	09/15/21	13:55	45%	68		
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	101.7787	09/14/21	11:15	45%	68		
Measurement 2	101.7791	09/15/21	13:55	45%	68		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7379	09/14/21	11:15	45%	68		
Measurement 2	1.7380	09/15/21	13:55	45%	68		

Blank and Titration Concentrations				
Blank Type	Weight	Volume	Concentration	Mass
	(g)	(ml)	(mg/ml)	(mg)
Acetone Blank Weight of Solids	0.0000	420.0000	0.000000	--
DI Water Blank Weight of Solids	0.0001	240.0000	0.000417	--
Hexane Blank Weight of Solids	0.0002	430.0000	0.000349	--
0.1N NH ₄ OH Correction	--	0.0000	--	0.0000

Gravimetric Concentrations			Run		3	Start Time	14:24
Sample Portion	Final	Tare	Gain	Volume	Blank Adjustment	Adjusted Gain	
	(g)	(g)	(mg)	(ml)	(mg)	(mg)	
Filter	68.7261	0.3657	-0.3000	--	--	0.0000	
Filter Beaker		68.3607		--	--		
Probe Wash	113.7086	113.7088	-0.2500	190.0000	-0.2500	0.0000	
Inorganic Impinger Contents	101.7789	101.7746	4.3000	480.0862	1.5904	2.7096	
Organic Impinger Contents	1.7380	1.7375	0.4500	60.0000	0.4096	0.0404	

SAMPLE ANALYTICAL DATA SHEET

Plant Name	Stewart and Stevenson Integration Center
Sampling Location	Caterpillar G3520 TALE
Project #	catc-21-houston.tx-start#1

Analytical Data		Run	R-1 100%-FB
Sample Leakage Evident	NO	Estimated Leak Volume	0.00 (mg)

Sample Type	Sample Number	Date	Time
Inorganic Impinger Contents	250-374	09/10/21	15:42
Organic Impinger Contents	0571	09/10/21	15:42

Weight Data			Run		R-1 100%-FB	Start Time	
Inorganic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	116.6108	09/14/21	11:15	45%	68		
Measurement 2	116.6112	09/15/21	13:55	45%	68		
Organic Impinger Contents and Beaker Weight	Weight	Date	Time	Humidity	Temp	Calibration Audit	
	(g)	(mm/dd/yy)	(hh:mm)	(%)	°F	(g)	
Measurement 1	1.7403	09/14/21	11:15	45%	68		
Measurement 2	1.7404	09/15/21	13:55	45%	68		

Gravimetric Concentrations			
Sample Portion	Final	Tare	Gain
	(g)	(g)	(mg)
Inorganic Impinger Contents	116.6110	116.6077	1.5904
Organic Impinger Contents	1.7404	1.7395	0.4096

max 2 mg total blank adjustment, proportioned

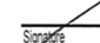
Actual Gain
(mg)
3.3000
0.8500

EQUIPMENT / INSTRUMENTATION IDENTIFICATION

Equipment / Instrumentation	Identification No.
Acetone Lot	21040287
Hexane Lot	21030109
Filterable Particulate Matter Oven ID	LABS-OV-0007
Condensable Particulate Matter Oven ID	LABS-OV-0008
Sonic Bath ID	LABS-UB-0001
LABS-SC-0004 Scale Weight Set ID (1st weights)	LABS-WT--0001
LABS-SC-0004 Scale Weight Set ID (2nd weights)	LABS-WT--0001
LABS-SC-0004 Scale Weight Set ID (3rd weights)	
LABS-SC-0004 Scale Weight Set ID (4th weights)	

A - 21040287
H - 21030109

Requested Standard Analysis - 5-10 business days after receipt at lab				Contact Information (deliver results to)			
SAMPLE DESCRIPTION AND LABELING RECORD				Name: Matt McBride Phone: (918) 307-8865 Email: mmcbride@airhygiene.com			
				 Air Hygiene International, Inc. 1600 W Tacoma Street Broken Arrow, Oklahoma 74012 (888) 461-8778 www.airhygiene.com			
Project Number:		catc-21-houston.tx-start#1		Laboratory Analysis Requested:			
Person Taking Samples:		TP		Gravimetric			
Sample Number	Location	Date	Volume	Analysis Method			
				RM 5	RM 202	--	--
R-1 100%-1-F	4 Unit R-1 100% - Run 1 - Filter	08/31/21	N/A	X		1023	100-766
R-1 100%-1-PW	5 Unit R-1 100% - Run 1 - Probe Wash	08/31/21	As Marked	X		140mL	250-726
R-1 100%-1-IC	6 Unit R-1 100% - Run 1 - Inorganic Impinger Contents	08/31/21	As Marked		X	670mL	250-802
R-1 100%-1-Hex	7 Unit R-1 100% - Run 1 - Organic Impinger Contents	08/31/21	As Marked		X	80mL	597
R-1 100%-1-CPM	8 Unit R-1 100% - Run 1 - CPM Filter	08/31/21	N/A		X		
R-1 100%-2-F	9 Unit R-1 100% - Run 2 - Filter	08/31/21	N/A	X		806	100-669
R-1 100%-2-PW	10 Unit R-1 100% - Run 2 - Probe Wash	08/31/21	As Marked	X		235mL	250-846
R-1 100%-2-IC	11 Unit R-1 100% - Run 2 - Inorganic Impinger Contents	08/31/21	As Marked		X	690mL	250-857
R-1 100%-2-Hex	12 Unit R-1 100% - Run 2 - Organic Impinger Contents	08/31/21	As Marked		X	66mL	594
R-1 100%-2-CPM	13 Unit R-1 100% - Run 2 - CPM Filter	08/31/21	N/A		X		
R-1 100%-3-F	14 Unit R-1 100% - Run 3 - Filter	08/31/21	N/A	X		852	100-745
R-1 100%-3-PW	15 Unit R-1 100% - Run 3 - Probe Wash	08/31/21	As Marked	X		190mL	250-357
R-1 100%-3-IC	16 Unit R-1 100% - Run 3 - Inorganic Impinger Contents	08/31/21	As Marked		X	710mL	250-083
R-1 100%-3-Hex	17 Unit R-1 100% - Run 3 - Organic Impinger Contents	08/31/21	As Marked		X	60mL	584
R-1 100%-3-CPM	18 Unit R-1 100% - Run 3 - CPM Filter	08/31/21	N/A		X		
R-1 100%-FB-IC	19 Unit R-1 100% - Run FB - Inorganic Impinger Contents	FB	As Marked		X	385mL	250-374
R-1 100%-FB-Hex	20 Unit R-1 100% - Run FB - Organic Impinger Contents	FB	As Marked		X	80mL	571
R-1 100%-FB-CPM	21 Unit R-1 100% - Run FB - CPM Filter	FB	N/A		X		
R-1 100%-B1-Acetone	22 Unit R-1 100% - Blank - Acetone	08/31/21	200		X	420mL	606
R-1 100%-B2-DI Water	23 Unit R-1 100% - Blank - DI Water	08/31/21	200	X		240mL	100-658
R-1 100%-B3-Hexane	24 Unit R-1 100% - Blank - Hexane	08/31/21	200		X	430mL	610

 Signature	9/2/21 Date	2:00 @ 10 Time	 Signature	9/3/21 Date	9:00 Time
 Signature	Date	Time	 Signature	Date	Time

catc-21-houston.tx-start#1-EG1-PM-100.xlsm

SD&L

APPENDIX E

FUEL ANALYSIS RECORDS

Client: Catalytic Combustion Corporation
Location: Stewart & Stevenson Integration Center
Date: July 29, 2021
Project #: catc-21-houston.tx-start#1

Natural Gas - Fuel Analysis

Standardized to 68 deg F and 14.696 psia - EPA Standards

Gas Component		Mole (%)	Molecular ¹ Weight (lb/lb-mole)	Lbs Component per Lb-Mole of Gas	Wt. % of Component	Ideal Gross ^{1,3} Heating Value (Btu/ft ³)	Fuel Heat Value [HHV] (Btu/SCF)	Ideal Net ^{1,3} Heating Value (Btu/ft ³)	Fuel Heat Value [LHV] (Btu/SCF)
Methane	CH ₄	98.3548	16.0430	15.78	96.76	994.85	978.48	895.75	881.02
Ethane	C ₂ H ₆	1.1343	30.0700	0.34	2.09	1,743.15	19.77	1,594.41	18.09
Propane	C ₃ H ₈	0.0197	44.0970	0.01	0.05	2,478.35	0.49	2,280.17	0.45
iso-Butane	iC ₄ H ₁₀	0.0005	58.1230	0.00	0.00	3,203.11	0.02	2,955.38	0.01
n-Butane	nC ₄ H ₁₀	0.0005	58.1230	0.00	0.00	3,213.35	0.02	2,965.62	0.01
Iso-Pentane	iC ₅ H ₁₂	0.0000	72.1500	0.00	0.00	3,940.87	0.00	3,643.50	0.00
n-Pentane	nC ₅ H ₁₂	0.0000	72.1500	0.00	0.00	3,948.75	0.00	3,648.32	0.00
Hexanes	C ₆ H ₁₄	0.0001	86.1770	0.00	0.00	4,684.54	0.00	4,337.82	0.00
Heptanes	C ₇ H ₁₆	0.0000	100.2040	0.00	0.00	5,419.94	0.00	5,023.77	0.00
Octanes	C ₈ H ₁₈	0.0000	114.2310	0.00	0.00	6,155.14	0.00	5,709.23	0.00
Carbon Dioxide	CO ₂	0.2558	44.0100	0.11	0.69	0.00	0.00	0.00	0.00
Nitrogen	N ₂	0.2239	28.0134	0.06	0.38	0.00	0.00	0.00	0.00
Hydrogen Sulfide	H ₂ S	0.0000	34.0800	0.00	0.00	627.54	0.00	578.00	0.00
Oxygen	O ₂	0.0057	31.9988	0.00	0.01	0.00	0.00	0.00	0.00
Helium	He	0.0000	4.0026	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	H ₂	0.0047	2.0159	0.00	0.00	319.34	0.02	269.82	0.01
Totals		100.0000		16.31	100.00	dry	998.79	dry	899.60
						wet^{2,5}	975.76	wet^{2,5}	878.86

Characteristics of Fuel Gas	
Molecular Weight of gas =	16.307 lb/lb-mole
Btu per lb. of gas ⁴ =	23,595.430 gross (HHV)
Btu per lb. of gas ⁴ =	21,252.128 net (LHV)
Density of fuel gas ² =	0.0423 lb/cu. ft
Wt % VOC in fuel gas =	0.06 %
Specific Gravity ¹ =	0.5630

Component	Wt%
carbon	74.35
oxygen	0.51
hydrogen	24.75
nitrogen	0.38
helium	0.00
sulfur	0.00
Total	100.00

F-Factor (SCF dry exhaust per MMBtu [HHV]) = 8,631.70
 (Based on EPA RM-19) at 68 deg F and 14.696 psia

F-Factor Calculation:

$$F\text{-Factor} = 1,000,000 \times ((3.64 \times \%H) + (1.53 \times \%C) + (0.57 \times \%S) + (0.14 \times \%N) - (0.46 \times \%O)) / GCV$$

GCV = Gross Btu per lb. of gas (HHV)

%H, %C, %S, %N, & %O are percent weight values calculated from fuel analysis and have units of (scf/lb)/%

Density of natural gas based on specific gravity multiplied by density of air at 68 deg F and 14.696 psia.

References:

¹ ASTM D 3588

² Civil Engineering Reference Manual, 7th ed. - Michael R. Lindeburg

³ Mark's Standard Handbook for Mechanical Engineers, 10th ed. - Eugene A. Avallone, Theodore Baumeister III

⁴ Introduction to Fluid Mechanics, 3rd ed. - William S. Janna

⁵ GPA Reference Bulletin 181-86, revised 1986, reprinted 1995

Client: Catalytic Combustion Corporation
Location: Stewart & Stevenson Integration Center
Date: July 30, 2021
Project #: catc-21-houston.tx-start#1

Natural Gas - Fuel Analysis

Standardized to 68 deg F and 14.696 psia - EPA Standards

Gas Component		Mole (%)	Molecular ¹ Weight (lb/lb-mole)	Lbs Component per Lb-Mole of Gas	Wt. % of Component	Ideal Gross ^{1,3} Heating Value (Btu/ft ³)	Fuel Heat Value [HHV] (Btu/SCF)	Ideal Net ^{1,3} Heating Value (Btu/ft ³)	Fuel Heat Value [LHV] (Btu/SCF)
Methane	CH ₄	98.2687	16.0430	15.77	96.57	994.85	977.62	895.75	880.25
Ethane	C ₂ H ₆	1.2050	30.0700	0.36	2.22	1,743.15	21.00	1,594.41	19.21
Propane	C ₃ H ₈	0.0205	44.0970	0.01	0.06	2,478.35	0.51	2,280.17	0.47
iso-Butane	iC ₄ H ₁₀	0.0003	58.1230	0.00	0.00	3,203.11	0.01	2,955.38	0.01
n-Butane	nC ₄ H ₁₀	0.0002	58.1230	0.00	0.00	3,213.35	0.01	2,965.62	0.01
Iso-Pentane	iC ₅ H ₁₂	0.0000	72.1500	0.00	0.00	3,940.87	0.00	3,643.50	0.00
n-Pentane	nC ₅ H ₁₂	0.0000	72.1500	0.00	0.00	3,948.75	0.00	3,648.32	0.00
Hexanes	C ₆ H ₁₄	0.0003	86.1770	0.00	0.00	4,684.54	0.01	4,337.82	0.01
Heptanes	C ₇ H ₁₆	0.0000	100.2040	0.00	0.00	5,419.94	0.00	5,023.77	0.00
Octanes	C ₈ H ₁₈	0.0000	114.2310	0.00	0.00	6,155.14	0.00	5,709.23	0.00
Carbon Dioxide	CO ₂	0.2992	44.0100	0.13	0.81	0.00	0.00	0.00	0.00
Nitrogen	N ₂	0.1976	28.0134	0.06	0.34	0.00	0.00	0.00	0.00
Hydrogen Sulfide	H ₂ S	0.0000	34.0800	0.00	0.00	627.54	0.00	578.00	0.00
Oxygen	O ₂	0.0033	31.9988	0.00	0.01	0.00	0.00	0.00	0.00
Helium	He	0.0000	4.0026	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	H ₂	0.0049	2.0159	0.00	0.00	319.34	0.02	269.82	0.01
Totals		100.000		16.33	100.00	dry	999.18	dry	899.97
						wet^{2,5}	976.14	wet^{2,5}	879.22

Characteristics of Fuel Gas	
Molecular Weight of gas =	16.325 lb/lb-mole
Btu per lb. of gas ⁴ =	23,577.669 gross (HHV)
Btu per lb. of gas ⁴ =	21,236.549 net (LHV)
Density of fuel gas ² =	0.0424 lb/cu. ft
Wt % VOC in fuel gas =	0.06 %
Specific Gravity ¹ =	0.5637

Component	Wt%
carbon	74.34
oxygen	0.59
hydrogen	24.73
nitrogen	0.34
helium	0.00
sulfur	0.00
Total	100.00

F-Factor (SCF dry exhaust per MMBtu [HHV]) = 8,632.09
 (Based on EPA RM-19) at 68 deg F and 14.696 psia

F-Factor Calculation:

$$F\text{-Factor} = 1,000,000 * ((3.64 * \%H) + (1.53 * \%C) + (0.57 * \%S) + (0.14 * \%N) - (0.46 * \%O)) / GCV$$

GCV = Gross Btu per lb. of gas (HHV)

%H, %C, %S, %N, & %O are percent weight values calculated from fuel analysis and have units of (scf/lb)/%

Density of natural gas based on specific gravity multiplied by density of air at 68 deg F and 14.696 psia.

References:

¹ ASTM D 3588

² Civil Engineering Reference Manual, 7th ed. - Michael R. Lindeburg

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⁴ Introduction to Fluid Mechanics, 3rd ed. - William S. Janna

⁵ GPA Reference Bulletin 181-86, revised 1986, reprinted 1995

Client: Catalytic Combustion Corporation
Location: Stewart & Stevenson Integration Center
Date: August 31, 2021
Project #: catc-21-houston.tx-start#1

Natural Gas - Fuel Analysis

Standardized to 68 deg F and 14.696 psia - EPA Standards

Gas Component		Mole (%)	Molecular ¹ Weight (lb/lb-mole)	Lbs Component per Lb-Mole of Gas	Wt. % of Component	Ideal Gross ^{1,3} Heating Value (Btu/ft ³)	Fuel Heat Value [HHV] (Btu/SCF)	Ideal Net ^{1,3} Heating Value (Btu/ft ³)	Fuel Heat Value [LHV] (Btu/SCF)
Methane	CH ₄	98.4117	16.0430	15.79	96.85	994.85	979.04	895.75	881.53
Ethane	C ₂ H ₆	1.0600	30.0700	0.32	1.96	1,743.15	18.48	1,594.41	16.90
Propane	C ₃ H ₈	0.0198	44.0970	0.01	0.05	2,478.35	0.49	2,280.17	0.45
iso-Butane	iC ₄ H ₁₀	0.0003	58.1230	0.00	0.00	3,203.11	0.01	2,955.38	0.01
n-Butane	nC ₄ H ₁₀	0.0002	58.1230	0.00	0.00	3,213.35	0.01	2,965.62	0.01
Iso-Pentane	iC ₅ H ₁₂	0.0000	72.1500	0.00	0.00	3,940.87	0.00	3,643.50	0.00
n-Pentane	nC ₅ H ₁₂	0.0000	72.1500	0.00	0.00	3,948.75	0.00	3,648.32	0.00
Hexanes	C ₆ H ₁₄	0.0000	86.1770	0.00	0.00	4,684.54	0.00	4,337.82	0.00
Heptanes	C ₇ H ₁₆	0.0000	100.2040	0.00	0.00	5,419.94	0.00	5,023.77	0.00
Octanes	C ₈ H ₁₈	0.0000	114.2310	0.00	0.00	6,155.14	0.00	5,709.23	0.00
Carbon Dioxide	CO ₂	0.2813	44.0100	0.12	0.76	0.00	0.00	0.00	0.00
Nitrogen	N ₂	0.2106	28.0134	0.06	0.36	0.00	0.00	0.00	0.00
Hydrogen Sulfide	H ₂ S	0.0000	34.0800	0.00	0.00	627.54	0.00	578.00	0.00
Oxygen	O ₂	0.0115	31.9988	0.00	0.02	0.00	0.00	0.00	0.00
Helium	He	0.0000	4.0026	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	H ₂	0.0046	2.0159	0.00	0.00	319.34	0.01	269.82	0.01
Totals		100.0000		16.30	100.00	dry	998.04	dry	898.91
						wet^{2,5}	975.03	wet^{2,5}	878.18

Characteristics of Fuel Gas	
Molecular Weight of gas =	16.303 lb/lb-mole
Btu per lb. of gas ⁴ =	23,583.835 gross (HHV)
Btu per lb. of gas ⁴ =	21,241.243 net (LHV)
Density of fuel gas ² =	0.0423 lb/cu. ft
Wt % VOC in fuel gas =	0.06 %
Specific Gravity ¹ =	0.5629

Component	Wt%
carbon	74.32
oxygen	0.57
hydrogen	24.74
nitrogen	0.36
helium	0.00
sulfur	0.00
Total	100.00

F-Factor (SCF dry exhaust per MMBtu [HHV]) = 8,631.42
 (Based on EPA RM-19) at 68 deg F and 14.696 psia

F-Factor Calculation:

$$F\text{-Factor} = 1,000,000 \times ((3.64 \times \%H) + (1.53 \times \%C) + (0.57 \times \%S) + (0.14 \times \%N) - (0.46 \times \%O)) / GCV$$

GCV = Gross Btu per lb. of gas (HHV)

%H, %C, %S, %N, & %O are percent weight values calculated from fuel analysis and have units of (scf/lb)/%

Density of natural gas based on specific gravity multiplied by density of air at 68 deg F and 14.696 psia.

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⁴ Introduction to Fluid Mechanics, 3rd ed. - William S. Janna

⁵ GPA Reference Bulletin 181-86, revised 1986, reprinted 1995



Certificate of Analysis

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10630 FALLSTONE RD. HOUSTON, TEXAS 77099
P.O. BOX 741905, HOUSTON, TEXAS 77274

TEL: (281) 495-2400

FAX: (281) 495-2410

CLIENT:	Air Hygiene International	REQUESTED BY:	Dr. Sean Barnes
CLIENT PROJECT:	catc-21-houston-start#1	PURCHASE ORDER NO:	PENDING
LABORATORY NO:	95248-001	REPORT DATE:	August 06, 2021
SAMPLE:	Natural Gas (Primary # 4651) (4651) 2021-07-29		

Composition of Natural Gas by Gas Chromatography (TCD/FID), GPA 2261

	<u>Results, Mol %</u>
Hydrogen	0.0047
Oxygen	0.0057
Nitrogen	0.2239
Carbon Dioxide	0.2558
Methane	98.3548
Ethane	1.1343
Propane	0.0197
iso-Butane	0.0005
n-Butane	0.0005
iso-Pentane	0.0000
n-Pentane	0.0000
Hexane Plus	0.0001
TOTAL	100.0000

Calorific Value and Specific Gravity, Calculated at 14.696 psia and 60°F, ASTM D 3588.e

	<u>Results</u>
NET (Dry basis), BTU/scf	913.3
Gross (Dry basis), BTU/scf	1,014
NET (Dry basis), BTU/lb	21,257
Gross (Dry basis), BTU/lb	23,599

Calorific Value and Specific Gravity, Calculated at 14.696 psia and 68°F, ASTM D 3588.e

	<u>Results</u>
NET (Dry basis), BTU/scf	899.5
Gross (Dry basis), BTU/scf	998.6
NET (Dry basis), BTU/lb	21,257
Gross (Dry basis), BTU/lb	23,599

Cert # L19-636,C2018-02457

Quality Management System Certified to ISO 9001:2015, and ISO/IEC 17025:2017

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TEL: (281) 495-2400

FAX: (281) 495-2410

CLIENT:	Air Hygiene International	REQUESTED BY:	Dr. Sean Barnes
CLIENT PROJECT:	catc-21-houston-start#1	PURCHASE ORDER NO:	PENDING
LABORATORY NO:	95248-001	REPORT DATE:	August 06, 2021
SAMPLE:	Natural Gas (Primary # 4651) (4651) 2021-07-29		

Respectfully submitted
For Texas OilTech Laboratories, L.P.

Mr. Ikenna "Ike" Ezeji
Laboratory Director

Cert # L19-636,C2018-02457

Quality Management System Certified to ISO 9001:2015, and ISO/IEC 17025:2017

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FAX: (281) 495-2410

CLIENT:	Air Hygiene International	REQUESTED BY:	Dr. Sean Barnes
CLIENT PROJECT:	catc-21-houston-start#1	PURCHASE ORDER NO:	PENDING
LABORATORY NO:	95248-003 Page 1 of 2	REPORT DATE:	August 06, 2021
SAMPLE:	Natural Gas (Primary # 4893) (4893) 2021-07-30		

Composition of Natural Gas by Gas Chromatography (TCD/FID), GPA 2261

	<u>Results, Mol %</u>
Hydrogen	0.0049
Oxygen	0.0033
Nitrogen	0.1976
Carbon Dioxide	0.2992
Methane	98.2687
Ethane	1.2050
Propane	0.0205
iso-Butane	0.0003
n-Butane	0.0002
iso-Pentane	0.0000
n-Pentane	0.0000
Hexane Plus	0.0003
TOTAL	100.0000

Calorific Value and Specific Gravity, Calculated at 14.696 psia and 60°F, ASTM D 3588.e

	<u>Results</u>
NET (Dry basis), BTU/scf	913.7
Gross (Dry basis), BTU/scf	1,014
NET (Dry basis), BTU/lb	21,241
Gross (Dry basis), BTU/lb	23,581

Calorific Value and Specific Gravity, Calculated at 14.696 psia and 68°F, ASTM D 3588.e

	<u>Results</u>
NET (Dry basis), BTU/scf	899.8
Gross (Dry basis), BTU/scf	999.0
NET (Dry basis), BTU/lb	21,241
Gross (Dry basis), BTU/lb	23,581

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CLIENT:	Air Hygiene International	REQUESTED BY:	Dr. Sean Barnes
CLIENT PROJECT:	catc-21-houston-start#1	PURCHASE ORDER NO:	PENDING
LABORATORY NO:	95248-003 Page 2 of 2	REPORT DATE:	August 06, 2021
SAMPLE:	Natural Gas (Primary # 4893) (4893) 2021-07-30		

Respectfully submitted
For Texas OilTech Laboratories, L.P.

Mr. Ikenna "Ike" Ezeji
Laboratory Director

Cert # L19-636,C2018-02457

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TEL: (281) 495-2400

FAX: (281) 495-2410

Conversion Factors (Gas Analysis) to adjust BTU/ft³ and Sulfur content @60°F and 68°F

NET (Dry Basis) BTU/scf @60°F, factor= 1

NET (Dry Basis) BTU/scf @68°F, factor= 0.984839

Gross (Dry Basis) BTU/scf @60°F, factor = 1

Gross (Dry Basis) BTU/scf @68°F, factor = 0.984839

NET (Dry Basis) BTU/lb @60°F, factor = 1

NET (Dry Basis) BTU/lb @68°F, factor = 1

GROSS (Dry Basis) BTU/lb @60°F, factor= 1

GROSS (Dry Basis) BTU/lb @68°F, factor= 1

Sulfur Total Volatile, ASTM D 6667 @60°F, wt% or ppmwt, factor= 1

Sulfur Total Volatile, ASTM D 6667 @68°F, wt% or ppmwt, factor= 0.984839

Sulfur Total Volatile, ASTM D 6667 @60°F, grains/100scf = ppmwt @60°F x 0.0300

Sulfur Total Volatile, ASTM D 6667 @68°F, grains/100scf = ppmwt @60°F x 0.0295

Conversion Factors (Liquid Fuel Analysis)

Liquid Fuel BTU/lb @60°F= Liquid fuel BTU/lb @68°F

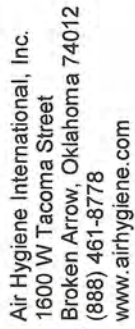


Cert. No.: 0005085, 17025

Quality Management System Certified to ISO 9001:2008, and ISO 17025:2005

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pmcgovern@airhygiene.com

Relinquished by: (Signature)



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P.O. BOX 741905, HOUSTON, TEXAS 77274

TEL: (281) 495-2400

FAX: (281) 495-2410

CLIENT:	Air Hygiene International	REQUESTED BY:	Dr. Sean Barnes
CLIENT PROJECT:	catc-21-Houston-Tx-Start#1	PURCHASE ORDER NO:	21011220
LABORATORY NO:	95477-001	REPORT DATE:	September 08, 2021
SAMPLE:	Primary Fuel line (3713) 2021-08-31		

TEST

RESULT

Composition of Natural Gas by Gas Chromatography (TCD/FID), GPA 2261

	<u>Results, Mol %</u>
Hydrogen	0.0046
Oxygen	0.0115
Nitrogen	0.2106
Carbon Dioxide	0.2813
Methane	98.4117
Ethane	1.0600
Propane	0.0198
iso-Butane	0.0003
n-Butane	0.0002
iso-Pentane	0.0000
n-Pentane	0.0000
Hexane Plus	0.0000
TOTAL	100.0000

Calorific Value and Specific Gravity, Calculated at 14.696 psia and 60°F, ASTM D 3588.e

	<u>Results</u>
NET (Dry basis), BTU/scf	912.6
Gross (Dry basis), BTU/scf	1,013
NET (Dry basis), BTU/lb	21,246
Gross (Dry basis), BTU/lb	23,587

Calorific Value and Specific Gravity, Calculated at 14.696 psia and 68°F, ASTM D 3588.e

	<u>Results</u>
NET (Dry basis), BTU/scf	898.8
Gross (Dry basis), BTU/scf	997.9
NET (Dry basis), BTU/lb	21,246
Gross (Dry basis), BTU/lb	23,587

Respectfully submitted
For Texas OilTech Laboratories, L.P.

Mr. Ikenna "Ike" Ezeji
Laboratory Director

Cert # L19-636,C2018-02457

Quality Management System Certified to ISO 9001:2015, and ISO/IEC 17025:2017

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TEL: (281) 495-2400

FAX: (281) 495-2410

Conversion Factors (Gas Analysis) to adjust BTU/ft³ and Sulfur content @60°F and 68°F

NET (Dry Basis) BTU/scf @60°F, factor= 1

NET (Dry Basis) BTU/scf @68°F, factor= 0.984839

Gross (Dry Basis) BTU/scf @60°F, factor = 1

Gross (Dry Basis) BTU/scf @68°F, factor = 0.984839

NET (Dry Basis) BTU/lb @60°F, factor = 1

NET (Dry Basis) BTU/lb @68°F, factor = 1

GROSS (Dry Basis) BTU/lb @60°F, factor= 1

GROSS (Dry Basis) BTU/lb @68°F, factor= 1

Sulfur Total Volatile, ASTM D 6667 @60°F, wt% or ppmwt, factor= 1

Sulfur Total Volatile, ASTM D 6667 @68°F, wt% or ppmwt, factor= 0.984839

Sulfur Total Volatile, ASTM D 6667 @60°F, grains/100scf = ppmwt @60°F x 0.0300

Sulfur Total Volatile, ASTM D 6667 @68°F, grains/100scf = ppmwt @60°F x 0.0295

Conversion Factors (Liquid Fuel Analysis)

Liquid Fuel BTU/lb @60°F= Liquid fuel BTU/lb @68°F

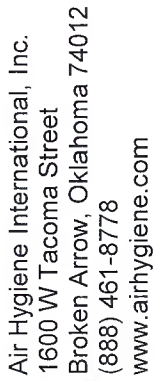


Cert. No.: 0005085, 17025

Quality Management System Certified to ISO 9001:2008, and ISO 17025:2005

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SAMPLE DESCRIPTION AND CHAIN OF CUSTODY RECORD

Fuel analysis

Laboratory Analysis Requested:

catc-21-houston.tx-start#1

MM

Person Taking Samples:

Analysis Method

[illegible]

	9/2/2021 Date: _____ Relinquished by: (Signature) _____	21:00 Time: _____		9/3/21 Date: _____ Received by: (Signature) _____	9:00 Time: _____
	_____ Date: _____ Relinquished by: (Signature) _____	_____ Time: _____		9/7/21 Date: _____ Received by: (Signature) _____	9:10 Time: _____

APPENDIX F

STRATIFICATION TEST DATA

Source Information	
Company	Catalytic Combustion
Plant Name	Stewart and Stevenson Integration Center
Equipment	Caterpillar engine
Location	Houston, Texas

Test Information	
Date	07/29/21
Project #	catc-21-houston.tx-start#1
Unit Number	G3520 TALE
Load	50%
Number of Ports Available	2
Number of Ports Used	2

Stack and Test Type	
☐ Isokinetic Traverse (Wet Chemistry Testing) ☐ Velocity Traverse (Flow and Flow RATA Test) ☒ Stratification Traverse (Compliance Test) ☐ Stratification Traverse (RATA)	<div style="display: flex; justify-content: space-between;"> <div> ☐ RM 20 ☐ Part 60 ☐ Part 75 </div> <div style="text-align: center;"> Circular Stack </div> </div>

Created with Traverse-AHI v20200108

catc-21-houston.tx-start#1-EG1-Strat

METHOD 1 - STRATIFICATION TEST FOR A CIRCULAR SOURCE

Company	Catalytic Combustion	Date	07/29/21
Plant Name	Stewart and Stevenson Integration Center	Project #	catc-21-houston.tx-start#1
Equipment	Caterpillar engine	# of Ports Available	2
Location	Houston, Texas	# of Ports Used	2

Circular Stack or Duct Diameter			
Distance to Far Wall of Stack	(L _{fw})	32.00	in.
Distance to Near Wall of Stack	(L _{nw})	0.125	in.
Diameter of Stack	(D)	31.88	in.
Area of Stack	(A _s)	5.54	ft ²

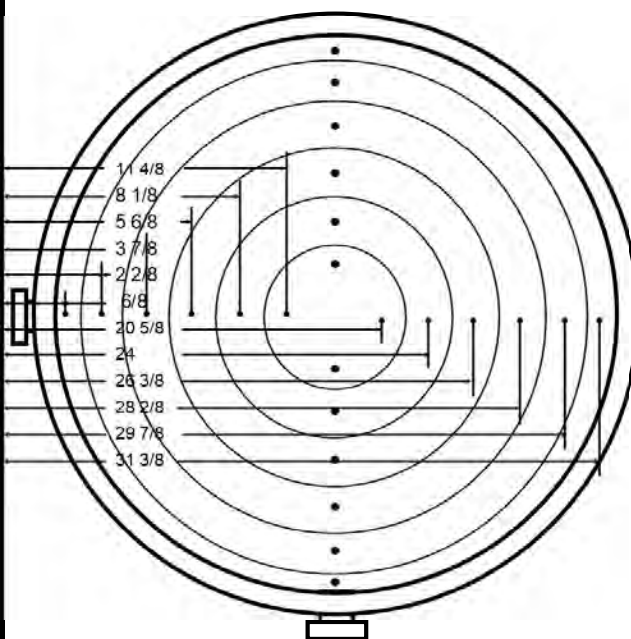
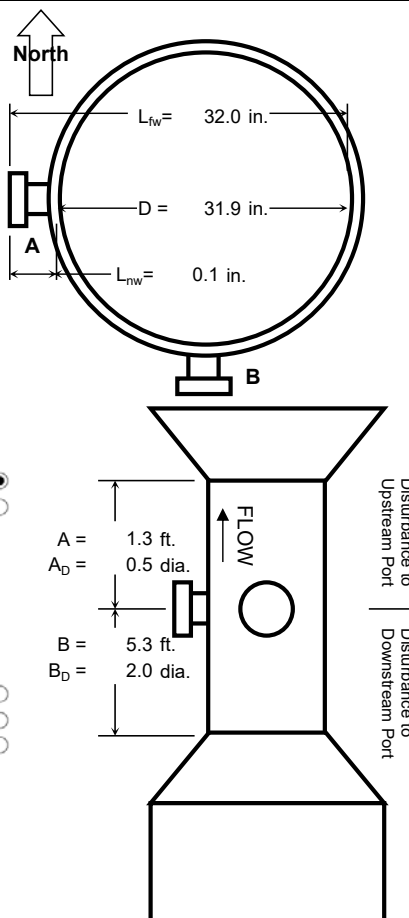
Distance from Disturbances to Port			
Distance Upstream	(A)	16.00	in.
Diameters Upstream	(A _D)	0.50	diameters
Distance Downstream	(B)	64.00	in.
Diameters Downstream	(B _D)	2.01	diameters

Number of Traverse Points Required					
Diameters to		Minimum Number of ¹		Minimum Number of	
Flow Disturbance		Traverse Points		Traverse Points	
Down (B _D)	Up (A _D)	Particulate	Velocity	Comp Stratification	
Stream	Stream	Points	Points	Criteria	Points
2.00-4.99	0.50-1.24	24	16	RM 7E 8.1.2	12 RM1 pts
5.00-5.99	1.25-1.49	20	16	Alt 7E 8.1.2	3 points
6.00-6.99	1.50-1.74	16	12	12 points	
7.00-7.99	1.75-1.99	12	12		
>= 8.00	>=2.00	8 or 12 ²	8 or 12 ²	Minimum Number of	
Upstream Spec		24	16	Traverse Points	
Downstream Spec		24	16	RATA Stratification	
Traverse Pts Required		24	16	Criteria	Points
¹ Check Minimum Number of Points for the Upstream and Downstream conditions, then use the largest.				Part75/60	12 RM1 pts
				75 abrv (a)	3 points
				75 abrv (b)	6 points
² 8 for Circular Stacks 12 to 24 inches 12 for Circular Stacks over 24 inches					

Number of Traverse Points Used				
2	Ports by	12	Pts / port	Stratification Traverse
24	Pts Used	12	Required	(Compliance Test)

Traverse Point Locations			
Traverse Point Number	Percent of Stack Diameter	Distance from Inside Wall	Distance Including Reference Length
	%	in.	in.
1	2.1%	5/8	6/8
2	6.7%	2 1/8	2 2/8
3	11.8%	3 6/8	3 7/8
4	17.7%	5 5/8	5 6/8
5	25.0%	8	8 1/8
6	35.6%	11 3/8	11 4/8
7	64.4%	20 4/8	20 5/8
8	75.0%	23 7/8	24
9	82.3%	26 2/8	26 3/8
10	88.2%	28 1/8	28 2/8
11	93.3%	29 6/8	29 7/8
12	97.9%	31 2/8	31 3/8
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Adjust Sample Points Out of Boundary Layer



STRATIFICATION TRAVERSE (COMPLIANCE TEST) RESULTS

Company	Catalytic Combustion	Date	07/29/21
Plant Name	Stewart and Stevenson Integration Center	Project #	catc-21-houston.tx-start#1
Equipment	Caterpillar engine	# of Ports Available	2
Location	Houston, Texas	# of Ports Used	2

Stack Dimensions				Traverse Data			
Diameter or Length of Stack	(D)	31.88	in.	2	Ports by	12	Pts / port
Width of Stack	(W)		in.	24	Pts Used	12	Required
Area of Stack	(A _s)	5.54	ft ²	Run Start	11:00:23	Run End	12:10:23

Traverse Point	Time Per Point	Point Start Time	Point Stop Time (Reading)	O ₂	Percent Difference	NOx	Percent Difference
	min.	hh:mm:ss	hh:mm:ss	%	%	ppm	%
B-12	2.50	11:00:23	11:02:53	8.90	0.44%	4.85	4.17%
B-11	2.50	11:02:53	11:05:23	8.89	0.55%	4.62	0.77%
B-10	2.50	11:05:23	11:07:53	8.88	0.67%	4.59	1.42%
B-9	2.50	11:07:53	11:10:23	8.88	0.67%	4.84	3.95%
B-8	2.50	11:10:23	11:12:53	8.88	0.67%	4.27	8.29%
B-7	2.50	11:12:53	11:15:23	8.87	0.78%	4.74	1.80%
B-6	2.50	11:15:23	11:17:53	8.88	0.67%	4.36	6.36%
B-5	2.50	11:17:53	11:20:23	8.90	0.44%	4.02	13.66%
B-4	2.50	11:20:23	11:22:53	8.88	0.67%	3.77	19.03%
B-3	2.50	11:22:53	11:25:23	8.87	0.78%	4.04	13.23%
B-2	2.50	11:25:23	11:27:53	8.92	0.22%	3.65	21.61%
B-1	2.50	11:27:53	11:30:23	8.90	0.44%	3.47	25.47%
A-12	2.50	11:40:23	11:42:53	9.00	0.68%	5.32	14.26%
A-11	2.50	11:42:53	11:45:23	8.96	0.23%	5.01	7.60%
A-10	2.50	11:45:23	11:47:53	8.95	0.12%	4.54	2.49%
A-9	2.50	11:47:53	11:50:23	8.94	0.00%	4.76	2.23%
A-8	2.50	11:50:23	11:52:53	8.91	0.33%	4.53	2.71%
A-7	2.50	11:52:53	11:55:23	8.89	0.55%	4.26	8.51%
A-6	2.50	11:55:23	11:57:53	8.92	0.22%	4.79	2.88%
A-5	2.50	11:57:53	12:00:23	8.88	0.67%	4.64	0.34%
A-4	2.50	12:00:23	12:02:53	8.88	0.67%	5.47	17.48%
A-3	2.50	12:02:53	12:05:23	9.09	1.68%	5.74	23.28%
A-2	2.50	12:05:23	12:07:53	9.14	2.24%	5.80	24.66%
A-1	2.50	12:07:53	12:10:23	9.34	4.48%	5.66	21.56%
Average				8.94		4.66	

side

front

			O ₂		NOx		AND criteria
			Criteria	Results	Criteria	Results	
Strat Method 7E	Non-Stratified %	≤	5%	Non (%)	5%		Under Method 7E criteria at least one measured pollutant or diluent demonstrates a stratified stack with subsequent testing from 12 points.
	Non-Stratified Δ	≤	0.3		0.5		
	Minimally-Stratified %	≤	10%		10%		
	Minimally-Stratified Δ	≤	0.5		1		
	Stratified	>	10%		10%	Strat (%)	
Outcome Location			1 point closest to the mean		12 points Method 1 points		
Maximum Concentration			9.34		5.80		
Upscale Δ = Max Concentration - Average			0.40	Mini	1.15	Strat	
Upscale % Difference			4.48%	Non	24.66%	Strat	
Minimum Concentration			8.87		3.47		
Downscale Δ = Average - Min Concentration			0.07	Non	1.19	Strat	
Downscale % Difference			0.78%	Non	25.47%	Strat	
First Point on List Closest to Average			A-8		A-4		
Port Averages with Maximum Concentration Indicator	Port A Average		9.00	<max	5.07	<max	
	Port B Average		8.89		4.13		
	Port C Average						
	Port D Average						
	Port E Average						
	Port F Average						
	Port G Average						

STRAT TEST DETERMINED SAMPLE POINTS FOR CIRCULAR STACK

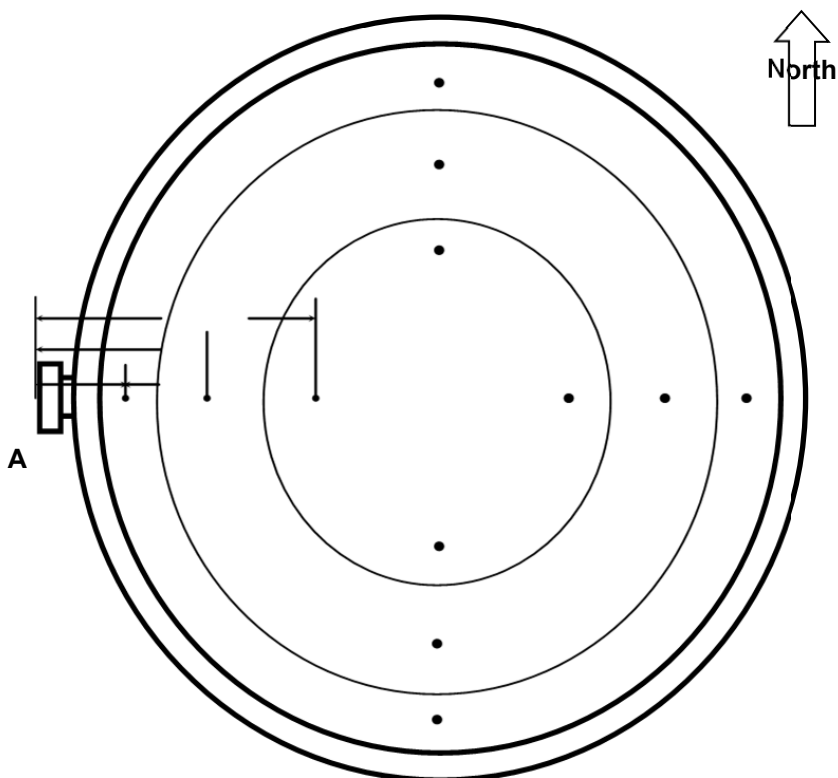
Company	Catalytic Combustion	Date	07/29/21
Plant Name	Stewart and Stevenson Integration Center	Project #	catc-21-houston.tx-start#1
Equipment	Caterpillar engine	# of Ports Available	2
Location	Houston, Texas	# of Ports Used	2

Stack Dimensions				Traverse Data			
Diameter or Length of Stack	(D)	31.88	in.	2	Ports by	12	Pts / port
Width of Stack	(W)		in.	24	Pts Used	12	Required
Area of Stack	(A _s)	5.54	ft ²	Run Start	11:00:23	Run End	12:10:23

40 CFR 60, Appendix A, Method 7E Criteria

Stratification Results		Traverse Point Number	Percent of Stack Diameter	Distance from Inside Wall	Distance Including Reference Length
Maximum Percent Difference	25.47 % for NO _x				
Maximum Pollutant Conc. Diff.	1.19 ppm for NO _x				
Maximum Diluent Conc. Diff.	0.40 % for O ₂				
Stratification Conclusions			%	in.	in.
Comparison	all diluents/pollutants	1			
Stack Diameter	D ≤ 93.6 in.	2			
Under Method 7E criteria at least one measured pollutant or diluent demonstrates a stratified stack with subsequent testing from 12 points.		3			

☐ Moisture, for MW	☐ 6.5.6(b)(2) alt. points do not apply
☐ Moisture, for wet-to-dry	
☒ Gas	



APPENDIX G

EQUIPMENT CALIBRATION RECORDS

S-TYPE PITOT TUBE CALIBRATION SHEET

Reference USEPA Reference Method 2 (40CFR60, App. A, Meth. 2)

PITOT SERIAL# <u>A5708</u>	CALIBRATION DATE: <u>17-Nov-14</u>
PITOT TYPE: <u>S</u>	BAROMETRIC PRESSURE: <u>29.40</u> in Hg
STD. PITOT TYPE: <u>HEMISPHERICAL</u>	STATIC PRESSURE: <u>-0.6</u> in H ₂ O
Cp(std): <u>0.990</u>	BLOCKAGE %: <u><2%</u>
PROBE SERIAL# <u>N/A</u>	CORRECTION FACTOR: <u>1.00</u>

SIDE "A" CALIBRATION				
RUN NO.	Δ Pstd in H ₂ O	Δ Ps in H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	0.550	0.793	0.824	0.001
2	0.550	0.798	0.822	-0.001
3	0.550	0.795	0.823	0.000
"A" AVERAGE			0.823	0.0013 <small>(must be ≤ 0.01)</small>

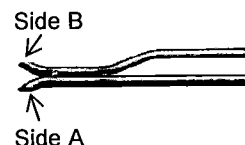
SIDE "B" CALIBRATION				
RUN NO.	Δ Pstd in H ₂ O	Δ Ps in H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	0.551	0.793	0.825	0.002
2	0.550	0.797	0.822	0.000
3	0.551	0.802	0.821	-0.002
"B" AVERAGE			0.823	0.0023 <small>(must be ≤ 0.01)</small>

ACCEPTANCE CRITERIA

AVERAGE 0.0005 AVG. Cp (A) - AVG. Cp (B) must be ≤ 0.01

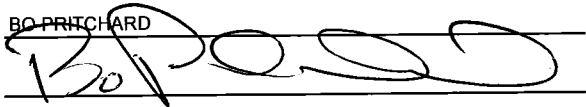
If the Average and both Deviation Averages "A" & "B" are ≤ 0.01, then the OVERALL AVERAGE below may be used.
* If NOT, use the "A" Average OR "B" Average.

OVERALL AVERAGE 0.8230



I certify that the above pitot tube was tested in accordance with the US EPA Method 2 standards.
See the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 2, Item 4.

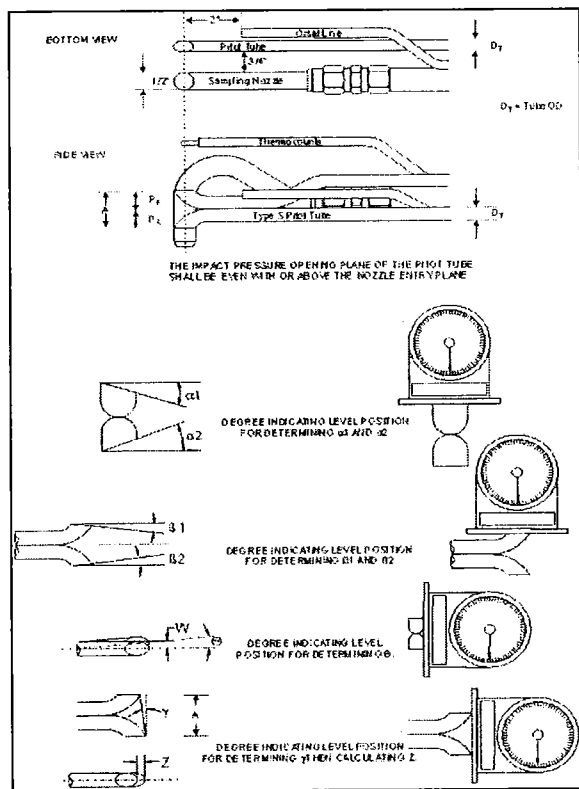
Print Name: BO PRITCHARD

Signature: 

Date 11/17/2014



Type S Pitot Tube Inspection Form



PITOT TUBE/PROBE # 5708

Parameter	Value	Allowable Range	Check
Assembly Level?	yes	Yes	OK
Ports Damaged?	no	No	OK
α_1	0	$-10^\circ < \alpha_1 < +10^\circ$	OK
α_2	0	$-10^\circ < \alpha_2 < +10^\circ$	OK
1	0	$-5^\circ < \beta_1 < +5^\circ$	OK
1	1	$-5^\circ < \beta_2 < +5^\circ$	OK
γ	0		
θ	1		
$Z = A \tan \gamma$	0.000	$Z \leq .125"$	OK
$W = A \tan \theta$	0.015	$W \leq .031"$	OK
Dt	0.375	.188" to .375"	OK
A/2Dt	1.136	$1.05 \leq P_A/D_t \leq 1.5$	OK
A	0.852	$2.1D_t \leq A \leq 3D_t$	OK

Certification

I certify that pitot tube/probe number 5708 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification factor of 0.84. See 40 CFR Pt. 60, App. A, EPA Method 2.

Certified by:

Bob [Signature] 11-12-14
Personnel (Signature/Date)

S-TYPE PITOT TUBE CALIBRATION SHEET

Reference *USEPA Reference Method 2 (40CFR60, App. A, Meth. 2)*

PITOT SERIAL# A6223
PITOT TYPE: S
STD. PITOT TYPE: ELLIPSOIDAL
Cp(std): 0.990
PROBE SERIAL# N/A

CALIBRATION DATE: 11-Aug-15
BAROMETRIC PRESSURE: 29.65 in Hg
STATIC PRESSURE: -0.6 in H₂O
BLOCKAGE %: N/A
CORRECTION FACTOR: 1.00

SIDE "A" CALIBRATION				
RUN NO.	Δ Pstd in H ₂ O	Δ Ps in H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	0.560	0.808	0.824	-0.002
2	0.560	0.806	0.825	-0.001
3	0.561	0.802	0.828	0.002

"A" AVERAGE	0.826	0.0020
-------------	-------	--------

(must be ≤ 0.01)

SIDE "B" CALIBRATION				
RUN NO.	Δ Pstd in H ₂ O	Δ Ps in H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	0.559	0.823	0.816	-0.001
2	0.559	0.822	0.816	-0.001
3	0.561	0.819	0.819	0.002

"B" AVERAGE	0.817	0.0019
-------------	-------	--------

(must be ≤ 0.01)

ACCEPTANCE CRITERIA

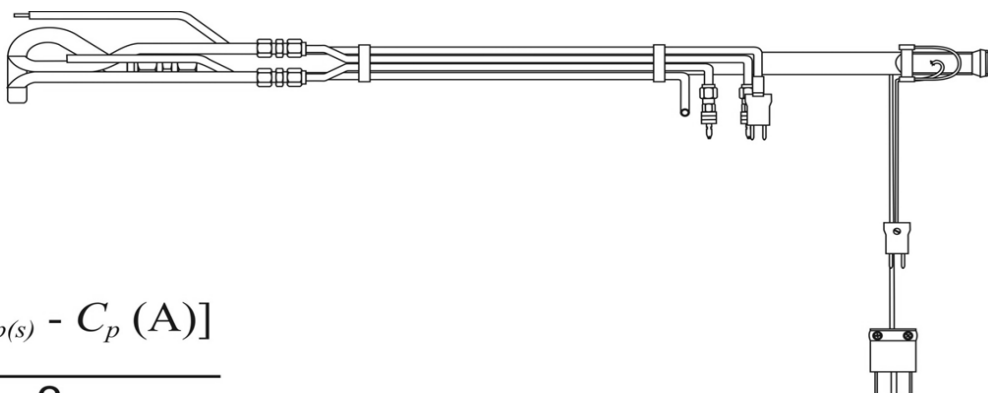
AVERAGE 0.0086 AVG. Cp (A) - AVG. Cp (B) must be ≤ 0.01

If the Average and both Deviation Averages "A" & "B" are ≤ 0.01, then the OVERALL AVERAGE below may be used.

* If NOT, use the "A" Average OR "B" Average.

OVERALL AVERAGE 0.8215

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$



$$\text{Deviation} = C_{p(s)} - \overline{C_p(A)}$$

$$\text{Avg Dev} = \sigma(A) = \frac{\sum_1^3 [C_{p(s)} - C_p(A)]}{3}$$

Method 2 Section 10.1.4.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see section 10.1.4.4).

I certify that the above pitot tube was tested in accordance with the US EPA Method 2 standards.
See the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 2, Item 4.

Print Name:

BO PRITCHARD

Date 8/11/2015

Signature:

B. Pritchard

S-TYPE PITOT TUBE CALIBRATION SHEET

Reference USEPA Reference Method 2 (40CFR60, App. A, Meth. 2)

PITOT SERIAL# A6904
PITOT TYPE: S
STD. PITOT TYPE: ELLIPSOIDAL
Cp(std): 0.990
PROBE SERIAL# N/A

CALIBRATION DATE: 27-May-16
BAROMETRIC PRESSURE: 30.16 in Hg
STATIC PRESSURE: -0.6 in H₂O
BLOCKAGE %: N/A
CORRECTION FACTOR: 1.00

SIDE "A" CALIBRATION				
RUN NO.	ΔP_{std} in H ₂ O	ΔP_s in H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	0.565	0.804	0.830	0.001
2	0.561	0.803	0.827	-0.002
3	0.562	0.800	0.830	0.001

"A" AVERAGE	0.829	0.0014
-------------	-------	--------

(must be ≤ 0.01)

SIDE "B" CALIBRATION				
RUN NO.	ΔP_{std} in H ₂ O	ΔP_s in H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	0.565	0.804	0.830	-0.001
2	0.566	0.803	0.831	0.000
3	0.565	0.801	0.831	0.001

"B" AVERAGE	0.831	0.0008
-------------	-------	--------

(must be ≤ 0.01)

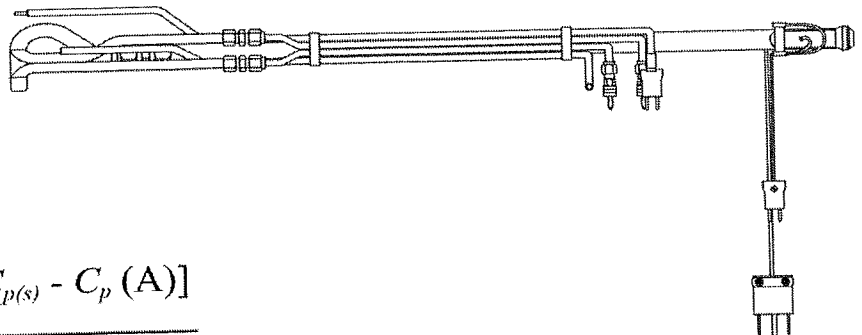
ACCEPTANCE CRITERIA

AVERAGE -0.0018 AVG. Cp (A) - AVG. Cp (B) must be ≤ 0.01

If the Average and both Deviation Averages "A" & "B" are ≤ 0.01 , then the OVERALL AVERAGE below may be used.
* If NOT, use the "A" Average OR "B" Average.

OVERALL AVERAGE 0.8300

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$



$$\text{Deviation} = C_{p(s)} - \overline{C_p(A)}$$

$$\text{Avg Dev} = \sigma(A) = \frac{\sum_{i=1}^3 [C_{p(s)} - C_p(A)]}{3}$$

Method 2 Section 10.1.4.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see section 10.1.4.4).

I certify that the above pitot tube was tested in accordance with the US EPA Method 2 standards.
See the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 2, Item 4.

Print Name:

Scott Bulger

Signature:



Date

5/27/2016

METERING SYSTEM DRY GAS METER CALIBRATION SHEET

EPA Reference Method

Metering System Pre-Test Calibration

Air Hygiene Asset ID: samp-cp-0021

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\PM-Equipment\M-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0021 Calibration 11-11-20.xls}Original (5 point)

Make: apex
Model #: 522
Serial #: 1204012

Date: 11/11/20
Barometric Pressure: 29.28 (in. Hg)
Theoretical Critical Vacuum: 13.81 (in. Hg)

DRY GAS METER READINGS

ΔH (in. H ₂ O)	Time (min)	Volume			Initial Temperature	
		Initial (ft ³)	Final (ft ³)	Total (ft ³)	Inlet (°F)	Outlet (°F)
0.33	17.00	490.230	495.820	5.590	76.0	76.0
0.67	12.00	495.820	501.510	5.690	77.0	77.0
1.10	10.00	501.510	507.780	6.270	77.0	77.0
2.00	10.00	507.780	515.930	8.150	78.0	78.0
3.50	10.00	515.930	527.070	11.140	79.0	79.0

Final Temperature		Orifice Serial# (number)	K' Orifice Coefficient (see above)	Actual Vacuum (in. Hg)	Ambient Temperature		
Inlet (°F)	Outlet (°F)				Initial (°F)	Final (°F)	Average (°F)
77.0	77.0	214	0.2433	16.0	73.2	73.5	73.4
77.0	77.0	240	0.3500	16.0	73.5	73.4	73.5
78.0	78.0	255	0.4634	16.0	73.4	73.8	73.6
79.0	79.0	263	0.5993	16.0	73.8	74.1	74.0
80.0	80.0	273	0.8208	16.0	74.1	74.0	74.1

RESULTS

DRY GAS METER		ORIFICE		
VOLUME CORRECTED Vm(std) (ft ³)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vcr(std) (ft ³)	VOLUME CORRECTED Vcr(std) (liters)	VOLUME NOMINAL Vcr (ft ³)
5.386	152.53	5.244	148.5	5.415
5.482	155.25	5.324	150.8	5.499
6.042	171.10	5.874	166.3	6.068
7.856	222.49	7.594	215.1	7.850
10.759	304.69	10.400	294.5	10.753

DRY GAS METER CALIBRATION FACTOR Y		ORIFICE CALIBRATION FACTOR $\Delta H@$		
Variation (number)	Value (number)	Value (in. H ₂ O)	Value (mm H ₂ O)	Variation (in. H ₂ O)
0.004	0.974	1.879	47.72	0.067
0.001	0.971	1.842	46.79	0.030
0.002	0.972	1.724	43.79	-0.088
-0.003	0.967	1.872	47.55	0.060
-0.003	0.967	1.743	44.28	-0.069
AVERAGE:	0.970	1.812	46.02	PASSED

Notes:

For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +/- 0.02. For Orifice Calibration Factor $\Delta H@$, the orifice differential pressure in inches of H₂O that equates to 0.75 cfm of air at 68 °F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +/- 0.2. For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above. The Critical Orifice Coefficient, K', must be entered in English units, (ft)³*(deg R)^{0.5}/((in.Hg)*(min)).

SIGNATURE: _____

Craig McCarty

DATE: 11/11/20 11/11/20

METERING SYSTEM THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Pre-Test Calibration

Air Hygiene Asset ID: samp-cp-0021

Filename: \\AHI-FILES\VR\public\Shared\QAQC\Calibrations\PM-Equipment\M-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0021 Calibration 11-11-20.xls}Original (5 point)

Make: apex
Model #: 522
Serial #: 1204012

Date: 11/11/20
Barometric Pressure: 29.28 (in. Hg)
Temperature (ASTM cal): 72.00 (°F)

Thermocouple	100 (°F)		600 (°F)		1200 (°F)	
	Reading	% Error	Reading	% Error	Reading	% Error
Stack	101.00	0.50	602.00	0.33	1206.00	0.50
Probe	101.00	0.50	602.00	0.33	1206.00	0.50
Filter	101.00	0.50	602.00	0.33	1206.00	0.50
Dryer	101.00	0.50	602.00	0.33	1206.00	0.50
Aux.	101.00	0.50	602.00	0.33	1206.00	0.50

Note: Calibrated against an ALTEK Thermocouple Source Series 22, ID: samp-tc-0004

Direct temperature output calibrated to ASTM and IPTS standards as outlined in ALTEK Data Sheet 22.

Thermocouple	72.00 (°F)		Responded to heating/cooling with the anticipated outcome?
	Reading	(±°F)	
DGM In	72.0	0.00	yes
DGM Out	72.0	0.00	yes

Note: Calibrated against Reference Thermometer ID: a070800

SIGNATURE: _____

Craig McCarty

DATE: 11/11/20 11/11/20

Standard for Calibration of Console Thermocouple Systems

40 CFR, Part 60

Appendix A, Method 5

10.3.2 The temperature data recorded in the field shall be considered valid. If, during calibration, the absolute temperature measured with the sensor being calibrated and the reference sensor **agree within 1.5 percent**, the temperature data taken in the field shall be considered valid.

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

PROBE (STACK), HOTBOX (FILTER), AND GOOSENECK (EXIT) THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Pre-Test Calibration

Air Hygiene Asset ID(s):

Probe: samp-hp-0086

Hotbox: samp-bh-0012

Gooseneck: samp-ad-0046

Filename: \\AHI-FILES\VR\public\Shared\QAQC\Calibrations\PM-Equipment\IM-5 Consoles\Calibration Sheet v4.1\Current\([SAMP-CP-0021 Calibration 11-11-20.xls]Original (5 point)

Barometric Pressure:

29.26

Thermo-couples		Temps	Signature	Date	
		(°F)			
Stack	Ref	72.00	<i>Craig McCarty</i>	11/11/20	11/11/20
	Read	72.00			
	±°F	0.00			
Probe	Ref	72.00	<i>Craig McCarty</i>	11/11/20	11/11/20
	Read	72.00			
	±°F	0.00			
Filter	Ref	72.00	<i>Craig McCarty</i>	11/11/20	11/11/20
	Read	72.00			
	±°F	0.00			
Cond.	Ref	72.00	<i>Craig McCarty</i>	11/11/20	11/11/20
	Read	72.00			
	±°F	0.00			
CPM	Ref	72.00	<i>Craig McCarty</i>	11/11/20	11/11/20
	Read	72.00			
	±°F	0.00			
Exit	Ref	72.00	<i>Craig McCarty</i>	11/11/20	11/11/20
	Read	72.00			
	±°F	0.00			

Note: Calibrated against Reference Thermometer ID: a070800

Thermocouple	Responded to heating/cooling with the anticipated outcome?
Stack	yes
Probe	yes
Filter	yes
Cond.	yes
CPM	yes
Exit	yes

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

METERING SYSTEM DRY GAS METER CALIBRATION SHEET

EPA Reference Method

Metering System Post-Test Calibration

Air Hygiene Asset ID: samp-cp-0021

Filename: \\AHL-FILES\VR\public\Shared\QAQC\Calibrations\PM-Equipment\IM-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0021 Calibration 11-11-20.xls}9-7-21 (3 point)

Make: Apex
Model #: XC-522
Serial #: 1204012

Date: 09/08/21
Barometric Pressure: 29.22 (in. Hg)
Theoretical Critical Vacuum: 13.78 (in. Hg)

DRY GAS METER READINGS

ΔH (in. H2O)		Time (min)	Volume			Initial Temperature	
			Initial (ft³)	Final (ft³)	Total (ft³)	Inlet (°F)	Outlet (°F)
1.90		10.00	111.800	119.800	8.000	72.0	72.0
1.90		10.00	119.800	127.800	8.000	72.0	72.0
1.90		10.00	127.800	135.810	8.010	73.0	73.0
Final Temperature		Orifice Serial# (number)	K' Orifice Coefficient (see above)	Actual Vacuum (in. Hg)	Ambient Temperature		
Inlet (°F)	Outlet (°F)				Initial (°F)	Final (°F)	Average (°F)
72.0	72.0	163	0.5930	16.0	72.2	72.7	72.5
73.0	73.0	163	0.5930	16.0	72.7	73.1	72.9
74.0	74.0	163	0.5930	16.0	73.1	73.7	73.4

RESULTS

DRY GAS METER		ORIFICE		
VOLUME CORRECTED Vm(std) (ft ³)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vcr(std) (ft ³)	VOLUME CORRECTED Vcr(std) (liters)	VOLUME NOMINAL Vcr (ft ³)
7.788	220.56	7.509	212.7	7.757
7.781	220.35	7.506	212.6	7.760
7.776	220.21	7.503	212.5	7.764
DRY GAS METER CALIBRATION FACTOR Y		ORIFICE CALIBRATION FACTOR $\Delta H@$		
Variation (number)	Value (number)	Value (in. H ₂ O)	Value (mm H ₂ O)	Variation (in. H ₂ O)
0.000	0.964	1.837	46.66	0.001
0.000	0.965	1.837	46.66	0.001
0.000	0.965	1.835	46.61	-0.001
AVERAGE:	0.965	1.836	46.64	PASSED
LAST 5-PT:	0.970	1.812	PASSED	5-PT Date:
% DIFF:	0.6%	1.3%		11/11/20

40 CFR - CHAPTER I - PART 60

Appendix A, Method 5

10.3.2 Calibration After Use

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test)...Calculate the average value of the DGM calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as detailed in Section 10.3.1.

10.3.3 Acceptable Variation in Calibration

If the DGM coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

Notes: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +/- 0.02. For Orifice Calibration Factor $\Delta H@$, the orifice differential pressure in inches of H₂O that equates to 0.75 cfm of air at 68 °F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +/- 0.2. For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above. The Critical Orifice Coefficient, K', must be entered in English units, (ft)³*(deg R)^{0.5}/((in.Hg)*(min)).

SIGNATURE: Craig McCarty

DATE: 09/08/21 09/08/21

METERING SYSTEM THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Post-Test Calibration

Air Hygiene Asset ID: samp-cp-0021

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\PM-Equipment\M-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0021 Calibration 11-11-20.xls}9-7-21 (3 point)

Make: Apex
Model #: XC-522
Serial #: 1204012

Date: 09/08/21
Barometric Pressure: 29.22 (in. Hg)
Temperature (ASTM cal): 73.70 (°F)

Thermocouple	100 (°F)		600 (°F)		1200 (°F)	
	Reading	% Error	Reading	% Error	Reading	% Error
Stack	101.00	0.50	604.00	0.67	1206.00	0.50
Probe	101.00	0.50	604.00	0.67	1206.00	0.50
Filter	101.00	0.50	604.00	0.67	1206.00	0.50
Dryer	101.00	0.50	604.00	0.67	1206.00	0.50
Aux.	101.00	0.50	604.00	0.67	1206.00	0.50

Note: Calibrated against an ALTEK Thermocouple Source Series 22, ID: samp-tc-0004

Direct temperature output calibrated to ASTM and IPTS standards as outlined in ALTEK Data Sheet 22.

Thermocouple	73.70 (°F)		Responded to heating/cooling with the anticipated outcome?
	Reading	(±°F)	
DGM In	74.0	0.30	yes
DGM Out	74.0	0.30	yes

Note: Calibrated against Reference Thermometer ID: a070717

SIGNATURE: _____

Craig McCarty

DATE: 09/08/21 09/08/21

Standard for Calibration of Console Thermocouple Systems

40 CFR, Part 60

Appendix A, Method 5

10.3.2 The temperature data recorded in the field shall be considered valid. If, during calibration, the absolute temperature measured with the sensor being calibrated and the reference sensor **agree within 1.5 percent**, the temperature data taken in the field shall be considered valid.

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

PROBE (STACK), HOTBOX (FILTER), AND GOOSENECK (EXIT) THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Post-Test Calibration

Air Hygiene Asset ID(s):

Probe: samp-hp-0086

Hotbox: samp-bh-0012

Gooseneck: samp-ad-0046

Filename: \\AHI-FILES\VR\public\Shared\QAQC\Calibrations\PM-Equipment\M-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0021 Calibration 11-11-20.xls}9-7-21 (3 point)

Barometric Pressure:

29.22

Thermo-couples		Temps	Signature		Date	
		(°F)				
Stack	Ref	73.20	<i>Craig McCarty</i>		<i>09/08/21</i>	09/08/21
	Read	74.00				
	±°F	0.80				
Probe	Ref	73.20	<i>Craig McCarty</i>		<i>09/08/21</i>	09/08/21
	Read	74.00				
	±°F	0.80				
Filter	Ref	73.20	<i>Craig McCarty</i>		<i>09/08/21</i>	09/08/21
	Read	74.00				
	±°F	0.80				
Cond.	Ref	73.20	<i>Craig McCarty</i>		<i>09/08/21</i>	09/08/21
	Read	74.00				
	±°F	0.80				
CPM	Ref	73.20	<i>Craig McCarty</i>		<i>09/08/21</i>	09/08/21
	Read	74.00				
	±°F	0.80				
Exit	Ref	73.20	<i>Craig McCarty</i>		<i>09/08/21</i>	09/08/21
	Read	74.00				
	±°F	0.80				

Note: Calibrated against Reference Thermometer ID: a070717

Thermocouple	Responded to heating/cooling with the anticipated outcome?
Stack	yes
Probe	yes
Filter	yes
Cond.	yes
CPM	yes
Exit	yes

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

METERING SYSTEM DRY GAS METER CALIBRATION SHEET

EPA Reference Method

Metering System Pre-Test Calibration

Air Hygiene Asset ID: samp-cp-0022

Filename: \\AHL-FILES\SVR\public\Shared\QAQC\Calibrations\PM-Equipment\IM-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0022 Calibration 7-14-21.xls}Original (5 point)

Make: apex

Date: 07/14/21

Model #: 522

Barometric Pressure: 29.29 (in. Hg)

Serial #:

Theoretical Critical Vacuum: 13.82 (in. Hg)

DRY GAS METER READINGS

ΔH (in. H ₂ O)	Time (min)	Volume			Initial Temperature	
		Initial (ft ³)	Final (ft ³)	Total (ft ³)	Inlet (°F)	Outlet (°F)
0.31	17.00	23.400	28.710	5.310	75.0	75.0
0.62	12.00	28.710	34.060	5.350	75.0	75.0
1.10	10.00	34.060	40.120	6.060	76.0	76.0
1.90	10.00	40.120	48.000	7.880	77.0	77.0
3.50	10.00	48.000	58.830	10.830	78.0	78.0

Final Temperature		Orifice Serial# (number)	K' Orifice Coefficient (see above)	Actual Vacuum (in. Hg)	Ambient Temperature		
Inlet (°F)	Outlet (°F)				Initial (°F)	Final (°F)	Average (°F)
75.0	75.0	140	0.2355	16.0	76.7	76.9	76.8
76.0	76.0	148	0.3374	16.0	76.9	77.2	77.1
77.0	77.0	155	0.4565	16.0	77.0	77.4	77.2
78.0	78.0	163	0.5930	16.0	77.4	77.6	77.5
80.0	80.0	173	0.8149	15.0	77.6	77.8	77.7

RESULTS

DRY GAS METER		ORIFICE		
VOLUME CORRECTED Vm(std) (ft ³)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vcr(std) (ft ³)	VOLUME CORRECTED Vcr(std) (liters)	VOLUME NOMINAL Vcr (ft ³)
5.132	145.34	5.061	143.3	5.258
5.170	146.41	5.117	144.9	5.319
5.852	165.73	5.769	163.4	5.998
7.611	215.54	7.492	212.2	7.794
10.473	296.59	10.293	291.5	10.712

DRY GAS METER CALIBRATION FACTOR Y		ORIFICE CALIBRATION FACTOR $\Delta H@$		
Variation (number)	Value (number)	Value (in. H ₂ O)	Value (mm H ₂ O)	Variation (in. H ₂ O)
0.000	0.986	1.901	48.28	0.069
0.004	0.990	1.851	47.02	0.020
0.000	0.986	1.791	45.50	-0.040
-0.001	0.984	1.831	46.51	0.000
-0.003	0.983	1.782	45.26	-0.049
AVERAGE:	0.986	1.831	46.51	PASSED

Notes:

For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +/- 0.02. For Orifice Calibration Factor $\Delta H@$, the orifice differential pressure in inches of H₂O that equates to 0.75 cfm of air at 68 °F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +/- 0.2. For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above. The Critical Orifice Coefficient, K', must be entered in English units, (ft)³*(deg R)^{0.5}/((in.Hg)*(min)).

SIGNATURE: _____

Craig McCarty

DATE: 07/14/21 07/14/21

METERING SYSTEM THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Pre-Test Calibration

Air Hygiene Asset ID: samp-cp-0022

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\PM-Equipment\M-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0022 Calibration 7-14-21.xls}Original (5 point)

Make: apex
Model #: 522
Serial #:

Date: 07/14/21
Barometric Pressure: 29.29 (in. Hg)
Temperature (ASTM cal): 76.70 (°F)

Thermocouple	100 (°F)		600 (°F)		1200 (°F)	
	Reading	% Error	Reading	% Error	Reading	% Error
Stack	100.00	0.00	599.00	0.17	1199.00	0.08
Probe	100.00	0.00	599.00	0.17	1199.00	0.08
Filter	100.00	0.00	599.00	0.17	1199.00	0.08
Dryer	100.00	0.00	599.00	0.17	1199.00	0.08
Aux.	100.00	0.00	599.00	0.17	1199.00	0.08

Note: Calibrated against an ALTEK Thermocouple Source Series 22, ID: samp-tc-0004

Direct temperature output calibrated to ASTM and IPTS standards as outlined in ALTEK Data Sheet 22.

Thermocouple	76.70 (°F)		Responded to heating/cooling with the anticipated outcome?
	Reading	(±°F)	
DGM In	75.0	1.70	yes
DGM Out	75.0	1.70	yes

Note: Calibrated against Reference Thermometer ID: a070717

SIGNATURE: Craig McCarty

DATE: 07/14/21 07/14/21

Standard for Calibration of Console Thermocouple Systems

40 CFR, Part 60

Appendix A, Method 5

10.3.2 The temperature data recorded in the field shall be considered valid. If, during calibration, the absolute temperature measured with the sensor being calibrated and the reference sensor **agree within 1.5 percent**, the temperature data taken in the field shall be considered valid.

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

PROBE (STACK), HOTBOX (FILTER), AND GOOSENECK (EXIT) THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Pre-Test Calibration

Air Hygiene Asset ID(s):

Probe: samp-hp-0086

Hotbox: samp-bh-0012

Gooseneck: samp-ad-0046

Filename: \\AHI-FILES\VR\public\Shared\QAQC\Calibrations\PM-Equipment\IM-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0022 Calibration 7-14-21.xls}Original (5 point)

Barometric Pressure:

29.29

Thermo-couples		Temps	Signature		Date	
		(°F)				
Stack	Ref	76.80	<i>Craig McCarty</i>		07/14/21	07/14/21
	Read	77.00				
	±°F	0.20				
Probe	Ref	76.80	<i>Craig McCarty</i>		07/14/21	07/14/21
	Read	77.00				
	±°F	0.20				
Filter	Ref	76.80	<i>Craig McCarty</i>		07/14/21	07/14/21
	Read	77.00				
	±°F	0.20				
Cond.	Ref	76.80	<i>Craig McCarty</i>		07/14/21	07/14/21
	Read	77.00				
	±°F	0.20				
CPM	Ref	76.80	<i>Craig McCarty</i>		07/14/21	07/14/21
	Read	77.00				
	±°F	0.20				
Exit	Ref	76.80	<i>Craig McCarty</i>		07/14/21	07/14/21
	Read	77.00				
	±°F	0.20				

Note: Calibrated against Reference Thermometer ID: a070717

Thermocouple	Responded to heating/cooling with the anticipated outcome?
Stack	yes
Probe	yes
Filter	yes
Cond.	yes
CPM	yes
Exit	yes

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

METERING SYSTEM DRY GAS METER CALIBRATION SHEET

EPA Reference Method

Metering System Post-Test Calibration

Air Hygiene Asset ID: samp-cp-0022

Filename: \\AHL-FILES\SVR\public\Shared\QAQC\Calibrations\PM-Equipment\IM-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0022 Calibration 7-14-21.xls}8-18-21 (3 point)

Make: Apex
Model #: XC-522
Serial #: 1204013

Date: 08/18/21
Barometric Pressure: 29.20 (in. Hg)
Theoretical Critical Vacuum: 13.77 (in. Hg)

DRY GAS METER READINGS

ΔH (in. H2O)		Time (min)	Volume			Initial Temperature	
			Initial (ft³)	Final (ft³)	Total (ft³)	Inlet (°F)	Outlet (°F)
1.90		10.00	862.800	870.790	7.990	78.0	78.0
1.90		10.00	870.790	878.790	8.000	77.0	77.0
1.90		10.00	878.790	886.800	8.010	78.0	78.0
Final Temperature		Orifice Serial# (number)	K' Orifice Coefficient (see above)	Actual Vacuum (in. Hg)	Ambient Temperature		
Inlet (°F)	Outlet (°F)				Initial (°F)	Final (°F)	Average (°F)
77.0	77.0	163	0.5930	16.0	74.0	73.9	74.0
78.0	78.0	163	0.5930	16.0	73.9	74.1	74.0
78.0	78.0	163	0.5930	16.0	74.1	74.1	74.1

RESULTS

DRY GAS METER		ORIFICE		
VOLUME CORRECTED Vm(std) (ft ³)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vcr(std) (ft ³)	VOLUME CORRECTED Vcr(std) (liters)	VOLUME NOMINAL Vcr (ft ³)
7.693	217.88	7.494	212.2	7.768
7.703	218.15	7.493	212.2	7.768
7.706	218.22	7.492	212.2	7.769
DRY GAS METER CALIBRATION FACTOR Y		ORIFICE CALIBRATION FACTOR $\Delta H@$		
Variation (number)	Value (number)	Value (in. H ₂ O)	Value (mm H ₂ O)	Variation (in. H ₂ O)
0.001	0.974	1.825	46.35	0.000
0.000	0.973	1.825	46.35	0.001
-0.001	0.972	1.823	46.32	-0.001
AVERAGE:	0.973	1.824	46.34	PASSED
LAST 5-PT:	0.986	1.831	PASSED	5-PT Date:
% DIFF:	1.3%	0.4%		07/14/21

40 CFR - CHAPTER I - PART 60

Appendix A, Method 5

10.3.2 Calibration After Use

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test)...Calculate the average value of the DGM calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as detailed in Section 10.3.1.

10.3.3 Acceptable Variation in Calibration

If the DGM coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

Notes: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +/- 0.02. For Orifice Calibration Factor $\Delta H@$, the orifice differential pressure in inches of H₂O that equates to 0.75 cfm of air at 68 °F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +/- 0.2. For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above. The Critical Orifice Coefficient, K', must be entered in English units, (ft)³*(deg R)^{0.5}/((in.Hg)*(min)).

SIGNATURE: Craig McCarty

DATE: 08/18/21 08/18/21

METERING SYSTEM THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Post-Test Calibration

Air Hygiene Asset ID: samp-cp-0022

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\PM-Equipment\M-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0022 Calibration 7-14-21.xls}8-18-21 (3 point)

Make: Apex
Model #: XC-522
Serial #: 1204013

Date: 08/18/21
Barometric Pressure: 29.19 (in. Hg)
Temperature (ASTM cal): 74.00 (°F)

Thermocouple	100 (°F)		600 (°F)		1200 (°F)	
	Reading	% Error	Reading	% Error	Reading	% Error
Stack	100.00	0.00	599.00	0.17	1198.00	0.17
Probe	100.00	0.00	599.00	0.17	1198.00	0.17
Filter	100.00	0.00	599.00	0.17	1198.00	0.17
Dryer	100.00	0.00	599.00	0.17	1198.00	0.17
Aux.	100.00	0.00	599.00	0.17	1198.00	0.17

Note: Calibrated against an ALTEK Thermocouple Source Series 22, ID: samp-tc-0004

Direct temperature output calibrated to ASTM and IPTS standards as outlined in ALTEK Data Sheet 22.

Thermocouple	74.00 (°F)		Responded to heating/cooling with the anticipated outcome?
	Reading	(±°F)	
DGM In	75.0	1.00	yes
DGM Out	75.0	1.00	yes

Note: Calibrated against Reference Thermometer ID: a070717

SIGNATURE: Craig McCarty

DATE: 08/18/21 08/18/21

Standard for Calibration of Console Thermocouple Systems

40 CFR, Part 60

Appendix A, Method 5

10.3.2 The temperature data recorded in the field shall be considered valid. If, during calibration, the absolute temperature measured with the sensor being calibrated and the reference sensor **agree within 1.5 percent**, the temperature data taken in the field shall be considered valid.

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

PROBE (STACK), HOTBOX (FILTER), AND GOOSENECK (EXIT) THERMOCOUPLE CALIBRATION SHEET

EPA Reference Method

Metering System Post-Test Calibration

Air Hygiene Asset ID(s):

Probe: samp-hp-0086

Hotbox: samp-bh-0012

Gooseneck: samp-ad-0046

Filename: \\AHI-FILES\VR\public\Shared\QAQC\Calibrations\PM-Equipment\IM-5 Consoles\Calibration Sheet v4.1\Current\{SAMP-CP-0022 Calibration 7-14-21.xls}8-18-21 (3 point)

Barometric Pressure:

29.19

Thermo-couples		Temps	Signature	Date	
		(°F)			
Stack	Ref	74.00	<i>Craig McCarty</i>	08/18/21	08/18/21
	Read	74.00			
	±°F	0.00			
Probe	Ref	74.00	<i>Craig McCarty</i>	08/18/21	08/18/21
	Read	74.00			
	±°F	0.00			
Filter	Ref	74.00	<i>Craig McCarty</i>	08/18/21	08/18/21
	Read	74.00			
	±°F	0.00			
Cond.	Ref	74.00	<i>Craig McCarty</i>	08/18/21	08/18/21
	Read	75.00			
	±°F	1.00			
CPM	Ref	74.00	<i>Craig McCarty</i>	08/18/21	08/18/21
	Read	75.00			
	±°F	1.00			
Exit	Ref	74.00	<i>Craig McCarty</i>	08/18/21	08/18/21
	Read	74.00			
	±°F	0.00			

Note: Calibrated against Reference Thermometer ID: a070717

Thermocouple	Responded to heating/cooling with the anticipated outcome?
Stack	yes
Probe	yes
Filter	yes
Cond.	yes
CPM	yes
Exit	yes

Standard for Calibration of Individual Thermocouples

EMC, ALT-011: After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall **agree to within ±2°F**.

Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

Field Balance Weight Verification
Annual 500g Field Balance Stock Weight vs. 500g ISO 17025 Traceable Weight
Air Hygiene Asset ID: samp-sc-0025

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\Field Balance Weights\2021[samp-sc-0025_225.xlsm]Balance
 Make: Ohaus ISO 17025 Weight ID LABS-WT-0005
 Model #: Scout Pro SP2001-US ISO S/N 1000128090
 Serial #: 7130410278 ISO Cal Due 8/4/2021
 Field Weight #: sc-0025
 Trailer #: 221

ISO 17025 Certified Weight (g)	Field Balance Weight (g)	± g
500.00	499.60	0.40
 (signature)		must be <0.5 <u>01/19/21</u> (date)

ISO 17025 Certified Weight (g)	Field Balance Weight (g)	± g
500.00	500.10	0.10
 (signature)		must be <0.5 <u>01/19/21</u> (date)

ISO 17025 Certified Weight (g)	Field Balance Weight (g)	± g
500.00	500.00	0.00
 (signature)		must be <0.5 <u>01/19/21</u> (date)

Note: Calibrated against ISO 17025 Certified weight LABS-WT-0005

EPA Method 4 - Section 10.3, EPA Method 5 - Section 10.7, EPA Method 202 - Section 10.3: Field Balance Calibration Check. Check the calibration of the balance used to weigh impingers with a weight that is at least 500g or within 50g of a loaded impinger. The weight must be ASTM E617-13 "Standard Specification for Laboratory Weights and Precision Mass Standards" Class 6 (or better). Daily before used, the field balance must measure within ±0.5g of the certified mass. If the daily balance calibration check fails, perform corrective measures and repeat the check before using balance.

ISO 17025 Certified 500g Weight is certified annually. Certified weight is used to verify Class 6 or better weight that accompanies each field balance on the balance it will be used. Acceptance criteria is certified weight must be within ±0.5g of Class 6 or better weight.

Field Balance Weight Verification
Annual 500g Field Balance Stock Weight vs. 500g ISO 17025 Traceable Weight
Air Hygiene Asset ID: samp-sc-0015

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\Field Balance Weights\2021\samp-sc-7130100125_Extra.xlsm]Balance
 Make: Ohaus ISO 17025 Weight ID LABS-WT-0005
 Model #: Scout Pro SP2001-US ISO S/N 1000128090
 Serial #: 7130100125 ISO Cal Due 8/4/2021
 Field Weight #:
 Trailer #: extra

ISO 17025 Certified Weight (g)	Field Balance Weight (g)	± g
500.00	500.00	0.00
<i>Sean Barnes</i>		must be <0.5
(signature)		01/19/21 (date)

ISO 17025 Certified Weight (g)	Field Balance Weight (g)	± g
500.00	499.70	0.30
<i>Sean Barnes</i>		must be <0.5
(signature)		01/19/21 (date)

ISO 17025 Certified Weight (g)	Field Balance Weight (g)	± g
500.00	499.80	0.20
<i>Sean Barnes</i>		must be <0.5
(signature)		01/19/21 (date)

Note: Calibrated against ISO 17025 Certified weight LABS-WT-0005

EPA Method 4 - Section 10.3, EPA Method 5 - Section 10.7, EPA Method 202 - Section 10.3: Field Balance Calibration Check. Check the calibration of the balance used to weigh impingers with a weight that is at least 500g or within 50g of a loaded impinger. The weight must be ASTM E617-13 "Standard Specification for Laboratory Weights and Precision Mass Standards" Class 6 (or better). Daily before used, the field balance must measure within ±0.5g of the certified mass. If the daily balance calibration check fails, perform corrective measures and repeat the check before using balance.

ISO 17025 Certified 500g Weight is certified annually. Certified weight is used to verify Class 6 or better weight that accompanies each field balance on the balance it will be used. Acceptance criteria is certified weight must be within ±0.5g of Class 6 or better weight.

WEATHER STATION CALIBRATION SHEET
Temperature, Barometric Pressure, and Relative Humidity Periodic Calibration
Air Hygiene Asset ID: samp-we-0014

Filename: \\AHI-FILESVR\public\Shared\QAQC\Calibrations\Weather Stations\2021\SAMP-WE-0014_224-012221.xlsm]112013
 Make: Kestrel ISO 17025 Weather Station ID SAMP-WE-0033
 Model #: 4000 ISO 17025 S/N A026334
 Serial #: 671144 ISO 17025 Cal Due 7/22/2021

ASTM Temp (deg F) (±1.5°)	Thermo. (deg F)	± deg F	ASTM Barometer (in. Hg) (±0.1 in Hg)	Barometric (in. Hg)	± in. Hg	Time
68.60	67.90	0.70	29.31	29.30	0.01	12:05
<div> <div>Sean Barnes</div> <div>(signature)</div> </div> <div> <div>Sean Karpas</div> <div>(signature)</div> </div> <div> <div>01/22/21</div> <div>(date)</div> </div>						

ASTM Temp (deg F) (±1.5°)	Thermo. (deg F)	± deg F	ASTM Barometer (in. Hg) (±0.1 in Hg)	Barometric (in. Hg)	± in. Hg	Time
69.30	69.20	0.10	29.28	29.30	0.02	12:35
<div> <div>Sean Barnes</div> <div>(signature)</div> </div> <div> <div>Sean Karpas</div> <div>(signature)</div> </div> <div> <div>01/22/21</div> <div>(date)</div> </div>						

ASTM Temp (deg F) (±1.5°)	Thermo. (deg F)	± deg F	ASTM Barometer (in. Hg) (±0.1 in Hg)	Barometric (in. Hg)	± in. Hg	Time
68.90	69.00	0.10	29.27	29.29	0.02	12:55
<div> <div>Sean Barnes</div> <div>(signature)</div> </div> <div> <div>Sean Karpas</div> <div>(signature)</div> </div> <div> <div>01/22/21</div> <div>(date)</div> </div>						

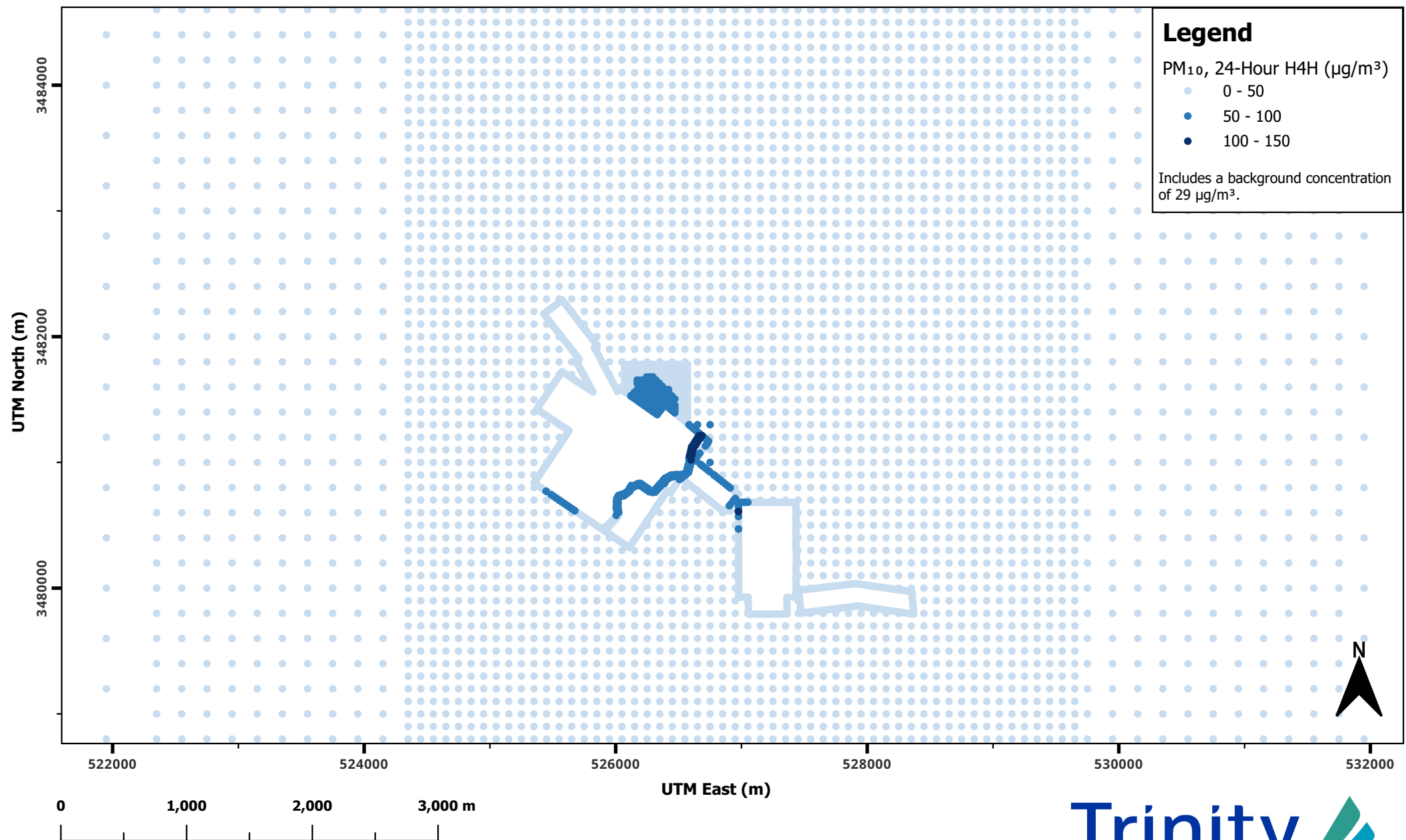
ASTM Temp (deg F) (±1.5°)	Thermo. (deg F)	± deg F	ASTM Barometer (in. Hg) (±0.1 in Hg)	Barometric (in. Hg)	± in. Hg	Time
68.70	68.80	0.10	29.27	29.28	0.01	13:20
<div> <div>Sean Barnes</div> <div>(signature)</div> </div> <div> <div>Sean Karpas</div> <div>(signature)</div> </div> <div> <div>01/22/21</div> <div>(date)</div> </div>						

Note: Verified against ISO 17025 Traceable Barometer and Thermometer (SAMP-WE-0033).

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end of report**

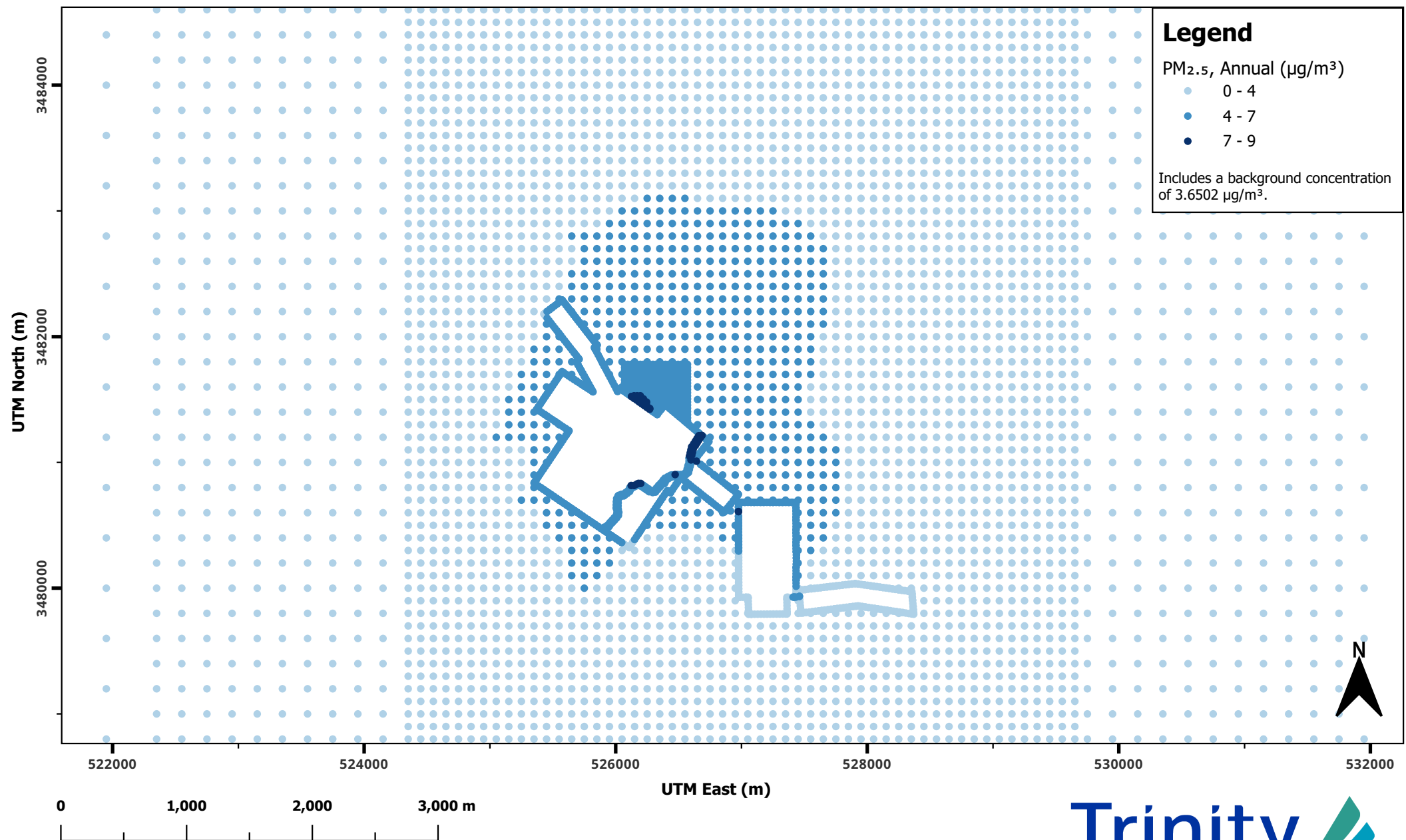
APPENDIX D. MODELED IMPACT CONTOUR PLOTS

Figure D.1 - Plan I - PM₁₀ 24-Hour Modeled Impacts



All Coordinates shown in UTM Coordinates
Zone 12 North, NAD 83 Datum
Scale: 1:40,000

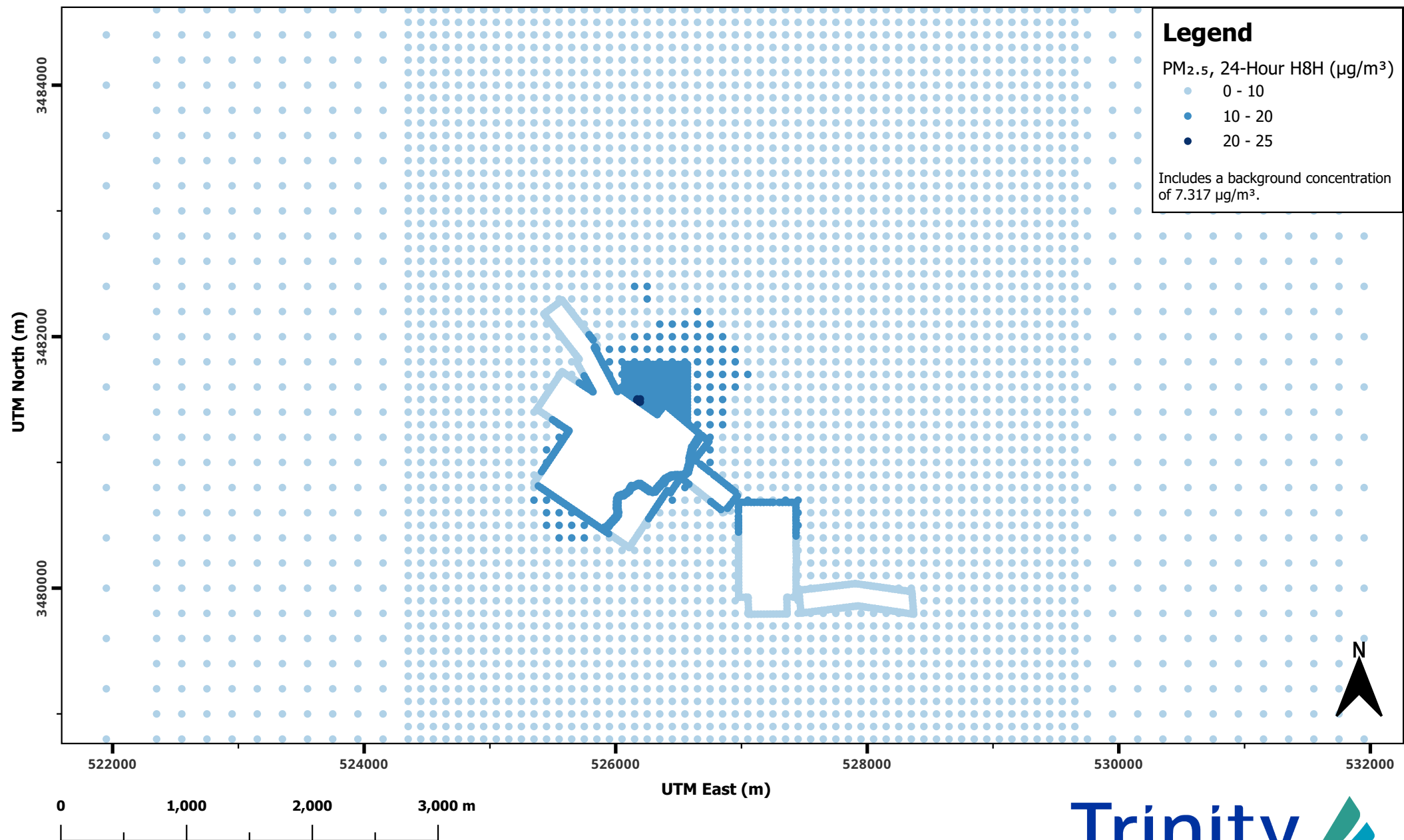
Figure D.2 - Plan I - PM_{2.5} Annual Modeled Impacts



All Coordinates shown in UTM Coordinates
Zone 12 North, NAD 83 Datum
Scale: 1:40,000

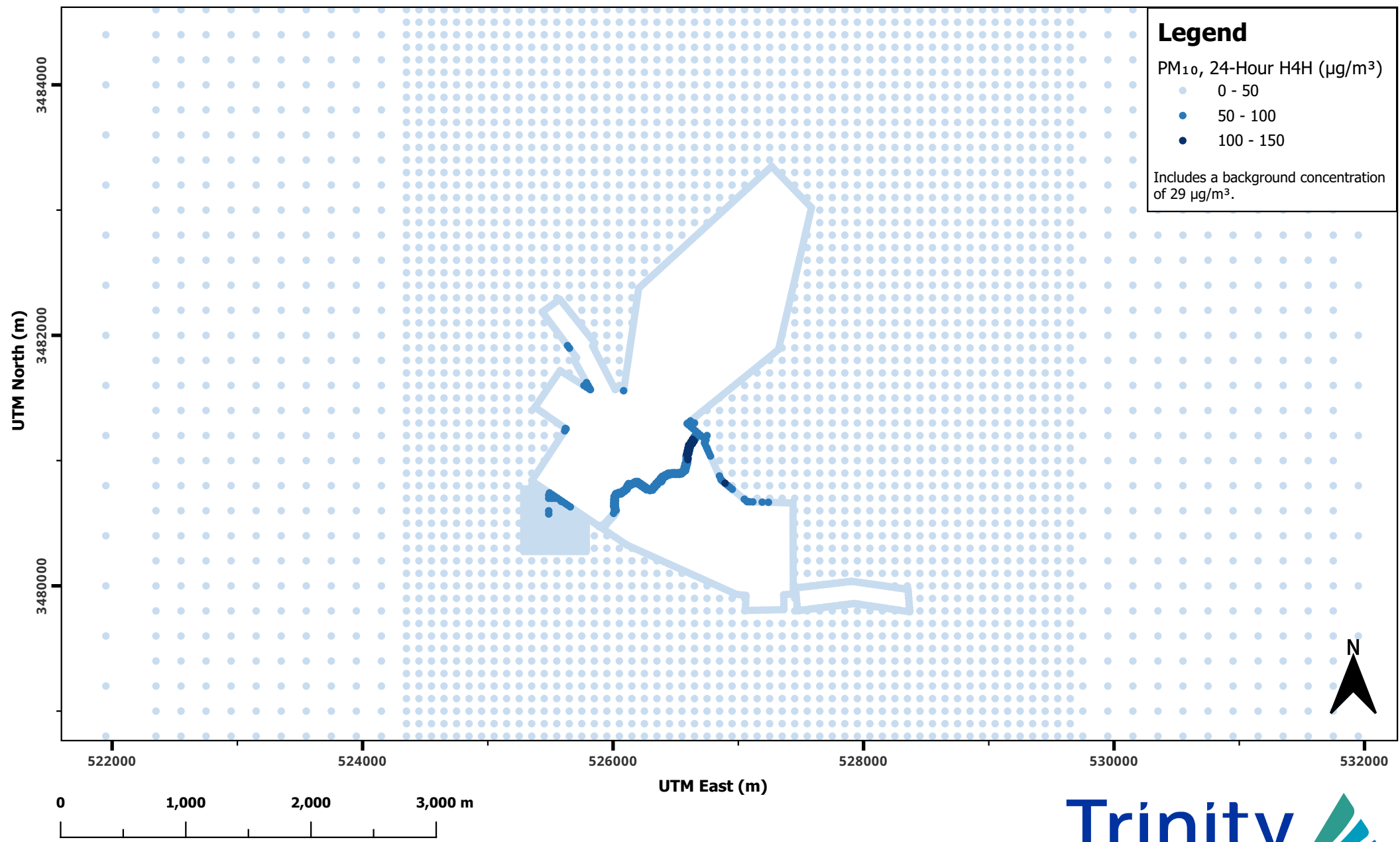


Figure D.3 - Plan I - PM_{2.5} 24-Hour Modeled Impacts



All Coordinates shown in UTM Coordinates
Zone 12 North, NAD 83 Datum
Scale: 1:40,000

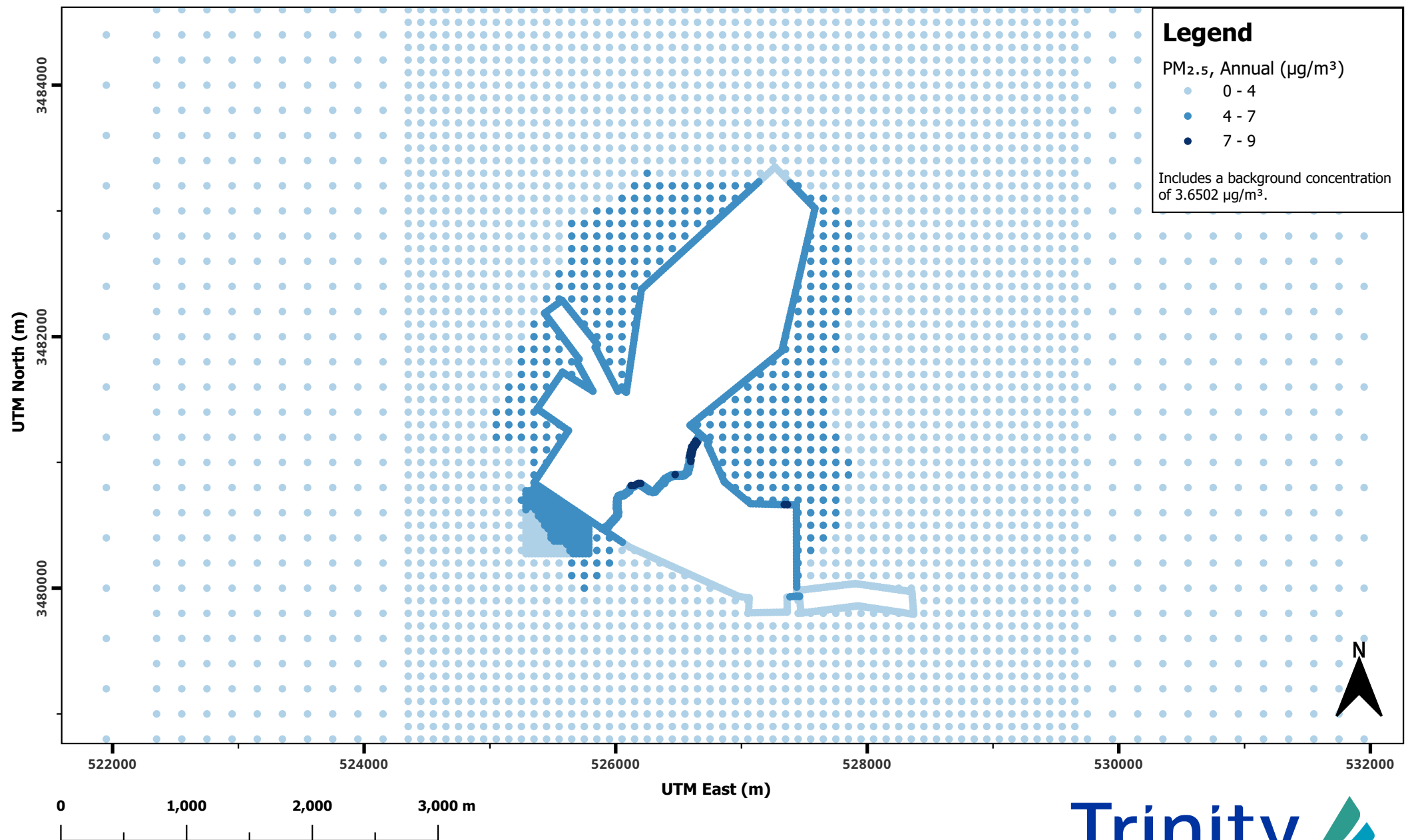
Figure D.4 - Plan II - PM₁₀ 24-Hour Modeled Impacts



All Coordinates shown in UTM Coordinates
Zone 12 North, NAD 83 Datum
Scale: 1:40,000

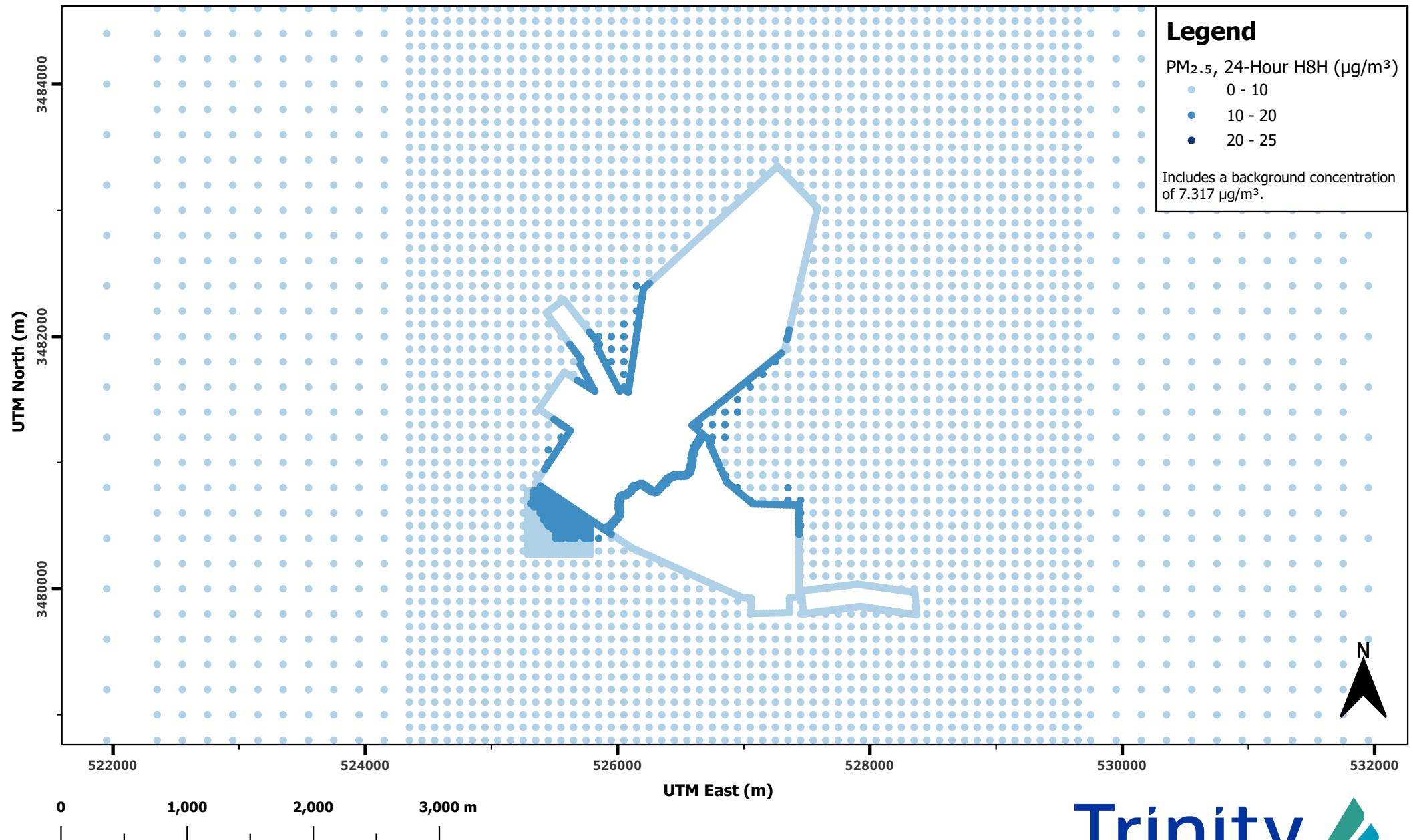


Figure D.5 - Plan II - PM_{2.5} Annual Modeled Impacts



All Coordinates shown in UTM Coordinates
Zone 12 North, NAD 83 Datum
Scale: 1:40,000

Figure D.6 - Plan II - PM_{2.5} 24-Hour Modeled Impacts



All Coordinates shown in UTM Coordinates
Zone 12 North, NAD 83 Datum
Scale: 1:40,000