March 13, 2020

Federal Minor NSR Permit Coordinator
US EPA, Region 8
1595 Wynkoop Street, 8P-AR
Denver, CO 80202-1129

**Subject: Application for Synthetic Minor Permit
Howling Wolf Production Pad**

Dear Coordinator:

Enclosed is a synthetic minor permit application for the Howling Wolf Production Pad. WPX Energy Williston, LLC (WPX) owns and operates the Howling Wolf Production Pad located on the Fort Berthold Indian Reservation in Dunn County, North Dakota.

At the request of the US EPA, WPX hereby rescinds all previous application submittals for a synthetic minor permit associated with the Howling Wolf Production Pad. This application submittal will stand-alone as a new application. WPX respectfully requests US EPA review this application with relative expediency as only a few attributes have changed from original submittal. One modification being WPX's adherence to US EPA's request to limit the VOC PTE to 230 tpy (8 percent less than PSD threshold).

The facility will employ a thermal oxidizer for emissions control with a VOC destruction efficiency of 99.5%. Based on our discussions with the ND DoAQ, we understand that a thermal oxidizer with a higher destruction efficiency than what is enforceable by the FBIR FIP requires a synthetic minor permit and associated compliance requirements.

WPX proposes that quarterly testing of the thermal oxidizer be performed until a full year of compliance has been demonstrated. After a year of compliance has been demonstrated, WPX requests that the testing frequency be reduced to semi-annual. WPX believes this proposed testing frequency adequately demonstrates proper operation of the thermal oxidizer.

The information provided in the submittal is consistent with the application requirements. If you have any questions regarding the information, please contact me at (539) 573-3847 or by email at John.Ritchie@wpxenergy.com. Thank you in advance for the efforts of your staff in reviewing this submittal.

Sincerely,

John Ritchie
Senior Environmental Specialist – Air Quality

Enclosures
CC: Edmund Baker (MHA)
WPX files

Synthetic Minor Source on Tribal Lands

Application Package

Howling Wolf Production Pad

WPX Energy, Williston LLC

March 13, 2020

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1.0 Process Description

This section of the application provides a detailed description of the operations at the Howling Wolf Production Pad. The Howling Wolf Production Pad is an oil and gas processing facility that receives gas, oil, and produced water from multiple wells drilled in the Twin Buttes area of the FBIR. The site operates 24 hours a day, 7 days a week, 52 weeks per year. The initial processing and flash emissions for six wells occur at the well pad before the oil and water are either trucked off site. The Howling Wolf Production Pad also receives pre-processed produced water and gas from a nearby well pad. The produced water is diverted to six post-flash storage tanks before being trucked off site.

Produced gas will be routed to thermal oxidizers with a manufacturer guaranteed 99.5% efficiency. In the event of an emergency or equipment upsets, gas will be sent to the two backup flares. Additionally, gas from the oil tanks and produced water tanks will be sent to the onsite Steffes flare.

The oil and produced water will be trucked from the site.

For purposes of estimating emissions from this facility, the maximum expected combined production, and a decline factor of 0.6 was used. The oil and produced water throughput, flared gas, and treater hours of operation are monitored to provide regular emission calculations.

The entire facility consists of the following primary equipment and capabilities.

12 – 400-bbl Oil Production Tanks
6 – 400-bbl Pre-flash Produced Water Tanks
6 – 400-bbl Post-flash Produced Water Tanks
Truck Oil Loadout
Truck Produced Water Loadout
3 – 1.25 MMBtu/hr Heater Treaters
1 – 2.5 MMBtu/hr Water Bath Heater
Intermittent Pneumatic Controllers
J-T Skid Gas Processing Unit
Miscellaneous Fugitive Emissions (Fugitives)
1 – Caterpillar G3516 TALE Engine
1 – 225kW Generator Engine

Air Pollution Control Equipment

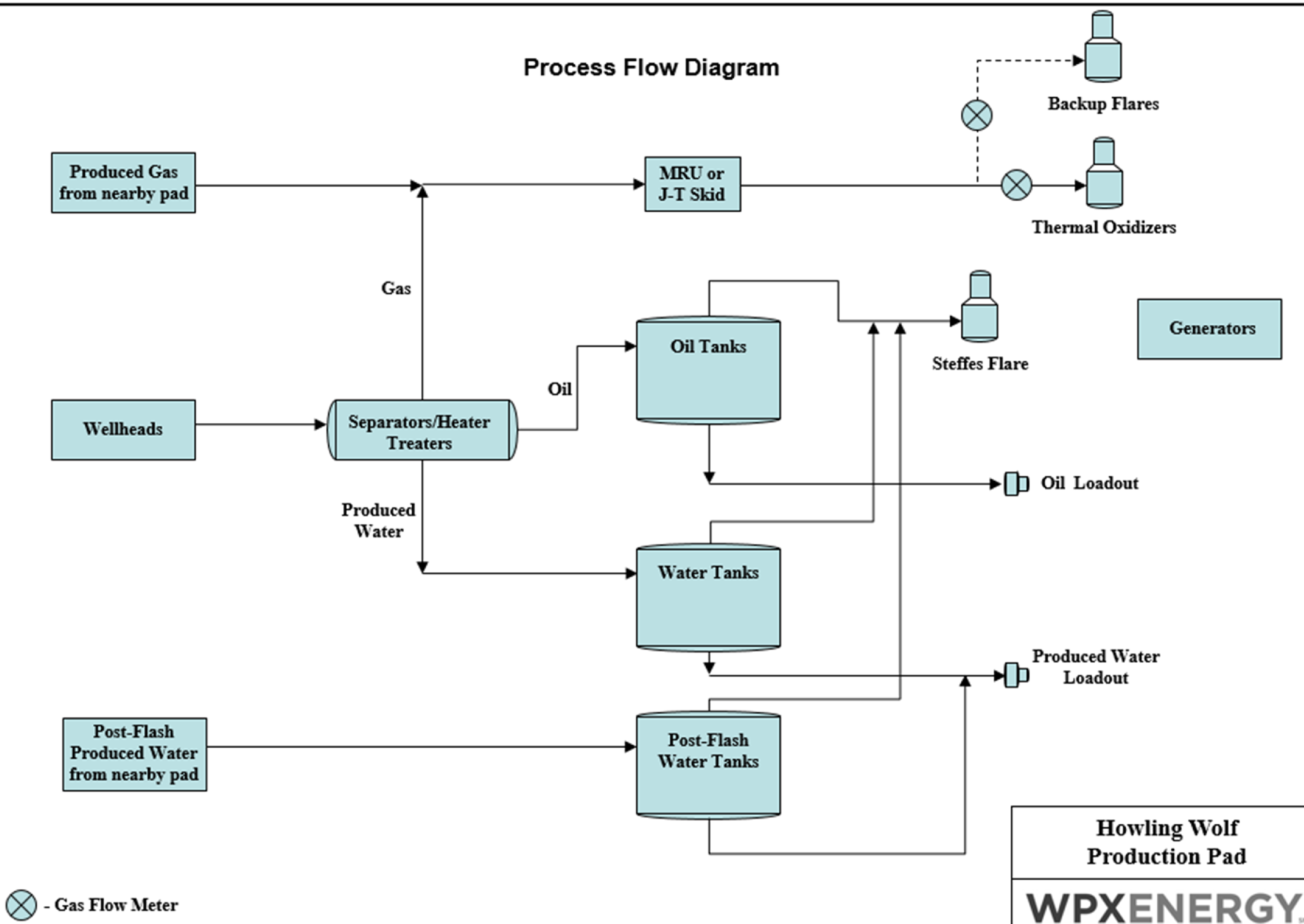
4 – Questor Q5000 Thermal Oxidizers
Steffes Utility Flares
2 – Backup Flares

Flashing, working, standing and breathing losses from storage tanks are routed to Steffes flares with an assumed flare efficiency of 98%. The flare control efficiency demonstration summary is in Attachment E.

Process Flow Diagram

A process flow diagram for the facility is included on the following page.

Process Flow Diagram



Note: The produced water and gas streams from a nearby pad will be processed at this pad

Howling Wolf Production Pad

WPX ENERGY

2.0 Regulatory Applicability

This section discusses the regulatory applicability of federal and state regulations.

2.1 40 CFR Part 52 Section 52.21 – Prevention of Significant Deterioration of Air Quality (PSD)

The requirements of this Subpart apply to the construction of new major stationary sources, the major modification of any existing major source, or any project at an existing major stationary source in an area designated as attainment or unclassified. A major stationary source is any of the 28 listed source categories that emits or has the potential to emit 100 tpy or more of any regulated pollutant or any other source type which emits or has the potential to emit any regulated pollutant in amount equal to or greater than 250 tpy. The Facility is a new source with emissions below all PSD applicability thresholds and is not one of the twenty-eight listed sources. Therefore, the Federal PSD rule set forth in 40 CFR §52.21 does not apply to the Facility.

2.2 40 CFR Part 71 – Federal Operating Permit Program.

This part sets forth the comprehensive Federal air quality operating permits permitting program consistent with the requirements of title V of the Act and defines the requirements, standards, and procedures by which the Administrator will issue operating permits. It applies to major sources, sources to a standard or limitation under Sections 111 and 112 of the Act, any “affected” sources, and any other sources designed by the Administrator as an affected source. There is no federally approved CAA Title V Operating Program for the FBIR and the North Dakota Title V Operating Program does not cover Indian country. Therefore, the EPA has the authority to issue a Title V Operating Permit to the Facility. If the Facility becomes a major source, WPX will submit an Operating Permit application within twelve months after becoming a major source.

2.3. 40 CFR Part 60 General Provisions.

Subpart A, General Provisions, applies to any stationary source that contains an affected facility to which an NSPS standard is applicable. This subpart applies if at least one NSPS standard is applicable.

2.4 40 CFR Part 60 Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels

(Including Petroleum Liquid Storage Vessels)...Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

The tanks at this facility are pre-custody transfer. Pre-custody transfer tanks that are subject to 40 CFR 60.110b are those that have a capacity greater than 10,000 bbl (1,589.874 m^3). All of the tanks at this facility are less than or equal to this capacity threshold. Therefore, this facility is not subject to 40 CFR 60.110b.

2.5 40 CFR Part 60, Subpart GG: Standards of Performance for Stationary Gas Turbines

There are no turbines at this facility therefore this facility is not subject to 40 CFR 60.330.

2.6 40 CFR Part 60 Subpart KKK – Standards of Performance for Equipment Leaks of VOC From Onshore Natural Gas Processing Plants

for Which Construction, Reconstruction, or Modification Commenced After January 20, 1984 and on or Before August 23, 2011

This subpart applies to facilities involved in onshore natural gas processing plants. This facility is not a natural gas processing plant; therefore, this subpart does not apply.

2.7 40 CFR Part 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

This subpart applies to manufacturers, owners, and operators of stationary compression ignition internal combustion engines (ICE). There are no compression ignition internal combustion engines at this facility therefore it is not subject to 40 CFR 60.4200.

2.8 40 CFR Part 60 Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

Subpart JJJJ applies to manufacturers, owners and operators of stationary spark ignition (SI) internal combustion engines (ICE). The stationary SI RICE at the facility commenced construction after June 12, 2006 and were manufactured:

On or after the July 1, 2008 regulatory applicability date for engines with less than 500 horsepower; or
On or after the January 1, 2008 regulatory applicability date for lean burn engines with greater than or equal to 500 horsepower and less than 1,350 horsepower.

Therefore, this subpart is applicable.

2.9 40 CFR Part 60, Subpart KKKK - Standards of Performance for Stationary Combustion Turbines

This subpart establishes emission standards and compliance schedules for the control of emissions from stationary combustion turbines that commenced construction, modification, or reconstruction after February 18, 2005. There are no turbines at this facility; therefore, this subpart does not apply.

2.10 40 CFR Part 60 Subpart OOOO: Crude Oil and Natural Gas Production, Transmission, and Distribution

The facility was constructed after September 18, 2015. Therefore, the facility is not subject to the requirements of this subpart.

2.11 40 CFR Part 60 Subpart OOOOa: Crude Oil and Natural Gas Production, Transmission, and Distribution

This subpart applies to each storage vessel affected facility, each pneumatic controller affected facility, each compressor affected facility, and each pneumatic pump affected facility constructed, modified or reconstructed after September 18, 2015. This subpart also applies to the collection of fugitive emission components at a well site, compressor station, or natural gas processing plant that were constructed, modified, or reconstructed after September 18, 2015.

The water storage tanks at this facility were constructed, modified or reconstructed after September 18, 2015. The potential to emit, as defined by this subpart, of the produced water tanks is less than or equal to 6 tpy per tank; therefore, the produced water tanks are not affected facilities and are not subject to this regulation. The potential to emit, as defined by this subpart, of the oil tanks is greater than or equal to 6 tpy per tank; therefore, the oil tanks are affected facilities and may subject to this regulation. The actual emissions from the oil tanks will be evaluated after the wells start production.

There are no continuous high-bleed pneumatic controllers at the facility.

Any reciprocating compressors at this facility constructed after September 18, 2015 do not fall under the requirements of this subpart because they are located at a well site (40 CFR 60.5365a(c)).

The fugitive emission components at this well site were constructed or modified after September 18, 2015; therefore, the fugitive emission components are subject to the monitoring requirements under this regulation.

The J-T skid process unit is not classified as a natural gas processing plant.

There will be no pneumatic pumps at the facility.

2.12 40 CFR Part 63 Subpart HH – National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities

This subpart applies to emission points at oil and gas production facilities located at area sources and major sources of HAP emissions. The facility emissions are below major source thresholds for HAPs, and there are no triethylene glycol (TEG) dehydration units at this facility; therefore, this subpart does not apply.

2.13 40 CFR Part 63 Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

This subpart establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emissions from stationary reciprocating internal combustion engines located at major and area sources of HAP emissions.

This facility is an area source of HAP emissions. Subpart ZZZZ applies to new or reconstructed engines at area sources of HAP emissions. Any engine at the facility will be a new stationary RICE located at an area source which commenced construction after June 12, 2006 [63.6590 (a)(2)(iii)]. New or reconstructed stationary RICE located at an area source must meet the requirements of NSPS Subpart JJJJ for SI engines. No further requirements apply for such engines under this subpart [63.6590(c)(1)].

2.14 40 CFR Part 51, 52, 70, and 71 – Greenhouse Gas Tailoring Rule

The greenhouse gas tailoring rule affects the PSD and operating permit requirements for existing source facilities with the potential to emit CO_2e greater than 100,000 tons per year under §51.166(b)(48)(v)(a), §52.21(b)(49)(v)(a), §70.2, and 71.2, respectively. The Facility does not meet the applicability requirements for the PSD program under these sections, but does meet the definition of major source under the title V Operating Program for non-GHG pollutants. The Facility has emissions below 100,000 tons per year of CO_2e. The Facility is not subject to this requirement, but greenhouse gas emissions were inventoried by permitting action. It should also be noted that the US Supreme Court has held in *Utility Air Regulatory Group v. Environmental Protection Agency* No. 12-1146 that the tailoring rule exceeded EPA's authority under the Clean Air Act and applicability of these provisions to this project is likely moot for this facility as such.

2.15 40 CFR Part 98 – Mandatory Greenhouse Gas Reporting

Subparts C and W apply to sources in certain segments of the oil and gas industry with the potential to emit Greenhouse Gases (GHG). It requires such sources above certain emissions thresholds to monitor, calculate, and report greenhouse gas emissions. This Facility meets the definition of "Onshore Petroleum and Natural Gas Production" in §98.230(a)(2) and is included in a geologic basin with aggregated emissions exceeding the reporting threshold of 25,000 metric tons CO_2e as defined in §98.231. Therefore, the Facility is subject to this Part.

2.16 40 CFR Part 68 – Chemical Accident Prevention Provisions

This rule applies to stationary sources that manufacture, process, use, store, or otherwise handle more than the threshold quantity of a regulated substance in a process. This regulation exempts facilities that only store naturally occurring hydrocarbons from the risk management program (RMP) plan requirements. As such, the Facility will be exempt from RMP plan requirements for oil storage as set forth by this regulation. A J-T Skid will be operated at this Facility and NGL will be stored onsite above the threshold requiring a RMP. A Program 1 RMP was prepared and submitted to EPA. In addition, the facility will be subject to the General Duty Clause set forth by this regulation that requires all facilities to prevent the accidental release of listed substances and to minimize the impact of any such releases. The facility follows standards and generally accepted safe practices to minimize the risks posed by the storage and handling of crude oil.

2.17 40 CFR Part 49 Subpart K

Implementation Plan for Tribes Region VIII. *Federal Implementation Plan (FIP) for Oil and Natural Gas Well Production Facilities; Fort Berthold Indian Reservation (Mandan, Hidatsa and Arikara Nation), North Dakota*.

This FIP applies apply to each owner or operator constructing, modifying or operating an oil and natural gas production facility located on the Fort Berthold Indian Reservation producing from the Bakken Pool with one or more oil and natural gas wells, for which completion or recompletion operations were performed on or after August 12, 2007. The Facility is a natural gas production facility with various wells producing from the Bakken pool and located in the Fort Berthold Indian Reservation. Therefore, the storage tanks and flares are subject to the control and emission reduction requirements established under this subpart.

3.0 Fugitive Requirement in Calculations

EPA's Tribal land synthetic minor source application form (Form NEW, Form No. 5900-247) states that emissions calculations must include fugitive emissions if the source is of the types listed on the form pursuant to CAA Section 302(j). This facility is an oil and gas production facility with a total storage capacity not exceeding 300,000 barrels. This means the only source type that may apply is "(aa) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Act."

Based on the review of potentially applicable federal regulations, this facility is regulated under Section 112 of the Clean Air Act, and fugitive VOC emissions calculations are included with this submittal.

4.0 Endangered Species Act and National Historic Preservation Act

To satisfy the requirements under §49.104(a)(1), documentation that another federal agency has complied with its requirements under the Endangered Species Act (ESA) and the National Historic Preservation Act (NHPA) when authorizing the activities for the facility/activity covered under this application were submitted to EPA for the Part 1 registration. The appropriate documents clearly show that the other federal agencies have met their obligations under both the ESA and NHPA.

This information was submitted to and accepted by EPA in the Part 1 registration for the Howling Wolf Production Pad.

5.0 Emission Calculations Methodologies

5.1 Thermal Oxidizer/Flare

Four Questor model Q5000 thermal oxidizers and additional flares are installed at the facility.

Thermal oxidizer emissions from the pilot, as well as NOx and CO from the produced gas stream, were calculated using AP-42 emission factors (Tables 1.4-1) in units of lb/MMscf. A J-T skid is used to treat all produced gas being sent to the thermal oxidizers.

Flare emissions from the pilot, as well as NOx from the oil and produced water tanks waste streams, were calculated using AP-42 emission factors (Table 13.5-1) in units of lb/MMscf. CO emissions from the oil and produced water tanks waste streams were calculated using TCEQ emission factors (TCEQ EI Guidelines, Appendix A, Table A-7) in units of lb/MMbtu. In addition, the flare may receive produced gas during thermal oxidizer downtime. During this upset condition, the produced gas sent to the flare will be metered separately so that the emission calculations can account for the decreased control efficiency.

A thermal oxidizer destruction efficiency of 99.5% was used based on manufacturer guarantee and a flare destruction efficiency of 98% was used based on the Federal Implementation Plan (FIP) for the Fort Berthold Indian Reservation (EPA, 3/22/2013). Compliance testing of the thermal oxidizer will be performed to demonstrate the increased destruction efficiency. WPX proposes that quarterly testing of the thermal oxidizer be performed until a full year of compliance has been demonstrated. After a year of compliance has been demonstrated, WPX requests that the testing frequency be reduced to semi-annual. WPX believes this proposed testing frequency adequately demonstrates proper operation of the thermal oxidizer

Example calculations are provided to show how VOC emissions will be calculated when produced gas is sent to the thermal oxidizer as well as when produced gas is sent to the flare.

Example controlled VOC emission equation for the thermal oxidizers:

$$= \frac{\left(150{,}000\,\frac{\text{scf}}{\text{hr}}\right) * \left(\frac{1\text{ lbmol}}{379\text{ scf}}\right) * \left(24.01\,\frac{\text{lb}}{\text{lbmol}}\right) * (24.56\text{ wt\% VOC}) * (1-0.995) * \left(8760\,\frac{\text{hr}}{\text{yr}}\right)}{\left(2000\,\frac{\text{lb}}{\text{ton}}\right)} = 51.1\,\frac{\text{ton}}{\text{yr}}$$

Example of controlled VOC emission equation for the flares in the event of a 5% downtime of the thermal oxidizers:

$$= \frac{\left(7{,}500\,\frac{\text{scf}}{\text{hr}}\right) * \left(\frac{1\text{ lbmol}}{379\text{ scf}}\right) * \left(24.01\,\frac{\text{lb}}{\text{lbmol}}\right) * (24.56\text{ wt\% VOC}) * (1-0.98) * \left(8760\,\frac{\text{hr}}{\text{yr}}\right)}{\left(2000\,\frac{\text{lb}}{\text{ton}}\right)} = 10.2\,\frac{\text{ton}}{\text{yr}}$$

Gas Flow Volume (scf/hr)	Destruction Efficiency (%)	VOC Emissions (tpy)*	Uptime (%)
150,000	99.5	51.1	100
142,500	99.5	48.6	95
7,500	98	10.2	5
150,000	-	58.8**	-

*These values are sample values only and not reflective of PTE emissions
**Total emission value taken from downtime event emissions only

5.2 Heaters

Heater emissions were calculated using AP-42 emission factors (Tables 1.4-1, 1.4-2 and 1.4-3) in units of lb/MMscf. The heaters use field gas for fuel. There is one 2.5 MMBtu/hr water bath heater and three 1.25 MMBtu/hr heater treater heaters at the facility. The water bath heater and three heater treater heaters use a combined 33.0 MMscf/yr of field gas.

Fuel gas flow rate for each treater was estimated using the fuel heating value in BTU/SCF and the heat input rate:

$$\text{Heater Fuel Gas Flow Rate} = \left(\frac{1.25\,\frac{\text{MMBTU}}{\text{hr}}}{1659\,\frac{\text{BTU}}{\text{SCF}}}\right) = 0.0008\,\frac{\text{MMSCF}}{\text{hr}}$$

Emissions for all pollutants for each heater treater burner were estimated using the lb/MMBTU emission factors, fuel gas flow rate, and assuming 8760 hours per year of operation. Example using NO_X:

$$\text{One Heater Treater NOx Emissions}\left(\frac{\text{lb}}{\text{hr}}\right) = \left(0.098\,\frac{\text{lb}}{\text{MMBTU}}\right) * \left(1.25\,\frac{\text{MMBTU}}{\text{hr}}\right) = 0.123\,\frac{\text{lb}}{\text{hr}}$$

$$\text{One Heater Treater NOx Emissions}\left(\frac{\text{ton}}{\text{yr}}\right) = \frac{\left(0.123\,\frac{\text{lb}}{\text{hr}}\right) * \left(8760\,\frac{\text{hr}}{\text{yr}}\right)}{\left(2000\,\frac{\text{lb}}{\text{ton}}\right)} = 0.537\,\frac{\text{ton}}{\text{yr}}$$

5.3 Tanks

Twelve 400-bbl oil storage tanks and twelve 400-bbl produced water storage tanks (6 pre-flash and 6 post-flash) are at the facility. Pre-flash tank emissions were calculated using E&P Tank 2.0. An average throughput of 1000 bbl/day was used for the model simulation and used to create emission factor in units of tpy/BOPD to estimate potential emissions for each pre-flash oil tank and produced water tank. To calculate emissions from the pre-flash produced water tanks, it was assumed 1.0% of the total produced water throughput is oil. Emissions were then calculated based on the produced water throughput, the 1.0% condensate assumption, and the lb/bbl condensate emission factor calculated based on E&P Tanks v2.0.

The 400-bbl post-flash produced water tanks are controlled by a flare. The facility receives post-flash produced water from nearby production pads; therefore, there are no flash emissions. The working and breathing emissions for the produced water tank battery were calculated using EPA Tanks 4.0.9d. E&P Tanks Version 2.0 results and a representative liquids analysis were used to speciate HAPs emissions. For permitting purposes, the emissions were conservatively calculated based on the produced water containing up to 1% oil. However, the average oil content of the produced water tanks on an annual basis is expected to be significantly lower than the 1% assumption as the produced water typically contains negligible amounts of oil.

Example calculation for VOC emissions:

$$\text{Tank VOC Emissions } \left(\frac{\text{ton}}{\text{yr}}\right) = \left(\text{Oil Production, }\frac{\text{bbl}}{\text{day}}\right) * \left(\text{Flash } \mathit{Emission\ Factor}\ \frac{\text{tpy}}{\text{bopd}}\right)$$

$$= 7{,}200\,\frac{\text{bbl}}{\text{day}} * 0.566\ \ \frac{\text{tpy}}{\text{bopd}} = 4{,}072\ \frac{\text{ton}}{\text{yr}}$$

These VOC emissions will be controlled by the 98% DE Steffes flare.

5.4 Loadout

Oil loadout emissions were calculated using the AP-42 methodology (EPA AP-42, Volume I, Fifth Edition – January 1995, Chapter 5, Section 2). Potential loadout emissions were calculated based on annual oil tank throughput. Truck loadout with submerged loading in normal service has a saturation factor of 0.6. The vapor pressure for crude oil at 50°F given in EPA AP-42 Table is 2.3 psi.

Example calculation:

$$\text{Loading Loss Emission Factor } \left(\frac{\text{lb}}{1000\text{ gal}}\right) = \frac{12.46*(0.6)*(2.30\text{ psi})*\left(40.93\,\frac{\text{lb}}{\text{lbmol}}\right)}{(50°\text{F}+460)°\text{R}} = 1.38\,\frac{\text{lb}}{1000\text{ gal}}.$$

$$\text{Loading Loss Emissions}\left(\frac{\text{ton}}{\text{yr}}\right) = 1.38\,\frac{\text{lb}}{1000\text{ gal}} * 2{,}628{,}000\,\frac{\text{bbl}}{\text{yr}} * \frac{42\text{ gal}}{\text{bbl}} * \frac{\text{ton}}{2000\text{ lb}} = 76.2\,\frac{\text{ton}}{\text{yr}}$$

Emissions were calculated based on the loading loss emissions and a representative analysis.

Example calculation:

$$\text{VOC Emissions}\left(\frac{\text{ton}}{\text{yr}}\right) = 76.2\,\frac{\text{ton}}{\text{yr}} * \frac{73.4}{100}\,\%\text{VOC} = 55.9\,\frac{\text{ton}}{\text{yr}}$$

5.5 Fugitives

Fugitive piping emissions were calculated using an estimated component count based on the equipment on site and emission factors from the EPA document EPA-453/R-95-017. Potential emissions were calculated using 8,760 hr/yr. An extended gas analysis from the facility heater treater inlet gas was used as the representative composition for calculating fugitive emissions. A copy of this analysis is included in this submittal.

6.0 Air Quality Modeling Analysis

WPX prepared an air quality modeling analysis based on the original application submitted on October 4, 2018. On October 31, 2018, Region 8 responded to the modeling results with comments and requested changes to be made to the modeling analysis. WPX submitted an updated modeling report that included the changes requested by Region 8 on December 4, 2018. The change between this synthetic minor permit application and the original application is a reduction in gas volume sent to the thermal oxidizer. The modeling results included in this application are based on a higher gas volume combusted at the thermal oxidizer, so the results are more conservative. A summary of the modeling comments from Region 8 can be found in Attachment F of this application.

Nitrogen Dioxide (NO_2), CO, PM_{10}, $PM_{2.5}$, and SO_2 were modeled for each averaging period of each applicable pollutant to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS). The results show that all modeled pollutants demonstrate compliance with the NAAQS standards.

ATTACHMENT A

Application for Synthetic Minor Limit (Form SYNMIN)
and
Application for New Construction (Form NEW)

OMB Control No. 2060-0003
Approval expires 04/30/2017

United States Environmental Protection Agency Program Address Phone Fax Web address	*Reviewing Authority* *Program* *Address* *Phone* *Fax* *Web address*

FEDERAL MINOR NEW SOURCE REVIEW PROGRAM IN INDIAN COUNTRY

Application For Synthetic Minor Limit

(Form SYNMIN)

Please submit information to:

[**Federal Minor NSR Permit Coordinator**
U.S. EPA, Region 8
1595 Wynkoop Street, 8P-AR
Denver, CO 80202-1129
R8airpermitting@epa.gov

A. GENERAL INFORMATION

Company Name WPX Energy Williston, LLC	**Source Name** Howling Wolf Production Pad
Company Contact or Owner Name John Ritchie	Title Senior Staff Environmental Specialist
Mailing Address 3500 One Williams Center, Tulsa, OK 74172	
Email Address John.Ritchie@wpxenergy.com	
Telephone Number 539-573-3847	Facsimile Number

B. ATTACHMENTS

For each criteria air pollutant, hazardous air pollutant and for all emission units and air pollutant generating activities to be covered by a limitation, include the following:

Item 1 - The proposed limitation and a description of its effect on current actual, allowable and the potential to emit.

Item 2 - The proposed testing, monitoring, recordkeeping, and reporting requirements to be used to demonstrate and assure compliance with the proposed limitation.

Item 3 - A description of estimated efficiency of air pollution control equipment under present or anticipated operating conditions, including documentation of the manufacturer specifications and guarantees.

Item 4 - Estimates of the Post-Change Allowable Emissions that would result from compliance with the proposed limitation, including all calculations for the estimates.

Item 5 – Estimates of the potential emissions of Greenhouse Gas (GHG) pollutants:

EPA Form No. 5900-246

Instructions

Use this form to provide general and summary information about the synthetic minor NSR source (source or plant) on Tribal lands and to indicate the emissions limitations requested. Submit this form once, in addition to FORM NEW, for each synthetic minor NSR source on Tribal lands.

1. Who Can Request Federally-Enforceable Limitations Under the Tribal NSR Authority?

The Tribal NSR Rule applies only to sources located within the exterior boundaries of an Indian reservation in the United States of America or other lands as specified in 40 CFR part 49, collectively referred to as "Indian country". So, to use the authority in the Tribal NSR Rule to create federally enforceable limitations, a source must be located within Indian country. Land ownership status (for example, whether the land is owned by a Tribal member or whether the land is owned in fee or in trust) does not affect how the rule applies.

2. Who Might Want to Request Federally-Enforceable Limitations?

The primary reason for requesting federally-enforceable limitations is to avoid an otherwise applicable federal Clean Air Act program, rule or requirement. Many federal Clean Air Act programs use a source's "potential to emit" (PTE) air pollution to determine which rules or requirements apply. A source's PTE is based on the maximum annual operational (production, throughput, etc) rate of the source taking into consideration the capacity and configuration of the equipment and operations. Emission or operational limits can also be taken into consideration as maximums if they are federally enforceable. So, using a synthetic minor NSR permit to establish federally enforceable limitations can lower a source's PTE and possibly allow the source to avoid certain federal Clean Air Act requirements.

Three examples of federal Clean Air Act programs that use PTE to determine whether they apply are (1) the Prevention of Significant Deterioration (PSD) construction permitting program, (2) the Title V operating permit program, and (3) the Maximum Achievable Control Technology (MACT) program. For example, existing sources that are considered "major" for Title V (meaning they have the potential to emit air pollution at levels defined in that rule as "major") must apply for a Title V operating permit. If a source accepts a federally-enforceable limitation through a synthetic minor NSR permit that reduces their PTE to below the "major" threshold, and the source does not meet any of the other requirements that would trigger applicability to the part 71 program, then the source no longer needs a Title V operating permit. When planning for the construction of a new source or expansion of an existing source, a source can also accept limitations on PTE (using a synthetic minor NSR permit) that allow the source to avoid PSD. Limitations on PTE can similarly help a source to avoid new MACT standards that would otherwise apply to the source.

3. Section B. ATTACHMENTS

This section lists the information that must be attached to the application form for each requested limitation. The requested limitation(s) must be described for each affected emissions unit (or pollutant generating activity) and pollutant and must be accompanied by the supporting information listed on the form and described below. Note that applicability of many federal Clean Air Act requirements (such as Title V, PSD and MACT) is often based on source-wide emission levels of specific pollutants. In that case, all emissions units at a source and all pollutants regulated by that given rule or regulation must be addressed by this section of the application form.

Item 1 – The requested limitation and its effect on actual emissions or potential to emit must be presented in enough detail to document how the limitation will limit the source's actual or potential emissions as a legal and practical matter and, if applicable, will allow the source to avoid an otherwise applicable requirement. The information presented must clearly explain how the limitation affects each emission unit and each air pollutant from that emission unit. Use the information provided in response to Item 4 below to explain how the limitation affects emissions before and after the limitation is in effect.

Item 2 – For each requested limitation, the application must include proposed testing, monitoring, recordkeeping and reporting that will be used to demonstrate and assure compliance with the limitation. Testing approaches should incorporate and reference appropriate EPA reference methods where applicable. Monitoring should describe the emission, control or process parameters that will be relied on and should address frequency, methods, and quality assurance.

Item 3 – The application must include a description and estimated efficiency of air pollution control equipment under present or anticipated operating conditions. For control equipment that is not proposed to be modified to meet the requested limit, simply note that fact; however, for equipment that is proposed to be modified (e.g. improved efficiency) or newly installed to meet the proposed limit, address both current and future descriptions and efficiencies. Include manufacturer specifications and guarantees for each control device.

Items 4 – Any emission estimates submitted to the Reviewing Authority must be verifiable using currently accepted engineering criteria. The following procedures are generally acceptable for estimating emissions from air pollution sources:

(i) Source-specific emission tests;
(ii) Mass balance calculations;
(iii) Published, verifiable emission factors that are applicable to the source. (i.e., manufacturer specifications).
(iv) Other engineering calculations; or
(v) Other procedures to estimate emissions specifically approved by the Reviewing Authority.

Post-Change Allowable Emissions: A source's allowable emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the allowed hourly emissions rate in pounds per hour (lbs/hr) times allowed hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

Item 5 - New construction projects that have the potential to emit GHG emissions of at least 100,000 tpy CO_2e and 100 or 250 tpy on a mass basis, modifications at existing PSD facilities that increase GHG emissions by at least 75,000 tpy CO_2e and minor sources that increase GHG emissions by at least 100,000 tpy CO_2e and 100 or 250 tpy on a mass basis are subject to PSD permitting requirements, even if they do not significantly increase emissions of any other pollutant. As such, any requested limits to avoid PSD must take into account greenhouse gases.

Therefore, please include in your permit application estimates of the potential emissions of the following pollutants. More information about GHG permitting and how to calculate CO_2 equivalents (CO_2e), the mass emissions of each individual GHG adjusted for its Global Warming Potential (GWP) can be found at: http://epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf

1. Carbon dioxide (CO_2)
2. Methane (CH_4) and its CO_2e
3. Nitrous oxide (N_2O) and its CO_2e
4. Hydrofluorocarbons (HFCs) and its CO_2e
5. Perfluorocarbons (PFCs) and its CO_2e
6. Sulfur hexafluoride (SF_6) and its CO_2e

United States Environmental Protection Agency **Program** **Address** **Phone** **Fax** **Web address**	*Reviewing Authority* *Program* *Address* *Phone* *Fax* *Web address*

FEDERAL MINOR NEW SOURCE REVIEW PROGRAM IN INDIAN COUNTRY

Application for New Construction

(Form NEW)

Please check all that apply to show how you are using this form:

Proposed Construction of a New Source
Proposed Construction of New Equipment at an Existing Source
x **Proposed Modification of an Existing Source**
Other – Please Explain

Please submit information to:

Federal Minor NSR Permit Coordinator
U.S. EPA, Region 8
1595 Wynkoop Street, 8P-AR
Denver, CO 80202-1129
R8airpermitting@epa.gov

A. GENERAL SOURCE INFORMATION

1. (a) **Company Name** WPX Energy Williston, LLC (b) **Operator Name** WPX Energy Williston, LLC		2. **Source Name** Howling Wolf Production Pad	
3. Type of Operation Oil and gas production		4. Portable Source? ☐ Yes ☒ No 5. Temporary Source? ☐ Yes ☒ No	
6. NAICS Code 213111		7. SIC Code 1311	
8. Physical Address (home base for portable sources) From the intersection of BIA Route 22 & 80th Ave NW in Twin Buttes, ND, travel westerly on BIA Route 22 for 0.78 miles to fork in roadway. Keep Right (westerly) for 6.1 miles to fork in roadway; Go Left (North Westerly) for 1.9 miles to proposed access road. Go Right (Northerly) on proposed access road for 0.2 miles to staked Howling Wolf Production Pad location.			
9. Reservation* Fort Berthold Indian Reservation	10. County* Dunn	11a. Latitude* 47.537008	11b. Longitude* -102.404483
12a. Quarter Quarter Section* NW1/4 SE1/4	12b. Section* 21	12c. Township* 147N	12d. Range* 92W

*Provide all proposed locations of operation for portable sources

B. PREVIOUS PERMIT ACTIONS (Provide information in this format for each permit that has been issued to this source. Provide as an attachment if additional space is necessary)

Source Name on the Permit N/A
Permit Number (xx-xxx-xxxxx-xxxx.xx) N/A
Date of the Permit Action N/A

Source Name on the Permit
Permit Number (xx-xxx-xxxxx-xxxx.xx)
Date of the Permit Action

Source Name on the Permit
Permit Number (xx-xxx-xxxxx-xxxx.xx)
Date of the Permit Action

Source Name on the Permit
Permit Number (xx-xxx-xxxxx-xxxx.xx)
Date of the Permit Action

Source Name on the Permit
Permit Number (xx-xxx-xxxxx-xxxx.xx)
Date of the Permit Action

C. CONTACT INFORMATION

Company Contact John Ritchie	Title Senior Staff Environmental Specialist
Mailing Address 3500 One Williams Center, Tulsa, OK 74172	
Email Address John.Ritchie@wpxenergy.com	
Telephone Number 539-573-3847	Facsimile Number
Operator Contact (if different from company contact)	Title
Mailing Address	
Email Address	
Telephone Number	Facsimile Number
Source Contact John Ritchie	Title Senior Staff Environmental Specialist
Mailing Address 3500 One Williams Center, Tulsa, OK 74172	
Email Address John.Ritchie@wpxenergy.com	
Telephone Number 539-573-3847	Facsimile Number
Compliance Contact John Ritchie	Title Senior Staff Environmental Specialist
Mailing Address 3500 One Williams Center, Tulsa, OK 74172	
Email Address John.Ritchie@wpxenergy.com	
Telephone Number 539-573-3847	Facsimile Number

D. ATTACHMENTS

Include all of the following information (see the attached instructions)

FORM SYNMIN - New Source Review Synthetic Minor Limit Request Form, if synthetic minor limits are being requested.

Narrative description of the proposed production processes. This description should follow the flow of the process flow diagram to be submitted with this application.

Process flow chart identifying all proposed processing, combustion, handling, storage, and emission control equipment.

A list and descriptions of all proposed emission units and air pollution-generating activities.

Type and quantity of fuels, including sulfur content of fuels, proposed to be used on a daily, annual and maximum hourly basis.

Type and quantity of raw materials used or final product produced proposed to be used on a daily, annual and maximum hourly basis.

Proposed operating schedule, including number of hours per day, number of days per week and number of weeks per year.

A list and description of all proposed emission controls, control efficiencies, emission limits, and monitoring for each emission unit and air pollution generating activity.

Criteria Pollutant Emissions - Estimates of Current Actual Emissions, Current Allowable Emissions, Post-Change Uncontrolled Emissions, and Post-Change Allowable Emissions for the following air pollutants: particulate matter, PM_{10}, $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compound (VOC), lead (Pb) and lead compounds, fluorides (gaseous and particulate), sulfuric acid mist (H_2SO_4), hydrogen sulfide (H_2S), total reduced sulfur (TRS) and reduced sulfur compounds, including all calculations for the estimates.

These estimates are to be made for each emission unit, emission generating activity, and the project/source in total.

Modeling – Air Quality Impact Analysis (AQIA)

ESA (Endangered Species Act)

NHPA (National Historic Preservation Act)

E. TABLE OF ESTIMATED EMISSIONS

The following tables provide the total emissions in tons/year for all pollutants from the calculations required in Section D of this form, as appropriate for the use specified at the top of the form.

E(i) – Proposed New Source

Pollutant	Potential Emissions (tpy)	Proposed Allowable Emissions (tpy)	
PM	8.34	8.34	PM - Particulate Matter PM_{10} - Particulate Matter less than 10 microns in size $PM_{2.5}$ - Particulate Matter less than 2.5 microns in size SOx - Sulfur Oxides NOx - Nitrogen Oxides CO - Carbon Monoxide VOC - Volatile Organic Compound Pb - Lead and lead compounds Fluorides - Gaseous and particulates H_2SO_4 - Sulfuric Acid Mist H_2S - Hydrogen Sulfide TRS - Total Reduced Sulfur RSC - Reduced Sulfur Compounds
PM_{10}	8.34	8.34	
$PM_{2.5}$	8.34	8.34	
SO_x	9.46	9.46	
NO_x	148.43	148.43	
CO	170.42	170.42	
VOC	230.00	230.00	
Pb	0.00	0.00	
Fluorides	0.00	0.00	
H_2SO_4	0.00	0.00	
H_2S	0.10	0.10	
TRS	0.00	0.00	
RSC	0.00	0.00	

Emissions calculations must include fugitive emissions if the source is one the following listed sources, pursuant to CAA Section 302(j):

(a) Coal cleaning plants (with thermal dryers);
(b) Kraft pulp mills;
(c) Portland cement plants;
(d) Primary zinc smelters;
(e) Iron and steel mills;
(f) Primary aluminum ore reduction plants;
(g) Primary copper smelters;
(h) Municipal incinerators capable of charging more than 250 tons of refuse per day;
(i) Hydrofluoric, sulfuric, or nitric acid plants;
(j) Petroleum refineries;
(k)) Lime plants;
(l) Phosphate rock processing plants;
(m)) Coke oven batteries;
(n) Sulfur recovery plants;
(o) Carbon black plants (furnace process);
(p) Primary lead smelters;
(q) Fuel conversion plants;
(r)) Sintering plants;
(s) Secondary metal production plants;
(t) Chemical process plants
(u) Fossil-fuel boilers (or combination thereof) totaling more than 250 million British thermal units per hour heat input;
(v)) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels;
(w) Taconite ore processing plants;
(x) Glass fiber processing plants;
(y) Charcoal production plants;
(z) Fossil fuel-fired steam electric plants of more that 250 million British thermal units per hour heat input, and
(aa) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Act.

E(ii) – Proposed New Construction at an Existing Source or Modification of an Existing Source

Pollutant	Current Actual Emissions (tpy)	Current Allowable Emissions (tpy)	Post-Change Potential Emissions (tpy)	Post-Change Allowable Emissions (tpy)
PM				
PM_{10}				
$PM_{2.5}$				
SO_x				
NO_x				
CO				
VOC				
Pb				
Fluorides				
H_2SO_4				
H_2S				
TRS				
RSC				

PM - Particulate Matter
PM_{10} - Particulate Matter less than 10 microns in size
$PM_{2.5}$ - Particulate Matter less than 2.5 microns in size
SOx - Sulfur Oxides
NOx - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compound
Pb - Lead and lead compounds
Fluorides - Gaseous and particulates
H_2SO_4 - Sulfuric Acid Mist
H_2S - Hydrogen Sulfide
TRS - Total Reduced Sulfur
RSC - Reduced Sulfur Compounds

Instructions

Use of This Form

- Proposed new construction or modifications should first be evaluated to determine if the change is major under the major NSR program using the procedures at 40 CFR 52.21 (i.e., baseline actual to projected actual applicability test). If the proposed construction does not qualify as a major under that test, then it may be subject to the requirements of the minor NSR rule at 40 CFR 49.151.

Helpful Definitions from the Federal Minor NSR Rule (40 CFR 49) – This is not a comprehensive list.

- *40 CFR 49.152(d) - Modification* means any physical or operational change at a source that would cause an increase in the allowable emissions of the affected emissions units for any regulated NSR pollutant or that would cause the emission of any regulated NSR pollutant not previously emitted.

  The following exemptions apply:

  (1) A physical or operational change does not include routine maintenance, repair, or replacement.

  (2) An increase in the hours of operation or in the production rate is not considered an operational change unless such increase is prohibited under any federally-enforceable permit condition or other permit condition that is enforceable as a practical matter.

  (3) A change in ownership at a source is not considered a modification.

- *40 CFR 49.152(d) - Allowable emissions* means ‘‘allowable emissions’’ as defined in §52.21(b)(16), except that the allowable emissions for any emissions unit are calculated considering any emission limitations that are enforceable as a practical matter on the emissions unit’s potential to emit.

- *52.21(b)(16) - Allowable emissions* means the emissions rate of a stationary source calculated using the maximum rated capacity of the source (unless the source is subject to federally enforceable limits which restrict the operating rate, or hours of operation, or both) and the most stringent of the following:

  (i) The applicable standards as set forth in 40 CFR parts 60 and 61;

  (ii) The applicable State Implementation Plan emissions limitation, including those with a future compliance date; or

  (iii) The emissions rate specified as a federally enforceable permit condition, including those with a future compliance date.

A. General Source Information

1. Company Name & Operator Name (if different): Provide the complete company and operator names. For corporations, include divisions or subsidiary name, if any.

2. Source Name: Provide the source name. Please note that a source is a site, place, location, etc… that may contain one or more air pollution emitting units.

3. Type of Operation: Indicate the generally accepted name for the operation (i.e., asphalt plant, gas station, dry cleaner, sand & gravel mining, oil and gas wellsite, tank battery, etc.).

4. Portable Source: Does the source operate in more than one location? Some examples of portable sources include asphalt batch plants and concrete batch plants.

5. Temporary Source: A temporary source, in general, would have emissions that are expected last less than 12 months. Do you expect to cease operations within the next 12 months?

6. NAICS Code: North American Industry Classification System. The NAICS Code for your source can be found at the following link → North American Industry Classification System (http://www.census.gov/epcd/naics/nsic2ndx.htm#S1).

7. SIC Code: Standard Industrial Classification Code. Although the new North American Industry Classification System (NAICS) has replaced the SIC codes, much of the Clean Air Act permitting processes continue to use these codes. The SIC Code for your source can be found at the following link → Standard Industrial Classification Code (http://www.osha.gov/pls/imis/sic_manual.html).

8. Physical Address: Provide the actual address of where the source is operating, not the mailing address. Include the State and the ZIP Code.

9. Reservation: Provide the name of the Indian reservation within which the source is operating.

10. County: Provide the County within which the source is operating.

11a & 11b. Latitude & Longitude: These are GPS (global positioning system) coordinates. This information can be provided in decimal format or degree-minute-second format.

12a – 12d. Section-Township-Range: Please provide these coordinates in 1/4 Section/Section/Township/Range. (e.g., SW ¼, NE ¼ /S36/T10N/R21E).

B. Current Permit Information

Provide a list of all permits that have been issued to your source. This should include any Federal Minor New Source Review (MNSR), Prevention of Significant Deterioration (PSD) or Non-Attainment New Source Review (NA NSR) permits, in addition to the most recent Part 71 permit. The permit number must be included with each permit identified.

C. Contact Information

Please provide the information requested in full.

1. Company Contact: List the full name (last, middle initial, first) of the owners of the source or the company contact.

2. Operator Contact: Provide the name of the operator of the source if it is different from the company contact.

3. Source Contact: The source contact must be the local contact authorized to receive requests for data and information.

4. Compliance Contact: The compliance contact must be the local contact responsible for the source's compliance with this rule. If this is the same as the Source Contact please note this on the form.

D. Attachments

This section lists the information needed to complete the requested approval. This information should be accompanied by the supporting information listed on the form and described below. The information should be presented in enough detail to document how the source is currently operating and/or how it is proposed to operate.

☐ **FORM SYNMIN**

If synthetic minor limits are being requested, a synthetic Minor Limit Application should be included with this application.

☐ Narrative description of the proposed production processes.

1. The narrative description should follow the flow of the process flow diagram to be submitted with this application. This needs to be as comprehensive as possible to help in understanding the proposed source and how it will be operated. For example:

What are the raw materials?
What are the properties of the raw materials?
Does the production process include heating, drying, the application of chemicals, etc?
How will the raw materials be affected by this process?
What are the out puts from each step of the process (i.e., crushed ore, dry gas, water, etc…)?
Etc….

2. The proposed operating schedule presented in terms of hours per day, days per week, and weeks per year.
3. A list of the type and quantity of fuels and/or raw materials used. Each fuel and raw material should be described in enough detail to indicate its basic chemical components.

☐ A process flow chart identifying all proposed processing, combustion, handling, storage, and emission control equipment (include the unit identification # or code). This flow chart should illustrate the detailed narrative description requested above.

☐ List and describe all proposed units, emission units and air pollution-generating activities. At a minimum, provide the following:

1. The hourly, daily and annual maximum operating rates for each operating unit, production process, and activity.
2. The hourly, daily and annual maximum firing rates for each fuel and combustion equipment.
3. The capacity for storage units and the hourly, daily and annual maximum throughput of material in the storage units.
4. Material and product handling equipment and the hourly, daily and annual maximum throughput of material and product.
5. Tank designs, tank storage capacities, hourly, daily and annual maximum throughput of material and product.

☐ Type and quantity of fuels, including sulfur content of fuels, proposed to be used on a daily, annual and maximum hourly basis.

☐ Type and quantity of raw materials used or final product produced proposed to be used on a daily, annual and maximum hourly basis.

☐ Proposed operating schedule, including number of hours per day, number of days per week and number of weeks per year.

☐ A list and description of all proposed emission controls, control efficiencies, emission limits, and monitoring for each emission unit and air pollution generating activity.

1. Include manufacturer specifications and guarantees for each control device.

Criteria Pollutant Emissions Estimates

☐ Estimates of Current Actual Emissions, Current Allowable Emissions, Post-Change Uncontrolled Emissions, and Post-Change Allowable Emissions for the following air pollutants: particulate matter, PM_{10}, $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compound (VOC), lead (Pb) and lead compounds, ammonia (NH_3), fluorides (gaseous and particulate), sulfuric acid mist (H_2SO_4), hydrogen sulfide (H_2S), total reduced sulfur (TRS) and reduced sulfur compounds, including all calculations for the estimates.

1. These estimates are to be made for each emission unit, emission generating activity, in addition to total emissions.

2. The information should include all of the supporting calculations, assumptions and references. Emission estimates must address all emission units and pollutants proposed and/or affected by the limitation and be presented in short term (e.g. pounds per hour) as well as annual (tons per year) units.

3. Any emission estimates submitted to the Regional Administrator must be verifiable using currently accepted engineering criteria. The following procedures are generally acceptable for estimating emissions from air pollution sources:

   - Source-specific emission tests;
   - Mass balance calculations;
   - Published, verifiable emission factors that are applicable to the source. (i.e. manufacturer specifications)
   - Other engineering calculations; or
   - Other procedures to estimate emissions specifically approved by the Regional Administrator.

4. Guidance for estimating emissions can be found at http://www.epa.gov/ttn/chief/efpac/index.html.

Current Actual Emissions: Current actual emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the actual hourly emissions rate in pounds per hour (lbs/hr) times actual hours operated (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

1. For an **existing air pollution source (permitted and unpermitted)** that operated prior to the application submittal, the current actual emissions are the actual rate of emissions for the preceding calendar year and must be calculated using the actual operating hours, production rates, in-place control equipment, and types of materials processed, stored, or combusted during the preceding calendar year. The emission estimates must be based upon actual test data or, in the absence of such data, upon procedures acceptable to the Regional Administrator.

Current Allowable Emissions: Current allowable emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the allowed hourly emissions rate in pounds per hour (lbs/hr) times allowed hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

1. “Allowed” means the source is restricted by permit conditions that limit its emissions and are enforceable as a practical matter (i.e., allowable emissions). The allowable emissions for any

emissions unit are calculated considering any emissions limitations that are enforceable as a practical matter on the unit's PTE.

2. For an **existing permitted air pollution source** that operated prior to the application submittal, the current allowable emissions are the allowable rate of emissions for the preceding calendar year and must be calculated using the permitted operating hours, production rates, in-place control equipment, and types of materials processed, stored, or combusted during the preceding calendar year.

3. For an **existing air pollution source** that does not have an established allowable emissions level prior to the modification must report the pre-change uncontrolled emissions.

Post-Change Potential Emissions (Potential uncontrolled emissions from proposed project): This is the maximum capacity of a source to emit a pollutant under its physical and operational design. This is expressed in tpy and generally is calculated by multiplying the maximum hourly emissions rate in pounds per hour (lbs/hr) times 8,760 hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

Post-Change Allowable Emissions: A source's allowable emissions for a pollutant is expressed in tpy and generally is calculated by multiplying the allowed hourly emissions rate in pounds per hour (lbs/hr) times allowed hours (which is the number of hours in a year) and dividing by 2,000 (which is the number of pounds in a ton).

1. Unless the source is restricted by permit conditions or other requirements that are enforceable as a practical matter, the post-change allowable emissions would be equivalent to post-change uncontrolled emissions. For the post-change allowable emissions a lower level of allowable emissions may be proposed.

2. For physical or operational changes at minor sources and for minor physical or operational changes at major sources, the total increase in allowable emissions resulting from your proposed change would be the sum of following:

   - For each new emissions unit that is to be added, the emissions increase would be the potential to emit of each unit.
   - For each emissions unit with an allowable emissions limit that is to be changed or replaced, the emissions increase would be the allowable emissions of the emissions unit after the change or replacement minus the allowable emissions prior to the change or replacement. However, this may not be a negative value. If the allowable emissions of an emissions unit would be reduced as a result of the change or replacement, use zero in the calculation.
   - For each unpermitted emissions unit (i.e., a unit without any emissions limitations before the change) that is to be changed or replaced, the emissions increase would be the allowable emissions of the unit after the change or replacement minus the potential to emit prior to the change or replacement. However, this may not be a negative value. If the allowable emissions of an emissions unit would be reduced as a result of the change or replacement, use zero in the calculation.

☐ Modeling Analysis

Do I need to do a modeling analysis?

The Federal Minor New Source Review Regulations at 40 CFR 49.159(d) requires that a modeling analysis (AQIA) of proposed emissions be performed if there is reason to be concerned that new construction would cause or contribute to a National Ambient Air Quality Standard (NAAQS) or Prevention of Significant Deterioration (PSD) increment violation.

In addition, if the AQIA reveals that the new construction could cause or contribute to a NAAQS or PSD increment violation; such impacts must be reduced before a pre-construction permit can be issued.

To facilitate the protection of the NAAQS and PSD Increment, EPA requests that those proposed activities that meet the following criteria perform an AQIA:

1. The proposed activity has air emissions that the Reviewing Authority determines has the potential to cause adverse air quality effects for which an air quality impact analysis is necessary for an accurate assessment of the environmental impact of the activities proposed.

2. Modeling of proposed emissions is usually warranted, even though the proposed activity does not meet the modeling requirements, above, if it is reasonable to believe the new activity may cause or contribute to a violation of applicable ambient air quality standards or increments in circumstances such as:

(a) A substantial portion of the new or modified emissions have poor dispersion characteristics (e.g., rain caps, horizontal stacks, fugitive releases, or ***building downwash***) in close proximity to ***ambient air*** at the site boundary;

(b) The new or modified emissions are located in ***complex terrain*** (e.g., terrain above stack height in close proximity to the source); or

(c) The new or modified emissions are located in areas with existing air quality concerns.

(d) If you have questions about whether modeling may be necessary based on the 4th criteria above, please contact the Reviewing Authority:

**[Reviewing Authority
Address
Phone]**

What Kind of Air Quality Modeling Analysis Is Needed?

1. EPA considers a stepped or phased approach to modeling to be appropriate, as follows:

   Step 1: Qualitative Air Quality Assessment
   Step 2: Screening Analysis
   Step 3: Preliminary Modeling Analysis (refined modeling)
   Step 4: Full Impact Modeling Analysis (refined modeling)
   Step 5: PSD Increment and NAAQS Analysis
   Step 6: Additional Impact Analysis

2. Step 1: Qualitative Air Quality Assessment

   Narrative description of the current air quality conditions and the expected impact the permitted source would have on that air quality. Some suggested factors to consider in the qualitative discussion could include meteorology, terrain, distance to ambient air, expected emissions, etc. If a convincing case cannot be made qualitatively that no impacts to air quality would be expected, a screening analysis should next be performed.

3. Step 2: Screening Analysis

   For proposed new or modified sources that meet the modeling requirement criteria identified above, protection of air quality from proposed emissions may be shown by using a simple screening technique (e.g., SCREEN3 or AERSCREEN). Screening models are available for download at the EPA SCRAM website: http://www.epa.gov/ttn/scram/dispersion_screening.htm. A pre-approved modeling protocol is not necessary prior to conducting a Screening Analysis.

4. If the proposed new or modified emission increases do not increase ambient concentrations of a pollutant by more than the significant impact levels, as compared to the SILs identified below, no further modeling is necessary.

Significant Impact Levels

Pollutant	Averaging Period	Class II Area SIL (ug/m^3)	Class I Area SIL (ug/m^3)
SO_2	1 hr	3 ppb or 7.8 ug/m^3 (interim)	----
	3 hr	25	1.0
	24 hr	5	0.2
	Annual	1	0.08
$PM_{2.5}$	24 hr	0.07	1.2
	Annual	0.06	0.3
PM_{10}	24 hr	5	0.2
	Annual	1	0.08
NO_2	1 hr	4 ppb or 7.5 ug/m^3 (interim)	----
	Annual	1	0.08
CO	1 hr	2,000 ppb	
	8 hr	500 ppb	

Note: The Class I area SILs are provided as guidance and have not been formalized by EPA.

5. Sources that cannot demonstrate protection of air quality using a screening technique should continue to the modeling requirements in ***Step 2*** through ***Step 5***. Modeling in Steps 2 through 5 should be performed based an approved protocol.

6. Applicants are encouraged to contact the Reviewing Authority prior to conducting any refined modeling analysis (Step 2 through Step 5) to obtain an approved protocol.

What Should I Include In My Application If Modeling Is Necessary?

1. Approved Modeling Protocol

   In order to expedite the permitting process, it is recommended that you include a protocol that has already been approved. An application will not be deemed complete until the protocol has been approved.

2. Modeling Results

   In all cases, the modeling results should include the name of the model used, all input parameters, and the resulting output. Electronic copies of the modeling input/output files should be provided to the Reviewing Authority.

☐ ESA

The Endangered Species Act requires us, in consultation with the U.S. Fish and Wildlife Service and/or the NOAA Fisheries Service, to ensure that actions we authorize are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species.

To expedite the approval of your proposed construction, we encourage you to identify any listed species that you may be readily aware of that could be affected by your proposal. The following website has been provided to assist you:

http://www.fws.gov/endangered/

Simply enter the State and County in which you propose to construct to obtain a general listing.

☐ NHPA

The National Historic Preservation Act requires us, in consultation with State and/or Tribal Historic Preservation Officers to ensure that actions we authorize are not likely to affect cultural resources.

To expedite the approval of your proposed construction, we encourage you to identify any cultural resources that you may be readily aware of that could be affected by your proposal. The following website has been provided to assist you:

http://nrhp.focus.nps.gov/natreghome.do?searchtype=natreghome

Simply enter the State and County in which you propose to construct to obtain a general listing.

ATTACHMENT B

Facility Emissions Summary and Equipment Emission Calculations

WPX Energy Williston, LLC

Input Data

GREEN = Requires input

RED = No input required. This is a calculated value.

Facility Information	Description
Howling Wolf Production Pad	Name of the facility and the well number.
Mandaree	Field facility is located in.
	Approximate first date of production or the date of modification of the facility.
	Date application packet is due to EPA Region 8.
6	Number of Wells

Production Data		Description
BOPD	12000.00	Average daily production in barrels of oil per day (BOPD)
BWPD	12000.00	Average daily production in barrels of water per day (BWPD)
Mscfd	5106.802	Average daily flared gas in Mscf per day
Decline Factor	0.600	Expected decline factor for the first year of operation. Based on data from previously producing wells in the same field and formation.
Adjusted BOPD	7200	This is the calculated BOPD expected to be produced using the above entered decline factor.
Adjusted BWPD	7200	This is the calculated BWPD expected to be produced using the above entered decline factor.
Adjusted Flared Gas (Mscfd)	3064	This is the calculated mcfd of gas the well is expected to flare using the above entered decline factor.

Oil/Condensate Tank Data		Description
Flash Gas Method: Process Simulator		Use the drop down menu to choose the appropriate flash gas method.
Process Simulator Estimated scf/bbl	39.1	The scf/bbl from direct measurement or representative sample. Based on representative E&P Tank Emission Summary Output.
Estimated Tank Vapors (scfd)	281520	This is the estimated scfd of tank vapors based on the following: adjusted BOPD multiplied by the scf/bbl entered on Line 9.
Lower Heating Value	2338.03	Lower heating value (Btu/scf) of tank vapors. Based on representative E&P Tank Emission Summary Output.
Molecular Weight	40.93	Molecular weight of the tank vapors in pounds per pound-mole (lb/lb-mole). Based on representative E&P Tank Emission Summary Output.
VOC%	73.42	VOC weight fraction of the tank vapor gas (C3+). Based on representative E&P Tank Emission Summary Output.
VOC TPY/BOPD Emission Factor	0.566	Based on representative E&P Tank Emission Summary Output. (Summary Output creates a linear relationship between TPY and BOPD)
HAP%	0.717	HAP weight fraction of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
HAP TPY/BOPD Emission Factor	0.006	Based on representative E&P Tank Emission Summary Output. (Summary Output creates a linear relationship between TPY and BOPD)
CO_2%	0.28%	CO_2 weight fraction of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
CH_4%	2.11%	CH_4 weight fraction of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
H_2S weight %	0.09%	H_2S weight percent of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
H_2S mole %	0.11%	H_2S mole percent of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
Utility Flare or Other 98% DRE Device		Use the drop down menu to choose the appropriate emission control type.
Control Destruction Efficiency	98%	Control efficiency of any applicable controls. This is a fixed number based on control type.

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Input Data

GREEN = Requires input

RED = No input required. This is a calculated value.

Facility Information		
Howling Wolf Production Pad		Name of the facility and the well number.

Produced Water Tank Data		Description
Flash Gas Method: Process Simulator		Use the drop down menu to choose the appropriate flash gas method.
Percentage of Oil in Produced Water (%)	1.00%	Percentage of oil in produced water (%)
Process Simulator Estimated scf/bbl	39.100	The scf/bbl from direct measurement or representative sample. Based on representative E&P Tank Emission Summary Output.
Estimated Tank Vapors (scfd)	4692	This is the estimated scfd of tank vapors based on the following: adjusted BOPD multiplied by the scf/bbl entered on Line 9.
Lower Heating Value	2338.03	Lower heating value (Btu/scf) of tank vapors. Based on representative E&P Tank Emission Summary Output.
Molecular Weight	40.93	Molecular weight of the tank vapors in pounds per pound-mole (lb/lb-mole). Based on representative E&P Tank Emission Summary Output.
VOC%	73.421	VOC weight fraction of the tank vapor gas (C3+). Based on representative E&P Tank Emission Summary Output.
VOC TPY/BOPD Emission Factor	0.566	Based on representative E&P Tank Emission Summary Output. (Summary Output creates a linear relationship between TPY and BOPD)
HAP%	0.717	HAP weight fraction of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
HAP TPY/BOPD Emission Factor	0.006	Based on representative E&P Tank Emission Summary Output. (Summary Output creates a linear relationship between TPY and BOPD)
CO2%	0.28%	CO2 weight fraction of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
CH4%	2.11%	CH4 weight fraction of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
H_2S weight %	0.09%	H_2S weight percent of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
H_2S mole %	0.11%	H_2S mole percent of the tank vapor gas. Based on representative E&P Tank Emission Summary Output.
Utility Flare or Other 98% DRE Device		Use the drop down menu to choose the appropriate emission control type.
Control Destruction Efficiency	98%	Control efficiency of any applicable controls. This is a fixed number based on control type.

Untreated Flared Gas Data		Description
Btu/scf	1659.00	Btu/scf of wellstream gas. (From representative field gas analysis)
Molecular Weight	29.88	Average molecular weight of the wellstream gas in lb/lb-mole. (From site specific field gas analysis)
Specific Gravity	1.04	If necessary to convert specific gravity to molecular weight, enter the specific gravity of the wellstream gas. (From site specific field gas analysis)
Average Molecular Weight	29.88	(From site specific field gas analyses)
VOC%	49.65%	VOC weight fraction of the wellstream gas (Note: Weight%, not Mole%). (From site specific field gas analysis)
HAP%	0.30%	HAP weight fraction of the wellstream gas. (Note: Weight%, not Mole%). (From site specific field gas analysis)
CO2%	0.88%	CO2 weight fraction of the wellstream gas. (Note: Weight%, not Mole%). (From site specific field gas analysis)
CH4%	23.94%	CH4 weight fraction of the wellstream gas. (Note: Weight%, not Mole%). (From site specific field gas analysis)
H_2S weight %	0.00%	H_2S weight percent of the wellstream gas. (From site specific field gas analysis)
H_2S mole %	0.00%	H_2S mole percent of the wellstream gas. (From site specific field gas analysis)
Connected to sales line		Use the drop down menu to choose the appropriate emission control type.
Control/Capture Efficiency	98.0%	If routed to pipeline, assumed 100% capture of gas. If flared, control efficiency of any applicable controls (combustor, pit flare, utility flare, etc).

Treater Gas Data		Description
Btu/scf	1700.39	Btu/scf of wellstream gas. (From representative field gas analysis)
Molecular Weight	29.77	Average molecular weight of the wellstream gas in lb/lb-mole. (From representative field gas analysis)
Specific Gravity	1.02	If necessary to convert specific gravity to molecular weight, enter the specific gravity of the wellstream gas. (From representative field gas analysis)

WPX Energy Williston, LLC

Input Data

GREEN = Requires input

RED = No input required. This is a calculated value.

Facility Information		
Howling Wolf Production Pad		Name of the facility and the well number.
Average Molecular Weight	29.77	(From representative field gas analyses)
VOC%	48.11%	VOC weight fraction of the wellstream gas (Note: Weight%, not Mole%). (From representative field gas analysis)
HAP%	0.52%	HAP weight fraction of the wellstream gas. (Note: Weight%, not Mole%). (From representative field gas analysis)
CO2%	0.85%	CO2 weight fraction of the wellstream gas. (Note: Weight%, not Mole%). (From representative field gas analysis)
CH4%	24.89%	CH4 weight fraction of the wellstream gas. (Note: Weight%, not Mole%). (From representative field gas analysis)
H_2S weight %	0.00%	H_2S weight percent of the wellstream gas. (From representative field gas analysis)
H_2S mole %	0.00%	H_2S mole percent of the wellstream gas. (From representative field gas analysis)
Connected to sales line		Use the drop down menu to choose the appropriate emission control type.
Control/Capture Efficiency	99.5%	If routed to pipeline, assumed 100% capture of gas. If flared, control efficiency of any applicable controls (combustor, pit flare, utility flare, etc).

Treater Burner(s)		Description
Total Btu/hr	6250000	Total burner rating for the heater treater burner(s) in btu/hr. If there are multiple burners, add the total heat input together.
Hours of Operation	8,760	The burner(s) is/are assumed to operate 8,760 hours per year.

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Input Data

GREEN = Requires input

RED = No input required. This is a calculated value.

Facility Information	
Howling Wolf Production Pad	Name of the facility and the well number.

Truck Loading		Description
Oil is hauled by truck		Use the drop down menu to choose the appropriate oil sales method. If oil is sold through a LACT, no input values are required in Lines 30-35.
Submerged loading: dedicated normal service	0.6	Use the drop down list to choose the appropriate mode of operation. The saturation factor will automatically be selected based on mode of operation.
Molecular Weight	40.93	Molecular weight of tank vapors in lb/lb-mole. Assumed same molecular weight as flashing emissions from representative E&P Tanks data.
Vapor Pressure	2.30	True vapor pressure of liquid loaded, pounds per square inch absolute (psia) If no site specific data is available, please refer to Table 2 on Truck Loading tab.
Temperature	50.00	Temperature of bulk liquid loaded in Fahrenheit. If no site specific data is available, use an estimated average annual temperature.
Load Rate (bbl/hr)	180	Load rate of liquid loaded in barrels per hour.
Load Time (hrs)	1.00	The time it takes to loadout one load (hrs).

Pneumatic Pumps and Contollers (None)	
Number of Pneumatic Pumps	0
Number of Pneumatic Controllers	0

Glycol Dehydrator (None)

WPX Energy Williston, LLC

Facility:
Howling Wolf Production

Howling Wolf Production Pad PTE Rolling 12 Month Projection

Uncontrolled

	Criteria Pollutants									
	VOC	HAP	NOx	PM	PM10	PM2.5	CO	H_2S	SO_2	HCHO
Oil/Condensate Tanks	4072.48	39.79	0.00	0.00	0.00	0.00	0.00	5.03	0.00	Negligible
Produced Water Tanks	40.72	0.66	0.00	0.00	0.00	0.00	0.00	0.08	0.00	Negligible
Post-Flash Produced Water Tanks	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Negligible
Casing Head Gas	14500.22	219.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Treater Burner	0.15	0.05	2.68	0.20	0.20	0.20	2.25	N/A	0.02	Negligible
RICE Engine	11.50	2.36	16.43	0.65	0.65	0.65	32.87	N/A	0.03	2.36
Truck Loading	55.92	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fuel Storage Tank	Negligible	Negligible	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pneumatic Pump	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pneumatic Controllers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Glycol Dehydrator	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fugitive Leaks[a]	7.66	0.08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Totals (TPY)	**18688.86**	**262.78**	**19.12**	**0.86**	**0.86**	**0.86**	**35.13**	**5.11**	**0.05**	**2.43**

Controlled

	Criteria Pollutants[b]									
	VOC	HAP	NOx	PM	PM10	PM2.5	CO	H_2S	SO_2	HCHO
Oil/Condensate Tanks	81.45	0.80	8.17	0.39	0.39	0.39	33.09	0.10	9.26	Negligible
Produced Water Tanks	0.81	0.01	0.14	0.01	0.01	0.01	0.55	0.00	0.15	Negligible
Post-Flash Produced Water Tanks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Negligible
Casing Head Gas	72.50	1.17	121.01	7.08	7.08	7.08	101.65	0.00	0.00	0.07
Treater Burner	0.15	0.05	2.68	0.20	0.20	0.20	2.25	N/A	0.02	Negligible
RICE Engine	11.50	2.36	16.43	0.65	0.65	0.65	32.87	N/A	0.03	2.36
Truck Loading	55.92	0.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fuel Storage Tank	Negligible	Negligible	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pneumatic Pump	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pneumatic Controllers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Glycol Dehydrator	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fugitive Leaks[a]	7.66	0.08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Totals (TPY)	**230.00**	**5.01**	**148.43**	**8.34**	**8.34**	**8.34**	**170.42**	**0.10**	**9.46**	**2.43**

[a] Emissions associated with fugitive leaks are not to be used for major source determination.
[b] Emissions lead and lead compounds, fluorides, sulfuric acid mist, total reduced sulfur, and reduced sulfur compounds are assumed to be negligiable for upstream oil & gas operations on the FBIR.

WPX Energy Williston, LLC

Facility:
Howling Wolf Production

	Uncontrolled Greenhouse Gases[c]			Actual Greenhouse Gases[c]		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Oil/Condensate Tanks	15.58	117.34	0.00	6180.87	2.35	0.11
Produced Water Tanks	0.26	1.96	0.00	103.01	0.04	0.00
Post-Flash Produced Water Tanks	0.00	0.01	0.00	0.45	0.00	0.00
Casing Head Gas	821.69	22929.53	0.00	111838.97	114.65	2.05
Treater Burner	3202.80	0.06	0.01	3202.80	0.06	0.01
RICE Engine	1023.49	0.02	0.00	1023.49	0.02	0.00
Truck Loading	0.21	1.61	N/A	0.21	1.61	N/A
Fuel Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A
Pneumatic Pump	N/A	N/A	N/A	N/A	N/A	N/A
Pneumatic Controllers	N/A	N/A	N/A	N/A	N/A	N/A
Glycol Dehydrator	N/A	N/A	N/A	N/A	N/A	N/A
Fugitive Leaks	0.13	3.20	N/A	0.13	3.20	N/A
Totals (TPY)	**5064.17**	**23053.73**	**0.01**	**122349.95**	**121.93**	**2.18**

	Uncontrolled	Actual
GHG Mass Emissions (tpy):	**28117.91**	**122474.05**
CO2e (tpy):	**489195.71**	**125584.81**
Applicable to the Tailoring Rule?:		**Yes**

[c] Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluorides (SF6) emissions are not created from O&G production operations.

WPX Energy Williston, LLC

RICE Input Data

Number of Engines	2	Enter the number of engines that will be installed at the production facility.

Engine #1		**Description**
Hours of Operation	8760	Engine is assumed to operate 8,760 hours per year.
Maximum HP Rating	1340	
NOx g/hp-hr	1.00E+00	
CO g/hp-hr	2.00E+00	
SO2 g/hp-hr	1.93E-03	
PM g/hp-hr	3.28E-02	
VOC g/hp-hr	7.00E-01	
HAP g/hp-hr	1.81E-01	
CO2 g/hp-hr	7.91E+01	
CH4 g/hp-hr	1.49E-03	
N2O g/hp-hr	1.49E-04	

Engine #2		**Description**
Hours of Operation	8760	Engine is assumed to operate 8,760 hours per year.
Maximum HP Rating	362	
NOx g/hp-hr	1.00E+00	
CO g/hp-hr	2.00E+00	
SO2 g/hp-hr	1.98E-03	
PM g/hp-hr	6.52E-02	
VOC g/hp-hr	7.00E-01	
HAP g/hp-hr	7.68E-02	
CO2 g/hp-hr	8.08E+01	
CH4 g/hp-hr	1.52E-03	
N2O g/hp-hr	1.52E-04	

WPX Energy Williston, LLC

RICE Input Data

Engine #3		Description
Hours of Operation	8760	Engine is assumed to operate 8,760 hours per year.
Maximum HP Rating	0	
NOx g/hp-hr	2.76E+00	
CO g/hp-hr	2.61E+00	
SO2 g/hp-hr	1.12E+00	
PM g/hp-hr	1.49E-01	
VOC g/hp-hr	2.20E-01	
HAP g/hp-hr	2.76E-01	
CO2 g/hp-hr	1.31E+02	
CH4 g/hp-hr	5.25E-03	
N2O g/hp-hr	1.05E-03	

Engine #4		Description
Hours of Operation	8760	Engine is assumed to operate 8,760 hours per year.
Maximum HP Rating	0	
NOx g/hp-hr	2.76E+00	
CO g/hp-hr	2.61E+00	
SO2 g/hp-hr	1.12E+00	
PM g/hp-hr	1.49E-01	
VOC g/hp-hr	2.20E-01	
HAP g/hp-hr	2.76E-01	
CO2 g/hp-hr	1.31E+02	
CH4 g/hp-hr	5.25E-03	
N2O g/hp-hr	1.05E-03	

WPX Energy Williston, LLC

Howling Wolf Production Pad

Oil Tanks

Oil Production	7200	bopd
Flare Gas Volume	11730	scfh
Lower Heating Value	2338.03	Btu/scf
Molecular Weight	40.93	lb/lb-mole
VOC wt Fraction	73.42%	
VOC Emission Factor	0.566	tpy/bo
HAPs:		
Benzene wt Fraction	0.0200%	
Toluene wt Fraction	0.0108%	
E-Benzene wt Fraction	0.0021%	
Xylene wt Fraction	0.0114%	
n-Hexane wt Fraction	0.6243%	
2,2,4-Trimethylpentane wt Fraction	0.0485%	
HAP Emission Factor	0.006	tpy/bopd
CO2 wt Fraction	0.28%	
CH4 wt Fraction	2.11%	
H2S wt Fraction	0.09%	

As per NSPS Subpart OOOO, Controlled and Uncontrolled emissions are calculated based on a 98% destruction efficiency of the VOC gas.

WPX Energy Williston, LLC

Howling Wolf Production Pad

Oil Tanks

CRITERIA POLLUTANT EMISSIONS[a]

Uncontrolled VOCs (PTE):

					DRE			
Using E&P Tanks Run:	0.566 TPY VOC/BO	x	7200 BO	x	0%	=	4072.48	TPY

Controlled VOCs (Allowable):

					DRE			
Using E&P Tanks Run:	0.566 TPY VOC/BO	x	7200 BO	x	98%	=	81.45	TPY

Uncontrolled HAPs (PTE):

Using E&P Tanks Run:

							wt%		DRE				TPY
Benzene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.02%	x	0%	=	0.2536 lb/hr	=	1.1107
E-Benzene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.00%	x	0%	=	0.0263 lb/hr	=	0.1150
Toluene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.01%	x	0%	=	0.1367 lb/hr	=	0.5989
n-Hexane	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.62%	x	0%	=	7.9080 lb/hr	=	34.6373
Xylene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.01%	x	0%	=	0.1444 lb/hr	=	0.6325
2,2,4-Trimethylpentane	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.05%	x	0%	=	0.6145 lb/hr	=	2.6916
											Uncontrolled TOTAL HAPS (TPY)	=	39.7859

Controlled HAPs (Allowable):

Benzene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.02%	x	98%	=	0.0051 lb/hr	=	0.0222
E-Benzene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.00%	x	98%	=	0.0005 lb/hr	=	0.0023
Toluene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.01%	x	98%	=	0.0027 lb/hr	=	0.0120
n-Hexane	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.62%	x	98%	=	0.1582 lb/hr	=	0.6927
Xylene	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.01%	x	98%	=	0.0029 lb/hr	=	0.0127
2,2,4-Trimethylpentane	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mol	x	0.05%	x	98%	=	0.0123 lb/hr	=	0.0538
											Controlled TOTAL HAPS (TPY)	=	0.7957

WPX Energy Williston, LLC

Howling Wolf Production Pad

Oil Tanks

NOx Created by Combustion (PTE)

NOx:	**11,730** scf/hr	x	**2,338** Btu/scf	x	1 MMBtu/1,000,000 Btu	x	0.068 lb/MMBtu	=	**1.86** lb/hr
			1.86 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**8.17** TPY

Uncontrolled H2S: (PTE)

							wt		DRE		
H2S:	**11,730** scf	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	0.09%	x	0%	=	**1.15** lb/hr
			1.15 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	**5.03** TPY		

Controlled H2S: (Allowable)

							wt%		DRE		
H2S	**11,730** scf	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	0.09%	x	98%	=	**0.02** lb/hr
			0.02 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	**0.10** TPY		

SO2 Created by Combustion: (PTE)

							DRE		
SO2	**1.15** lb H2S/hr	x	1/34.08 lb H2S/lb-mole	x	64.07 lb SO2/lb-mole	x	98.00%	=	**2.11** lb/hr
			2.11 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	**9.26** TPY

PM Created by Combustion (PTE)

PM:	**11,730** scf/hr	x	**7.6** lb/1,000,000 scf	=	**0.09** lb/hr				
			0.09 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**0.39** TPY

CO Created by Combustion (PTE)

CO:	**11,730** scf/hr	x	**2,338** Btu/scf	x	1 MMBtu/1,000,000 Btu	x	0.276 lb/MMBtu	=	**7.56** lb/hr
			7.56 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**33.09** TPY

[a]NOx emission factor is from AP-42 Table 13.5-1
(Emission Factors for Flare Operations).
[b]CO emission factor is from TCEQ EI Guidelines, Appendix A, Table A-7.

WPX Energy Williston, LLC

Howling Wolf Production Pad

Oil Tanks

REGULATED GREENHOUSE GAS EMISSIONS[b]

Uncombusted CO2: (PTE)

							wt		DRE		
CO2:	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	0.28%	x	0%	=	3.56 lb/hr
			3.56 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	15.58 TPY		

CO2 Created by Combustion (PTE)

CO2:	11,730 scf/hr	x	120,000.0 lb/1,000,000 scf	=	1407.60 lb/hr			
			1407.60 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	= 6165.29 TPY

Uncontrolled CH4: (PTE)

							wt		DRE		
CH4:	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	2.11%	x	0%	=	26.79 lb/hr
			26.79 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	117.34 TPY		

Controlled CH4: (Allowable)

							wt%		DRE		
CH4:	11,730 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	2.11%	x	98%	=	0.54 lb/hr
			0.54 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	2.35 TPY		

N2O Created by Combustion: (PTE)

CH4:	11,730 scf/hr	x	2.2 lb/1,000,000 scf	=	0.03 lb/hr			
			0.03 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	= 0.11 TPY

[b]CO2, PM, and N2O emission factors are from AP-42 Table 1.4-2
(Emission Factors for Natural Gas Combustion).

WPX Energy Williston, LLC

Howling Wolf Production Pad

Produced Water Tanks

Oil Production	72.0	bopd
Flare Gas Volume	195.5	scfh
Lower Heating Value	2338.03	Btu/scf
Molecular Weight	40.93	lb/lb-mole
VOC wt Fraction	73.42%	
VOC Emission Factor	0.566	tpy/bo
HAPs:		
Benzene wt Fraction	0.0200%	
Toluene wt Fraction	0.0108%	
E-Benzene wt Fraction	0.0021%	
Xylene wt Fraction	0.0114%	
n-Hexane wt Fraction	0.6243%	
2,2,4-Trimethylpentane wt Fraction	0.0485%	
HAP Emission Factor	0.006	tpy/bopd
CO2 wt Fraction	0.28%	
CH4 wt Fraction	2.11%	
H2S wt Fraction	0.09%	

Note: This oil production is based on the oil content (1%) in the produced water tanks and the produced water throughput

As per NSPS Subpart OOOO, Controlled and Uncontrolled emissions are calculated based on a 98% destruction efficiency of the VOC gas.

WPX Energy Williston, LLC

Howling Wolf Production Pad

Produced Water Tanks

CRITERIA POLLUTANT EMISSIONS[a]

Uncontrolled VOCs (PTE):

						DRE			
Using E&P Tanks Run:	**0.566**	TPY VOC/BO	x	**72.0** BO	x	0%	=	**40.72**	TPY

Controlled VOCs (Allowable):

						DRE			
Using E&P Tanks Run:	**0.566**	TPY VOC/BO	x	**72.0** BO	x	98%	=	**0.81**	TPY

Uncontrolled HAPs (PTE):

Using E&P Tanks Run:

								wt%		DRE					TPY
Benzene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.02%	x	0%	=	**0.0042** lb/hr	=	**0.0185**
E-Benzene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.00%	x	0%	=	**0.0004** lb/hr	=	**0.0019**
Toluene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.01%	x	0%	=	**0.0023** lb/hr	=	**0.0100**
n-Hexane	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.62%	x	0%	=	**0.1318** lb/hr	=	**0.5773**
Xylene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.01%	x	0%	=	**0.0024** lb/hr	=	**0.0105**
2,2,4-Trimethylpentane	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.05%	x	0%	=	**0.0102** lb/hr	=	**0.0449**

Uncontrolled TOTAL HAPS (TPY) = **0.6631**

Controlled HAPs (Allowable):

Benzene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.02%	x	98%	=	**0.0001** lb/hr	=	**0.0004**
E-Benzene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.00%	x	98%	=	**0.0000** lb/hr	=	**0.0000**
Toluene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.01%	x	98%	=	**0.0000** lb/hr	=	**0.0002**
n-Hexane	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.62%	x	98%	=	**0.0026** lb/hr	=	**0.0115**
Xylene	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.01%	x	98%	=	**0.0000** lb/hr	=	**0.0002**
2,2,4-Trimethylpentane	**196**	scf/hr	x	1/379 scf/lb-mole	x	40.93	lb/lb-mol	x	0.05%	x	98%	=	**0.0002** lb/hr	=	**0.0009**

Controlled TOTAL HAPS (TPY) = **0.0133**

WPX Energy Williston, LLC

Howling Wolf Production Pad

Produced Water Tanks

NOx Created by Combustion (PTE)

NOx:	196 scf/hr	x	2,338 Btu/scf	x	1 MMBtu/1,000,000 Btu	x	0.068 lb/MMBtu	=	0.03 lb/hr	
			0.03 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.14 TPY	

Uncontrolled H2S: (PTE)

							wt		DRE			
H2S:	196 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	0.09%	x	0%	=	0.02 lb/hr	
			0.02 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	0.08 TPY			

Controlled H2S: (Allowable)

							wt%		DRE		
H2S	196 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	0.09%	x	98%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	0.00 TPY		

SO2 Created by Combustion: (PTE)

							DRE		
SO2	0.0 lb H2S/hr	x	1/34.08 lb H2S/lb-mole	x	64.07 lb SO2/lb-mole	x	98.00%	=	0.04 lb/hr
			0.04 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	0.15 TPY

PM Created by Combustion (PTE)

PM:	196 scf/hr	x	7.6 lb/1,000,000 scf	=	0.00 lb/hr				
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.01 TPY

CO Created by Combustion (PTE)

CO:	196 scf/hr	x	2,338 Btu/scf	x	1 MMBtu/1,000,000 Btu	x	0.276 lb/MMBtu	=	0.13 lb/hr
			0.13 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.55 TPY

[a]NOx emission factor is from AP-42 Table 13.5-1
(Emission Factors for Flare Operations).
[b]CO emission factor is from TCEQ EI Guidelines, Appendix A, Table A-7.

WPX Energy Williston, LLC

Howling Wolf Production Pad

Produced Water Tanks

REGULATED GREENHOUSE GAS EMISSIONS[b]

Uncombusted CO2: (PTE)

						wt		DRE				
CO2:	196 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	0.28%	x	0%	=	0.06	lb/hr
			0.06 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.26	TPY		

CO2 Created by Combustion (PTE)

CO2:	196 scf/hr	x	120,000.0 lb/1,000,000 scf	=	23.46 lb/hr				
			23.46 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	102.75 TPY

Uncontrolled CH4: (PTE)

						wt		DRE				
CH4:	196 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	2.11%	x	0%	=	0.45	lb/hr
			0.45 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	1.96	TPY		

Controlled CH4: (Allowable)

						wt%		DRE				
CH4:	196 scf/hr	x	1/379 scf/lb-mole	x	40.93 lb/lb-mole	x	2.11%	x	98%	=	0.01	lb/hr
			0.01 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.04	TPY		

N2O Created by Combustion: (PTE)

CH4:	196 scf/hr	x	2.2 lb/1,000,000 scf	=	0.00 lb/hr				
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY

[b]CO2, PM, and N2O emission factors are from AP-42 Table 1.4-2
(Emission Factors for Natural Gas Combustion).

WPX Energy Williston, LLC

Howling Wolf Production Pad

Post-Flash Produced Water Tanks - Howling Wolf 28-33 Pad

Oil Production	72.0	bopd
Flare Gas Volume	0.86	scfh
Lower Heating Value	2338.03	Btu/scf
Molecular Weight	66.0	lb/lb-mole
VOC wt Fraction	100.00%	
VOC Emission Factor	2.77E-03	tpy/bopd
HAPs:		
Benzene wt Fraction	0.0200%	
Toluene wt Fraction	0.0108%	
E-Benzene wt Fraction	0.0021%	
Xylene wt Fraction	0.0114%	
n-Hexane wt Fraction	0.6243%	
2,2,4-Trimethylpentane wt Fraction	0.0485%	
HAP Emission Factor	1.98E-05	tpy/bopd
CO2 wt Fraction	0.28%	
CH4 wt Fraction	2.11%	
H2S wt Fraction	0.09%	

Note: This oil production is based on the oil content (1%) in the produced water tanks and the produced water throughput

As per NSPS Subpart OOOO, Controlled and Uncontrolled emissions are calculated based on a 98% destruction efficiency of the VOC gas.

WPX Energy Williston, LLC

Howling Wolf Production Pad

Post-Flash Produced Water Tanks - Howling Wolf 28-33 Pad

CRITERIA POLLUTANT EMISSIONS[a]

Uncontrolled VOCs (PTE):

						DRE		
Using EPA Tanks 4.0.9d Run:	0.003 TPY VOC/BO	x	72.0 BO	x		0%	=	0.20 TPY

Controlled VOCs (Allowable):

						DRE		
Using EPA Tanks 4.0.9d Run:	0.003 TPY VOC/BO	x	72.0 BO	x		98%	=	0.00 TPY

Uncontrolled HAPs (PTE):

Using E&P Tanks Run:

							wt%		DRE				TPY
Benzene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.02%	x	0%	=	0.0000 lb/hr	=	0.0001
E-Benzene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.00%	x	0%	=	0.0000 lb/hr	=	0.0000
Toluene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.01%	x	0%	=	0.0000 lb/hr	=	0.0001
n-Hexane	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.62%	x	0%	=	0.0009 lb/hr	=	0.0041
Xylene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.01%	x	0%	=	0.0000 lb/hr	=	0.0001
2,2,4-Trimethylpentane	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.05%	x	0%	=	0.0001 lb/hr	=	0.0003
											Uncontrolled TOTAL HAPS (TPY)	=	0.0047

Controlled HAPs (Allowable):

Benzene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.02%	x	98%	=	0.0000 lb/hr	=	0.0000
E-Benzene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.00%	x	98%	=	0.0000 lb/hr	=	0.0000
Toluene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.01%	x	98%	=	0.0000 lb/hr	=	0.0000
n-Hexane	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.62%	x	98%	=	0.0000 lb/hr	=	0.0001
Xylene	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.01%	x	98%	=	0.0000 lb/hr	=	0.0000
2,2,4-Trimethylpentane	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mol	x	0.05%	x	98%	=	0.0000 lb/hr	=	0.0000
											Controlled TOTAL HAPS (TPY)	=	0.0001

WPX Energy Williston, LLC

Howling Wolf Production Pad

Post-Flash Produced Water Tanks - Howling Wolf 28-33 Pad

NOx Created by Combustion (PTE)

NOx:	0.9 scf/hr	x	2,338 Btu/scf	x	1 MMBtu/1,000,000 Btu	x	0.068 lb/MMBtu	=	0.00 lb/hr		
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY		

Uncontrolled H2S: (PTE)

							wt		DRE		
H2S:	0.9 scf/hr	x	1/379 scf/lb-mole	x	66.00 lb/lb-mole	x	0.09%	x	0%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	0.00 TPY		

Controlled H2S: (Allowable)

							wt%		DRE		
H2S	0.9 scf/hr	x	1/379 scf/lb-mole	x	66.00 lb/lb-mole	x	0.09%	x	98%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	0.00 TPY		

SO2 Created by Combustion: (PTE)

							DRE		
SO2	1.36E-04 lb H2S/hr	x	1/34.08 lb H2S/lb-mole	x	64.07 lb SO2/lb-mole	x	98.00%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hrs / 1 yr	x	1 ton/2000 lb	=	0.00 TPY

PM Created by Combustion (PTE)

PM:	0.9 scf/hr	x	7.6 lb/1,000,000 scf	=	0.00 lb/hr			
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	= 0.00 TPY

CO Created by Combustion (PTE)

CO:	0.9 scf/hr	x	2,338 Btu/scf	x	1 MMBtu/1,000,000 Btu	x	0.276 lb/MMBtu	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY

[a]NOx emission factor is from AP-42 Table 13.5-1
(Emission Factors for Flare Operations).
[b]CO emission factor is from TCEQ EI Guidelines, Appendix A, Table A-7.

WPX Energy Williston, LLC

Howling Wolf Production Pad

Post-Flash Produced Water Tanks - Howling Wolf 28-33 Pad

REGULATED GREENHOUSE GAS EMISSIONS[b]

Uncombusted CO2: (PTE)

CO2:	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mole	x	wt 0.28%	x	DRE 0%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY		

CO2 Created by Combustion (PTE)

CO2:	0.9 scf/hr	x	120,000.0 lb/1,000,000 scf	=	0.10 lb/hr				
			0.10 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.45 TPY

Uncontrolled CH4: (PTE)

CH4:	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mole	x	wt 2.11%	x	DRE 0%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.01 TPY		

Controlled CH4: (Allowable)

CH4:	0.9 scf/hr	x	1/379 scf/lb-mole	x	66 lb/lb-mole	x	wt% 2.11%	x	DRE 98%	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY		

N2O Created by Combustion: (PTE)

CH4:	0.9 scf/hr	x	2.2 lb/1,000,000 scf	=	0.00 lb/hr				
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY

[b]CO2, PM, and N2O emission factors are from AP-42 Table 1.4-2
(Emission Factors for Natural Gas Combustion).

WPX Energy Williston, LLC

Howling Wolf Production Pad

Thermal Oxidizer - Refrigerated Casing Head Gas

Flare Gas Volume	**212,783**	scfh
Lower Heating Value	**1324.34**	Btu/scf
Avg. Molecular Weight	**24.01**	lb/lb-mole
VOC wt fraction	**24.56%**	
HAP wt fraction	**0.37%**	
Benzene wt fraction	**0.04%**	
E-Benzene wt fraction	**0.14%**	
Toluene wt fraction	**0.00%**	
n-Hexane wt fraction	**0.01%**	
Xylene wt fraction	**0.14%**	
2,2,4-Trimethylpentane wt fraction	**0.03%**	
CO2 wt fraction	**1.39%**	
CH4 wt fraction	**38.84%**	
H2S wt fraction	**0.00%**	
Hours of Operation for PTE:	**8760**	hours/yr
Control Effiiciency	**99.5%**	DRE

WPX Energy Williston, LLC

Howling Wolf Production Pad

Thermal Oxidizer - Refrigerated Casing Head Gas

CRITERIA POLLUTANT EMISSIONS[a]

Uncontrolled VOCs (PTE) :

							wt%		Control %			
VOC:	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	24.56%	x	0%	=	3310.55 lb/hr	
			3310.55 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb			=	14500.22 TPY	

Controlled VOCs (Allowable):

							wt%		Control %			
VOC:	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	24.56%	x	99.5%	=	16.55 lb/hr	
			16.55 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb			=	72.50 TPY	

Uncontrolled HAPs (PTE):

Using E&P Tanks Run:							wt%		Control %				TPY
Benzene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.04%	x	0%	=	5.80 lb/hr	=	25.42
E-Benzene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.14%	x	0%	=	19.00 lb/hr	=	83.22
Toluene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.00%	x	0%	=	0.65 lb/hr	=	2.85
n-Hexane	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.01%	x	0%	=	0.88 lb/hr	=	3.86
Xylene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.14%	x	0%	=	19.30 lb/hr	=	84.53
2,2,4-Trimethylpentane	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.03%	x	0%	=	4.42 lb/hr	=	19.35
Formaldehyde	212,783 scf/hr		7.50E-02 lb/MMscf							=	0.02 lb/hr	=	0.07
`			50.07 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb			=	219.30 TPY		

Controlled HAPs (Allowable):

Using E&P Tanks Run:							wt%		Control %				TPY
Benzene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.04%	x	99.5%	=	0.03 lb/hr	=	0.13
E-Benzene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.14%	x	99.5%	=	0.10 lb/hr	=	0.42
Toluene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.00%	x	99.5%	=	0.00 lb/hr	=	0.01
n-Hexane	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.01%	x	99.5%	=	0.00 lb/hr	=	0.02
Xylene	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.14%	x	99.5%	=	0.10 lb/hr	=	0.42
2,2,4-Trimethylpentane	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mol	x	0.03%	x	99.5%	=	0.02 lb/hr	=	0.10
Formaldehyde	212,783 scf/hr	x	7.50E-02 lb/MMscf	x	1000000 scf/MMscf					=	0.02 lb/hr	=	0.07
`			0.27 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb			=	1.17 TPY		

WPX Energy Williston, LLC

Howling Wolf Production Pad

Thermal Oxidizer - Refrigerated Casing Head Gas

Uncontrolled NOx (PTE):

NOx:	**0** scf/hr	x	**1,324** Btu/scf	x	1 Mmbtu/1,000,000 Btu	x	0.098 lb/MMBtu	=	**0.00** lb/hr		
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**0.00** TPY		

NOx Created by Combustion (PTE):

NOx:	**212,783** scf/hr	x	**1,324** Btu/scf	x	1 Mmbtu/1,000,000 Btu	x	0.098 lb/MMBtu	=	**27.63** lb/hr		
			27.63 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**121.01** TPY		

Uncontrolled H2S (PTE):

							wt%		Control %		
H_2S:	**212,783** scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	0.00%	x	0%	=	**0.00** lb/hr
					0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**0.00** TPY

Controlled H2S (Allowable):

							wt%		Control %		
H_2S:	**212,783** scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	0.00%	x	99.5%	=	**0.00** lb/hr
					0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**0.00** TPY

WPX Energy Williston, LLC

Howling Wolf Production Pad

Thermal Oxidizer - Refrigerated Casing Head Gas

Uncontrolled SO2 (PTE):

							wt%		Control %			
SO_2	212,783 scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	0.00%	x	0%	=	0.00	lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb			=	0.00	TPY

SO2 Created by Combustion (PTE):

					H2S mol%						
SO_2	212,783 scf/hr	x	1/379 scf/lb-mole	x	0.00%	x	1 lb-mole SO2/lb-mole H2S	x	64.066 lb/lb-mole	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY		

Uncontrolled CO (PTE):

CO:	0 scf	x	1,324 Btu/scf	x	1 Mmbtu/1,000,000 Btu	x	0.082 lb/MMBtu	=	0.00 lb/hr
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	0.00 TPY

CO Created by Combustion (PTE):

CO:	212,783 scf	x	1,324 Btu/scf	x	1 Mmbtu/1,000,000 Btu	x	0.082 lb/MMBtu	=	23.21 lb/hr
			23.21 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	101.65 TPY

WPX Energy Williston, LLC

Howling Wolf Production Pad

Thermal Oxidizer - Refrigerated Casing Head Gas

Uncontrolled PM (PTE):

PM:	**0** scf/hr	x	**7.6** lb/1,000,000 scf	=	**0.00** lb/hr			
			0.00 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	= **0.00** TPY

PM Created by Combustion (PTE):

PM:	**212,783** scf/hr	x	**7.6** lb/1,000,000 scf	=	**1.62** lb/hr			
			1.62 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	= **7.08** TPY

[a]NOx, SO2, PM, & CO emission factors are from AP-42 Table 1.4-1 and Table 1.4-2
(Emission Factors for Natural Gas Combustion).

WPX Energy Williston, LLC

Howling Wolf Production Pad

Thermal Oxidizer - Refrigerated Casing Head Gas

REGULATED GREENHOUSE GAS EMISSIONS[b]

CO2 (PTE):

CO2 Entrained in the Produced Gas:

										Control %		
CO2:	**212,783** scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	1.39%	x		0%	=	**187.60** lb/hr
				187.60 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb			=	**821.69** TPY

CO2 Created by Combustion:

CO2:	**212,783** scf/hr	x	**120,000.0** lb/1,000,000 scf	=	**25534.01** lb/hr				
			25534.01 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**111838.97** TPY
							Total CO2 Emitted (Allowable):		**112660.67 TPY**

Uncontrolled CH4 (PTE):

							wt%		Control %		
CH4:	**212,783** scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	38.84%	x	0%	=	**5235.05** lb/hr
				5235.05 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb		=	**22929.53** TPY

Controlled CH4 (PTE):

							wt%		Control %		
CH4:	**212,783** scf/hr	x	1/379 scf/lb-mole	x	24.01 lb/lb-mole	x	38.84%	x	99.5%	=	**26.18** lb/hr
				26.18 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb		=	**114.65** TPY

N2O Created by Combustion (PTE):

N2O:	**212,783** scf/hr	x	**2.2** lb/1,000,000 scf	=	**4.68E-01** lb/hr				
			4.68E-01 lb/hr	x	8760 hr/yr	x	1 ton/2000 lb	=	**2.05E+00** TPY

[b]CO2 and N2O emission factors are from AP-42 Table 1.4-2

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Howling Wolf Production Pad

Heater Treater Burner[a]

Burner Rating **6,250,000** Btu/hr **This burner rating reflects the combined size of all of the proposed heater treater burners at the facility.**

NOx:	0.10 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.613** lb/hr
	0.6127 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**2.684** TPY
CO:	0.08 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.515** lb/hr
	0.51 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**2.254** TPY
SO2:	5.88E-04 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.004** lb/hr
	3.68E-03 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**0.016** TPY
PM:	0.01 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.047** lb/hr
	0.05 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**0.204** TPY
VOC:	0.01 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.034** lb/hr
	0.03 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**0.148** TPY

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Howling Wolf Production Pad

Heater Treater Burner[a]

HAP:	0.002 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.012** lb/hr
	1.16E-02 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**0.051** TPY

CO2	116.997 lb/MMBtu	x	6.25 MMBtu/hr			=	**731.233** lb/hr
	7.31E+02 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**3,202.801** TPY

CH4:	0.002 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.014** lb/hr
	1.38E-02 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**0.060** TPY

N2O:	0.000 lb/MMBtu	x	6.25 MMBtu/hr			=	**0.001** lb/hr
	1.38E-03 lb/hr	x	8,760 hr/yr	x	1 ton / 2000 lb	=	**0.006** TPY

[a]NOx, CO, CO2, & VOC Emission Factors are from AP-42 Table 1.4-1 and 1.4-2 (Emission Factors for Nitrogen Oxides (N2O) and Methane come from Table C-1 of Subpart W).

2.68	NOx TPY
2.25	CO TPY
0.02	SO2 TPY
0.20	PM TPY
0.15	VOC TPY
0.05	HAP TPY
3202.80	CO2 TPY
0.06	CH4 TPY
0.01	N2O TPY

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Howling Wolf Production Pad

Truck Loadout Emission Calculation

		Saturation Factor (S)		Vapor Pressure (P)		Molecular Weight (MW)		Temp + 460		Load Loss lb/1000 gal
12.46	x	0.60	x	2.30	x	40.93	/	510.00	=	1.38

LL lb/1,000 gal		Truck Load Rate bbl/hr		Load Time hrs		gal/bbl		Total Gas Emissions lb/hr
1.38	x	180.00	/	1.00	x	42.00	=	10.43

LL lb/1,000 gal		Annual bbl/yr		gal/bbl		lb/ton		Emissions TPY	Uncontrolled C3+ VOC tpy
1.38	x	2628000.00	x	42.00	/	2000.00	=	76.16	55.9173

Uncontrolled	Control %		**VOC Emissions TPY**
55.92	0%	1.00	55.92

LL lb/1,000 gal		Annual bbl/yr		gal/bbl		lb/ton		Emissions TPY	Uncontrolled HAPs tpy
1.38	x	2628000.00	x	42.00	/	2000.00	=	76.16	0.55

Uncontrolled	Control %		**HAPs Emissions TPY**
0.55	0%	1.00	0.55

LL lb/1,000 gal		Annual bbl/yr		gal/bbl		lb/ton		Emissions TPY	Uncontrolled CO2 tpy
1.38	x	2628000.00	x	42.00	/	2000.00	=	76.16	0.21

Uncontrolled	Control %		**CO2 Emissions TPY**
0.21	0%	1.00	0.21

LL lb/1,000 gal		Annual bbl/yr		gal/bbl		lb/ton		Emissions TPY	Uncontrolled CH4 tpy
1.38	x	2628000.00	x	42.00	/	2000.00	=	76.16	1.61

Uncontrolled	Control %		**CH4 Emissions TPY**
1.61	0%	1.00	1.61

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Howling Wolf Production Pad

Reciprocating Engine Emissions

ENGINE #1

	1340 MAX HP	0%	NOx DRE	0%	CO DRE	0%	VOC DRE	0%	SO2 DRE	0%	HAP DRE	0%	PM DRE
		100.0%		100.00%		100.00%		100.00%		100.00%		100.00%	

	Emission Factor		HP		Conversion		Rate		Hours		Conversion		Annual
NOx:	1.00E+00 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	2.95E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	1.29E+01 NOx TPY
CO:	2.00E+00 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	5.91E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.59E+01 CO TPY
SO2:	1.93E-03 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	5.71E-03 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.50E-02 SO2 TPY
PM:	3.28E-02 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	9.70E-02 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	4.25E-01 PM TPY
VOC:	7.00E-01 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	2.07E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	9.06E+00 VOC TPY
HAP:	1.81E-01 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	5.34E-01 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.34E+00 HCHO TPY
CO2:	7.91E+01 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	2.34E+02 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	1.02E+03 CO2
CH4:	1.49E-03 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	4.41E-03 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	1.93E-02 CH4
N2O:	1.49E-04 g/HP-HR	x	1340 HP	x	1 lb / 453.6 grams	=	4.41E-04 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	1.93E-03 N2O

ENGINE #2

	362 MAX HP	0%	NOx DRE	0%	CO DRE	0%	VOC DRE	0%	SO2 DRE	0%	HAP DRE	0%	PM DRE
		100.0%		100.00%		100.00%		100.00%		100.00%		100.00%	

	Emission Factor		HP		Conversion		Rate		Hours		Conversion		Annual
NOx:	1.00E+00 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	x	0.80 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	3.50E+00 NOx TPY
CO:	2.00E+00 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	x	1.60 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	6.99E+00 CO TPY
SO2:	1.98E-03 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	=	1.58E-03 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	6.90E-03 SO2 TPY
PM:	6.52E-02 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	=	5.20E-02 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.28E-01 PM TPY
VOC:	7.00E-01 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	x	0.56 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.45E+00 VOC TPY
HAP:	5.31E-03 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	=	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	1.86E-02 HAP TPY
CO2:	1.87E-03 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	=	1.50E-03 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	6.55E-03 CO2 TPY
CH4:	8.33E-05 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	=	6.65E-05 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.91E-04 CH4 TPY
N2O:	6.55E-04 g/HP-HR	x	362 HP	x	1 lb / 453.6 grams	=	5.23E-04 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	=	2.29E-03 N2O TPY

WPX Energy Williston, LLC

Howling Wolf Production Pad

Reciprocating Engine Emissions

ENGINE #3

	0 MAX HP		0% NOx DRE 100.0%		27% CO DRE 73.01%		1% VOC DRE 99.5%		0% SO2 DRE 100.00%		0% HAP DRE 100.00%	0% PM DRE 100.00%
NOx:	2.76E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	x	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 NOx TPY
CO:	2.61E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	x	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 CO TPY
SO2:	1.12E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 SO2 TPY
PM:	1.49E-01 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 PM TPY
VOC:	2.20E-01 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	x	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 VOC TPY
HAP:	3.60E-03 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 HAP TPY
CO2:	1.58E-03 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 CO2 TPY
CH4:	0.00E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 CH4 TPY
N2O:	1.10E-03 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 N2O TPY

ENGINE #4

	0 MAX HP		0% NOx DRE 100.0%		0% CO DRE 100.00%		27% VOC DRE 73.0%		0% SO2 DRE 100.00%		0% HAP DRE 100.00%	0% PM DRE 100.00%
NOx:	2.76E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	x	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 NOx TPY
CO:	2.61E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	x	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 CO TPY
SO2:	1.12E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 SO2 TPY
PM:	1.49E-01 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 PM TPY
VOC:	2.20E-01 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	x	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 VOC TPY
HAP:	3.60E-03 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 HAP TPY
CO2:	1.58E-03 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 CO2 TPY
CH4:	0.00E+00 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 CH4 TPY
N2O:	1.10E-03 g/HP-HR	x	0 HP	x	1 lb / 453.6 grams	=	0.00E+00 lb/hr	x	8760 hr/yr	x	1 ton / 2000lb	= 0.00E+00 N2O TPY

TOTALS	
1.64E+01	NOx TPY
3.29E+01	CO TPY
3.19E-02	SO2 TPY
6.53E-01	PM TPY
1.15E+01	VOC TPY
2.36E+00	HAP TPY
1.02E+03	CO2 TPY
1.96E-02	CH4 TPY
4.22E-03	N2O TPY

WPX Energy Williston, LLC

Howling Wolf Production Pad

Emissions from Pneumatic Controllers

Emissions (lb/hr) = PSCR (scf/hr) x (1/379 scf/lb-mole) x (VOC wt. Fraction)
Emissions (TPY) = (lb/hr VOC) x (8760 hr/yr) x (1 ton/2000)

Where:

PSCR = Pneumatic Source Consumption Rate (scf/min), as per manufacturers literature
Gas MW = Supply Gas Average Molecular Weight (lb/lb-mole)

						Supply Gas MW		VOC wt fraction			
0 scf/hr	x	60 min/1 hr	x	1/379 scf/lb-mole	x	**29.77**	x	**48.11%**	=	**0.00**	lb/hr VOC
				lbs/hr		Hours (winter months)					
				0.00	x	**0**	x	2000 lbs/ton	=	**0.00**	TPY VOC
						Supply Gas MW		HAP wt fraction			
0 scf/hr	x	60 min/1 hr	x	1/379 scf/lb-mole	x	**29.77**	x	**0.52%**	=	**0.00**	lb/hr HAP
				lbs/hr		Hours (winter months)					
				0.00	x	**0**	x	2000 lbs/ton	=	**0.00**	TPY HAP

WPX Energy Williston, LLC

Howling Wolf Production Pad

Emissions from Pneumatic Pumps

Emissions (lb/hr) = PSCR (scf/min) x (60 min/1hr) x (1/379 scf/lb-mole) x (VOC wt. Fraction)
Emissions (TPY) = (lb/hr VOC) x (8760 hr/yr) x (1 ton/2000)

Where:

PSCR = Pneumatic Source Consumption Rate (scf/min), as per manufacturers literature
Gas MW = Supply Gas Average Molecular Weight (lb/lb-mole)

					Supply Gas MW		VOC wt fraction			
0 scfm/min	*	60 min/1 hr	*	1/379 scf/lb-mole	x	**29.77**	x	**48.11%**	=	**0.00**	lb/hr VOC Uncontrolled
				lbs/hr		Hours (winter months)					
				0.00	x	**0**	x	2000 lbs/ton	=	**0.00**	TPY VOC Uncontrolled
						Supply Gas MW		HAP wt fraction			
0 scfm/min	*	60 min/1 hr	*	1/379 scf/lb-mole	x	**29.77**	x	**0.52%**	=	**0.00**	lb/hr HAP Uncontrolled
				lbs/hr		Hours (winter months)					
				0.00	x	**0**	x	2000 lbs/ton	=	**0.00**	TPY HAP Uncontrolled

Control Efficiency	**100%**	
Number of Pumps	**0**	
Total Controlled Emissions	**0.00**	**TPY VOC**
Total Controlled Emissions	**0.00**	**TPY HAP**

WPX Energy Williston, LLC

Howling Wolf Production Pad

Fugitive Emissions

VOC Fugitive Calculations:	Emission Factor[a] (lbs/hr/ comp.)	Component Number[b]	VOC Weight Fraction[c,d]	HAP weight Fraction[c,d]	VOC Emission Rate, (lbs/hr)	VOC Emission Rate, (tons/yr)	HAPs Emissions Rate, (lbs/hr)	HAPs Emissions Rate, (tons/yr)
Gas Valve VOC's:	9.90E-03	144	48.11%	0.52%	6.86E-01	3.00E+00	7.38E-03	3.23E-02
Light Oil Valve VOC's:	5.50E-03	173	73.42%	0.72%	6.99E-01	3.06E+00	6.82E-03	2.99E-02
Gas Connection VOC's:	4.40E-04	198	48.11%	0.52%	4.19E-02	1.84E-01	4.51E-04	1.98E-03
Light Oil Connection VOC's:	4.62E-04	198	73.42%	0.72%	6.72E-02	2.94E-01	6.56E-04	2.87E-03
Gas Flange VOC's:	8.58E-04	219	48.11%	0.52%	9.04E-02	3.96E-01	9.73E-04	4.26E-03
Light Oil Flange VOC's:	2.42E-04	206	73.42%	0.72%	3.66E-02	1.60E-01	3.57E-04	1.57E-03
Gas Other VOC's	1.94E-02	6	48.11%	0.52%	5.60E-02	2.45E-01	6.03E-04	2.64E-03
Light Oil Other VOC's	1.65E-02	6	73.42%	0.72%	7.27E-02	3.18E-01	7.10E-04	3.11E-03
Light Oil Service Total Emissions:					8.75E-01	3.83E+00	8.55E-03	3.74E-02
Gas Service Total Emissions:					8.74E-01	3.83E+00	9.41E-03	4.12E-02
Single Well Total Emissions:					**0.29**	**1.28**	**2.99E-03**	**1.31E-02**
Total Number of Wells:		6	Total Emission (tons/yr):		**1.75**	**7.66**	**0.02**	**0.08**

[a]Referenced EPA Protocol for Equipment Leak Emission Estimates, Table 2-4: Oil and Gas Production Operations Average Emission Factors

[b]Component count based upon 40 CFR 98 Table W-1C and applying a safety factor of 1.5 (rounding up to the next whole number).

[c]Constituent Weight % values for gas components are based on Casing Head Gas values

[d]Constiuent Weight % values for heavy oil components are based on Tank Vapor values

Individual Constituent Components	HAP Fraction, Weight Percentage		Emission Rate, (lbs/hr)		Emission Rate, (tons/yr)		Single Well Total Emissions		Howling Wolf Production Pad	
	Light Oil Service[e]	Gas Service[f]	Light Oil Service	Gas Service	Light Oil Service	Gas Service	lbs/hr	tons/yr	lbs/hr	tons/yr
Total VOCs	73.42%	48.11%	8.75E-01	8.74E-01	3.83E+00	3.83E+00	2.92E-01	1.28E+00	1.75	**7.66**
Total HAPS	0.72%	0.52%	8.55E-03	9.41E-03	3.74E-02	4.12E-02	2.99E-03	1.31E-02	0.02	**0.08**
Benzene	0.02%	0.04%	2.39E-04	7.82E-04	1.04E-03	3.43E-03	1.70E-04	7.45E-04	0.00	**0.00**
E-Benzene	0.002%	0.14%	2.47E-05	2.56E-03	1.08E-04	1.12E-02	4.31E-04	1.89E-03	0.00	**0.01**
Toluene	0.01%	0.00%	1.29E-04	8.77E-05	5.63E-04	3.84E-04	3.61E-05	1.58E-04	0.00	**0.00**
n-Hexane	0.62%	0.01%	7.44E-03	1.19E-04	3.26E-02	5.20E-04	1.26E-03	5.52E-03	0.01	**0.03**
Xylene	0.01%	0.14%	1.36E-04	2.60E-03	5.95E-04	1.14E-02	4.56E-04	2.00E-03	0.00	**0.01**
2,2,4 - Trimethylpentane	0.05%	0.03%	5.78E-04	5.96E-04	2.53E-03	2.61E-03	1.96E-04	8.57E-04	0.00	**0.01**
CO_2	0.28%	1.39%	3.35E-03	2.53E-02	1.47E-02	1.11E-01	4.77E-03	2.09E-02	0.03	**0.13**
CH_4	2.11%	38.84%	2.52E-02	7.06E-01	1.10E-01	3.09E+00	1.22E-01	5.34E-01	0.73	**3.20**

[e]Constituent Weight % values for light oil components are based on Tank Vapor values

[f]Constituent Weight % values for gas components are based on Casing Head Gas values

ATTACHMENT C

Gas and Liquid Analyses and Laboratory Analytical Reports

Gas Analysis Supplied by WPX- Howling Wolf

Gas Composition and Properties

Effective January 1, 2016 06:00 - January 18, 2038 21:14

WPXENERGY

Source #: 75374567
Name: HOWLING WOLF 28-33HC CHECK

Component	Mole %	Liquid Content	Mass %
Carbon Dioxide, CO_2	0.6131		0.8999
Nitrogen, N_2	4.9057		4.5834
Methane, C1	45.2752		24.2243
Ethane, C2	20.3106	5.4304	20.3686
Propane, C3	17.8266	4.9100	26.2170
iso-Butane, iC4	1.8862	0.6171	3.6564
n-Butane, nC4	5.9793	1.8846	11.5908
iso-Pentane, iC5	0.9235	0.3377	2.2222
n-Pentane, nC5	1.2200	0.4421	2.9357
Neo-Pentane, NeoC5			
Hexanes, C6	0.6049	0.2487	1.7385
Heptanes, C7	0.3674	0.1695	1.2278
Octanes, C8	0.0832	0.0426	0.3170
Nonanes Plus, C9+	0.0043	0.0024	0.0184
Water, H_2O			
Hydrogen Sulfide, H_2S	0.0000		0.0000
Oxygen, O_2			
Carbon Monoxide, CO			
Hydrogen, H_2			
Helium, He			
Argon, Ar			
Totals	100.0000	14.0860	100.0000

Property	Total Sample	C9 Plus Fraction
Pressure Base	14.730	
Temperature Base	60.00	
HCDP @ Sample Pressure		
Cricondentherm		
HV, Dry @ Base P, T	1678.28	
HV, Sat @ Base P, T	1650.79	
HV, Sat @ Sample P, T	1678.28	
Relative Density	1.0426	

C9+: 100

Sample

Date:	01/07/2016	Pressure:	30.0
Type:	Spot	Temperature:	41.0
Tech:	FERRY	H2O:	lbs/mm
		H2S:	0 ppm

Remarks: Gatec Tube 4LB 0.0 ppm

Analysis

Date:		Instrument:	
		Cylinder:	
Tech:			

Remarks:

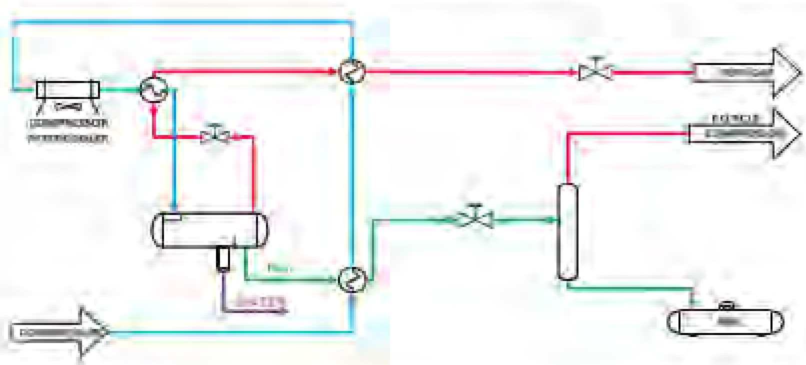
GTUIT 3000 MCFD NGL Pro System Performance Model -Howling Wolf

WPX ENERGY
Howling Wolf@575 psi

	Feed Mol %	Residue Mol %	NGL Mol %	NGL Vol %	NGL bbl/day	NGL Recovery
N2	4.83%	6.36%	0.02%	0.01%	0.1	
CO2	0.60%	0.76%	0.11%	0.06%	0.3	
C1	44.62%	58.18%	1.57%	0.89%	4.2	
C2	20.02%	22.20%	13.68%	12.18%	58.3	15%
C3	17.57%	10.50%	42.59%	39.23%	187.6	54%
IC4	1.86%	0.51%	6.58%	7.16%	34.3	79%
NC4	5.89%	1.26%	22.05%	23.14%	110.7	84%
IC5	0.91%	0.09%	3.77%	4.58%	21.9	92%
NC5	1.20%	0.10%	5.02%	6.05%	28.9	93%
C6	0.60%	0.02%	2.81%	3.57%	17.1	98%
C7	0.36%	0.00%	1.81%	2.46%	11.8	99%
C8	0.09%	0.00%	0.38%	0.66%	3.1	100%
H2O	1.45%	0.03%	0.00%	0.00%		
H2S	0.0000%	0.0000%	0.0000%	0.0000%		
Total	100.0%	100.0%	100.0%	100.0%	478.2	

	Feed	Residue	NGL		
C3+ Recovery			70%	Feed Cooler Pressure, psig	190
Flare Reduction, CO_2 Based	42%			Ambient Air Temp, F	50
Temperature, °F	100	143	48	Air Cooler Temp, F	60
Pressure, psig	50	20	117	Separator Temp, F	49
MSCFD	3,000	2,279		Hot Gas Return, F	120
NHV, BTU/SCF	1,518	1,192		Methanol, gal/day	0
GHV, BTU/SCF	1,659	1,309		NGL Heater, °F	120
True Vapor Pressure, psig			208	Separator SEP-2 P, psig	128

Compressor	Stage 1	Stage 2	Stage 3		
Adiabatic Efficiency, %	70	70	70	Inlet Sep Water, bbl/day	0.89
Pressure Ratio	2.4	2.4	1.6	Engine Fuel, MSCFD	31
Discharge Pressure, psig	140	350	575	Recycle %	100%
Suction Temperature, °F	86	113	144	Specific Gravity	1.05
Discharge Temperature, °F	190	223	209	Total Flow, MSCFD	4,025
Horsepower	240	243	129	Total Horsepower	612



NGL Pro is Patent Pending ~ Aspen Engineering Services ~ Golden, CO ~ 303-387-2032

ATTACHMENT D

E&P TANKS
Analysis and Calculation Reports

```
*************************************************************************
****************
*     Project Setup Information
*
*************************************************************************
****************
Project File              : Y:\Projects\Williams Exploration & Production
WEP\WEP211324 Ft. Berthold IR Well Work\Williams\Submittal
Application\Williams FBIR Application Documents\Attachments\Mandaree
Representative E&P Tanks Summary.ept
Flowsheet Selection        : Oil Tank with Separator
Calculation Method         : RVP Distillation
Control Efficiency         : 95.0%
Known Separator Stream     : Low Pressure Oil
Entering Air Composition   : No

Filed Name                 : Mandaree
Well Name                  : Dakota-3 Cross 2-13H and Patricia Charging 4-
15H
Well ID                    : Mandaree Facilities
Permit Number              : Dakota-3, LLC (Williams E&P)
Date                       : 2011.09.13

*************************************************************************
****************
*     Data Input
*
*************************************************************************
****************

Separator Pressure         : 51.00[psig]
Separator Temperature      : 83.00[F]
Ambient Pressure           : 13.70[psia]
Ambient Temperature        : 50.00[F]
C10+ SG                    : 0.8000
C10+ MW                    : 235.14

-- Low Pressure Oil -----------------------------------------------------
----------------
   No.     Component              mol %
   1       H2S                    0.0060
   2       O2                     0.0000
   3       CO2                    0.0140
   4       N2                     0.0080
   5       C1                     0.2890
   6       C2                     1.7620
   7       C3                     3.9750
   8       i-C4                   0.8590
   9       n-C4                   3.7900
   10      i-C5                   1.3080
   11      n-C5                   2.4490
   12      C6                     2.1400
```

13	C7	9.7720
14	C8	20.2270
15	C9	16.1840
16	C10+	33.1760
17	Benzene	0.0890
18	Toluene	0.1570
19	E-Benzene	0.0820
20	Xylenes	0.5460
21	n-C6	2.5010
22	224Trimethylp	0.4650

-- Sales Oil --

Production Rate : 1000[bbl/day]
Days of Annual Operation : 365 [days/year]
API Gravity : 41.9
Reid Vapor Pressure : 5.90[psia]

****

* Calculation Results *

****

-- Emission Summary --

Item	Uncontrolled	Uncontrolled	Controlled	Controlled
	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]
Total HAPs	5.530	1.263	0.276	0.063
Total HC	766.999	175.114	38.350	8.756
VOCs, C2+	750.685	171.389	37.534	8.569
VOCs, C3+	565.622	129.137	28.281	6.457

Uncontrolled Recovery Info.

Vapor	39.1000	[MSCFD]
HC Vapor	38.8900	[MSCFD]
GOR	39.10	[SCF/bbl]

-- Emission Composition --

No	Component	Uncontrolled	Uncontrolled	Controlled	Controlled
		[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]
1	H2S	0.699	0.160	0.035	0.008
2	O2	0.000	0.000	0.000	0.000
3	CO2	2.167	0.495	2.167	0.495
4	N2	0.789	0.180	0.789	0.180
5	C1	16.314	3.725	0.816	0.186
6	C2	185.063	42.252	9.253	2.113

7	C3	386.149	88.162	19.307	4.408
8	i-C4	31.451	7.181	1.573	0.359
9	n-C4	90.157	20.584	4.508	1.029
10	i-C5	13.045	2.978	0.652	0.149
11	n-C5	17.683	4.037	0.884	0.202
12	C6	5.242	1.197	0.262	0.060
13	C7	8.583	1.960	0.429	0.098
14	C8	5.975	1.364	0.299	0.068
15	C9	1.803	0.412	0.090	0.021
16	C10+	0.002	0.000	0.000	0.000
17	Benzene	0.154	0.035	0.008	0.002
18	Toluene	0.084	0.019	0.004	0.001
19	E-Benzene	0.016	0.004	0.001	0.000
20	Xylenes	0.089	0.020	0.004	0.001
21	n-C6	4.816	1.100	0.241	0.055
22	224Trimethylp	0.374	0.085	0.019	0.004
	Total	770.655	175.949	38.533	8.797

-- Stream Data --

No.	Component	MW	LP Oil mol %	Flash Oil mol %	Sale Oil mol %	Flash Gas mol %	W&S Gas mol %	Total Emissions mol %
1	H2S	34.80	0.0060	0.0050	0.0002	0.0984	0.1115	0.1089
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.0140	0.0088	0.0000	0.5074	0.2013	0.2615
4	N2	28.01	0.0080	0.0011	0.0000	0.6585	0.0249	0.1495
5	C1	16.04	0.2890	0.1022	0.0000	17.8727	2.3474	5.4015
6	C2	30.07	1.7620	1.3660	0.0137	39.2491	31.0838	32.6900
7	C3	44.10	3.9750	3.7220	1.5738	28.4714	50.9314	46.5131
8	i-C4	58.12	0.8590	0.8447	0.7467	2.3639	2.9991	2.8742
9	n-C4	58.12	3.7900	3.7608	3.5461	7.2507	8.4810	8.2389
10	i-C5	72.15	1.3080	1.3150	1.3305	0.9026	0.9745	0.9604
11	n-C5	72.15	2.4490	2.4670	2.5192	1.2280	1.3199	1.3018
12	C6	86.16	2.1400	2.1638	2.2470	0.3124	0.3361	0.3315
13	C7	100.20	9.7720	9.8914	10.3197	0.4391	0.4776	0.4700
14	C8	114.23	20.2270	20.4809	21.3997	0.2640	0.2913	0.2859
15	C9	128.28	16.1840	16.3887	17.1308	0.0674	0.0804	0.0779

16 C10+	235.14	33.1760	33.5971	35.1259	0.0000	0.0000	0.0000
17 Benzene	78.11	0.0890	0.0900	0.0936	0.0098	0.0106	0.0105
18 Toluene	92.13	0.1570	0.1589	0.1660	0.0045	0.0049	0.0048
19 E-Benzene	106.17	0.0820	0.0830	0.0868	0.0007	0.0008	0.0008
20 Xylenes	106.17	0.5460	0.5529	0.5778	0.0041	0.0045	0.0044
21 n-C6	86.18	2.5010	2.5298	2.6312	0.2791	0.3012	0.2968
22 224Trimethylp	114.24	0.4650	0.4707	0.4913	0.0163	0.0177	0.0174
MW		143.21	144.35	149.00	36.13	42.11	40.93
Stream Mole Ratio		1.0000	0.9895	0.9464	0.0105	0.0431	0.0536
Heating Value	[BTU/SCF]				2065.82	2404.70	2338.03
Gas Gravity	[Gas/Air]				1.25	1.45	1.41

Bubble Pt. @ 100F	[psia]	32.34	23.15	7.30
RVP @ 100F	[psia]	15.37	13.15	5.98
Spec. Gravity @ 100F		0.677	0.678	0.680

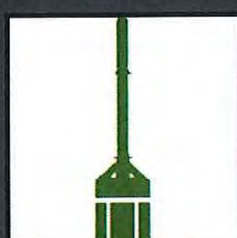
ATTACHMENT E

Equipment Manufacturer Specifications

QUESTOR

ClearPower SYSTEMS Inc.

Solutions Powered By Clean **Combustion**



CLEAN COMBUSTION

HEAT TO POWER GENERATION

WATER VAPORIZATION

WPX Energy
Questor Solutions & Technology Inc.
Proposal Number: 2018-05-727
May 15th 2018

QUESTOR ClearPower SYSTEMS Inc

TELEPHONE: +1-844-477-8669
EMAIL: CONTACT@QUESTORTECH.COM
WEBSITE: WWW.QUESTORTECH.COM

May 15th 2018

WPX Energy
1001 17th Street Suite 1200
Denver, CO
80202
Cell: (303) 819-5717

Attention: Robert King
Email: robert.king@wpxenergy.com

Re: Request for Proposal: WPX Energy
Questor Solutions & Technology Inc. Proposal Number: 201805-727

Questor Solutions & Technology Inc. ('Questor', 'QTI', or 'the Company') is pleased to respond to WPX Energy's request for rental proposal information.

The number of ECD's is based upon the pre-treated gas assuming 10 mmscfd and a pressure of 27.5 psig. As the level of gas reduces QTI would remove the incinerators to accommodate the reduced level. Based upon the preliminary information provided, we are proposing that you will need **4 x Q5000** ECD's (incinerators).

Questor specializes in waste gas incineration at well test sites and permanent facilities. Questor ECD's help reduce fuel gas usage, reduce lease sizes, eliminate odors, smoke and visible flame and address neighbor concerns.

Key Benefits:

- No odors, visible flames or black smoke
- No blowers/fans or costly diesel generator required
- ECDs are equipped to combust High Pressure and Low Pressure gas using separate manifolds – NO VRU and NO separate combustor required
- High capacity means fewer ECDs for multi-well pads
- ECDs are portability with detachable, hydraulic trailer - wellsite maximizes its footprint with no unnecessary equipment onsite during flow back operation
- No costly cranes with complex logistics
- ECDs set up and take down in less than 10 minutes

Q5000 ECD Features

Questor ECDs are fiber refractory lined with natural draw and a number of factors contribute to the high combustion efficiency (>99.99%):

- Separate manifolds introduce each waste gas stream and fuel stream into the combustion zone
- Lined refractory retains heat and minimizes losses from combustion to stack exit
- Kinetic energy (pressure) from either a fuel source or burnable waste stream contributes to high energy vortex within the ECD to promote air draw and efficient turbulent mixing of the air and gases prior to combustion.
- Air is naturally draw in proportionate to demand which optimizes air/fuel/waste ratio for efficient use of fuel

TELEPHONE: +1-844-477-8669
EMAIL: CONTACT@QUESTORTECH.COM
WEBSITE: WWW.QUESTORTECH.COM

About Questor Technology

Questor Technology Inc. is a leading, publicly traded clean technology company. With a focus on solid engineering and design, our products and creative solutions enable our clients to operate cost effectively in an environmentally responsible and sustainable manner.

We manufacture high efficiency waste gas ECD systems, power generation from excess heat and water treatment solutions that reduces costs for our clients. Our solutions deliver regulatory compliance, greenhouse gas (GHG) emission reduction, reduced operating costs and trusting relationships with the public.

Questor's proprietary combustion technology destroys noxious or toxic hydrocarbon gases which ensures regulatory compliance, environmental protection, public confidence and reduced operating costs for our clients. We are recognized for our particular expertise in the combustion of sour gas (H2S).

Questor's incineration technology is recognized as **Best Available Technology** by many of our client's including **Shell *Exploration, Enbridge U.S., Dominion Transmission, Williams Midstream*** and others. Our combustion technology is consistently selected over flaring due to the measurable, proven and reliable performance.

In addition to the resource sector, we have assisted a number of clients throughout the United States, the Caribbean, Western Europe, Russia, Thailand, Indonesia and China in a variety of applications. While our primary focus is on the resource sector, our technology is applicable to other industries including landfills, water and sewage treatment facilities, tire recycling and agriculture.

With headquarters in Calgary and offices in Alberta, Colorado and Florida, our company is proud to have solid leadership, experienced management, and a strong balance sheet. We have an extensive resume of handling similar waste streams at all types of facilities and are well equipped to handle the unique challenges associated with this process.

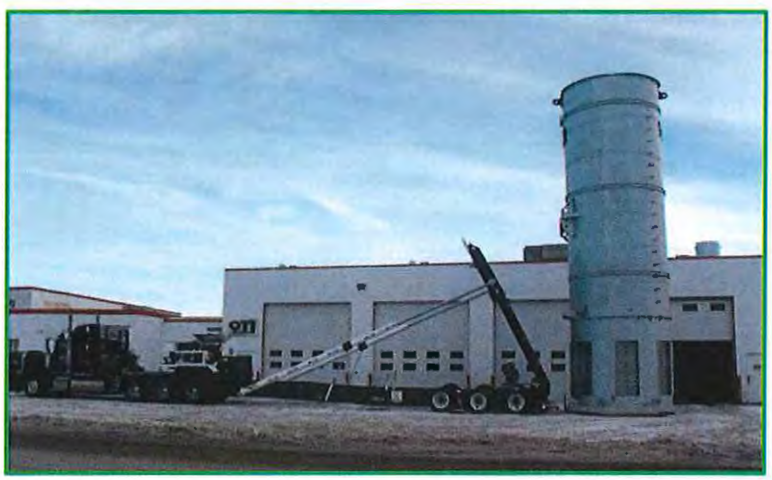
Let *Questor Solutions & Technology* demonstrate how we can help WPX Energy succeed with your waste gas concerns and challenges.

Thank you for the opportunity to provide you with a proposal for an efficient and effective combustion solution. If you have any questions or require further information, please feel free to email or contact me at the information below.

Yours Sincerely,

Justin Mahendra
Vice President of Sales & Marketing
Questor Solutions & Technology Inc.
Cell: (970) 889-4962
Email: jmahendra@questortech.com

Q5000 ECD System



TELEPHONE: +1-844-477-8669
EMAIL: CONTACT@QUESTORTECH.COM
WEBSITE: WWW.QUESTORTECH.COM

Product Specifications

Overall dimensions: **12' diameter x 40' height**

Burner Section
- 12' x 10' air induction / burner section
- Air intakes complete with manual air flow doors
- Air intake arrestors
- 2" stainless steel fuel gas manifold
- 2 x 6" stainless steel waste gas manifolds
- 2 x 4" inline flash arrestor
- 2 x 4" ball valve with proximity switch
- Fixed air pilot complete with flash arrested housing
- Sight glass

Stack Section
- 12' x 30' stack section
- 6" fiber refractory
- Lifting lugs
- Temperature/sampling port
- Stack top thermocouple probe and thermowell

Base Skid
- 1' x 12' x 12' base section
- Self-supporting design

Burner Management System
- NFPA approved
- Ionization flame detection
- Integrated pilot and ignition system
- Temperature control
- Local display and controls
- Remote monitoring, startup and shutdown controls

Paint Specifications

ECD
- Surface preparation: SSPC – SP 6 Commercial Blast Cleaning
- Paint: Highland International HiTemp Dryfall 827 HB Series - Gray

Base Skid
- Surface preparation: SSPC – SP6 Commercial Blast Cleaning
- Paint: Endura

Electrical Specifications
- 24 volt DC
- Class 1 Div 2 area classification

TELEPHONE: +1-844-477-8669
EMAIL: CONTACT@QUESTORTECH.COM
WEBSITE: WWW.QUESTORTECH.COM

Product Information

Questor ECDs have been independently tested to demonstrate a combustion efficiency >99.99% which ensures that hydrocarbon vapors are converted into carbon dioxide and water. The incineration is carried out inside a controlled combustion chamber and therefore is unaffected by cross winds which can adversely affect the combustion of open flame options, such as a flare stack. Due to the enclosed combustion chamber, nozzle design and refractory lining, a minimum stack top temperature is readily and continuously achieved.

Questor's proprietary incineration technology utilizes the pressure of the incoming fuel gas stream to create an internal vortex for homogenous mixing and highly efficient combustion. This minimizes fuel consumption, especially in low heat content waste gas situation such as a still column vent stream.

Piping and Manifold Systems:
Waste streams and fuel gas are not premixed in the Questor ECDs, they are introduced into the ECD through their own piping and manifold system. The gases are introduced through manifolds and burner nozzles that have been appropriately sized for the designed rates and pressures.

NO Flame, NO Smoke, NO Odor
Questor designs its ECDs to operate with no visible flame, odors or black smoke which is often present in other, less efficient combustion systems. Questor's proprietary combustion technology safely and reliably addresses issues relating to visibility, odors, air quality, compliance and Noise Levels.

Power:
The Questor system utilizes natural air draw and therefore avoids potential downtime that is often associated with assisted air and waste intakes systems such as blowers and fans. If required, the incorporation of a solar panel power system ensures reliable and remote operation with the capability of stored power for seven (7) days without direct sunlight.

Natural Draft Air Intake:
Questor's natural draft system avoids potential downtime that is often associated with assisted air and waste intakes. Air is naturally drawn into the combustion zone as the flow of waste/fuel gas increases and, conversely, air flow reduces as the flow of fuel/waste gas lowers. The simplified natural draft air intake ensures that the combustion is supplemented with sufficient oxygen resulting in smoke-free destruction of heavy compounds.

Low Level Ground Heat:
Questor ECDs are refractory lined which retains heat and minimizes losses from combustion to stack exit. Low level ground heat radiation allows for facility integration as well as ensuring the safety of site personnel.

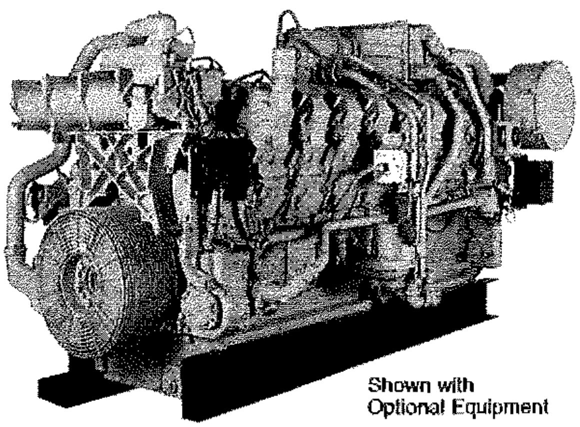
Safety:
Questor ECDs are equipped with a number of safeguards that prevent any transmission between the internal ECD process and the external environment. The continuous pilot is flash arrested with the same type used on reboilers or line heaters, so that there is no possibility of igniting any combustible vapors outside of the ECD. The inclusion of an inline flame arrestor can prevent the possibility of any flash back on the waste stream extending outside of the ECD. It is these features that allow the ECD to be placed immediately adjacent to the other process equipment.

CATERPILLAR®

G3516 LE Gas Petroleum Engine

858-999 bkW
1150-1340 bhp
1200-1400 rpm

2.0 g/bhp-hr NOx (NTE)



Shown with Optional Equipment

CAT® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle

Bore	170 mm (6.7 in.)
Stroke	190 mm (7.5 in.)
Displacement	69 L (4210 cu. in.)
Aspiration	Turbocharged-Aftercooled
Digital Engine Management	
Governor and Protection	Electronic (ADEM™ A3)
Combustion	Low Emission (Lean Burn)
Engine Weight, net dry (approx)	8015 kg (17,670 lb)
Power Density	8 kg/kW (13.2 lb/bhp)
Power per Displacement	19.3 bhp/L
Total Cooling System Capacity	217.7 L (57.5 gal)
Jacket Water	200.6 L (53 gal)
Aftercooler Circuit	17 L (4.5 gal)
Lube Oil System (refill)	424 L (112 gal)
Oil Change Interval	1000 hours
Rotation (from flywheel end)	Counterclockwise
Flywheel and Flywheel Housing	SAE No. 00
Flywheel Teeth	183

FEATURES

Engine Design
- Proven reliability and durability
- Ability to burn a wide spectrum of gaseous fuels
- Robust diesel strength design prolongs life and lowers owning and operating costs
- Broad operating speed range

Emissions
Meets U.S. EPA Spark Ignited Stationary NSPS Emissions for 2007/8

Lean Burn Engine Technology
Lean-burn engines operate with large amounts of excess air. The excess air absorbs heat during combustion reducing the combustion temperature and pressure, greatly reducing levels of NOx. Lean-burn design also provides longer component life and excellent fuel consumption.

Advanced Digital Engine Management
ADEM A3 control system providing integrated ignition, speed governing, protection, and controls, including detonation-sensitive variable ignition timing. ADEM A3 has improved: user interface, display system, shutdown controls, and system diagnostics.

Ease of Operation
Side covers on block allow for inspection of internal components

Full Range of Attachments
Large variety of factory-installed engine attachments reduces packaging time

Testing
Every engine is full-load tested to ensure proper engine performance.

Gas Engine Rating Pro
GERP is a PC-based program designed to provide site performance capabilities for Cat® natural gas engines for the gas compression industry. GERP provides engine data for your site's altitude, ambient temperature, fuel, engine coolant heat rejection, performance data, installation drawings, spec sheets, and pump curves.

Product Support Offered Through Global Cat Dealer Network
More than 2,200 dealer outlets

Cat factory-trained dealer technicians service every aspect of your petroleum engine

Cat parts and labor warranty

Preventive maintenance agreements available for repair-before-failure options

S·O·S℠ program matches your oil and coolant samples against Caterpillar set standards to determine:
- Internal engine component condition
- Presence of unwanted fluids
- Presence of combustion by-products
- Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience
Over 60 years of natural gas engine production

Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable products.
- Cast engine blocks, heads, cylinder liners, and flywheel housings
- Machine critical components
- Assemble complete engine

Web Site
For all your petroleum power requirements, visit www.catoilandgas.cat.com.

STANDARD EQUIPMENT

Air Inlet System
Air cleaner — intermediate-duty with service indicator

Control System
A3 ECU
Air-fuel ratio control

Cooling System
Thermostats and housing
Jacket water pump
Aftercooler water pump
Aftercooler core for sea-air atmosphere
Aftercooler thermostats and housing

Exhaust System
Watercooled exhaust manifolds

Flywheels & Flywheel Housings
SAE No. 00 flywheel
SAE No. 00 flywheel housing
SAE standard rotation

Fuel System
Gas pressure regulator
Natural gas carburetor

Ignition System
A3 ECU

Instrumentation
PL1000 Advisor panel

Lubrication System
Crankcase breather — top mounted
Oil cooler
Oil filter — RH
Oil bypass filter
Oil pan — shallow
Oil sampling valve
Turbo oil accumulator

Mounting System
Rails, engine mounting — 254 mm (10 in)

Protection System
Electronic shutoff system
Gas shutoff valve

General
Paint — Cat yellow
Vibration damper and guard — dual 484 mm (23 in)

OPTIONAL EQUIPMENT

Air Inlet System
Remote air inlet adapters
Precleaner

Charging System
Battery chargers
Charging alternators

Cooling System
Aftercooler core
Thermostatic valve
Temperature switch
Connections
Expansion and overflow tank
Water level switch gauge

Exhaust System
Flexible fittings
Elbows
Flange
Flange and exhaust expanders
Rain cap
Mufflers

Fuel System
Low pressure gas conversions
Propane gas valve and jet kits
Fuel filter

Instrumentation
PL1000 communications modules

Lubrication System
Oil bypass filter removal and oil pan accessories
Sump pump
Air prelube pump
Manual prelube pump
Lubricating oil

Mounting System
Rails
Vibration isolators

Power Take-Offs
Front accessory drives
Auxiliary drive shafts and pulleys
Front stub shaft
Pulleys

Protection System
Explosion relief valves, status control box interconnect wiring harness

Starting System
Air starting motor
Air pressure regulator
Air silencer
Electric air start controls
Electric starting motors — dual 24-volt
Starting aids
Battery sets (24-volt dry), cables, and rack

General
Flywheel interlia weight
Guard removal
Engine barring group
Premium 8:1 pistons
Premium cylinder heads

CATERPILLAR®

G3516 LE GAS PETROLEUM ENGINE

858-999 bkW (1150-1340 bhp)

TECHNICAL DATA

G3516 LE Gas Petroleum Engine

Fuel System		2 g NOx NTE Rating DM8618-01	2 g NOx NTE Rating DM8620-01
Engine Power			
@ 100% Load	bkW (bhp)	999 (1340)	858 (1150)
@ 75% Load	bkW (bhp)	749 (1004)	643 (862)
Engine Speed	rpm	1400	1200
Max Altitude @ Rated Torque and 38°C (100°F)	m (ft)	304.8 (1000)	1219.2 (4000)
Speed Turndown @ Max Altitude, Rated Torque, and 38°C (100°F)	%	25	9.2
SCAC Temperature	°C (°F)	54 (130)	54 (130)
Emissions*			
NOx	g/bkW-hr (g/bhp-hr)	2.68 (2)	2.68 (2)
CO	g/bkW-hr (g/bhp-hr)	2.49 (1.86)	2.35 (1.75)
CO_2	g/bkW-hr (g/bhp-hr)	632 (471)	624 (466)
VOC**	g/bkW-hr (g/bhp-hr)	0.35 (0.26)	0.4 (0.3)
Fuel Consumption***			
@ 100% Load	MJ/bkW-hr (Btu/bhp-hr)	10.48 (7405)	10.36 (7324)
@ 75% Load	MJ/bkW-hr (Btu/bhp-hr)	10.79 (7628)	10.76 (7605)
Heat Balance			
Heat Rejection to Jacket Water			
@ 100% Load	bkW (Btu/mn)	741 (42,123)	639 (36,343)
@ 75% Load	bkW (Btu/mn)	616.7 (35,075)	554 (31,480)
Heat Rejection to Aftercooler			
@ 100% Load	bkW (Btu/mn)	167.8 (9546)	131.9 (7509)
@ 75% Load	bkW (Btu/mn)	108.6 (6179)	72.2 (4108)
Heat Rejection to Exhaust			
@ 100% Load LHV to 25° C (77° F)	bkW (Btu/mn)	837.8 (47,643)	694.6 (39,536)
@ 75% Load LHV to 25° C (77° F)	bkW (Btu/mn)	630.4 (35,848)	524.1 (29,806)
Exhaust System			
Exhaust Gas Flow Rate			
@ 100% Load	m^3/min (cfm)	217.0 (7663)	182.9 (6460)
@ 75% Load	m^3/min (cfm)	163.8 (5785)	138.9 (4905)
Exhaust Stack Temperature			
@ 100% Load	°C (°F)	467.22 (873)	452.2 (846)
@ 75% Load	°C (°F)	467.22 (873)	450.5 (843)
Intake System			
Air Inlet Flow Rate			
@ 100% Load	m^3/min (scfm)	80.6 (2847)	69.5 (2453)
@ 75% Load	m^3/min (scfm)	60.8 (2147)	52.8 (1864)
Gas Pressure	kPag (psig)	241.5-275.8 (35-40)	241.5-275.8 (35-40)

*at 100% load and speed, all values are listed as not to exceed

**Volatile organic compounds as defined in U.S. EPA 40 CFR 60, subpart JJJJ

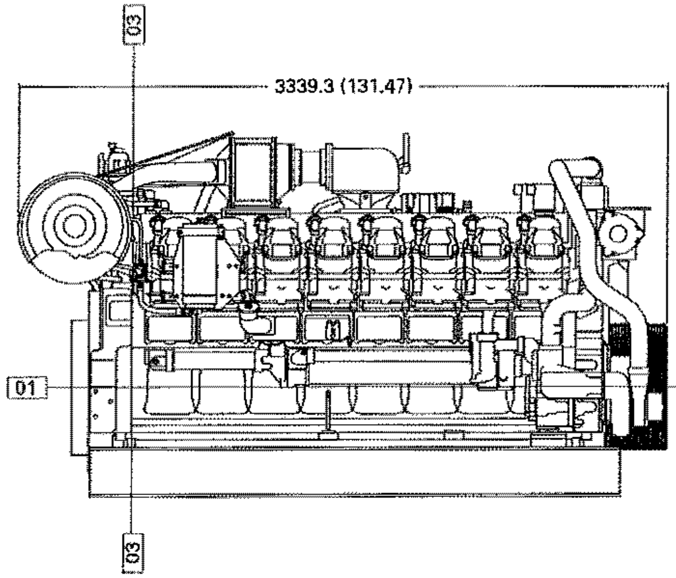
***ISO 3046/1

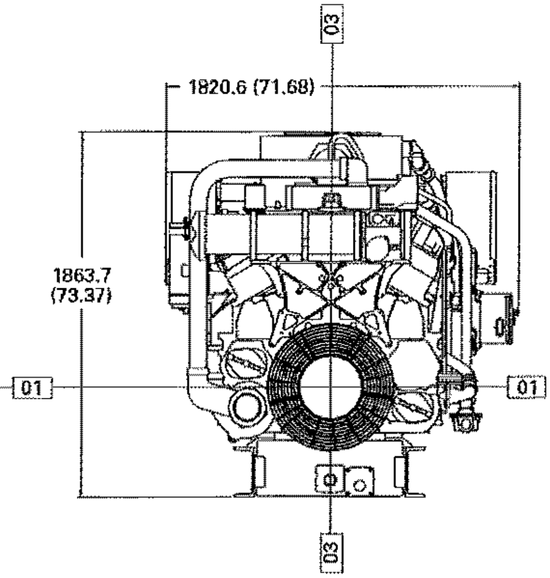
CATERPILLAR®

G3516 LE GAS PETROLEUM ENGINE

858-999 bkW (1150-1340 bhp)

GAS PETROLEUM ENGINE





DIMENSIONS		
Length	mm (in.)	3339.3 (131.47)
Width	mm (in.)	1820.6 (71.68)
Height	mm (in.)	1863.7 (73.37)
Shipping Weight	kg (lb)	8015 (17,670)

Note: General configuration not to be used for installation. See general dimension drawings for detail (drawing #289-2971).

Dimensions are in mm (inches).

RATING DEFINITIONS AND CONDITIONS

Engine performance is obtained in accordance with SAE J1995, ISO3046/1, BS5514/1, and DIN6271/1 standards.

Transient response data is acquired from an engine/generator combination at normal operating temperature and in accordance with ISO3046/1 standard ambient conditions. Also in accordance with SAE J1995, BS5514/1, and DIN6271/1 standard reference conditions.

Conditions: Power for gas engines is based on fuel having an LHV of 33.74 kJ/L (905 Btu/cu ft) at 101 kPa (29.91 in. Hg) and 15° C (59° F). Fuel rate is based on a cubic meter at 100 kPa (29.61 in. Hg) and 15.6° C (60.1° F). Air flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and 25° C (77° F). Exhaust flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and stack temperature.

Performance Numbers: DM8618-01, DM8620-01
LEHW0036-00 (11-09)
Supersedes LEHW6046-02

Emissions data form 225KW

Applicant Information			
Company Name:	WPX Energy		
Mailing Address:			
Company Official:		Title:	
Facility Name:	Cornstalk 20H	API:	
Engine Installed			
Manufacturer:	Doosan	Model: D146TA	Unit # 14-15-008
Installation Date:		Engine Serial Number:	EEZOG401207
Start-up Date:		Generator Serial Number	MT0016578
Engine Manufacture Date:	12/4/2014	Order Date:	
Generator Mfr Date:			
Nameplate Horsepower:	362 hp	Engine Type: (4SLB, 4SRB, or 2SLB)	4SRB
Diesel or Gas-fired?	Natural Gas		
		BTU/Hph	7251
EPA Cert # 2015	FPSIB14.6NGP-017	BTU/KWh	12,057
Engine Reconstruction Costs ($)			
Engine Reconstructed? (Yes or No)	No		
Engine Repair:		Commissioning:	
Parts and Labor:		Start-up Labor:	
Trucking & lifting Services:		Air Emission Controls:	
Other:		Other:	
Stack Parameters			
Height (ft):	9'8" (118")	Temperature (°F):	1,350 °F
Diameter (ft):	3.5 inches	Velocity (ft/s):	1,895 CFM/2491lb/hr
Emissions Control Equipment			
Rich Burn	Yes	NSCR Catalyst: (Yes or No)	Yes
AFR Controller (Yes or No)	Yes	SCR Catalyst:	
Oxidation Catalyst:		Other:	

V-8000	HTR-8000	ET-8000
FUEL GAS SCRUBBER 10¾" O.D. X 3'-0" 250 PSIG @ 210°F	72" O.D. X 20'-0" LG 125 PSIG @ X 3.5MM BTU/HR	HORIZONTAL EXPANSION RESERVOIR 30" O.D. X 10'-0" LG NON-CODE

NOZZLE LEGEND

- C1 COIL INLET 8" 150# R.F. FLG.
- C2 COIL OUTLET 8" 150# R.F. FLG.
- C3 DRAIN 2" 150# GATE VALVE NPT W/PLUG
- C4 THIEF HATCH/OUTLET 8" FLAT FACE FLG.
- C5 FUEL GAS INLET 2" 3000# NPT CPLG.

PAINT:

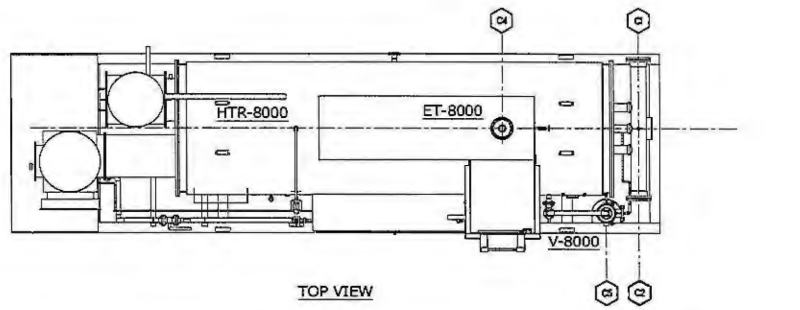
CARBON STEEL UN-INSULATED SURFACES (VESSELS):
SURFACE PREP: SSPC-SP6, 1.5-2.5 MIL PROFILE
PRIMER: 1 COAT COROTHANE 1 GALVAPAC ZINC PRIMER, 3.0-4.0 DFT
FINISH: 2 COATS SW ENVIOLASTIC 940 B65-940 DTM 6-9 MIL DFT PER COAT. BLM SHALE GREEN

CARBON STEEL INSULATED SURFACES (VESSELS AND PIPING):
SURFACE PREP: SSPC-SP6, 1.5-2.5 MIL PROFILE
PRIMER: 2 COATS SW HEAT FLEX 1200 B59A225, 5-6 MIL DFT PER COAT.

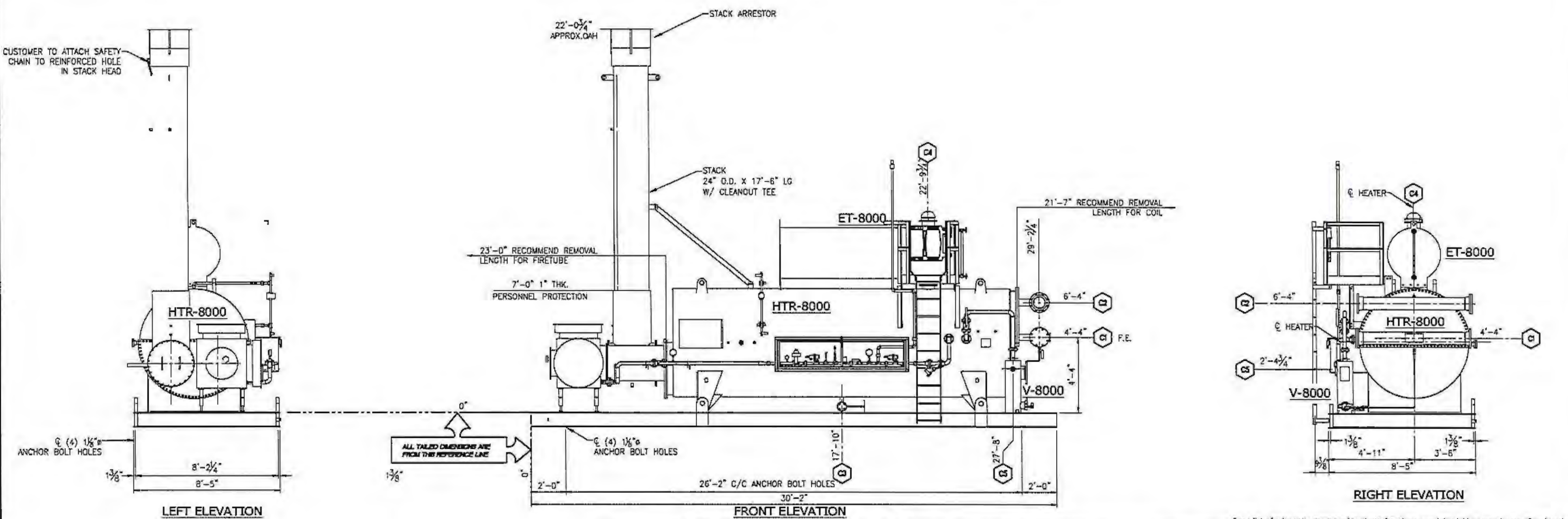
STACK:
SURFACE PREP: SSPC-SP6, 2.0-3.0 MIL PROFILE
PRIMER: 1 COAT SW HEAT FLEX 1200 B59A225, 5-6 MIL DFT PER COAT.
FINISH: 1 COAT SW HEAT FLEX 1000 BLM SHALE GREEN, 1.0-2.0 MIL DFT.

CARBON STEEL UN-INSULATED SURFACES (PIPING):
SURFACE PREP: SSPC-SP6, 1.5-2.5 MIL PROFILE
PRIMER:
FINISH: 2 COATS SW ENVIOLASTIC 940 B65-940 DTM 6-9 MIL DFT PER COAT. BLM SHALE GREEN

EMPTY WEIGHT: 22,500#



TOP VIEW



LEFT ELEVATION

FRONT ELEVATION

RIGHT ELEVATION

PARTS AND SERVICE, PHONE 1-918-492-0508, EMAIL SALES@ETIENGINEERING.COM

NO.	DATE	BY	ECO	DESCRIPTION	DWG NO.	DESCRIPTION
1	6/19/18	CGS		REVISED EQUIPMENT DESCRIPTION		
REVISIONS					REFERENCE DRAWINGS	

REVISED-DESTROY ALL PREVIOUS PRINTS

ETI ENGINEERING | TECHNOLOGY | INNOVATION

JOHN ZINK HAMWORTHY COMBUSTION
JOHN ZINK COMPANY, LLC

GENERAL ARRANGEMENT
WATER BATH HEATER 72" O.D. X 20'-0" LG. X 3.5MM BTU/HR

FOR:	
USER:	
JOBSITE:	
QUOTE NO:	
S.O. NO:	
P.O. NO:	
SCALE:	NOT TO SCALE

DRAWN: CGS	CHK:	APP:	SHEET:
DATE: 3/14/17	DATE:	DATE:	1 OF 1
DRAWING NUMBER: HTR072003-300GA		PART NUMBER: HTR072002	REV. 1

DRAWING: S:\ETI\CAD\ETI_STD_ASSM\CAD\DWGS\INDIRECT FIRED HEATER 72 X 20\HTR072003-300GA.DWG
PLOTTED ON: 6/19/2018 11:42:49 AM BY SILVA, GREG

BILL OF MATERIALS					
ITEM	DESCRIPTION	TAG	SERVICE	SIZE	MODEL
	72" X 25'-0" S/S TREATER	V-3000	HEATER TREATER		
	10-3/4" X 20" FUEL GAS SCRUBBER	V-4000	FUEL GAS SCRUBBER		
1	OIL LEVEL CONTROL	LC-3000	LEVEL CONTROL-OIL	2" NPT	KIMRAY GEN II CMKH
2	OIL LEVEL CONTROL VALVE	LCV-3000	FLUID DUMP-OIL	3" CL150	KIMRAY EWI
3	WATER LEVEL CONTROL	LC-3100	LEVEL CONTROL-WATER	4" CL150	KIMRAY GEN II CMK
4	WATER LEVEL CONTROL VALVE	LCV-3100	FLUID DUMP-WATER	3" CL150	KIMRAY EWI
5	INLET			4" CL150	
6	GAS OUTLET			4" CL150	
7	DRAIN		MANUAL DRAIN	2" NPT	2" 750# REG PORT
8	MANWAY		MANWAY W DAVIT	18" CL150	
9	SIGHT GLASS	LG-3000/LG-3100/LG-3002	SIGHT GLASS	3/4" NPT	
10	HIGH LEVEL SHUT DOWN	LSHH-3000	SAFETY SHUT DOWN HIGH	2" NPT	VLF 21200DVE5YE0080
11	ANODE			4" CL150	4" REDHEAD
12	LOW LEVEL SHUT DOWN (OIL BUCKET)	LSLL-3000	SAFETY SHUT DOWN LOW	2" NPT	WELLMARK W-1200 DEV-E4
13	LOW LEVEL SHUT DOWN (FIRETUBE)	LSLL-3100	SAFETY SHUT DOWN LOW	2" NPT	VLF 21200DVE5YE0080
14	INSTRUMENT GAS OUT		INST GAS SUPPLY	1" NPT	1" 1500# REG PORT
15	SPARE		SPARE	1" NPT	
16	THERMOCOUPLE	TW/TE-3002	PROCESS TEMP/BMS	3/4" NPT	ROSEMOUNT DUAL TYPE K
17	PRESSURE GAUGE	PI-3002	VESSEL	1/4" NPT	0-125 PSI
18	PRESSURE GAUGE	PI-4000	MAIN GAS	1/4" NPT	0-30 PSI
19	PRESSURE GAUAGE	PI-4100	PILOT GAS	1/4" NPT	0-30 PSI
20	PRESSURE CONTROL VALVE-MAIN FUEL	PCV-3000	MAIN REGULATOR	1" NPT	WELLMARK IPR-1V50S
21	PRESSURE CONTROL VALVE-DEVISE	PCV-4001-PCV-4002	IGS PRESS REG	1/4" NPT	WELLMARK W67FR600A
22	PRESSURE RELIEF VALVE	PRV-3001/PRV-3002	SAFETY RELIEF VALVE	2" NPT	WELLMARK, SET @ 75 PSI
23	TEMP GAUGE	TW/TI-3001	TEMP GAGE/W WELL	3/4" NPT	50-350F
24	TEMP CONTROL VALVE	TCV-3000	TEMP CONTROL	1" NPT	KIMRAY MXA
25	SAFETY SHUT DOWN VALVE-MAIN	XV-3000	SDV-MAIN	1" NPT	ASCO
26	PRESSURE CONTROL VALVE-PILOT	PCV-3100	PILOT REG	1/4" NPT	WELLMARK W67FR350
27	SAFETY SHUTDOWN VALVE-PILOT	XV-3100	SDV-PILOT	1/4" NPT	ASCO
28	STACK TEMP	TW/TE-3100	STACK TEMP	3/4" NPT	ROSEMOUNT TYPE K
29	PRESSURE TRANSMITTER	PIT-3000	PRESSURE TRANS	1/2" NPT	ROSEMOUNT
30	BURNER MANAGEMENT SYSTEM	BMS-3000	BMS		PROFIRE 2100

ISSUED FOR APPROVAL

GENERAL ARRANGEMENT PRINT

CUSTOMER DATE

COMMENTS:

COAT/PAINT SPECIFICATIONS

INTERNAL: NONE

EXTERIOR: NEAR WHITE BLAST SP10
MACROPOXY 646, 5-10 MILS DFT

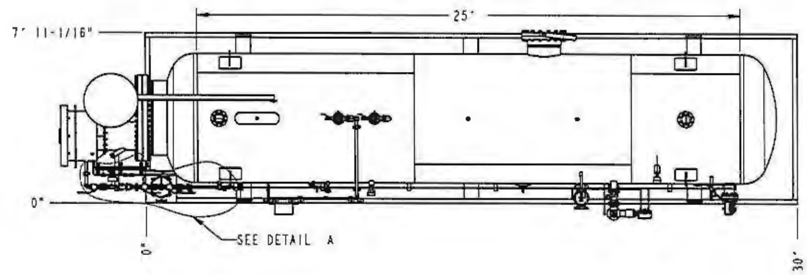
COLOR: CARLSBAD CANYON TAN

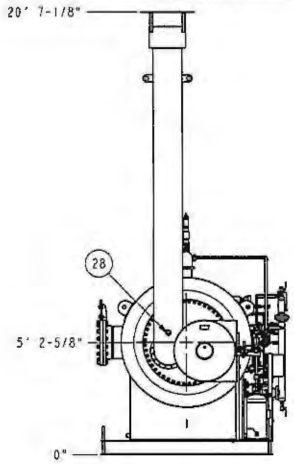
VESSEL DATA

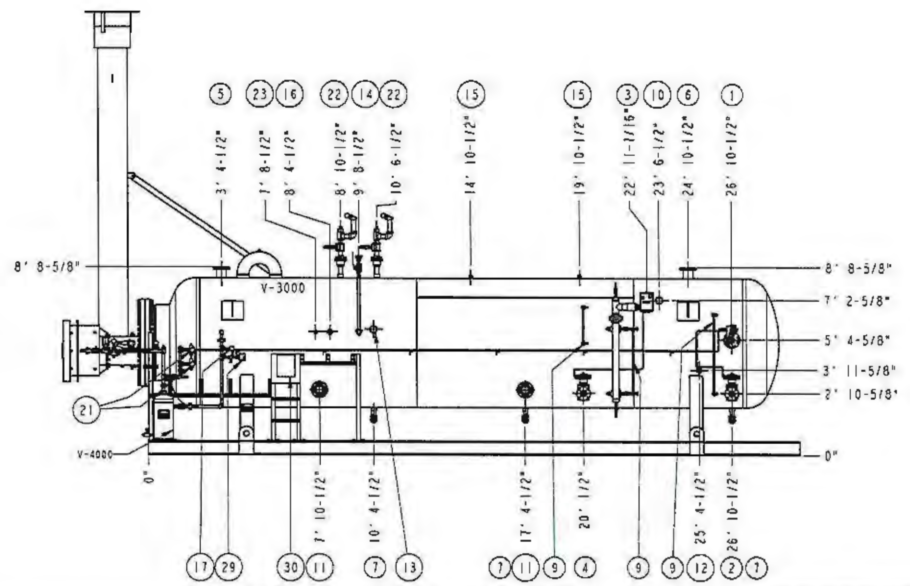
V-3000
72" X 25'-0"
HEATER TREATER
MAWP: 75 PSIG @ 245F
MDMT: -20F @ 75 PSIG

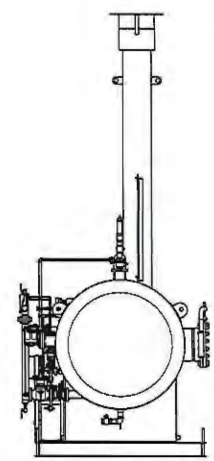
V-4000
10-3/4" X 20 20"
FUEL GAS SCRUBBER
MAWP: 75 PSIG @ 245F
MDMT: -20F @ 75 PSIG

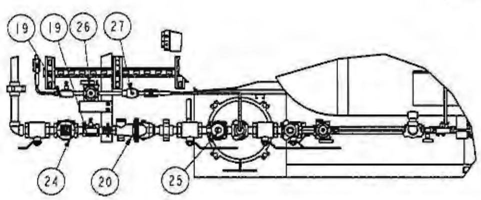
WEIGHT AS SHOWN 16451.375 LBS











DETAIL A
SCALE 0.090

REV	DESCRIPTION	DATE	INIT	ECN#
	ISSUED FOR CONSTRUCTION			

WORTHINGTON INDUSTRIES

TITLE: 9D0038-72" X 25'-0" 75# HEATER TREATER

DWG BY: RW	MTL:	SCALE: 0.030	JOB NO:
CUSTOMER: WPX	JOB#: 377739	SHT: 1 OF 1	
DWG NAME: 9D0038A-GA			REV NO: 5

BILL OF MATERIALS					
ITEM	DESCRIPTION	TAG	SERVICE	SIZE	MODEL
	60" X 20'-0" S/S SEPARATOR	V-1000	3 PHASE SEP		
	10-3/4" X 20" FUEL GAS SCRUBBER	V-2000	INST GAS KNOCK OUT		
1	OIL LEVEL CONTROL	LC-1000	LEVEL CONTROL-OIL	2" NPT	KIMRAY GEN II CMKH
2	OIL LEVEL CONTROL VALVE	LCV-1000	FLUID DUMP-OIL	3" CL150	KIMRAY 2150SMT-EFG
3	WATER LEVEL CONTROL	LC-1100	LEVEL CONTROL-WATER	2" NPT	KIMRAY GEN II CMK
4	WATER LEVEL CONTROL VALVE	LCV-1100	FLUID DUMP-WATER	3" CL150	KIMRAY 2200SMT-ECP
5	INLET			6" CL150	
6	GAS OUTLET			6" CL150	
7	DRAIN		MANUAL DRAIN	2" NPT	2" 750# REG PORT
8	MANWAY		MANWAY W DAVIT	18" CL150	
9	SIGHT GLASS	LG-1000/LG-1100	SIGHT GLASS	3/4" NPT	
10	HIGH LEVEL SHUT DOWN	LSHH-1000	SAFETY SHUT DOWN HIGH	2" NPT	VLF 2120DDVIESYED0B0
11	ANDOE			4" CL150	4" REDHEAD
12	LOW LEVEL SHUT DOWN (OIL BUCKET)	LSLL-1001	SAFETY SHUT DOWN LOW	2" NPT	WELLMARK W-1200 DEV-E4
13	INSTRUMENT GAS OUT		INST GAS SUPPLY	1" NPT	1" 1500# REG PORT
14	SPARE		SPARE	1" NPT	
15	TEMPERATURE GAUGE	TW/TI-1000	TEMP GAGE W/WELL	3/4" NPT	50-300F
16	PRESSURE GAUGE	PI-1000	PRESSURE GAGE	1/4" NPT	0-600 PSI
17	PRESSURE GAUGE	PI-1100	PRESSURE GAGE	1/4" NPT	0-160 PSI
18	PRESSURE CONTROL VALVE-INSTRUMENT GAS	PCV-2000	PRESSURE REGULATOR	1" NPT	WELLMARK IPR-3V25S
19	PRESSURE CONTROL VALVE-DEVISE	PCV-2001-PCV-2002	IGS PRESS REG	1/4" NPT	WELLMARK WG7FR600A
20	PRESSURE RELIEF VALVE	PRV-1001/PRV-1002	SAFETY RELIEF VALVE	2" NPT	WELLMARK, SET @ 250 PSI
21	PRESSURE RELIEF VALVE	PRV-2000	SAFETY RELIEF VALVE	1" NPT	WELLMARK, SET @ 125 PSI

COAT/PAINT SPECIFICATIONS

INTERNAL: NONE

EXTERIOR: NEAR WHITE BLAST SP10
MACROPOXY 646, 5-10 MILS DFT

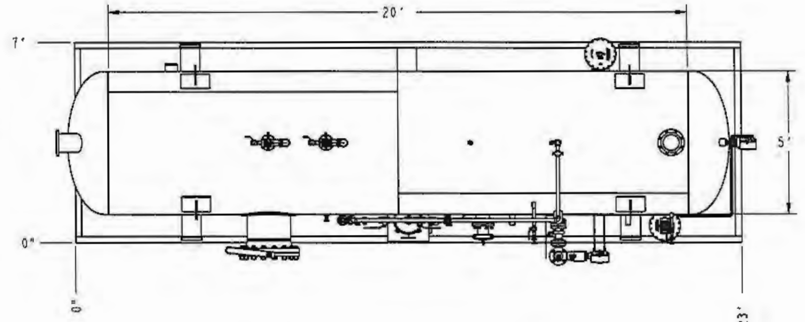
COLOR: CARLSBAD CANYON TAN

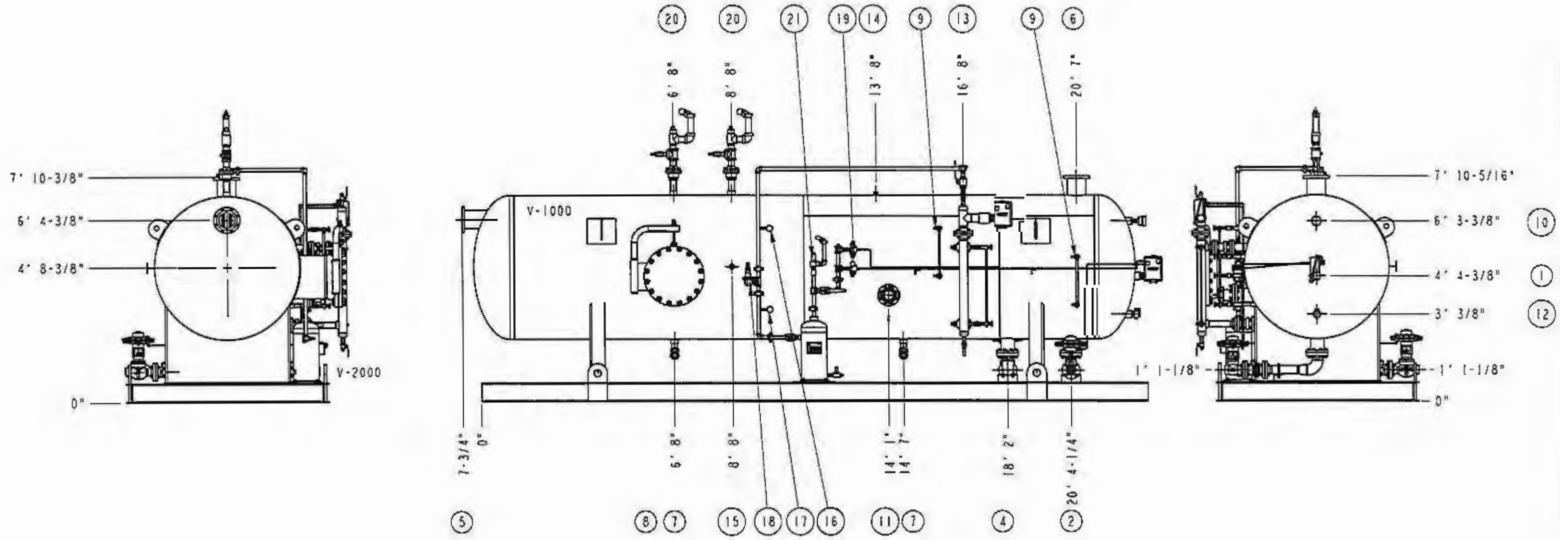
VESSEL DATA

V-1000
60" X 20'-0"
3 PHASE SEP
MAWP: 250 PSIG @ 245F
MDMT: -20F @ 250 PSIG

V-2000
10-3/4" X 20 20"
FUEL GAS SCRUBBER
MAWP: 125 PSIG @ 245F
MDMT: -20F @ 125 PSIG

WEIGHT AS SHOWN 12997.859 LBS





ISSUED FOR APPROVAL

GENERAL ARRANGEMENT PRINT

CUSTOMER	DATE
COMMENTS:	

REV	DESCRIPTION	DATE	INIT	ECN#
	ISSUED FOR CONSTRUCTION			

WORTHINGTON INDUSTRIES

TITLE: 9D0040 60" X 20' 250# SEPARATOR

DWG BY: NJ	MTL:	SCALE: 0.040	JOB NO:
CUSTOMER: WPX	JOB#: 377738	SHT: 1 OF 1	
DWG NAME: 9D0040A-GA			REV NO: 5

ATTACHMENT F

Air Dispersion Modeling Results
Howling Wolf Production Pad

Air Dispersion Modeling Results

Howling Wolf Production Pad

WPX Energy, Williston LLC

March 13, 2020

Purpose of Modeling

WPX Energy, Inc. (WPX) is replacing a synthetic minor permit application submitted October 4, 2018 for the construction of the planned facility. The proposed construction will include the installation of the equipment as detailed in the modeling protocol submitted previously. The installation will result in the emission of Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Particulate Matter (PM_{10} and $PM_{2.5}$) and Sulfur Dioxide (SO_2), therefore, Nitrogen Dioxide (NO_2), CO, PM_{10}, $PM_{2.5}$, and SO_2 were considered for air dispersion modeling based on their respective emission rates. Pollutants above the thresholds provided in EPA Form No. 5900-248 of the EPA's Application for New Construction were modeled for each averaging period of each applicable pollutant. WPX seeks to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) for the applicable pollutants.

The modeling results below are based on the original application that was submitted on October 4, 2018, and comments received by Region 8 on October 31, 2018. A summary of the modeling comments from Region 8 can be found below. The change between this synthetic minor permit application and the original application is a reduction in gas volume sent to the thermal oxidizer. The modeling results included are based on a higher gas volume combusted at the thermal oxidizer, so the results are more conservative. WPX has demonstrated at a higher gas volume that Howling Wolf Production Pad is compliant with NAAQS for the applicable pollutants.

Summary of Region 8 Modeling Comments:

1. Background Concentrations – Region 8 suggests WPX to use background concentrations based on the latest monitoring data at Lostwood (38-013-0004), Dunn (38-025-0003), and TRNP (38-053-0002), instead of a North Dakota Department of Environmental Quality – Division of Air Quality (NDDEQ) guidance document. This has been updated in the modeling report.
2. Values for NAAQS Demonstration – For the NAAQS analyses, Region 8 suggests the model results to be reported in the probabilistic form of the standard instead of showing results in the highest-first-highest form. This has been updated in the modeling report.
3. Meteorological Years – Region 8 commented WPX incorrectly listed the time period as 2009-2014. The time period has been corrected to reflect the years 2009-2013.
4. Property Boundary – Region 8 could not find evidence in the application that suggested a property boundary will exist when the development activities occur. WPX addressed that there will be a permanent fence around the pad to mark the boundary.
5. Analysis of Ozone and Secondary $PM_{2.5}$ NAAQS Pollutants – Region 8 requested an assessment on the projects impacts to ozone and secondary $PM_{2.5}$. WPX performed a Modeled Emission Rates for Precursors (MERP) analysis to address secondary pollutants. The analysis can be found on page 8 of the modeling report.

6. Model Files – Region 8 requested additional modeling files. WPX submitted all the appropriate modeling files on a flash drive to Region 8. A list of these files can be found in Table 3 of the modeling report.
7. Presentation of Model Assumptions and Results – Region 8 requested WPX to include a column to Table 4 of the modeling report to outline the percent of the total predicted concentrations relative to the NAAQS values. This column has been added to Table 4 of the modeling report.

Modeling Performed for this Application

Table 1: List of pollutants modeled at various averaging periods and corresponding ROI and analysis

Pollutant	**Period**	**ROI (m)**	**Cumulative Analysis**
NO_2	1-hr	9,400	Background Added
NO_2	Annual	532.8	Background Added
CO	1-hr	N/A	N/A
CO	8-hr	N/A	N/A
PM_{10}	24-hr	N/A	N/A
PM_{10}	Annual	N/A	N/A
$PM_{2.5}$	24-hr	176.6	Background Added
$PM_{2.5}$	Annual	132.4	Background Added
SO_2	1-hr	3113.4	Background Added
SO_2	3-hr	265.3	Background Added
SO_2	24-hr	602.8	Background Added
SO_2	Annual	269.0	Background Added

ROI – Radius of significant impact

Modeling Options

The AERMOD dispersion model was used for this analysis. BEEST for Windows (Version 11.12) was used to facilitate the modeling effort. BEEST for Windows is a modeling manager used to prepare and run AERMOD. The following US EPA software version numbers were used in conjunction with BEEST to model this facility: AERMOD (18081), AERMET (18081), AERMINUTE (15272), AERMAP (18081), AERSURFACE (13016), ISC3 (02035), BPIPPRM (04274), ISC-PRIME (04269).

WPX ran the model in Regulatory Default mode with the following options:

- the use of stack-tip downwash;
- incorporating the effects of elevated terrain;
- including the calms and missing data processing routines;
- forcing the use of a 4-hour half-life when modeling SO in an urban source (not applicable for this location); and
- disallowing for exponential decay for other applications.

To estimate NO_2 concentrations, the national default minimum ambient ratio (0.5) was used. The default maximum ratio of 0.9 was also used (ARM 2).

Building Downwash

A building downwash analysis using BPIP-Prime was conducted to account for any buildings, tanks, fans or other obstacles if the stack height is less than good engineering practice (GEP). The following structures were included in the modeling scenario: one (1) water bath heater, three (3) heater treaters, and two (2) engines. The following tanks were included in the modeling scenario: twelve (12) oil storage tanks, six (6) pre-flash produced water storage tanks, and six (6) post-flash produced water storage tanks.

Receptors and Modeled Property Boundary

For each pollutant, the radius of significant impact (ROI) around the facility was established using a Cartesian grid. The property boundary is defined by a fence. A construction plat showing the location of the fence can be found in Figure 26. Fence line receptors were spaced every 25 meters along the property boundary as recommended by North Dakota's Air Quality Dispersion Modeling Analysis Guide (revised June 21, 2013). A Cartesian grid was be used beyond the fence line as follows: 50-meter spacing out to 500 meters, 100-meter spacing out to 1 km, 250-meter spacing out to 5 km, and finally, an outer Cartesian grid with 1000-meter spacing from 5 km out to a distance from the facility fence line in all directions that would capture the ROI up to a maximum of 50 km. Receptor elevations were determined using the AERMAP terrain processor and seamless DEM terrain data downloaded from the USGS website. The DEM terrain data were processed such that an actual, true elevation is assigned to each receptor as determined through satellite data. AERMAP also utilizes the DEM terrain data to assign appropriate hill height scale elevations to each receptor for determining potential nearby terrain impacts.

Sensitive Areas

There are no schools, hospitals, or other sensitive receptors near the facility.

NO_2 Modeling

To estimate NO_2 concentrations, the national default minimum ambient ratio (0.5) was used. The default maximum ratio of 0.9 was also used (ARM 2). The following design values were used for each averaging period modeled per the EPA AERMOD User Guide Document (April 2018):
1-hour: High eighth high
Annual: High first high

Nearby Sources and Background Concentrations

All nearby sources that could impact the project have been defined by the North Dakota Department of Environmental Quality (NDDEQ) Division of Air Quality. Background concentrations were added to NO_2, PM_{10}, $PM_{2.5}$, and SO_2. The following hourly background sites were used according to the 2009-2013 data set provided by NDDEQ, including the distance to the Howling Wolf Production Facility: Beulah North (34.2 mi), Hannover (52.0 mi), TRNP North Unit (42.0 mi), Lostwood NWR (76.5 mi), Fargo NW (264.3 mi). A map showing the locations of the background sites and the distances to the Howling Wolf Production Pad can be found in Figure 22. A list of the background concentrations utilized in the modeling analysis is provided below in Table 3. This table can be found in the NDDEQ Air Quality Dispersion Modeling Analysis Guide (June 21, 2013) and is representative of the entire State of North Dakota. The values shown in Table 3 are not derived from a specific monitor but are a conservative composite of what statewide monitors register.

Table 2: Fixed Background Concentrations for North Dakota (μg/m^3)

	Averaging Period				
Pollutant	**1-hour**	**3-hour**	**8-hour**	**24-hour**	**Annual**
SO_2	13	11	---	9	3
NO_2	35	---	---	---	5
PM_{10}	---	---	---	30	15
$PM_{2.5}$	---	---	---	13.7	4.75
CO	1149	---	1149	---	---

Meteorological Data

WPX used the pre-approved five-year data set collected in 2009-2013 at Williston, ND for this analysis based on the ND Department of Environmental Quality Air Quality Dispersion Modeling Guidance (MET(NDDEQ).PFL, MET(NDDEQ).SFC) as provided by the ND Division of Air Quality. This met station is located in comparable terrain not far from the facility. Therefore, we believe these data are representative of meteorological conditions at the facility. Additionally, a wind rose plot based on the met data can be found in Figure 21 in the modeling appendix. A map detailing the locations of the met stations in comparison to the Howling Wolf Production Pad can be found in Figure 23.

Terrain

WPX has defined the domain as complex terrain since there are elevations above stack height within 10 km of the facility. The elevated terrain is primarily east of the facility and reaches about 40 feet above the facility elevation about 2.3 km away. The elevations of receptors were determined using the AERMAP terrain processor and seamless DEM terrain data downloaded from the USGS The National Map server. The DEM terrain data was processed such that an actual, true elevation is assigned to each receptor as determined through satellite data. The area within the inner property boundary will be graded and therefore was assumed to be at constant elevation.

Modeling Files

Source only modeling was performed for NO_x, CO, $PM_{2.5}$, PM_{10}, and SO_2. Inputs files (.DTA) and Output files (.GRF, and .LST) are provided for each run. AERMET, AERMAP, and BPIPPRIME files are also provided. AERSURFACE and AERMINUTE files were not included because the data is in the AERMET file provided by the modeling department of North Dakota.

Table 3: Modeling file details

File Name	Pollutant	Purpose
Howling Wolf Prod Pad_6yrs_CO.DTA	CO	Input
Howling Wolf Prod Pad_6yrs_NO2.DTA	NO_2	Input
Howling Wolf Prod Pad_6yrs_PM10.DTA	PM_{10}	Input
Howling Wolf Prod Pad_6yrs_PM2.5.DTA	$PM_{2.5}$	Input
Howling Wolf Prod Pad_6yrs_SO2.DTA	SO_2	Input
Howling Wolf Prod Pad_6yrs_CO.GRF .LST	CO	ROI/SIA
Howling Wolf Prod Pad_6yrs_NO2.GRF .LST	NO_2	ROI/SIA
Howling Wolf Prod Pad_6yrs_PM10.GRF .LST	PM_{10}	ROI/SIA
Howling Wolf Prod Pad_6yrs_PM2.5.GRF .LST	$PM_{2.5}$	ROI/SIA
Howling Wolf Prod Pad_6yrs_SO2.GRF .LST	SO_2	ROI/SIA
MET(NDDoH). PFL .SFC	N/A	AERMET
NED_48038509.tif , Elevation.MAP	N/A	AERMAP
Included in the MET file that was provided by the State.	N/A	AERSURFACE
Included in the MET file that was provided by the State.	N/A	AERMINUTE
Howling Wolf Prod Pad.PIP	N/A	BPIPPRIME

Modeling Results

After modeling and adding background concentration, CO, NO_2, SO_2, $PM_{2.5}$, and PM_{10}, the emission concentrations all fall within the NAAQS.

Table 4: Summary of modeling results

Pollutant	Period	Facility Concentration (μg/m^3)	Total Modeled Concentration (μg/m^3)	Background Concentration	Cumulative Concentration	Standard	Value of Standard	Units of Standard, Background, and Total	Percent of Standard
CO	1-hr	293.76	293.76	N/A	293.76	SIL	2,000.00	μg/m^3	14.7%
CO	1-hr	293.76	293.76	N/A	293.76	NAAQS	40,000.00	μg/m^3	0.7%
CO	8-hr	224.18	224.18	N/A	224.18	SIL	500.00	μg/m^3	44.8%
CO	8-hr	224.18	224.18	N/A	224.18	NAAQS	10,000.00	μg/m^3	2.2%
NO_2	1-hr	122.23	122.23	N/A	122.23	SIL	7.5	μg/m^3	1629.8%
NO_2	1-hr	113.10	113.10	24.5	137.56	NAAQS	188	μg/m^3	73.2%
NO_2	Annual	6.06	6.06	N/A	6.06	SIL	1	μg/m^3	606.1%
NO_2	Annual	6.06	6.06	5	11.06	NAAQS	100	μg/m^3	11.1%
$PM_{2.5}$	24-hr	3.05	3.05	N/A	3.05	SIL	1.2	μg/m^3	254.4%
$PM_{2.5}$	24-hr	2.06	2.06	24	26.06	NAAQS	35	μg/m^3	74.5%
$PM_{2.5}$	Annual	0.36	0.36	N/A	0.36	SIL	0.3	μg/m^3	120.6%
$PM_{2.5}$	Annual	0.36	0.36	5.8	6.16	NAAQS	12	μg/m^3	51.3%
PM_{10}	24-hr	3.97	3.97	N/A	3.97	SIL	5	μg/m^3	79.5%
PM_{10}	24-hr	3.97	3.97	N/A	3.97	NAAQS	150	μg/m^3	2.6%
SO_2	1-hr	58.35	58.35	N/A	58.35	SIL	7.8	μg/m^3	748.1%
SO_2	1-hr	58.35	58.35	52.4	110.76	NAAQS	196	μg/m^3	56.5%
SO_2	3-hr	54.63	54.63	N/A	54.63	SIL	25	μg/m^3	218.5%
SO_2	3-hr	54.63	54.63	11	65.63	NAAQS	1309	μg/m^3	5.0%
SO_2	24-hr	35.63	35.63	N/A	35.63	SIL	5	μg/m^4	712.7%
SO_2	24-hr	35.63	35.63	9	44.63	NAAQS	365	μg/m^4	12.2%
SO_2	Annual	2.99	2.99	N/A	2.99	SIL	1	μg/m^5	299.0%
SO_2	Annual	2.99	2.99	3	5.99	NAAQS	80	μg/m^5	7.5%

Location of Maximum Concentrations

Table 5 below identifies the locations of the maximum concentrations for the various pollutants that were modeled.

Table 5: Locations of the maximum concentrations for modeled pollutants

Pollutant	Period	UTM East (m)	UTM North (m)	Elevation (ft)	Distance (m)	Radius of Impact (ROI) (m)
NO_2	1-hr	695439.6	5268153.6	703.34	106	9,400
NO_2	Annual	695411.4	5268050.6	703.34	93	532.8
CO	1-hr	695439.6	5268153.6	703.34	106	N/A
CO	8-hr	695439.6	5268153.6	703.34	106	N/A
$PM_{2.5}$	24-hr	695318.7	5268181.3	703.34	74	176.6
$PM_{2.5}$	Annual	695411.4	5268050.6	703.34	93	132.4
PM_{10}	24-hr	695273.6	5268173.4	703.34	93	N/A
PM_{10}	Annual	695411.4	5268050.6	703.34	93	N/A
SO_2	1-hr	695366.3	5268042.7	703.34	74	3,113
SO_2	3-hr	695366.3	5268042.7	703.34	74	265.3
SO_2	24-hr	695366.3	5268042.7	703.34	74	602.8
SO_2	Annual	695366.3	5268042.7	703.34	74	269.0

Ozone and Secondary $PM_{2.5}$ Analysis

Table 6: Results of Tier I Demonstration Using MERPs for 8-hour Ozone

	Critical Air Quality Threshold (ppb)	Modeled Emission Rate from Hypothetical Source (tpy)	Modeled Air Quality Impact from Hypothetical Source (ppb)	MERP (tpy)	Project Potential Emissions (tpy)	Percentage of MERPs
NOx*	1.0	500	0.18	2777.78	180.86	6.51%
VOC**	1.0	500	0.21	2380.95	249.43	10.48%
					Total Percentage of MERPs	**16.99%**

* - Hypothetical NOx Source found on pg. 45 of MERP guidance; Mercer, ND.

** - Hypothetical VOC Source found on pg. 50 of MERP guidance; Mercer, ND.

Table 7: Results of Tier I Demonstration Using MERPs for Daily and Annual Particulate Matter

$PM_{2.5}$ Precursor	Averaging Period	MERP (Western US) (tpy)	Project Potential Emissions (tpy)	Estimated Secondary PM from Project (µg/m³)	Percentage of MERPs
NO_X	24-hour	1,155	180.86	N/A	15.66%
	Annual	3,184		N/A	5.68%
SO_2	24-hour	225	9.46	N/A	4.21%
	Annual	2,289		N/A	0.41%
			24-hour Total Secondary Impact:	**N/A**	**19.86%**
			Annual Total Secondary Impact:	**N/A**	**6.09%**

Primary Pollutant	Averaging Period	Impact Level (µg/m3)	NAAQS Level (µg/m³)	Primary Impact Percentage
$PM_{2.5}$	24-hour	3.05	35	8.72%
	Annual	0.36	12	3.02%

Pollutant	Averaging Period	Total Percentage of MERPs
Total $PM_{2.5}$	24-hour	28.59%
	Annual	9.11%

Summary and Conclusions

The facility was modeled for NO_2, CO, $PM_{2.5}$, PM_{10}, and SO_2 impacts. Source-only modeling was completed for each pollutant to determine the existence of significant impacts. This was followed by a cumulative NAAQS analysis for each pollutant exceeding the significance levels.

Source only NO_2, CO, $PM_{2.5}$, PM_{10}, and SO_2 modeling results are presented in Table 3 for the proposed facility and define the air quality impacts associated with the proposed facility. NO_2, $PM_{2.5}$, and SO_2 impacts are above the Significance Levels, while CO and PM_{10} impacts are below the Significance Levels. A radius of impact analysis was performed for each pollutant as illustrated in Figures 1 through 8. The modeled concentration gradient of each pollutant at each averaging period is illustrated in Figures 9 through 20.

For pollutants that were above the Significance Levels background concentrations were added to the modeled results. The background concentrations were added to the 8th high 1-hr NO_2, the annual NO_2, the 8th high 24-hr $PM_{2.5}$, the annual $PM_{2.5}$, the 4th high 1-hr SO_2, the 2nd high 3-hr SO_2, 24-hr SO_2, and annual SO_2. The results demonstrated compliance with the NAAQS as shown in Table 4.

An analysis for Modeled Emission Rates for Precursors (MERPs) was performed for Ozone and $PM_{2.5}$ as shown in Table 6 and Table 7 to demonstrate that combined primary and secondary impacts would not exceed the NAAQS.

- For ozone, a hypothetical source near the facility (Mercer, ND) was selected from the EPA guidance document (EPA 2016). The selected maximum impact value for the hypothetical source was based on the facility characteristics of 500 tpy and "L" for surface release height because that is the most representative of the Howling Wolf Production Pad. The equation from Section 5 of the EPA guidance document was used to calculate the total percentage of the MERPs based on the facility's PTE and the hypothetical facility's MERP value for the ozone precursors NO_x and VOC:

  MERP = Critical Air Quality Threshold * (Modeled emission rate from hypothetical source / Modeled air quality impact from hypothetical source)

  NO_x and VOC MERPs added together show ozone is below 100%, demonstrating that the facility does not exceed significant levels of ozone.

- For $PM_{2.5}$, the primary impacts and the secondary impacts were added together for comparison to the NAAQS. The primary $PM_{2.5}$ impacts for each averaging period (24-hour and annual) were modeled based on the project PTE calculations and compared to the $PM_{2.5}$ NAAQS to estimate the primary impact percentage of the NAAQS. The secondary $PM_{2.5}$ impacts were calculated using a ratio of potential project emissions to the MERPs for the Western US for both NO_x and SO_2. The resulting percentage of MERPs for NO_x and SO_2 were added together to represent total secondary impacts for each averaging period (24-hour and annual). The sum of the primary and secondary impact percentages shows that $PM_{2.5}$ is below 100% of the NAAQS, therefore, the facility does not exceed the $PM_{2.5}$ NAAQS.

The modeling results show that all modeled pollutants demonstrate compliance with the NAAQS standards.

All figures can be found in the attached modeling appendix.

References:

EPA 2016. EPA guidance document *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program.* EPA-454/R-16-006, December 2016.

Modeling Appendix

Source Only **NO_2 Annual ROI: 533m** **Max: 6.061 µg/m^3**

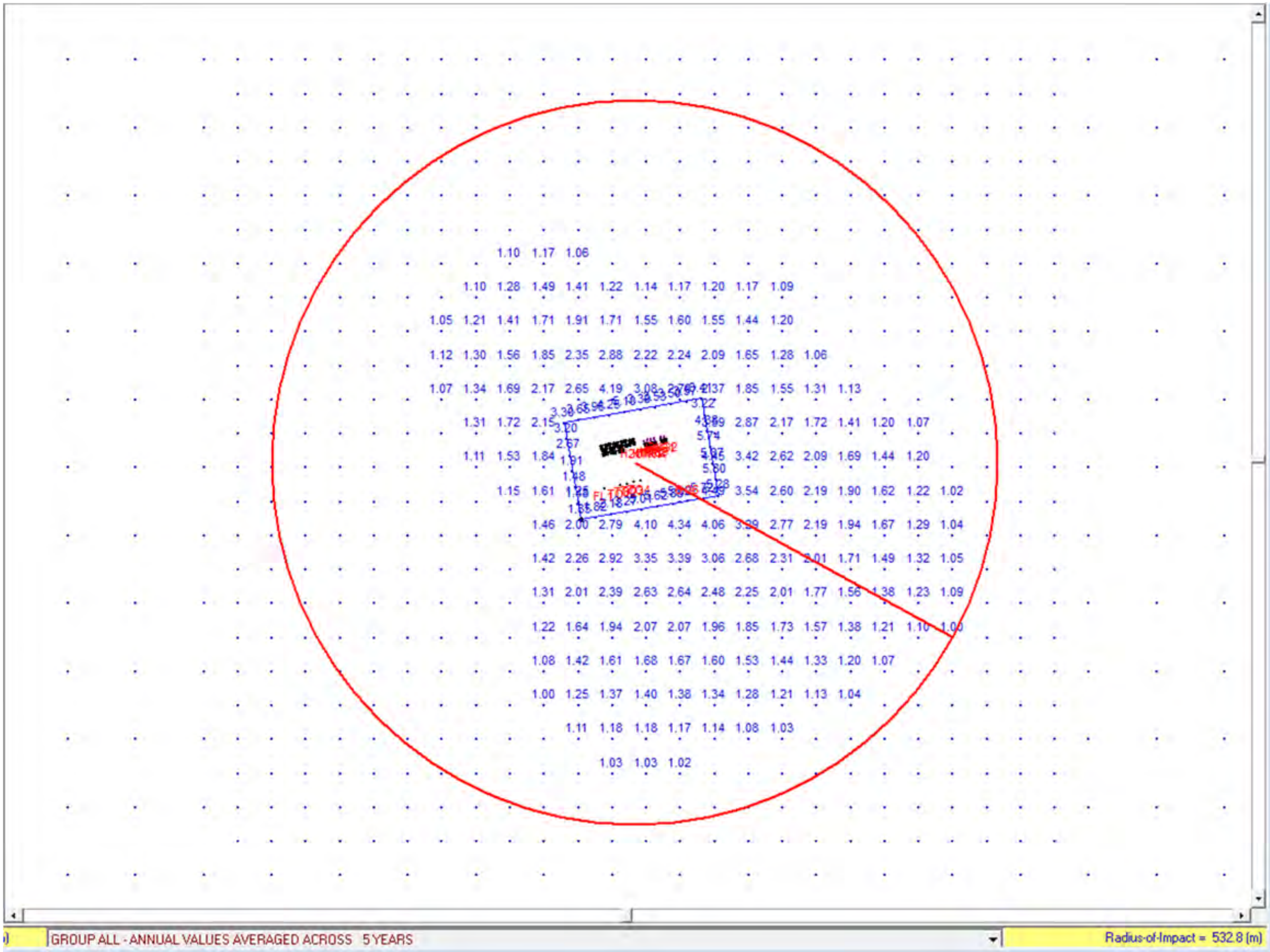


Figure 1

Source Only **NO_2 High 1st High 1-hr ROI: 9,400m** **Max: 122.2 µg/m³**

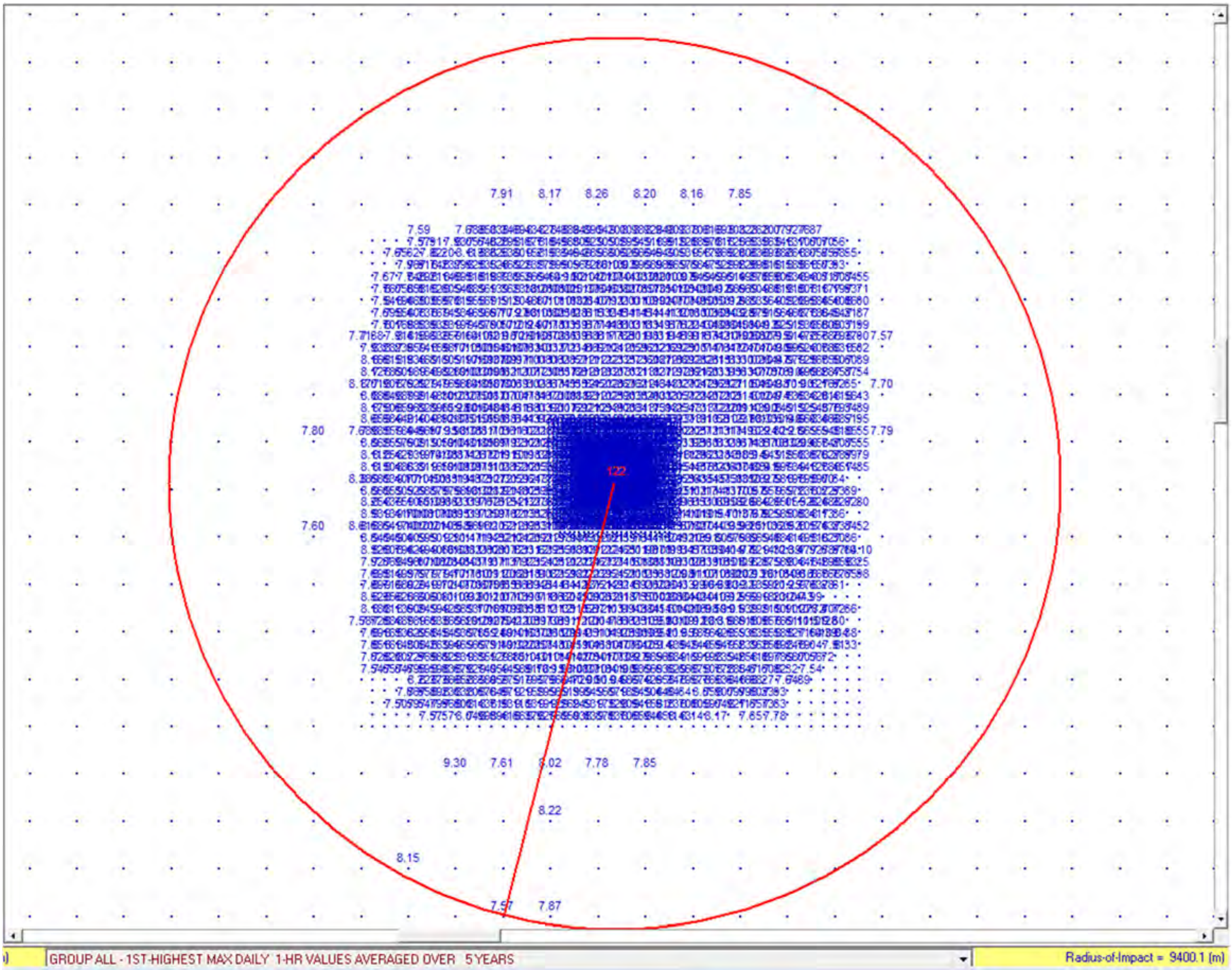


Figure 2

Source Only **PM$_{2.5}$ High 1st High 24-hr ROI: 176.6m** **Max: 3.053 µg/m^3**

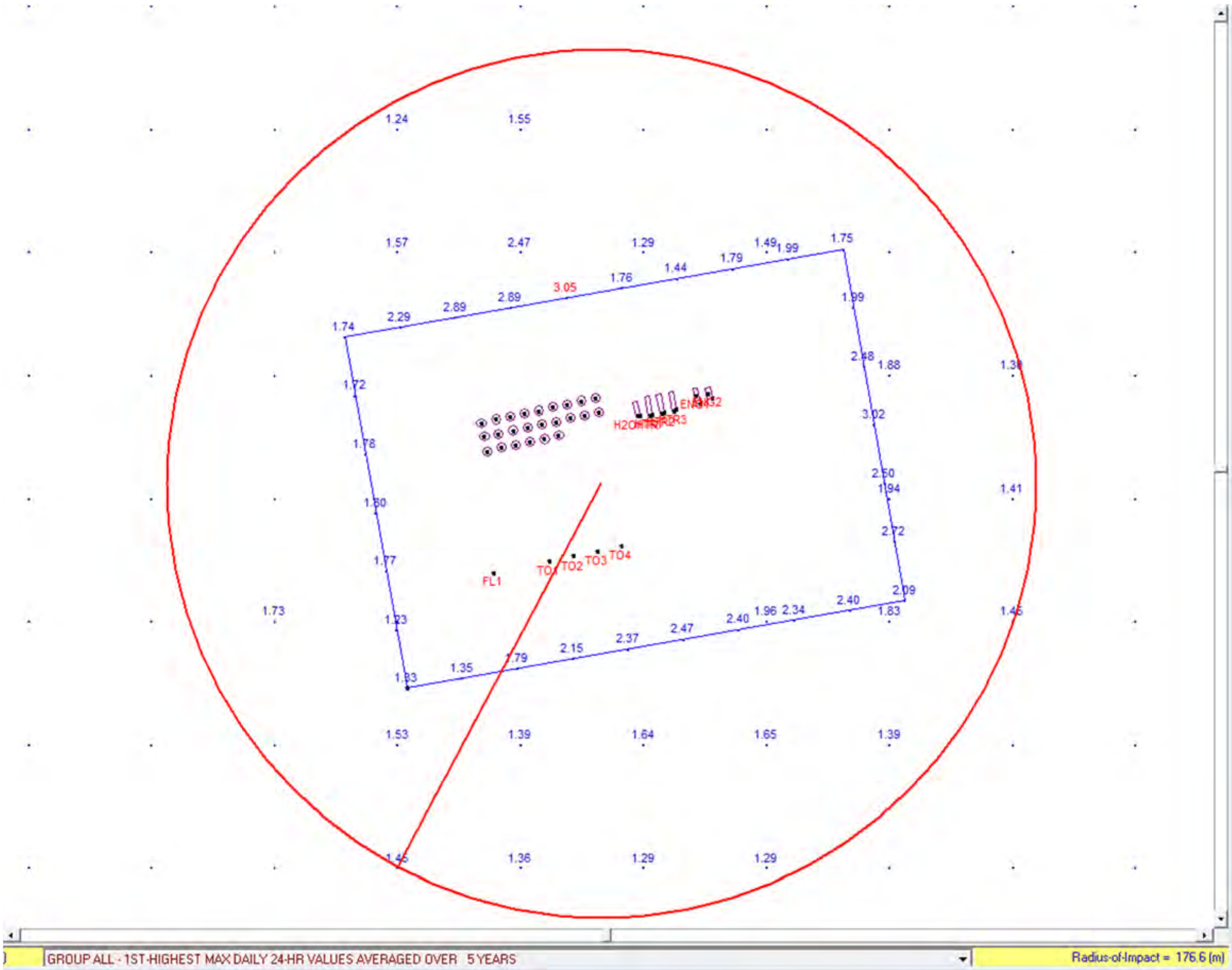


Figure 3

Source Only **$PM_{2.5}$ Annual ROI: 132m** **Max: 0.362 μg/m³**

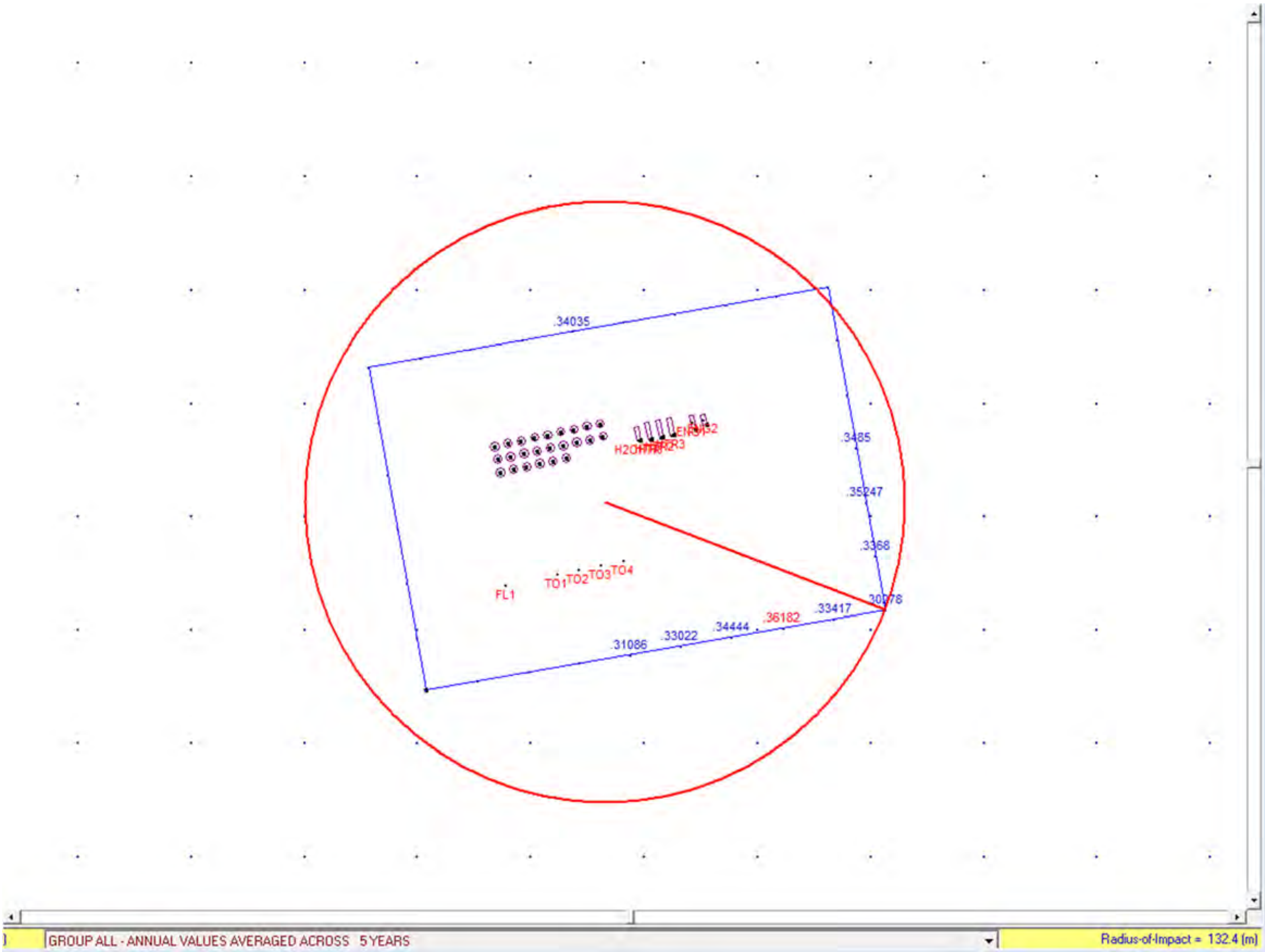


Figure 4

Source Only SO_2 High 1st High 1-hr ROI: 3,113m Max: 58.352 μg/m^3

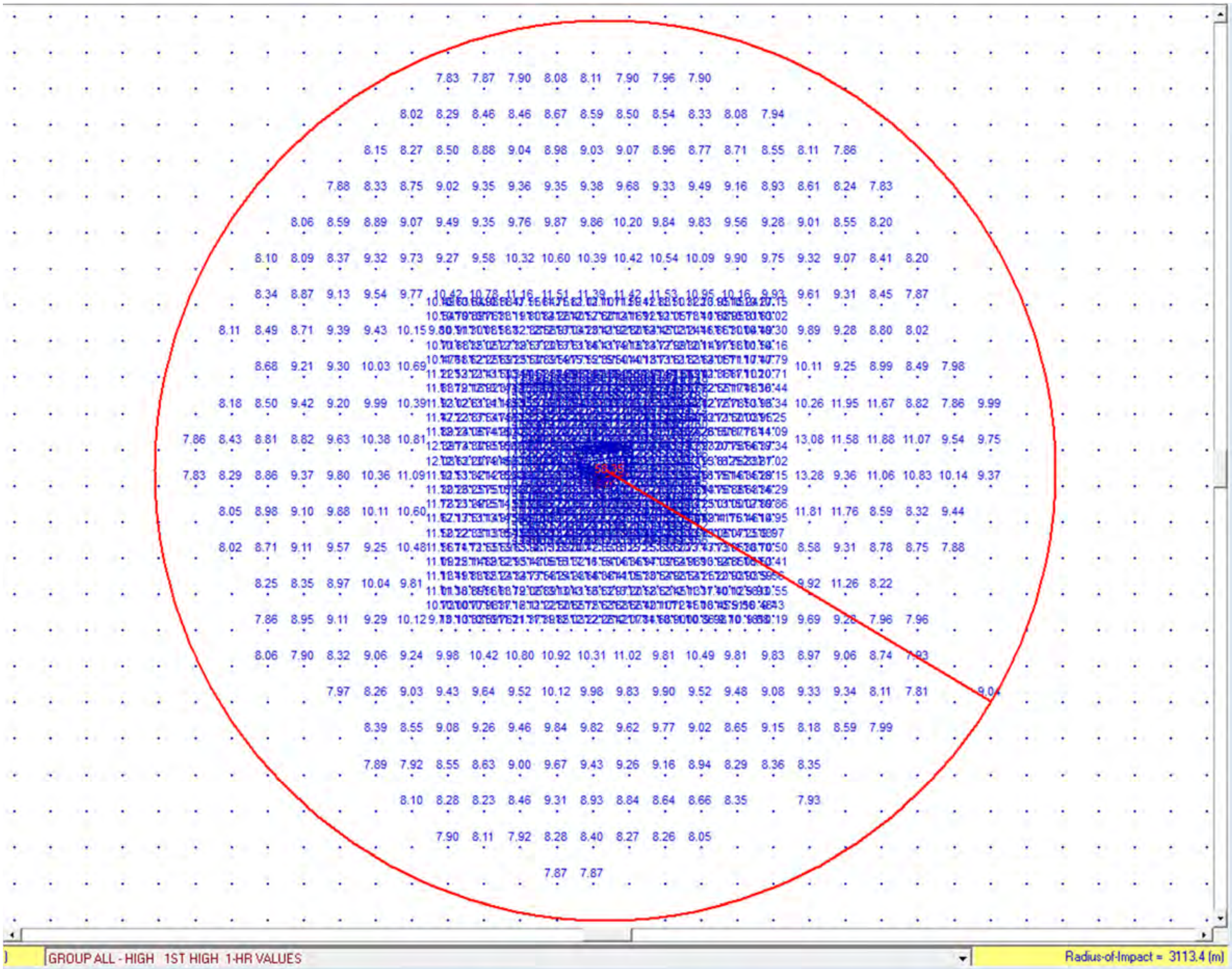


Figure 5

Source Only **SO_2 High 1st High 3-hr ROI: 265m Max: 54.626 µg/m^3**

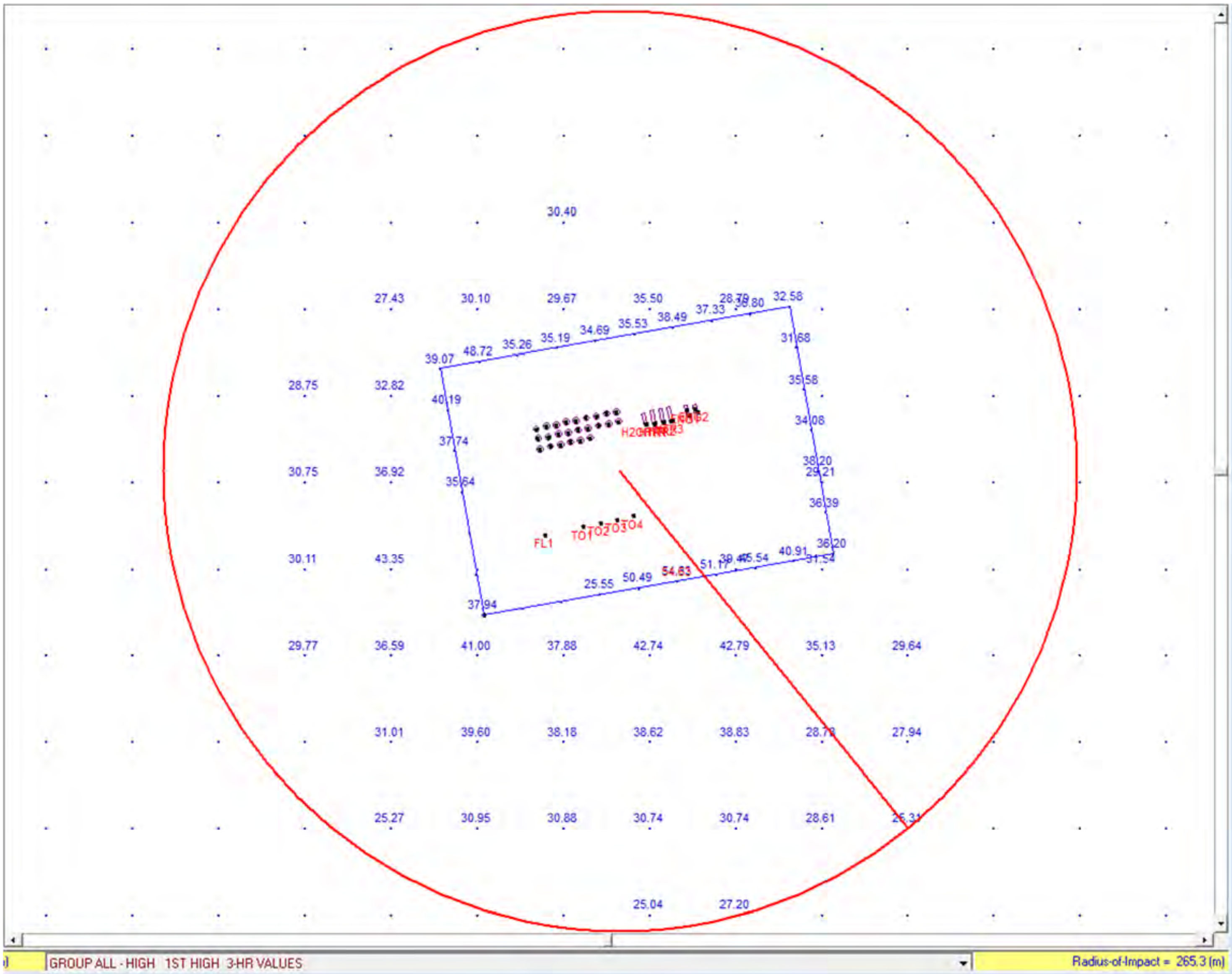


Figure 6

Source Only **SO_2 24-hr ROI: 602.8m** **Max: 35.634 µg/m³**

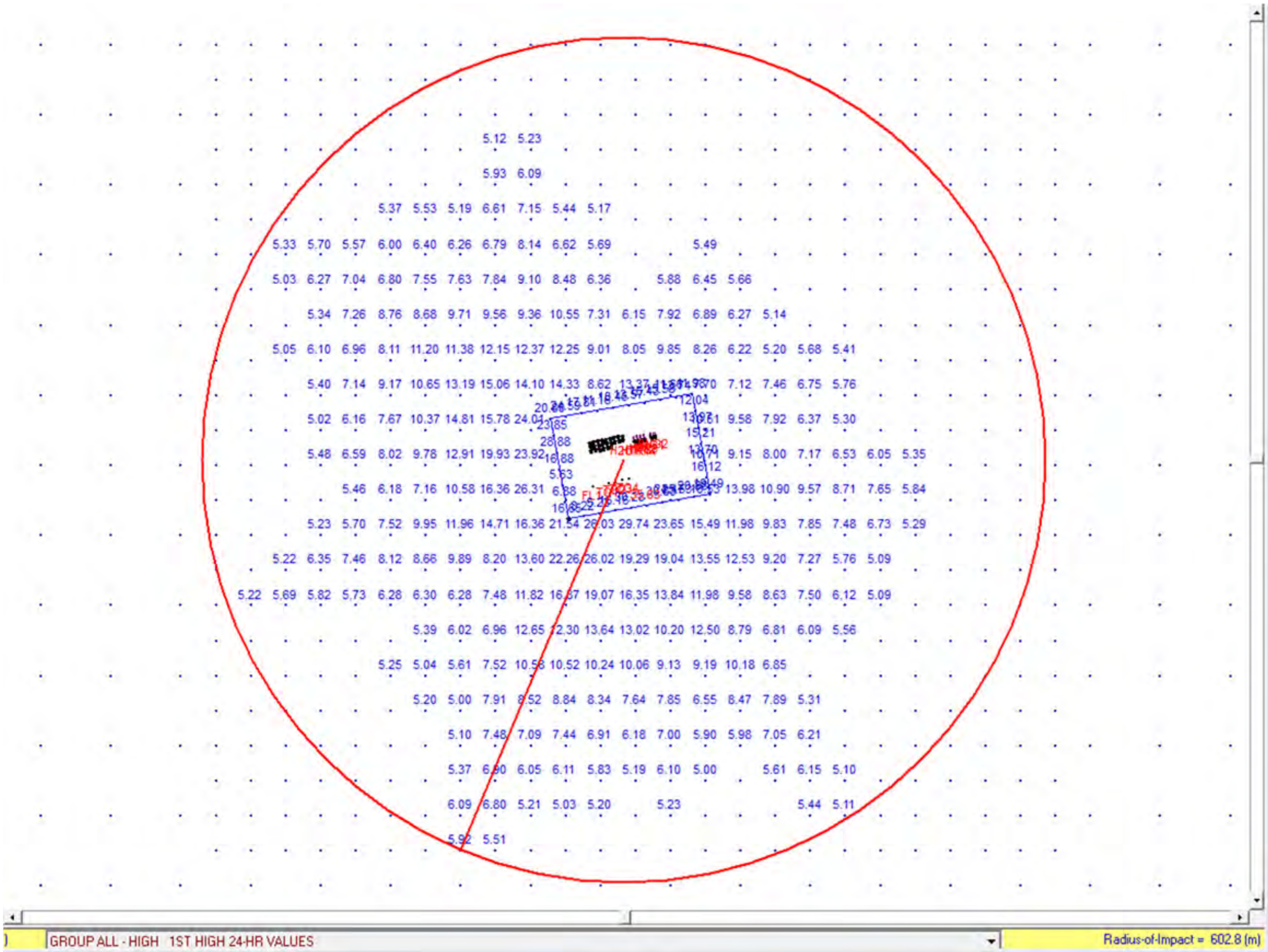


Figure 7

Source Only **SO_2 Annual ROI: 269m** **Max: 2.990 µg/m³**

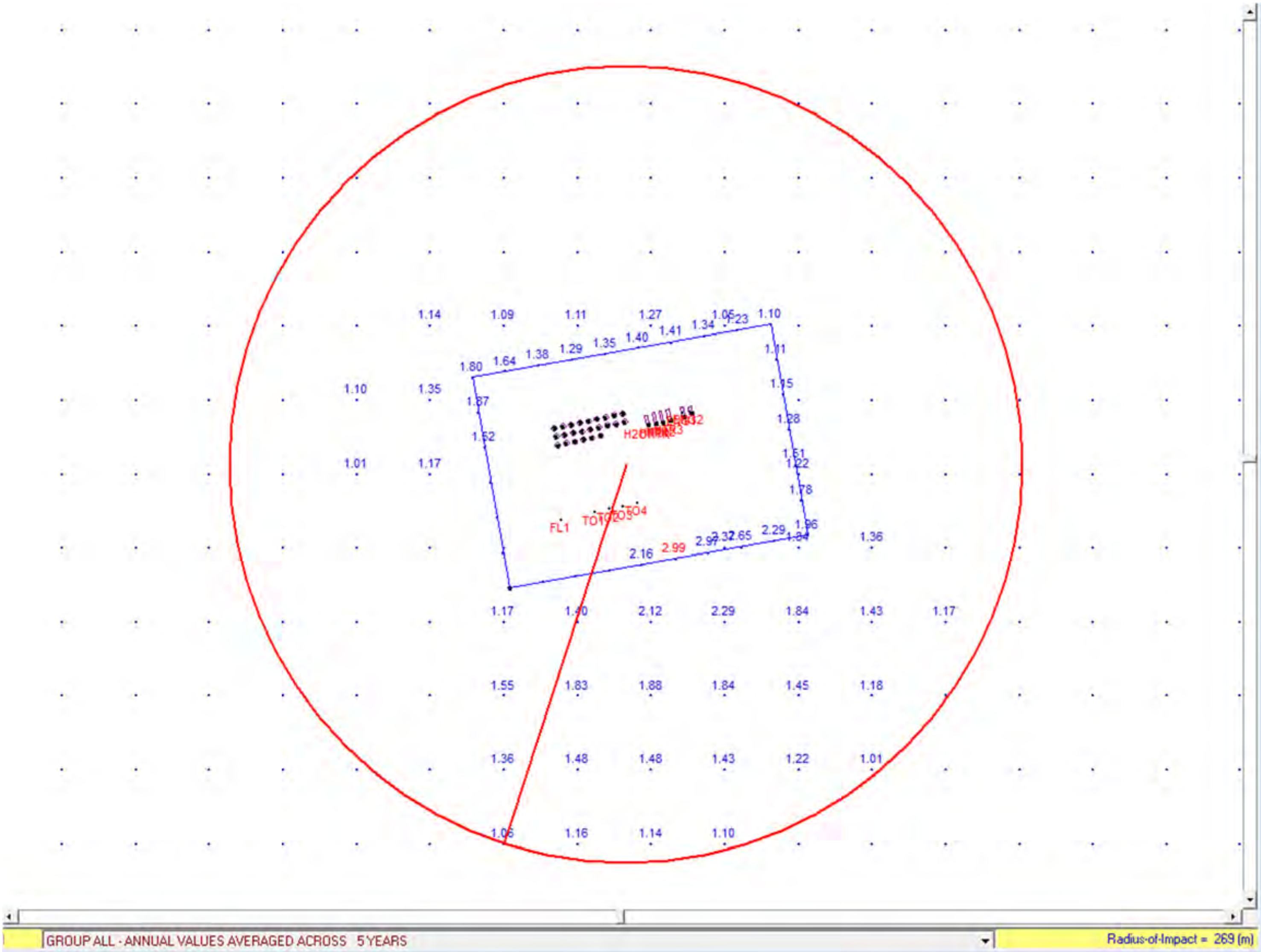


Figure 8

Source Only **NO_2 Annual Conc. Contour Map** **Max: 6.061 µg/m³**

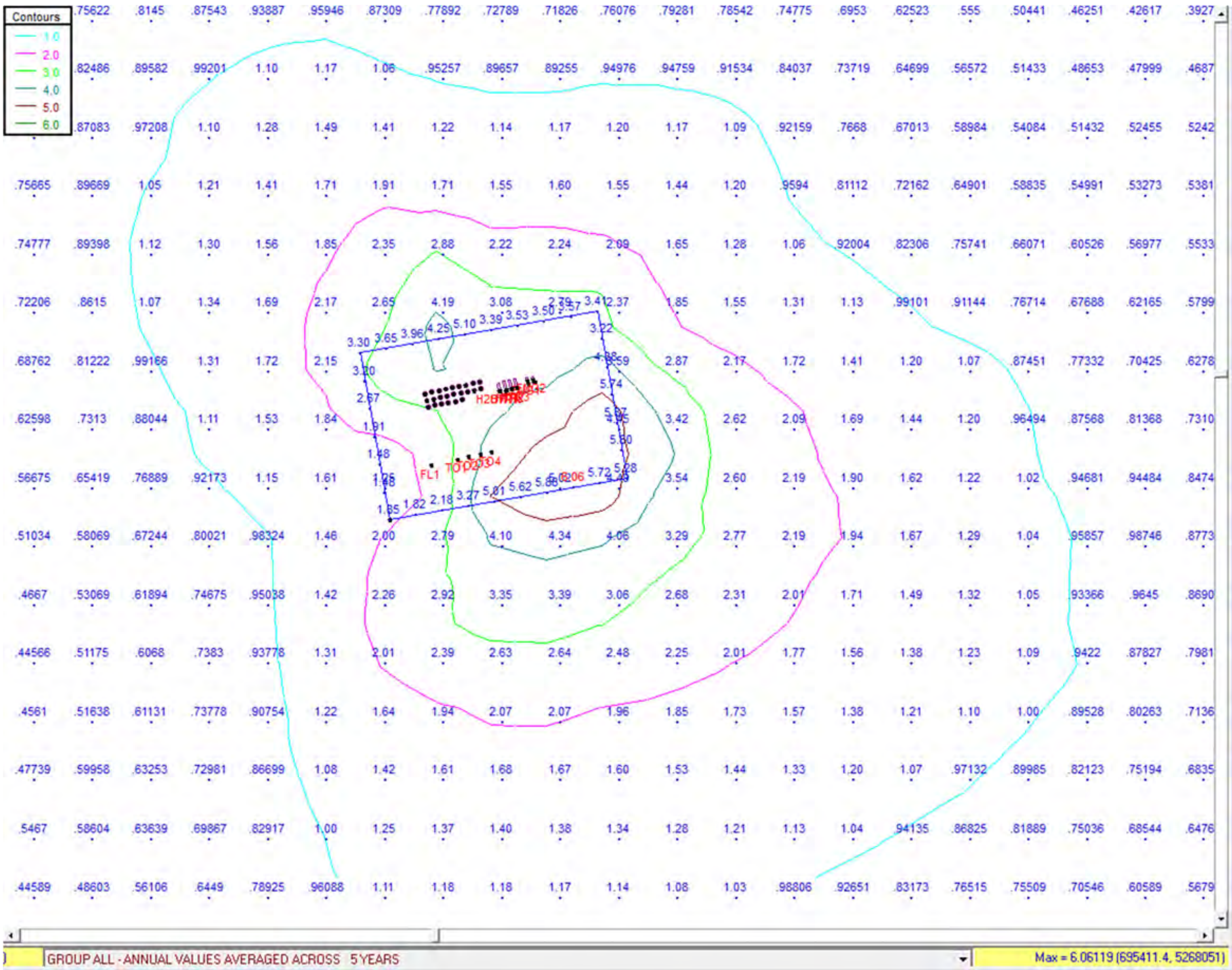


Figure 9

Source Only NO$_2$ High 1st High 1-hr Conc. Contour Map Max: 122.2 µg/m^3

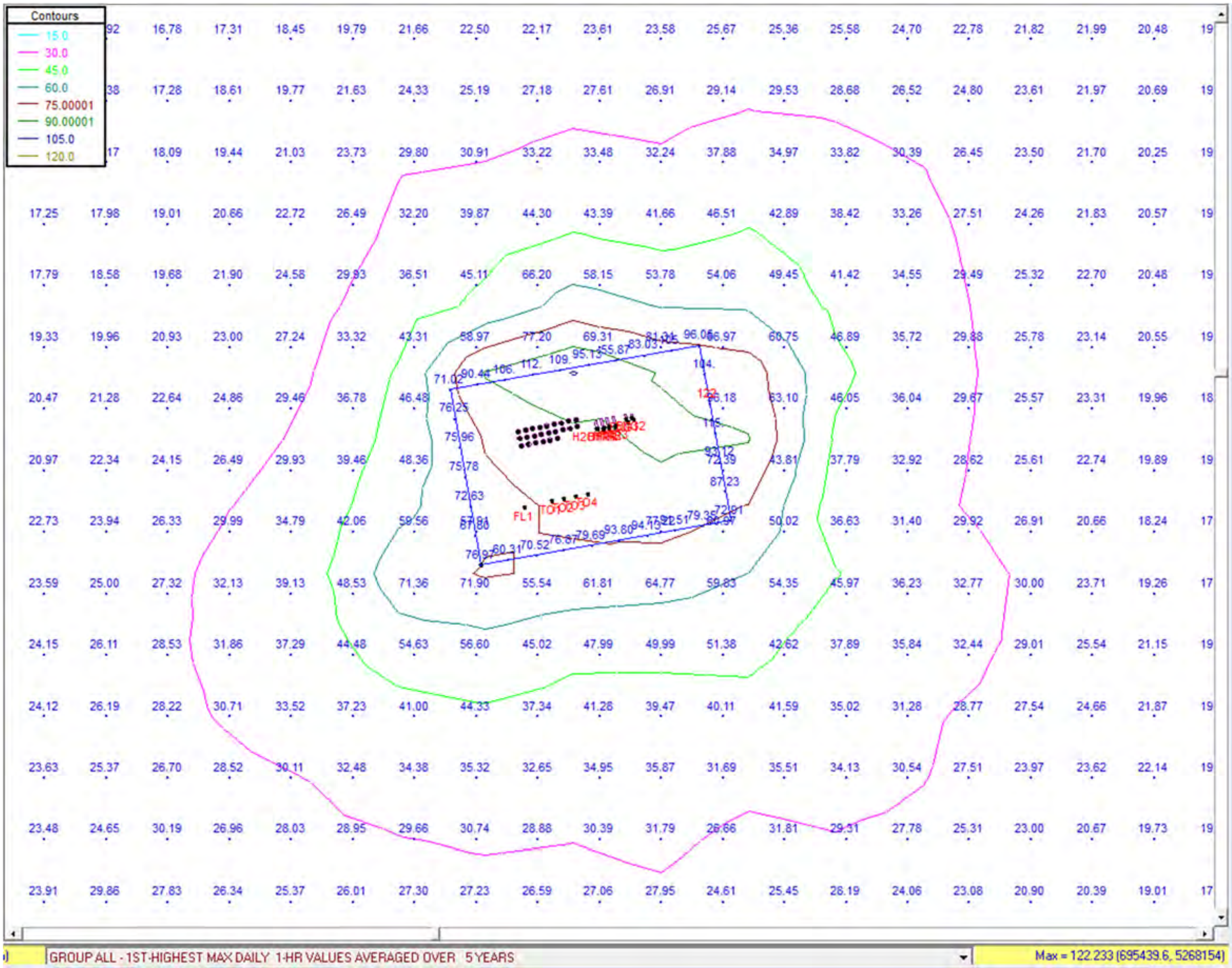


Figure 10

Source Only PM$_{2.5}$ High 1st High 24-hr Conc. Contour Map Max: 3.053 µg/m^3

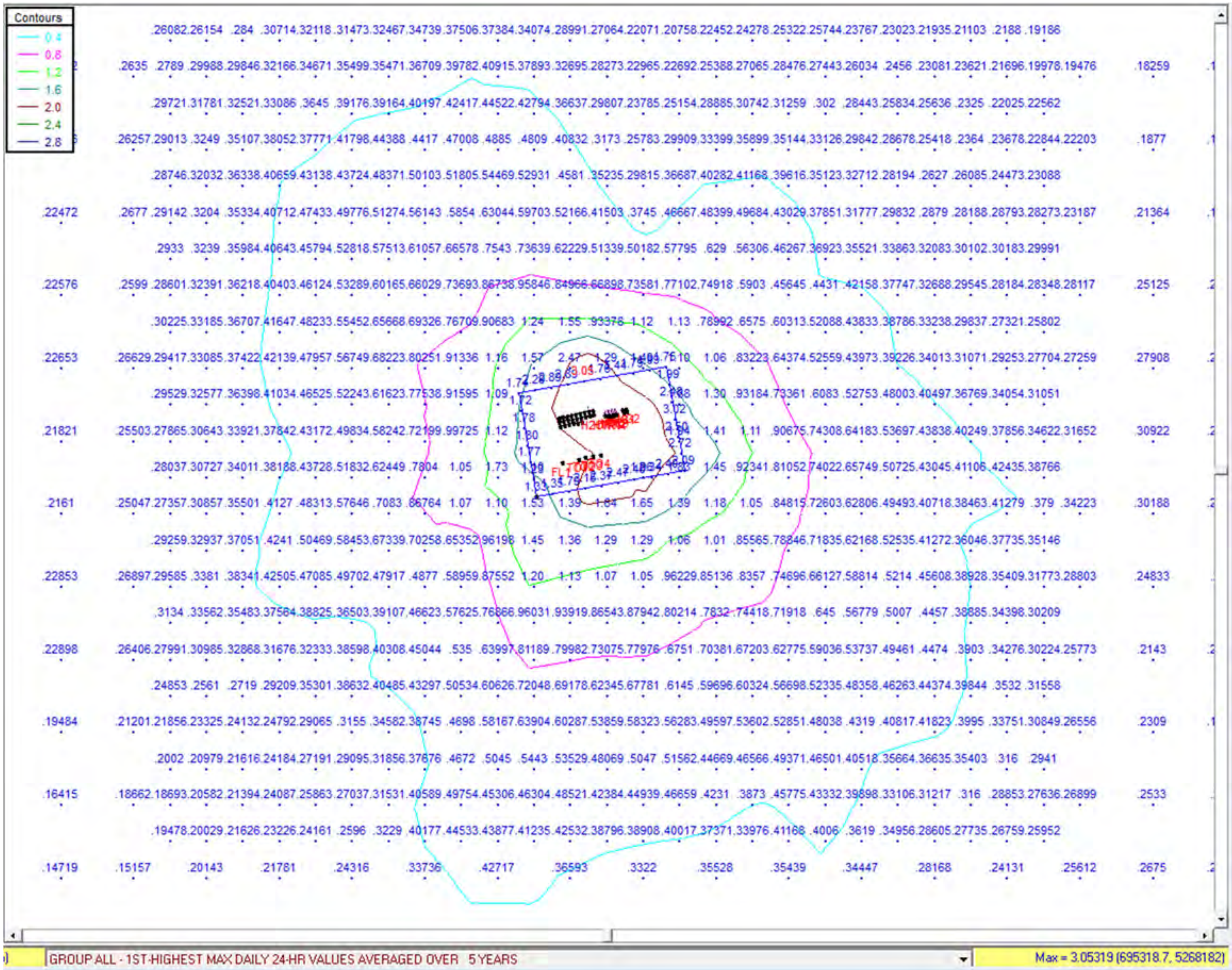


Figure 11

Source Only **$PM_{2.5}$ Annual Conc. Contour Map** **Max: 0.362 µg/m^3**

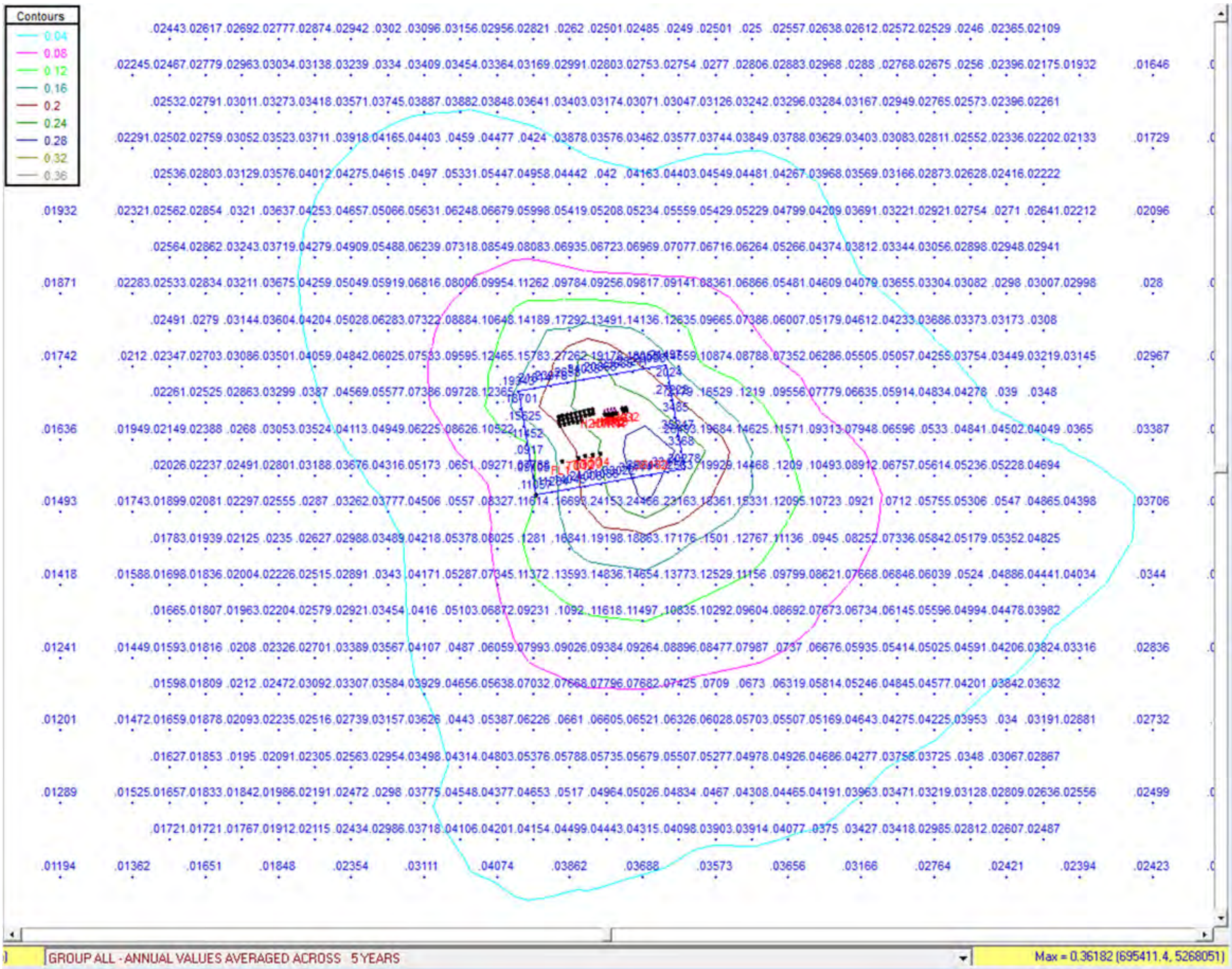


Figure 12

Source Only PM$_{10}$ High 1st High 24-hr Conc. Contour Map Max: 3.974 µg/m^3

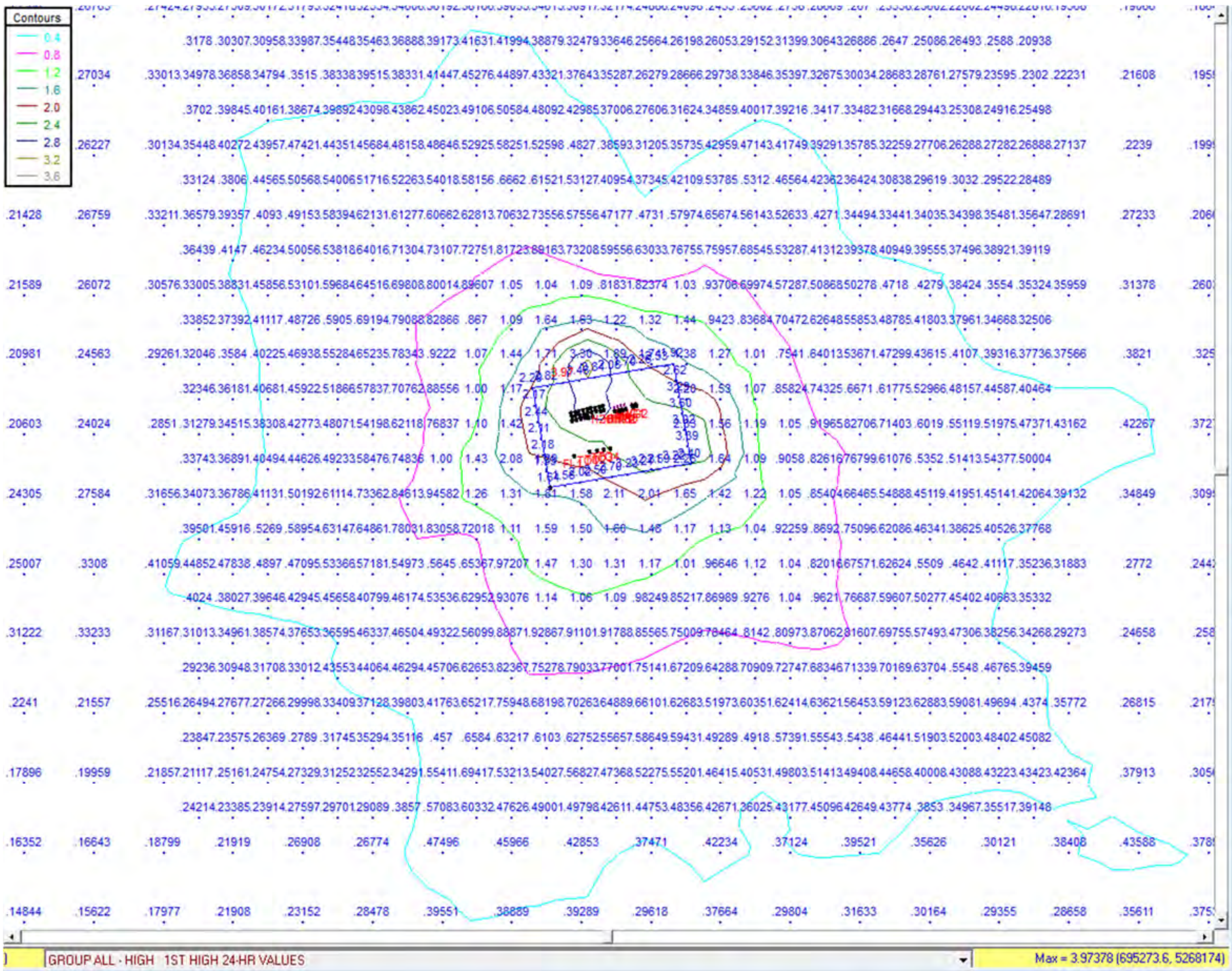


Figure 13

Source Only **PM_{10} Annual Conc. Contour Map** **Max: 0.362 $\mu g/m^3$**

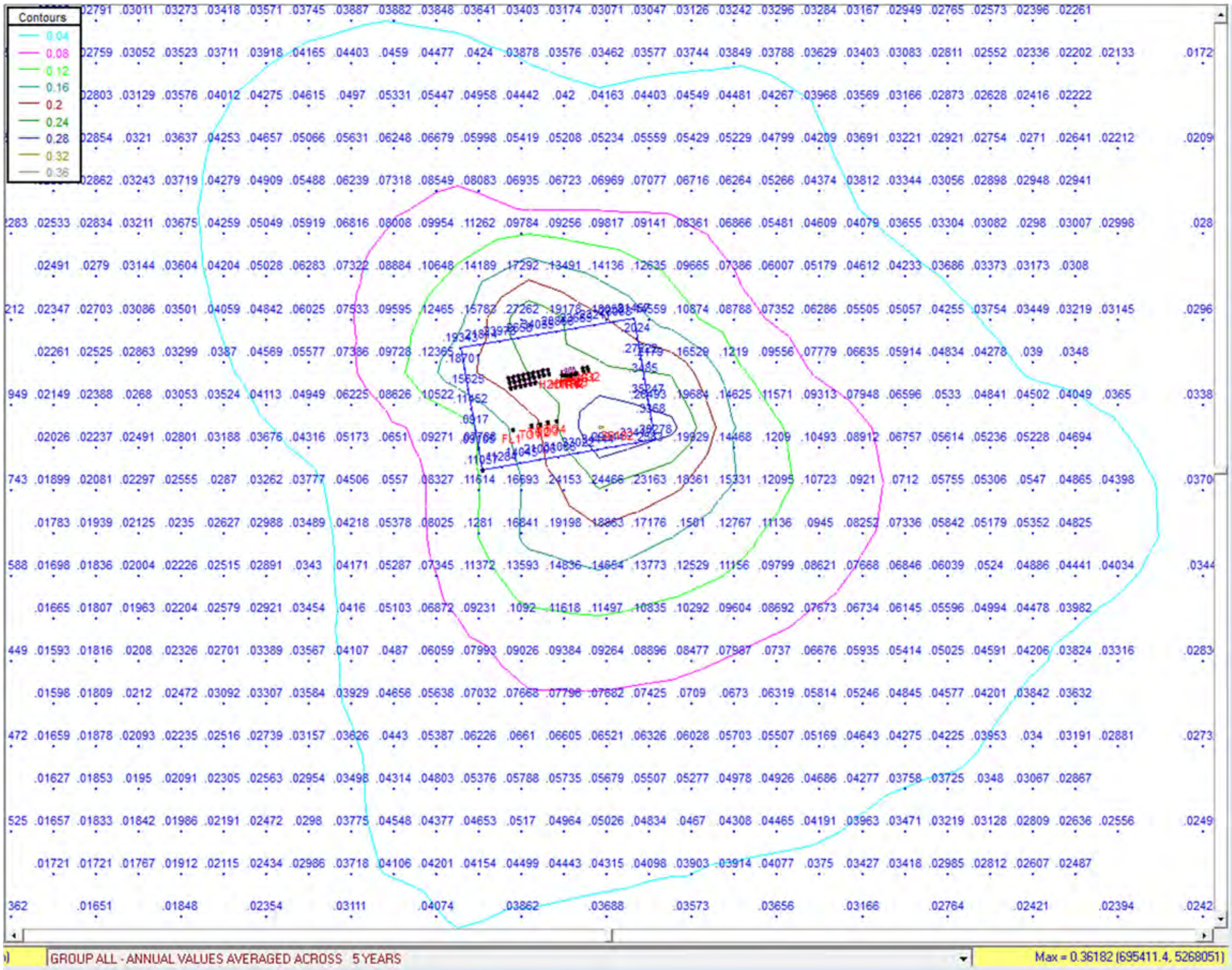


Figure 14

Source Only SO$_2$ High 1st High 1-hr Conc. Contour Map Max: 58.352 μg/m^3

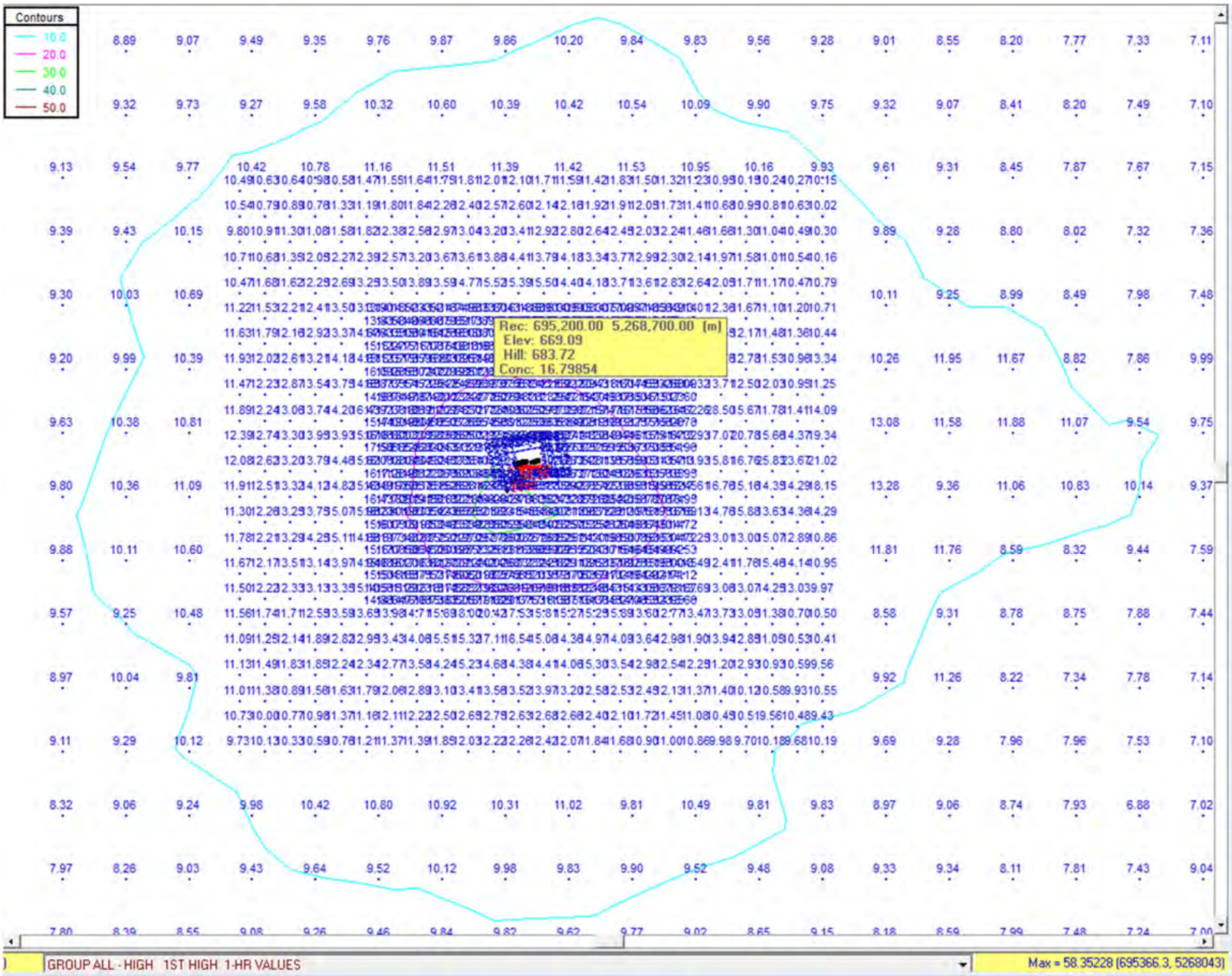


Figure 15

Source Only SO$_2$ High 1st High 3-hr Conc. Contour Map Max: 54.626 μg/m^3

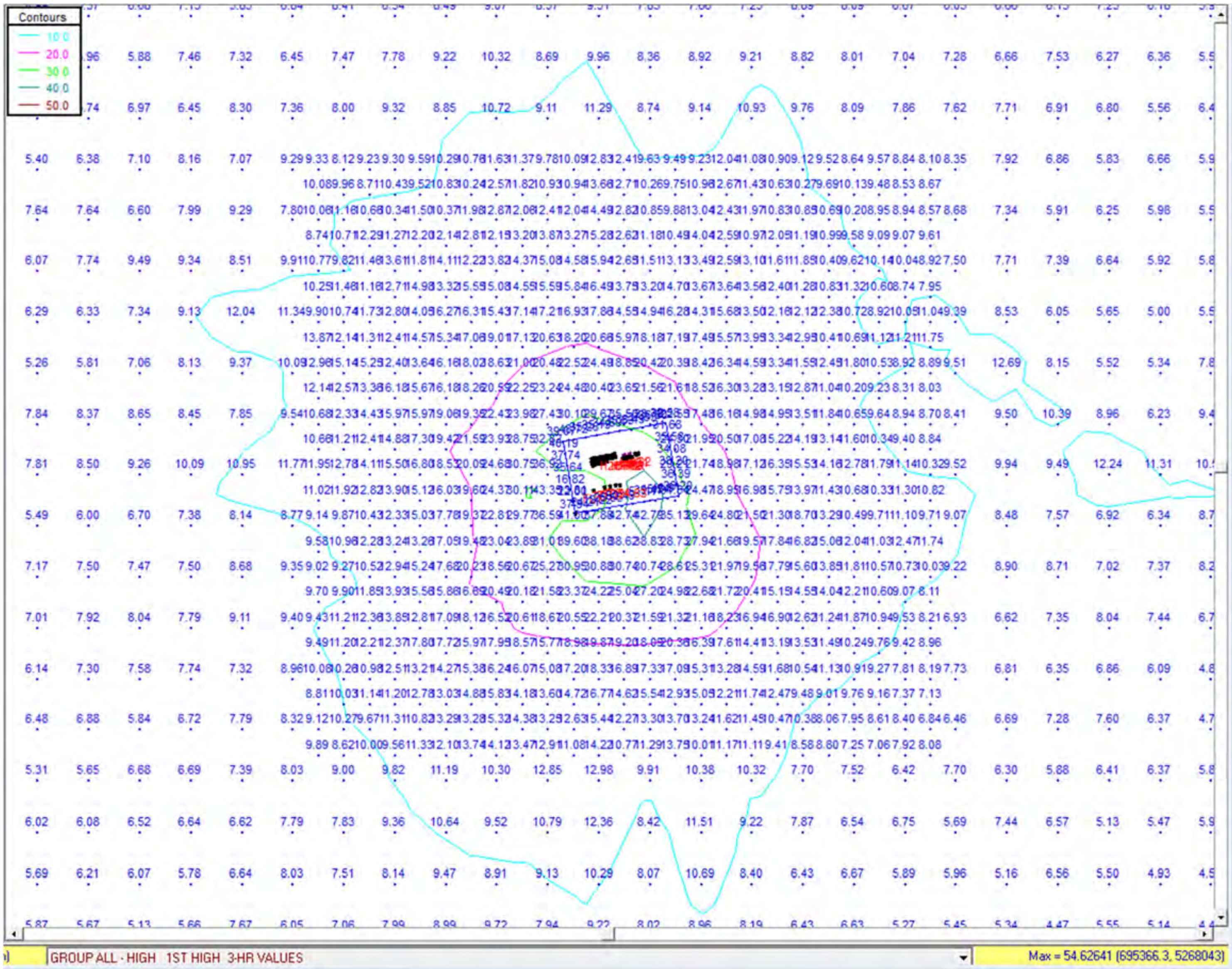


Figure 16

Source Only $SO_{2.5}$ High 1st High 24-hr Conc. Contour Map Max: 35.634 µg/m^3

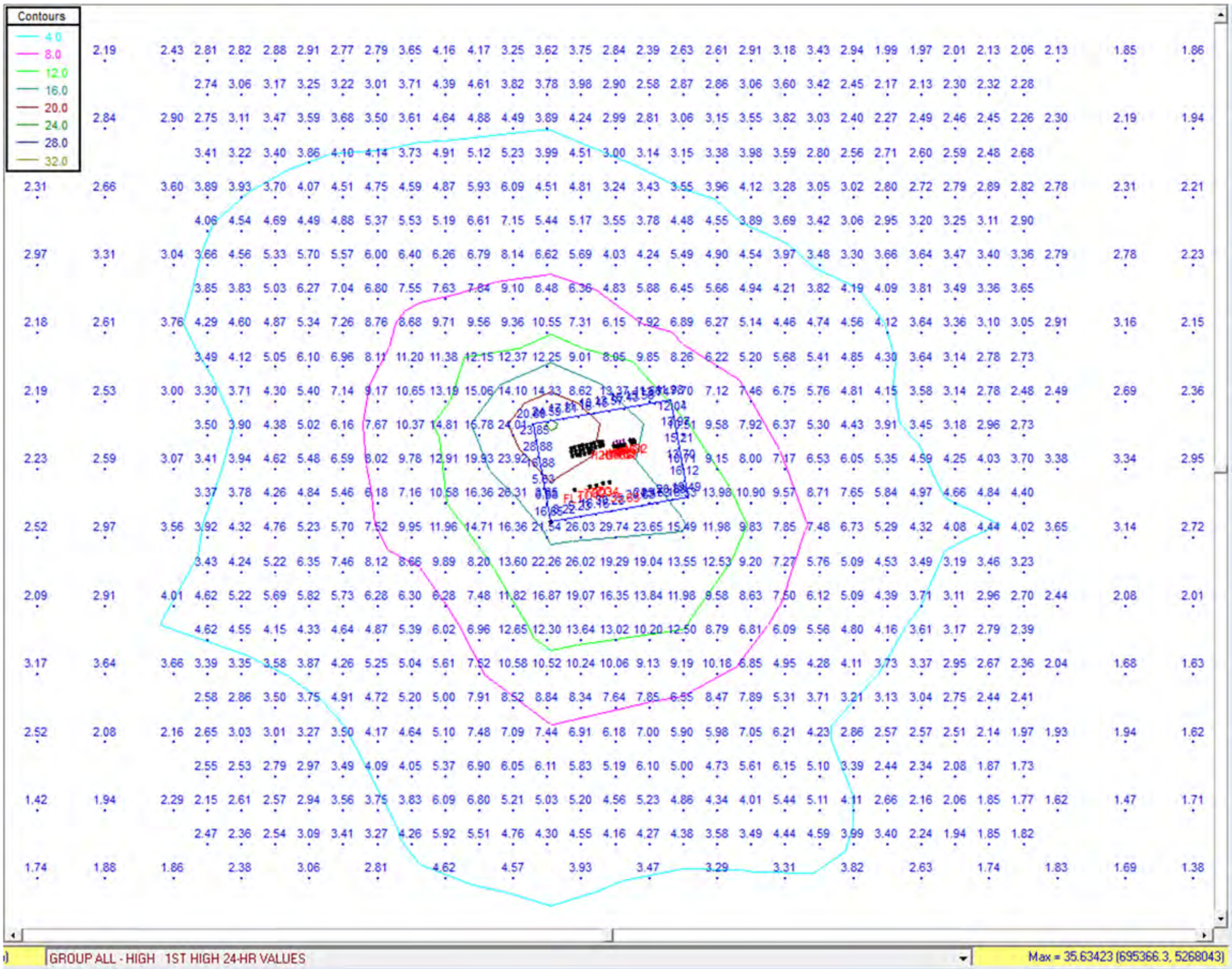


Figure 17

Source Only **SO_2 Annual Conc. Contour Map** **Max: 2.990 µg/m^3**

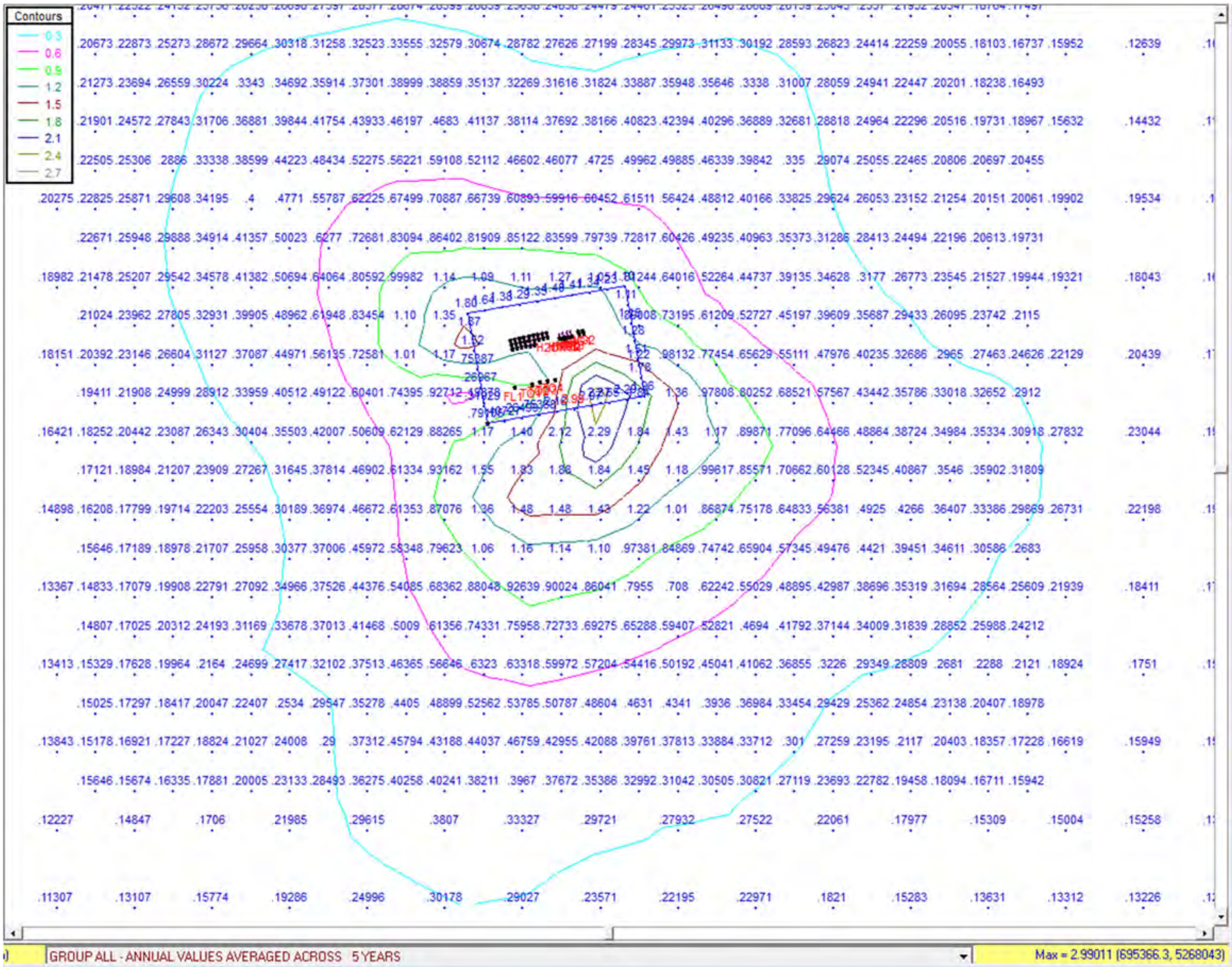


Figure 18

Source Only CO High 1st High 1-hr Conc. Contour Map Max: 293.759 µg/m^3

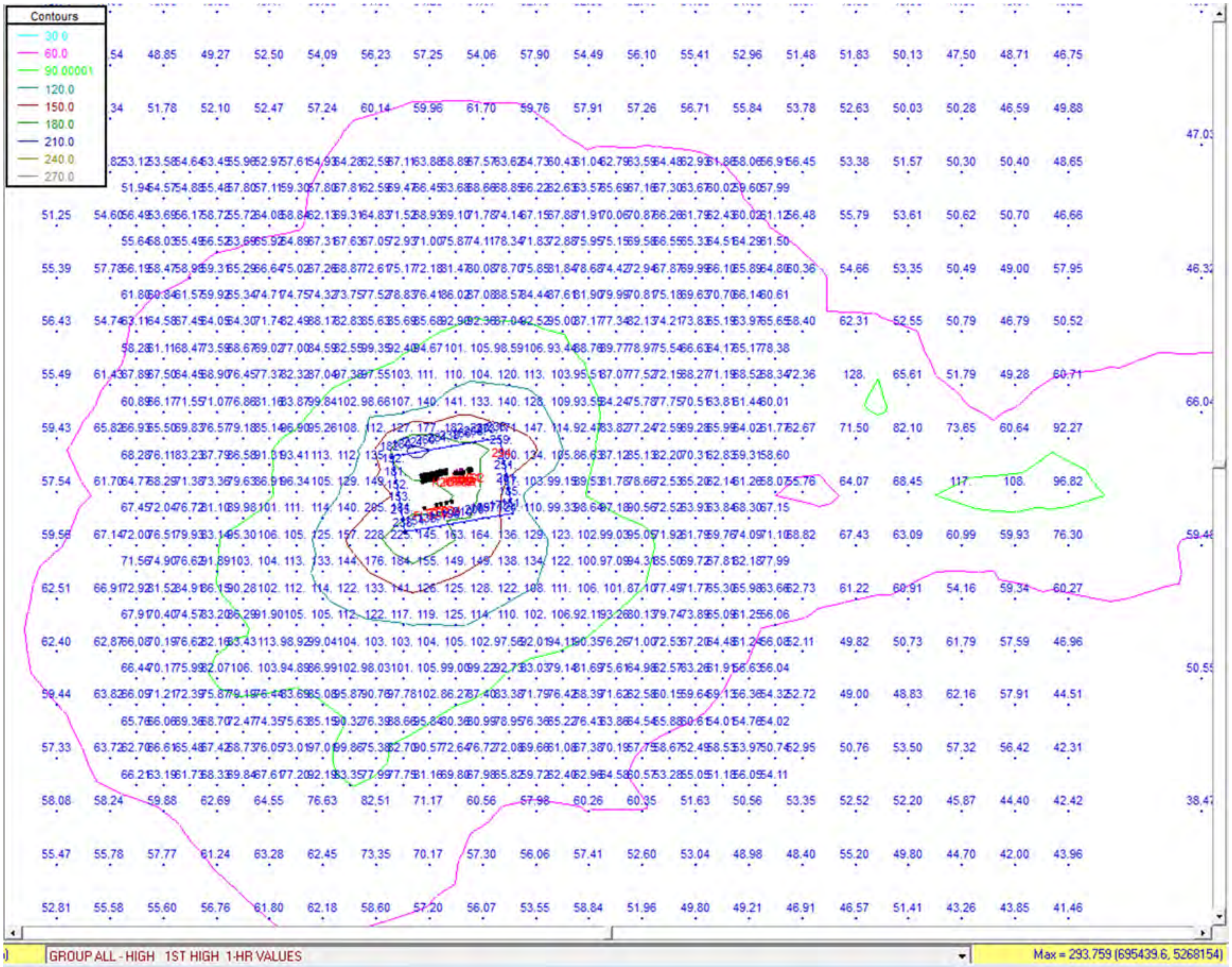


Figure 19

Source Only CO High 1st High 8-hr Conc. Contour Map Max: 224.177 μg/m³

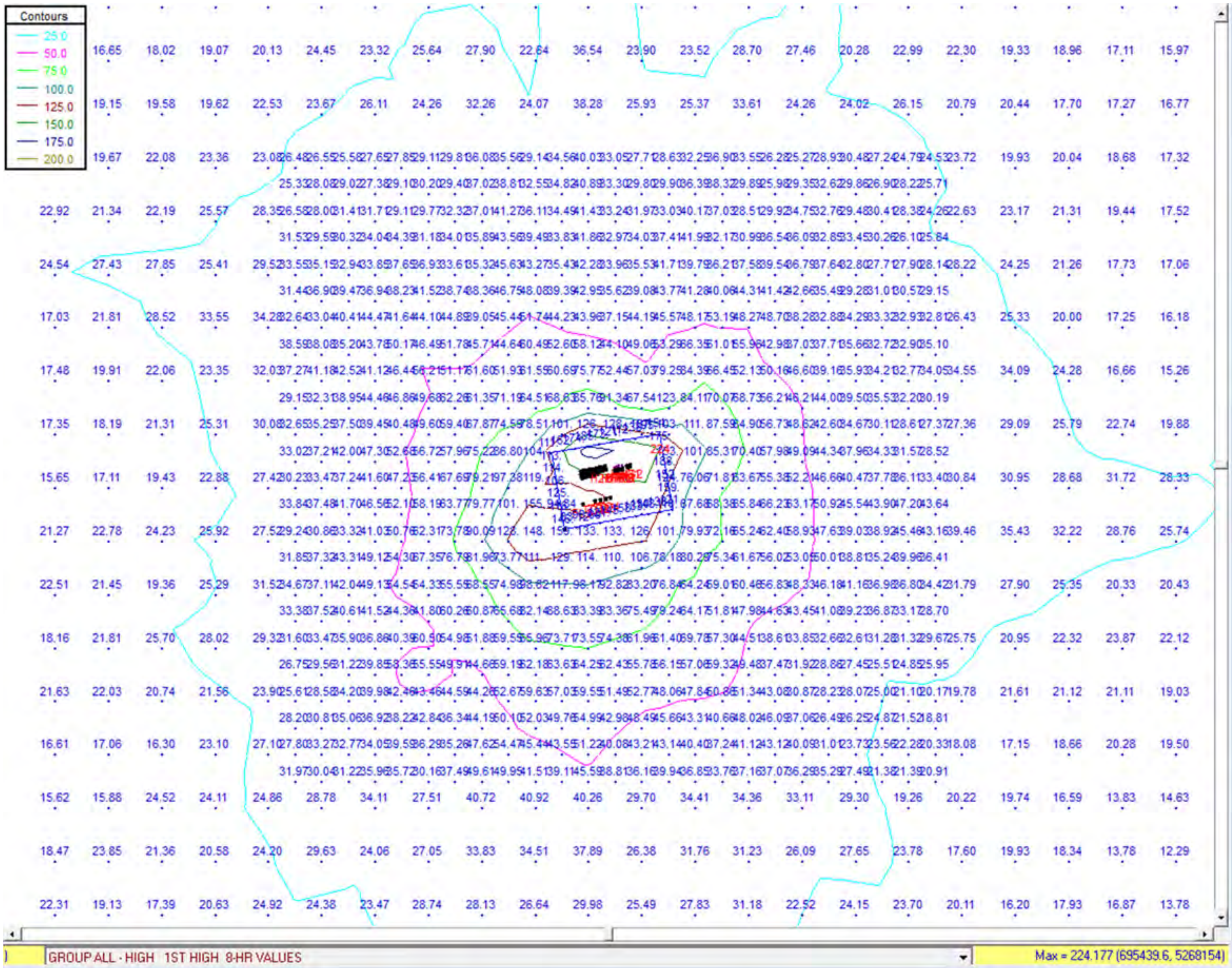


Figure 20

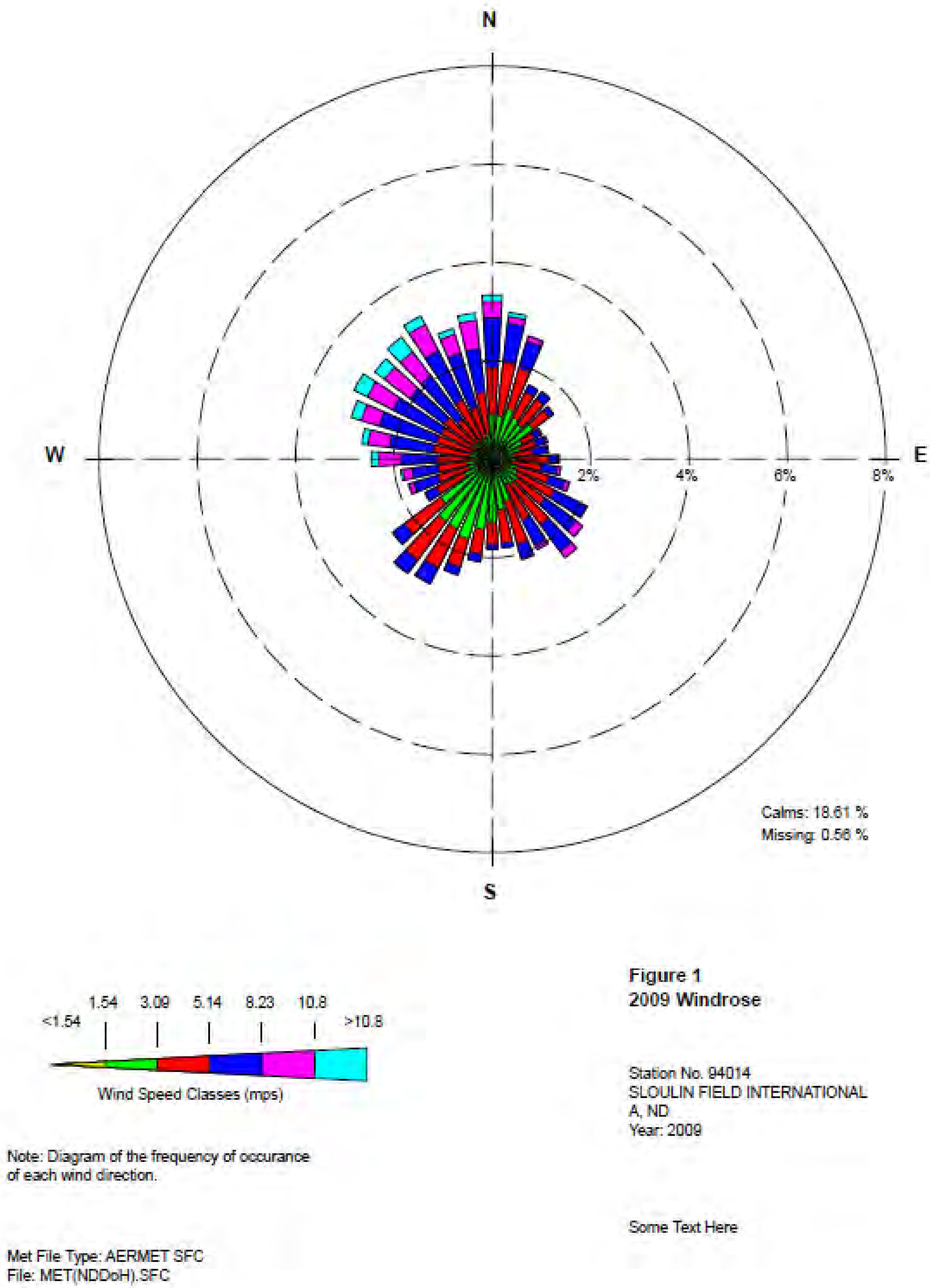


Figure 21: Wind Rose

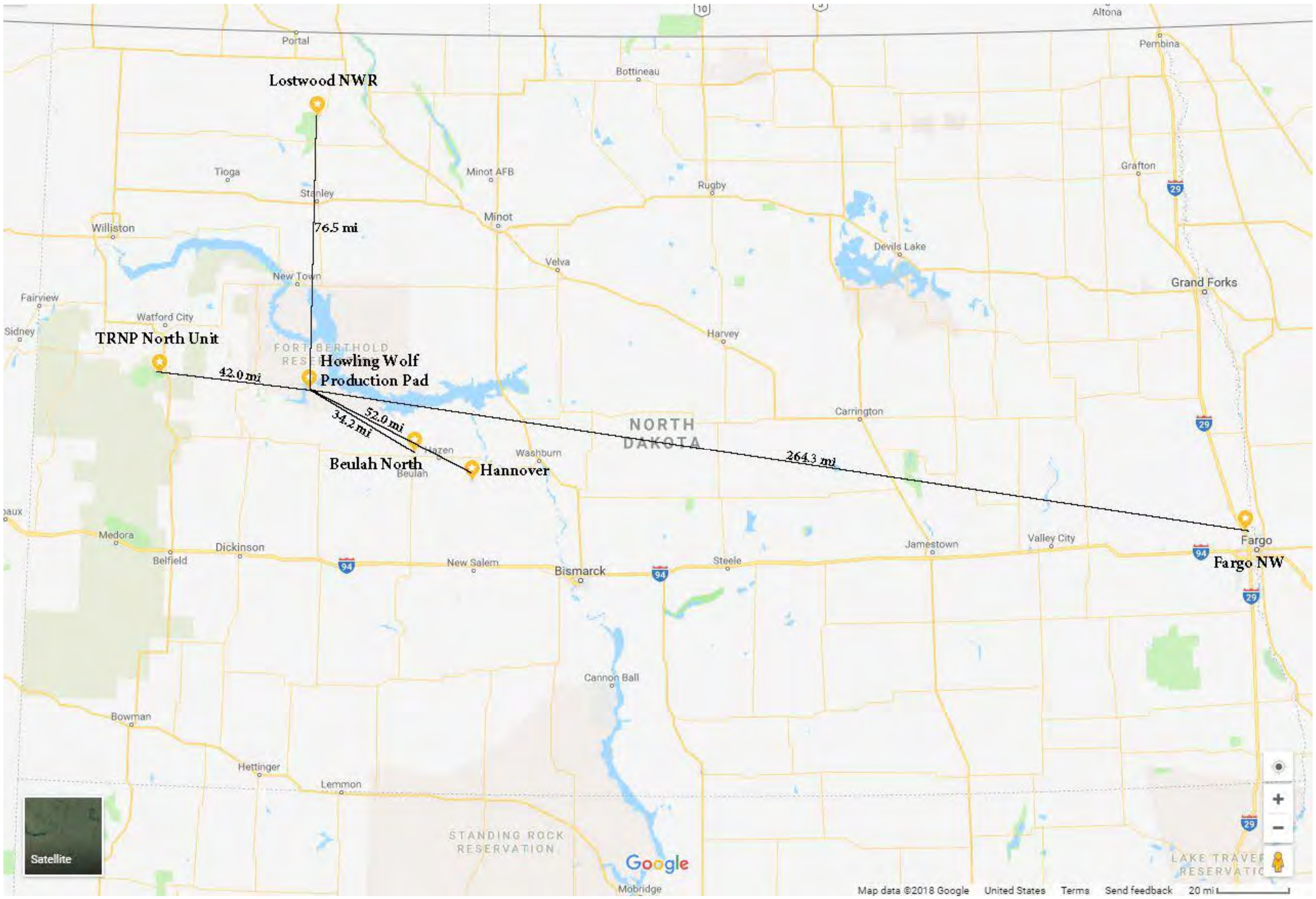


Figure 22: Background Data Sources Map & Distances to Howling Wolf Production Pad

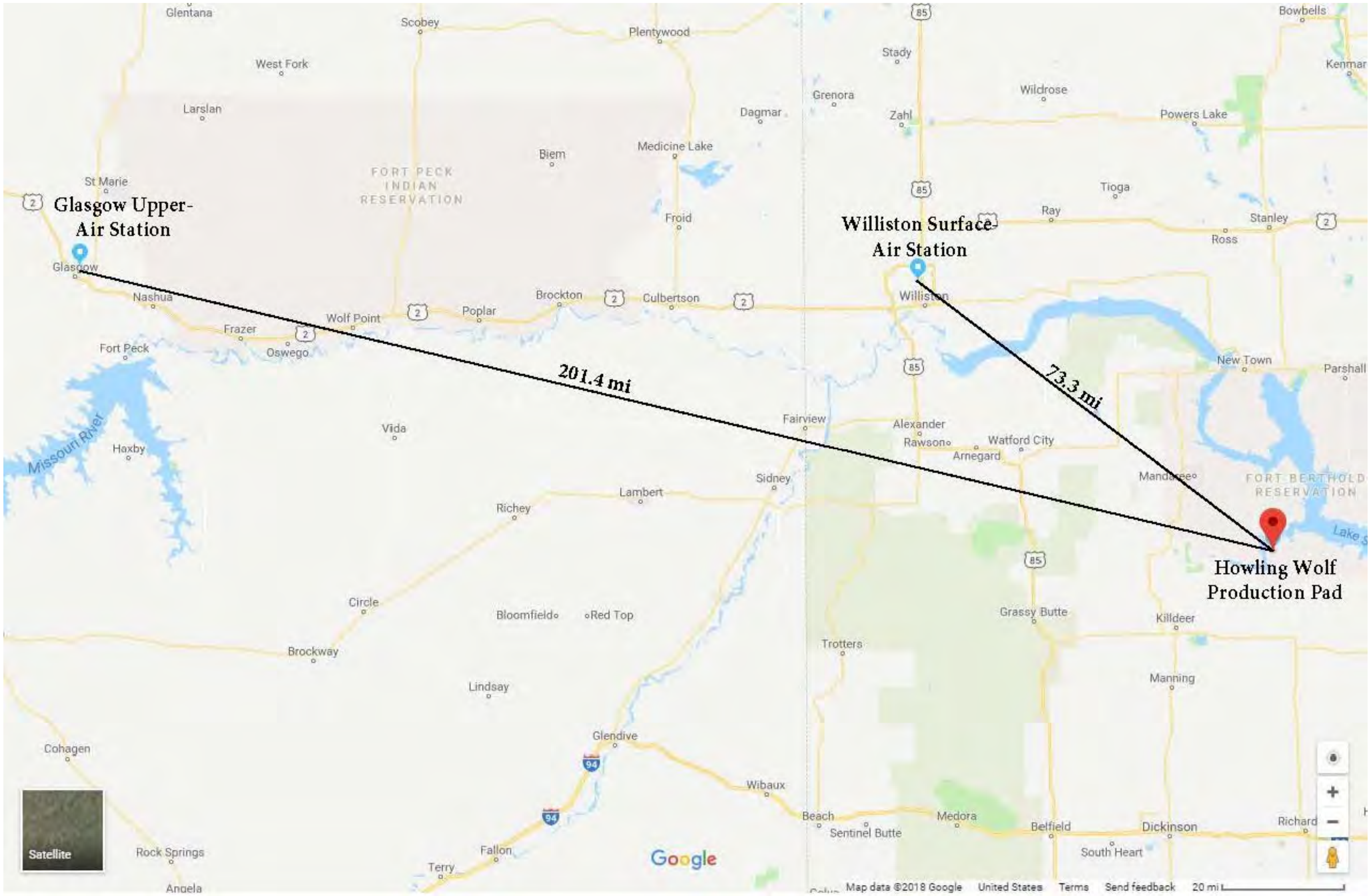


Figure 23: AERMET Data Sources Map & Distances to Howling Wolf Production Pad

Figure 24: Topographical Map of Howling Wolf Production Pad and Surrounding Area

Figure 25: Topographical Map of Howling Wolf Production Pad and Surrounding Area

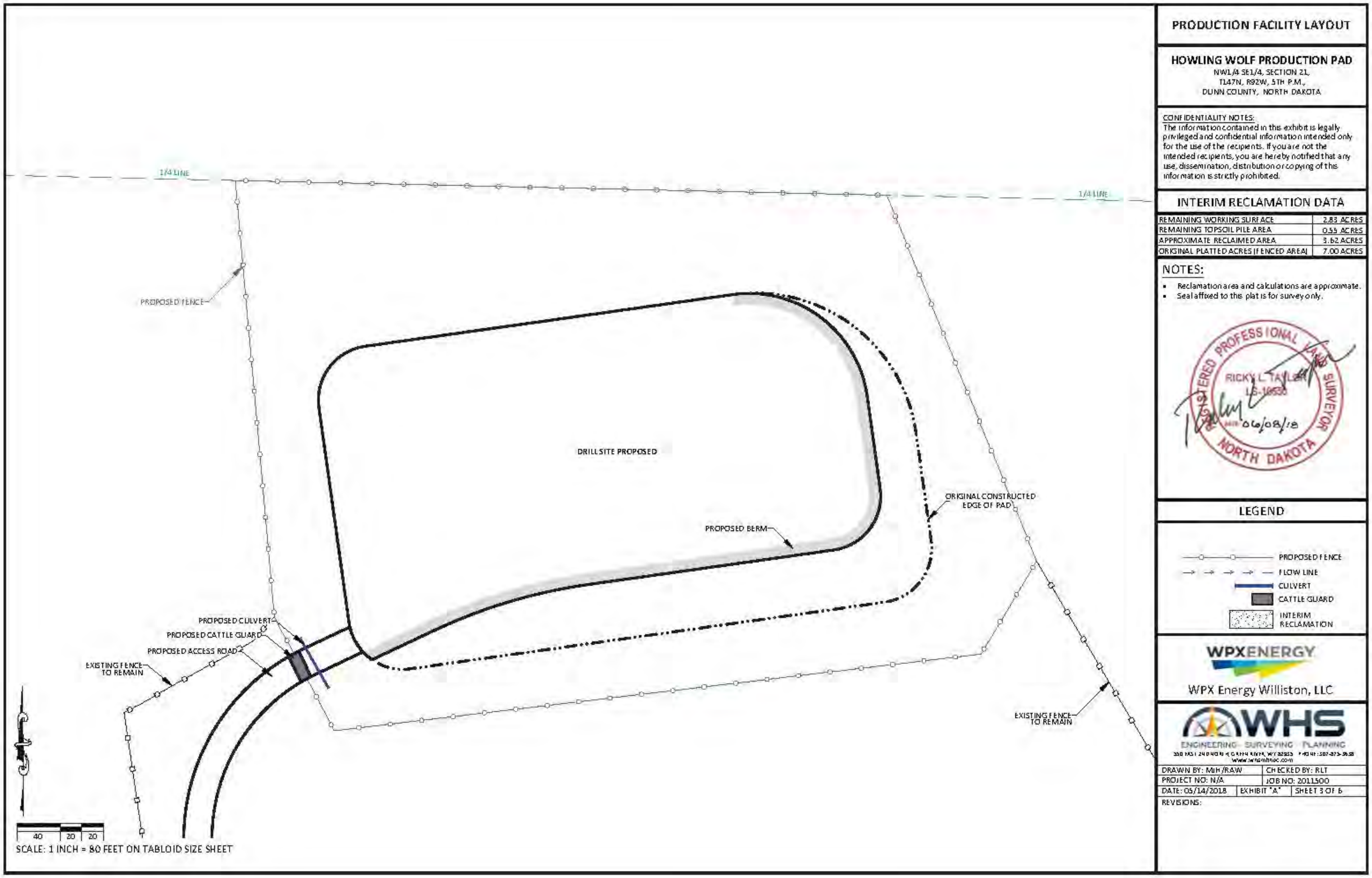


Figure 26: Howling Wolf Production Pad Construction Plat

ATTACHMENT G

Test Reports

TABLE 2.1					
SUMMARY OF QUESTOR THERMAL OXIDIZER, Q5000, UNIT #Q5000-16-91 RESULTS					
Parameter	**Maximum Load, Run - 1-Out**	**Maximum Load, Run - 2-Out**	**Maximum Load, Run - 3-Out**	**Average**	**Permit Limits**
Start Time (hh:mm:ss)	9:53:03	11:01:03	12:09:03	9:53:03	--
End Time (hh:mm:ss)	10:52:33	12:00:33	13:08:33	13:08:33	--
Run Duration (min / run)	60	60	60	60	--
Bar. Pressure (in. Hg)	25.31	25.29	25.25	25.28	--
Amb. Temp. (°F)	60	67	78	69	--
Rel. Humidity (%)	33	35	26	32	--
Spec. Humidity (lb water / lb air)	0.004349	0.005838	0.006352	0.005513	--
Stack Flow (M2) (DSCFH)	1,314,656	1,304,006	1,319,597	1,312,753	--
Stack Moisture (% Method 4)	5.8	6.3	4.6	5.6	--
Load (btu/scf)	2,226.0	2,226.0	2,226.0	2,226.0	--
VOC (ppmvd)	2.61	2.19	2.12	2.31	--
VOC (ppm@15%O_2)	4.94	4.03	3.93	4.30	--
VOC (lb/hr)	0.39	0.33	0.32	0.35	--
VOC (lb/hr Destruction)	99.99885	99.99906	99.99911	99.99901	99%
VOC (ppmvd Destruction)	99.99963	99.99970	99.99972	99.99968	--
CO_2 (%)	1.97	2.02	2.01	2.00	--
O_2 (%)	17.78	17.70	17.73	17.73	--

TABLE 2.1					
SUMMARY OF QUESTOR THERMAL OXIDIZER, Q5000, UNIT #Q5000-17-121 RESULTS					
Parameter	**Maximum Load, Run - 1-Out**	**Maximum Load, Run - 2-Out**	**Maximum Load, Run - 3-Out**	**Average**	**Permit Limits**
Start Time (hh:mm:ss)	14:18:03	15:29:03	16:35:03	14:18:03	--
End Time (hh:mm:ss)	15:17:33	16:28:33	17:34:33	17:34:33	--
Run Duration (min / run)	60	60	60	60	--
Bar. Pressure (in. Hg)	25.19	25.17	25.14	25.17	--
Amb. Temp. (°F)	82	82	76	80	--
Rel. Humidity (%)	18	20	18	19	--
Spec. Humidity (lb water / lb air)	0.005055	0.005408	0.003941	0.004801	--
Stack Flow (M2) (DSCFH)	1,412,118	1,399,480	1,539,023	1,450,207	--
Stack Moisture (% Method 4)	3.4	2.5	2.6	2.8	--
Load (btu/scf)	2,226.0	2,226.0	2,226.0	2,226.0	--
VOC (ppmvd)	9.03	15.87	12.98	12.63	--
VOC (ppm@15%O_2)	19.68	34.99	27.85	27.50	--
VOC (lb/hr)	1.46	2.54	2.28	2.09	--
VOC (lb/hr Destruction)	99.99561	99.99203	99.99408	99.99391	99%
VOC (ppmvd Destruction)	99.99879	99.99785	99.99828	99.99831	--
CO_2 (%)	1.69	1.66	1.73	1.69	--
O_2 (%)	18.19	18.22	18.15	18.19	--

AIR EMISSIONS PERFORMANCE TEST REPORT

Q-50 THERMAL OXIDIZER (TO)

Operating under MDEQ Permit No. 1680-00063
(SOURCE AA-014)

LOCATION:	
COMPANY:	
TEST DATE(S):	FEBRUARY 6, 2012
TRC PROJECT:	190377.0000.0000

TRC

Air Emissions Performance Test Report

Q-50 Thermal Oxidizer (TO)

Prepared by:

TRC

9225 US HWY 183 South
Austin, Texas 78747

TRC Project No. 190377.0000.0000

Test Date February 6, 2012

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LIST OF ACRONYMS AND ABBREVIATIONS

%	Percent
°F	Degrees Fahrenheit
CFR	Code of Federal Regulations
CEMS	Continuous Emission Monitoring System
CO	Carbon Monoxide
EPN	Emission Point Number
GFC IR	Gas Filter Correlation Infrared
LB/HR	Pounds per Hour
LB/MMBTU	Pounds per Million British Thermal Units
NO_X	Nitrogen Oxides
O_2	Oxygen
PPMV	Parts Per Million Volume
BTEX	Benzene, Toluene, Ethyl-Benzene, and Xylene's
SCFH	Standard Cubic Feet per Hour
RM	Reference Method
QA/QC	Quality Assurance/Quality Control
MDEQ	Mississippi Department of Environmental Quality
VOC	Volatile Organic Compounds
THC	Total Hydrocarbons
TO	Thermal Oxidizer
TEG	Tri-Ethylene Glycol

ASTM D7036-04 REPORT CERTIFICATION

I certify that to the best of my knowledge:

- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).
- This report includes a total of 57 pages.

Greg Wallentine
TRC Associate Project Manager

March 23, 2012

Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.

Jeffrey W. Burdette
TRC Air Measurements Technical Director

1.0 INTRODUCTION

Air emissions performance testing was conducted on a thermal oxidizer (TO) associated with two tri-ethylene glycol (TEG) dehydrators in service at this facility. TRC of Austin, Texas conducted these tests February 6, 2012.

This document presents the results for the performance testing on the TO. Table 2-1 presents the results in tabular form and Appendix 1 of this report includes detailed summaries of the test results.

Table 1-1 presents the general facility and testing information. Section 2.0 of this report describes the summary of results. Section 3.0 of this report describes the test methods used including details specific to this test program. Section 4.0 describes the QA/QC procedures that were used during the sampling phase of this testing.

1.1 Test Objectives

The purpose of this test was to determine the operational performance of the TO as it relates to the reduction of air emissions of total volatile organic compounds (VOC) and hazardous air pollutants (HAPS). The test matrix consisted of three 1-hour test runs conducted simultaneously at both the inlet and outlet of the thermal oxidizer. The methods shown in Table 1-1 were used to measure the components of interest. Table 1-2 presents a summary of the sample collection strategies used during the testing.

In addition, MDEQ Permit 1680-00063, for Emission Point AA-014 (thermal oxidizer), Condition S-3, requires to determine a monitored operating parameter value for the thermal oxidizer (TO) which can be used to demonstrate compliance with the HAPs and VOC limitations. The TO manufacturer (QTI) and CEP believe that stack temperature would be a viable monitored operating parameter to demonstrate compliance. To that end, the TO was operated at stack temperature of 1200°F during the first one- hour performance test, increased to 1325°F during the second one-hour performance test, and then increased to 1450°F during the third one-hour test run in order to observe the effects (if any) on the emissions of HAPs and VOC.

1.2 Process Description

operates a thermal oxidizer which is used to reduce VOC and HAPS from the dehydration of rich glycol. The glycol dehydration process produces a waste gas stream that serves as the inlet feed to the thermal oxidizer. The thermal oxidizer uses pipeline grade sweet natural gas in order to maintain a sufficient firebox temperature which then oxidizes volatile organic compounds contained in the inlet gas stream.

The exhaust gas from the thermal oxidizer is vented to atmosphere through a 13 inch inside diameter exhaust stack located approximately 40 feet above natural grade. Two sample ports which meet EPA requirements are provided at approximately 33.5-ft. Access to the sample ports was achieved with a mechanical personnel lift.

Table 1-1. General Facility and Testing Information

Source Owner	
Source Operator	
Source Location	
Contact Person	
Contact Email Address	
Type of Process To Be Sampled	Thermal Oxidizer used to reduce waste gas emissions from two TEG dehydrators.
Person Responsible for Report	Greg Wallentine
TRC Field Staff	Greg Wallentine Marc Christal
Telephone Number	(512) 243-0202
Fax Number	(512) 243-0222
Company Name	TRC Environmental Corporation
Address	9225 US HWY 183 South Austin, Texas 78747
Test Methods To Be Performed	EPA Method 1 – velocity point locations EPA Method 2 – flue gas velocity measurements EPA Method 4 – exhaust gas moisture content EPA Method 18 – hydrocarbon concentration EPA Method TO-15 – fuel/waste gas composition
Date(s) of Test	February 6, 2012

Table 1-2. Performance Test Methods

Parameter	Test Method	Measurement Technique	Modifications to Method
VOC	EPA Method 18	Gas Chromatography (GC)	Samples collected in evacuated Summa Canisters
THC	EPA Method TO-15	Gas Chromatography (GC)	Samples collected in evacuated Summa Canisters

2.0 SUMMARY OF RESULTS

Table 2-1 contains the test results in tabular format. Detailed summaries of results are presented in Appendix 1. Detailed descriptions of the procedures used to determine the EPA test method measurements are presented in Section 3.0 of this report. The test matrix consisted of three 1-hour test runs conducted simultaneously at both the inlet and outlet sample ports of the thermal oxidizer.

MDEQ Permit 1680-00063 permit limitations for the TO are given below:

VOC- 0.37 lb/ hr and 1.34 tons/ yr

HAPs- 0.53 tons/ yr (no lb/hr limitation)

As shown in Table 2-1, the performance test results indicate HAPs and VOC levels are well below the permit limitations.

The performance of the thermal oxidizer at various stack temperatures is also summarized in Table 2-1. Increasing the TO stack temperature above 1200°F slightly increases the VOC/ HAPs destruction efficiency but does not warrant higher operating temperatures. Operating the TO at a stack temperature above 1200°F demonstrates compliance with the VOC and HAPS limitations.

Table 2-1. Executive Summary

Parameter	Results of 1 hour Test Runns			Thermal Oxidizer Overall Performance (3- 1hour avg.)
	Thermal Oxidizer Stack Temperature @ 1200°F Set Point	Thermal Oxidizer Stack Temperature @ 1325°F Set Point	Thermal Oxidizer Stack Temperature @ 1450°F Set Point	
VOC (lb/hr)	0.0011	0.0013	0.0013	0.0012
VOC (tons/yr) *	0.0049	0.0055	0.0059	0.0054
HAPs (lb/hr)	0.0000142	0.0000012	0.0000025	0.000006
HAPs (tons/yr) *	0.0000624	0.0000051	0.0000144	0.0000262
% VOC Reduction Efficiency	99.977+	99.996+	99.997+	99.997+
% HAPs Reduction Efficiency	99.999+	99.999+	99.999+	99.999+

* tons/ yr based on 8,760 hr/yr TO operation

3.0 PROCEDURES

The performance testing for the unit consisted of three 1-hour test runs conducted simultaneously at both the inlet and outlet test ports.

3.1 Analytical Technique

The stack velocity determination per Method 2 was used to determine the stack volumetric flow rate. The moisture content of the exhaust was measured by Method 4. The moisture content was used to correct the wet basis VOC results to dry basis results.

EPA Method 18 analysis on integrated grab samples collected in SUMMA canisters was chosen to characterize the inlet hydrocarbon concentrations due to the high levels that were expected. ASTM D1946-90 was also conducted on the SUMMA canister samples in order to determine the molecular weight of the sample gas.

TRC personnel collected ambient absolute pressure, temperature and humidity data. A wet/dry bulb sling psychrometer was used to determine ambient temperature and humidity conditions. An aircraft-type aneroid barometer (altimeter) was used to measure atmospheric pressure.

Enstor personnel collected key operational data during each of the test runs and supplied it to TRC. Thermal oxidizer firebox temperature, glycol pump rate, and gas throughput are contained in Appendix 6 of this report.

4.0 QUALITY ASSURANCE / QUALITY CONTROL

A number of quality assurance activities were undertaken to ensure the accuracy of the test results. This section of the report and the documentation contained in Appendix 3 describe each quality assurance activity that was performed. All sampling and analyses were conducted on-site to afford any interested parties the opportunity to observe all aspects of the test and to circumvent the possibility of sample loss or contamination during transport.

Appendix 1:

Detailed Summary of Results

Detailed Summary of Results
Thermal Oxidizer Inlet/Destruction Efficiency

Source: **Thermal Oxidizer Inlet**
Technician: **GSW/ MDC**

Test Run No.	**1**	**2**	**3**	
Date	2/6/2012	2/6/2012	2/6/2012	
Start Time	13:38	15:07	16:22	
Stop Time	14:38	16:07	17:22	
Glycol Dehydrator/Thermal Oxidizer Operation				
Thermal Oxidizer Firebox Temperature (°F) -Set Point	1200	1325	1450	
Thermal Oxidizer Firebox Temperature (°F) -Actual Average	1208	1336	1459	
Glycol Dehydrator Pump Rate (gal/min)	16.42	16.42	16.42	
Processed Gas Throughput (MMbtu/day)	342461	345047	341241	
Ambient Conditions				
Atmospheric Pressure ("Hg)	29.90	29.90	29.90	
Temperature (°F) : Dry bulb	68.0	70.0	72.0	
(°F): Wet bulb	63.0	65.0	65.0	
Humidity (lb/lb air)	0.0110	0.0118	0.0114	
Measured Inlet Gas Concentrations				
Benzene (ppmv)	4580	7990	11600	
Toluene (ppmv)	3270	5130	6730	
Ethylbenzene (ppmv)	153	212	227	
Xylene (ppmv)	773	1038	986	
C1 (ppmv)	175188	241863	202106	
C2 (ppmv)	21164	33082	33221	
C3 (ppmv)	8225	13082	13502	
C4 (ppmv)	8856	15274	16509	
C5 (ppmv)	5102	8538	9487	
C6 (ppmv)	2787	4855	5542	
C6+ (ppmv)	17831	34433	38496	
Inlet Gas Volumetric Flow Rate				
Stack Moisture (%)	11.6	9.5	9.1	
via EPA Methods 1-4 (SCFH, wet)	493	1754	2431	
Calculated Mass Flow Rates (via EPA Methods 1-4)				**AVERAGE**
C1 (lbs/hr)	3.59	17.62	20.40	
C2 (lbs/hr)	0.82	4.53	6.31	
C3 (lbs/hr)	0.46	2.63	3.76	
C4 (lbs/hr)	0.66	4.04	6.05	
C5 (lbs/hr)	0.47	2.80	4.32	
C6 (lbs/hr)	0.31	1.90	3.01	
C6+ (lbs/hr)	1.97	13.51	20.93	
Total Inlet VOC (lbs/hr)	4.69	29.42	44.38	**26.16**
Total Inlet VOC (tons/year)*	20.52	128.85	194.38	**114.58**
Calculated Mass Emission Rates (via EPA Methods 1-4)				
Benzene (lbs/hr)	0.46	2.84	5.72	
Toluene (lbs/hr)	0.39	2.15	3.91	
Ethylbenzene (lbs/hr)	0.02	0.10	0.15	
Xylene (lbs/hr)	0.11	0.50	0.66	
Total HAPS (lbs/hr)	0.97	5.60	10.44	**5.67**
Total HAPS (tons/year)*	4.25	24.51	45.73	**24.8**

Detailed Summary of Results
Thermal Oxidizer Inlet/Destruction Efficiency

Source: **Thermal Oxidizer Outlet**
Technician: **GSW/ MDC**

Test Run No.	**1**	**2**	**3**	
Date	2/6/2012	2/6/2012	2/6/2012	
Start Time	13:38	15:07	16:22	
Stop Time	14:38	16:07	17:22	
Glycol Dehydrator/Thermal Oxidizer Operation				
Thermal Oxidizer Firebox Temperature (°F) -Set Point	1200	1325	1450	
Thermal Oxidizer Firebox Temperature (°F) -Actaul Average	1208	1336	1459	
Glycol Dehydrator Pump Rate (gal/min)	16.42	16.42	16.42	
Processed Gas Throughput (MMbtu/day)	342461	345047	341241	
Ambient Conditions				
Atmospheric Pressure ("Hg)	29.90	29.90	29.90	
Temperature (°F) : Dry bulb	68.0	70.0	72.0	
(°F): Wet bulb	63.0	65.0	65.0	
Humidity (lb/lb air)	0.0110	0.0118	0.0114	
Measured Outlet Gas Concentrations				
Benzene (ppmv)	0.0259	0.0003	0.0010	
Toluene (ppmv)	0.0020	0.0005	0.0009	
Ethylbenzene (ppmv)	0.0008	0.0005	0.0009	
Xylene (ppmv)	0.0008	0.0005	0.0009	
C1 (ppmv)	2.0	0.5	0.5	
C2 (ppmv)	0.5	0.5	0.5	
C3 (ppmv)	0.5	0.5	0.5	
C4 (ppmv)	0.5	0.5	0.5	
C5 (ppmv)	0.5	0.5	0.5	
C6 (ppmv)	0.5	0.5	0.5	
C6+ (ppmv)	0.5	0.5	0.5	
Inlet Gas Volumetric Flow Rate				
Stack Moisture (%)	8.1	7.8	7.6	
via EPA Methods 1-4 (SCFH, wet)	2310	2571	2752	
Calculated Mass Flow Rates (via EPA Methods 1-4)				**AVERAGE**
C1 (lbs/hr)	0.0002	0.0001	0.0001	
C2 (lbs/hr)	0.0001	0.0001	0.0001	
C3 (lbs/hr)	0.0001	0.0001	0.0002	
C4 (lbs/hr)	0.0002	0.0002	0.0002	
C5 (lbs/hr)	0.0002	0.0002	0.0003	
C6 (lbs/hr)	0.0003	0.0003	0.0003	
C6+ (lbs/hr)	0.0003	0.0003	0.0003	
Inlet Total Hydrocarbons (lbs/hr)	0.0011	0.0013	0.0013	**0.0012**
Total VOC (tons/year)*	0.0049	0.0055	0.0059	**0.0054**
Calculated Mass Emission Rates (via EPA Methods 1-4)				
Benzene (lbs/hr)	0.0000121	0.0000002	0.0000006	
Toluene (lbs/hr)	0.0000011	0.0000003	0.0000006	
Ethylbenzene (lbs/hr)	0.0000005	0.0000004	0.0000007	
Xylene (lbs/hr)	0.0000005	0.0000004	0.0000007	
Total HAPS (lbs/hr)	0.0000142	0.0000012	0.0000025	**0.0000060**
Total HAPS (tons/year)*	0.0000624	0.0000051	0.0000110	**0.0000262**

Public Safety and Air Quality Management
84 Bermondsey Rise NW
Calgary, AB T3K 1T9
Phone/Fax: (403) 274-7904
Email: PSAQM@shaw.ca

August 3, 2004

Vaquero Energy Ltd.
1600, 202 - 6th Avenue SW
Calgary, AB T2P 2R9

Attention: Brian Ness

Subject: **Field Test Monitoring of an Incinerator during Vaquero et al Pembina 15-7-51-6 W5M Well Clean-up and Test EUB Flaring Permit DV150**

Vaquero Energy Inc. utilized a Questor 3000 incinerator during the clean-up and testing of the subject well in compliance with Alberta Energy and Utilities Board (EUB) flaring permit DV150. The sour gas flow started at 1730 h on April 2 and was completed at 0600 h on April 4, 2004. During the flow test the sour gas to the incinerator, stack gas from the incinerator, and downwind ambient SO_2 and H_2S concentrations and wind speed and direction were monitored. The purpose of this letter report is to summarize the source and ambient monitoring, present the results of incinerator modelling and provide conclusions and recommendations.

Permit Parameters

The actual versus permitted parameters are:

- Maximum flaring rate of 16.3 vs. permit of 15 10^3 m^3 per day,
- Maximum concentration of H_2S of 15.9 and average of 15.2 vs. permit of 20.5 %,
- Maximum total volume to be flared of 16.37 vs. permit of 80 10^3 m^3,
- Average flaring rate of 9.7 vs. expected of 10 10^3 m^3 per day,
- Heating value of gas of 39.8 vs. modelled of 45.4 MJ/m^3, and
- Total sulphur emissions of 3.3 vs. permit of 22 tonnes.

Sour Gas Inlet to Incinerator

Figure 1 provides the flow rate and cumulative flow volume during the test. The maximum, average and minimum flow rate during the test was 16.3, 9.7 and 5.8 $10^3 m^3/d$, respectively. The maximum limit of 15 was exceeded for a short time until the choke was reduced in size. The flow rate during the stack tests increased from 8.2 to 10.5 and averaged 9.3 $10^3 m^3/d$.

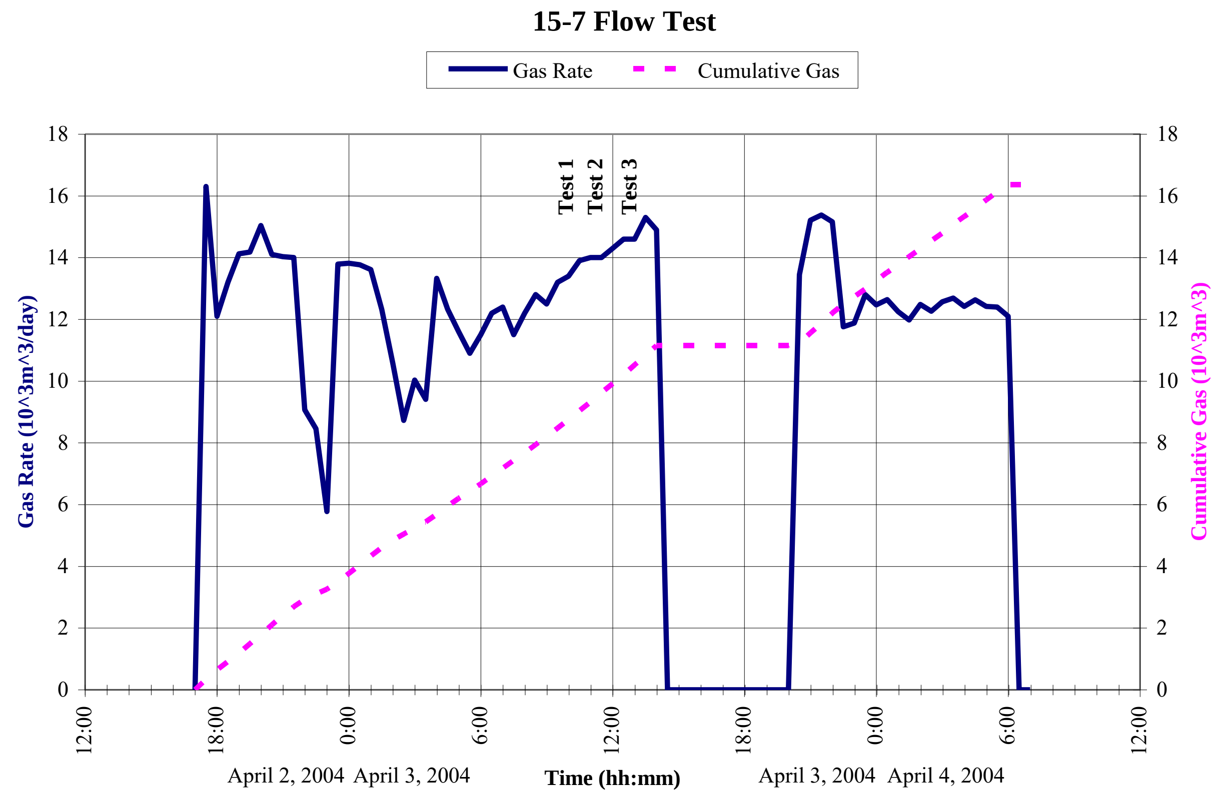

Figure 1 Sour Gas Flow During Well Test

Table 1 Average Analysis of Sour Gas Inlet to Incinerator (before C_3 addition)

Component	Mole Fraction
H_2	0.0000
He	0.0002
N_2	0.0197
CO_2	0.0090
H_2S	0.1494
CH_4	0.6309
C_2H_6	0.0827
C_3H_8	0.0685
i-C_4H_{10}	0.0096
n-C_4H_{10}	0.0193
i-C_5H_{12}	0.0041
n-C_5H_{12}	0.0034
n-C_6H_{14}	0.0019
C7+	0.0013
Total	1.0000

Table 1 provided the average of 12 inlet sour gas samples analyzed off-site by AGAT with a gas chromatograph. The analyses are available upon request.

Stack Gas Outlet from Incinerator

Table 2 provides the stack gas compositions sampled by AGAT using one hour absorption methods and analyzed off-site. The report is available upon request. The samples were drawn down a stainless steel tube that was hung into the top of the stack. The O_2 and CO_2 varied as the flow rate changed by about 28% during the 3 tests. The sulphur destruction efficiency (SDE%) can be calculated from:

$$SDE\% = \frac{SO_2}{SO_2 + H_2S} \cdot 100$$

Table 2 On-site Analysis of Stack Gas Outlet from Incinerator

Time	0913-1013 h	1034-1134 h	1153-1253 h	Average
Average Flow Rate ($10^3 m^3/d$)	8.5	9.3	10.2	**9.3**
H_2S (mole ppm dry)	0.06	0.07	0.07	0.06
SO_2 (mole ppm dry)	5790	6080	5780	**5883**
O_2 (mole % dry)	13.8	13.0	13.3	**13.4**
CO_2 (mole % dry)	3.5	5.0	5.0	**4.5**
Sulphur DE (%)	99.999	99.999	99.999	99.999

The residual H_2S was not detectable (the detection limit is presented) and the SO_2 averaged 5883 ppm. The sulphur destruction efficiency was about 99.999% based on the detection limit of the H_2S measured in the exhaust gas. The temperature also increased as the excess air decreased, as shown in the following data.

Table 3 provides the stack gas compositions sampled on the hour during the 3 stack tests with a hand-held electronic analyzer supplied by Profire Combustion Inc. These are wet concentrations and do not match the values collected by AGAT given in Table 2. The temperature average 861 °C and was highest during high flow rates. The O_2 decreased while the CO_2 increased with the increasing flow rate from Test 1 to 3. The device also measures CO in the stack gas allowing the carbon destruction efficiency (CDE%) to be calculated as follows:

$$CDE\% = \frac{CO_2}{CO_2 + \frac{CO}{10000}} \cdot 100$$

Table 3 Hand-held Analysis of Stack Gas Outlet from Incinerator

Time	1100 h	1200 h	1300 h	1400 h	Average
Temperature (°C)	814	857	883	891	**861**
O_2 (mole % wet)	17.2	16.5	16.0	17.4	16.8
CO_2 (mole % wet)	5.2	6.0	6.2	6.2	5.9
CO (mole ppm wet)	48	0	100	6	39
Carbon DE (%)	99.91	100.00	99.84	99.99	99.93

The average carbon destruction efficiency was about 99.93%. From the above it can be concluded that the incinerator burned the sour gas efficiently before discharging it to the atmosphere.

Material and Energy Balance for Incinerator

A material and energy balance of the incinerator was performed using a modified version of the *EUB-WellTest Ver 1.xls* spreadsheet known as *PSAQM Incinerator Ver 5.xls.* The balance was done to match the measured average O_2, CO_2, SO_2 and the temperature. Ideally they should provide the same results. The sampled O_2 levels could be diluted by air and are thus less reliable. The CO_2 and SO_2 originate from the carbon and sulphur in the sour gas, respectively, and is less sensitive to sampling dilution. The O_2, CO_2, SO_2 levels were matched by adjusting the excess air and then the temperature was matched by adjusting the heat loss fraction. The residual H_2S is also predicted. Table 4 summarizes the incinerator modelling results to match the stack monitoring averages given in **bold** font in Table 2 and 3 on using the gas composition of Table 1.

Table 4 Incinerator Performance based on Material and Energy Balance

Parameter	O_2 Balance	CO_2 Balance	SO_2 Balance
Excess Air (%)	160	140	140
Temperature (°C)	**861**	**861**	**861**
Heat Loss (%)	20	26	26
O_2 (mole % dry)	**13.4**	12.7	12.7
CO_2 (mole % dry)	4.1	**4.5**	4.5
SO_2 (ppm dry)	5391	5858	**5883**
Residence Time (s)	2.1	2.2	2.2
Predicted Residual H_2S (mole ppm dry)	0.8	0.9	0.9
Sulphur DE (%)	99.985	99.985	99.985

Using O_2 to balance requires 160% excess air and a heat loss of 20% while using CO_2 or SO_2 to balance requires 140% excess air and a heat loss of 26%. The water content is about 7%. The residual H_2S are the same. The predicted sulphur destruction efficiency is about 99.99%, less than the measured values and the same as the manufacturer's claims of 99.99%.

Ambient H_2S and SO_2 and Wind Speed

Figure 2 provides the ambient SO_2 and H_2S concentration (ppb) and wind speed (km/h) that was monitored downwind by EMax using a mobile unit. Clock hour averages are required by Alberta Environment in their Air Monitoring Directive. The Alberta ambient air quality guideline for SO_2 and H_2S as a one hour average is 172 and 10 ppb, respectively. The Flare Permit also included a limit on the wind speed of 20 km/h to prevent stack tip downwash from the incinerator.

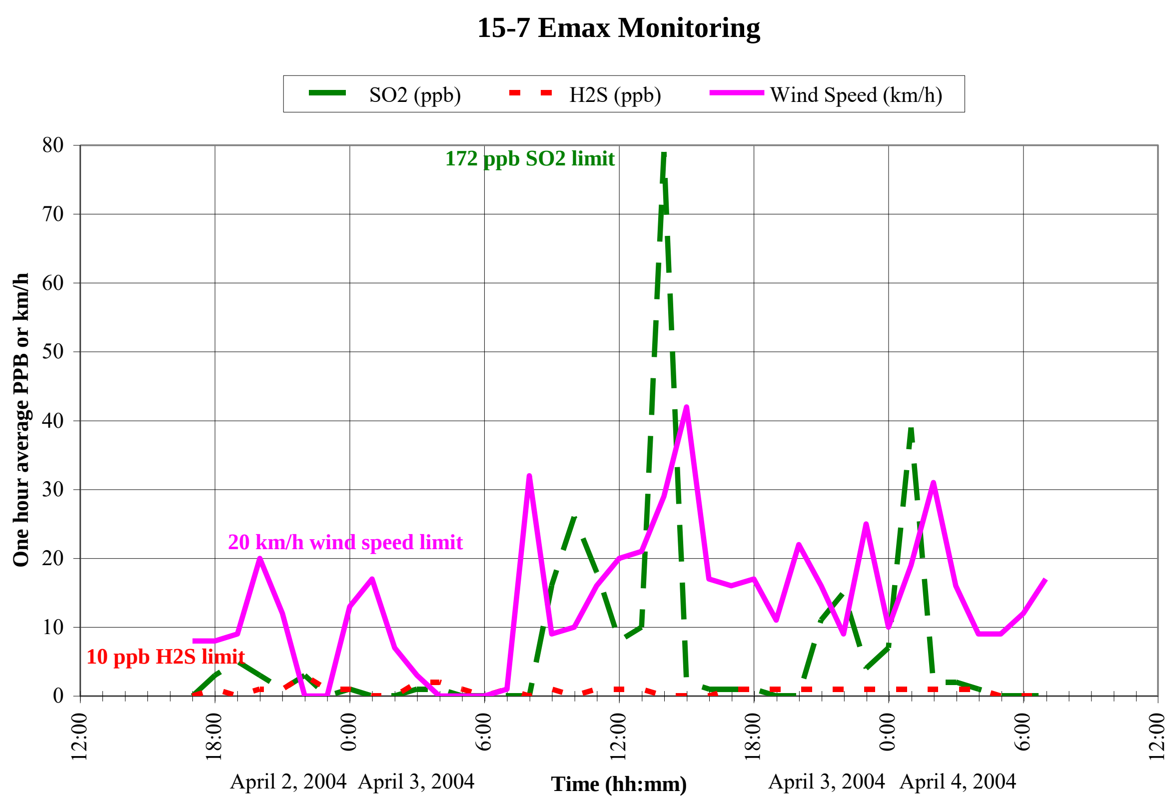

Figure 2 EMax monitoring of Permitted Parameters

The SO_2 and H_2S guideline was not exceeded. The well test was shut-in at 1400 h on April 3rd due to prolonged high wind speeds. The one hour average wind speed exceeded 20 km/h on several other occasions, however the well was not shut in as the next 15 minute average reading was acceptable and subsequent readings continued to show the wind speed was dropping to acceptable levels. Notice how the SO_2 reading was increasing as the well was shut-in.

Wind Direction

Figure 3 provides the wind direction that was monitored downwind by EMax using a mobile unit. Wind direction is where the winds are from measured in degrees from North. The required direction is where the winds must come from to blow a release from the well site to the mobile monitoring unit current location. The mobile unit was generally downwind, as shown in the figure. If the operator sensed he was not in the correct position, the unit was moved.

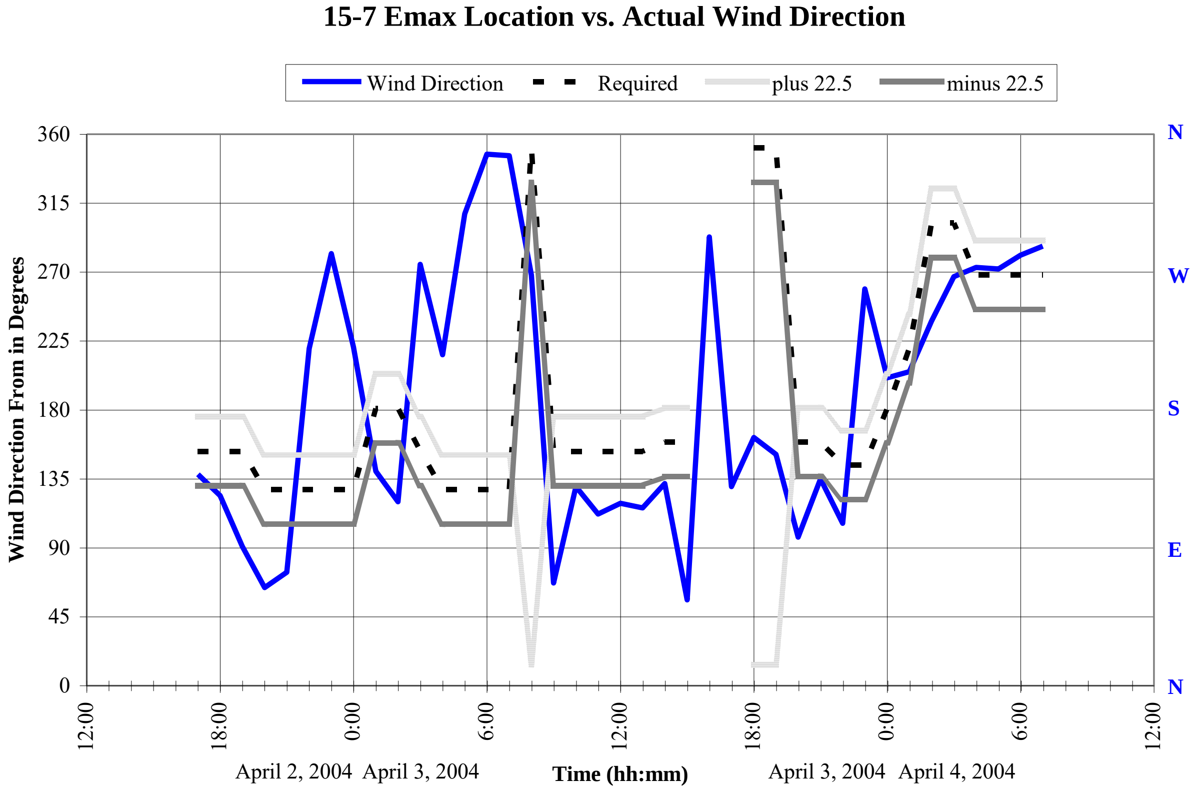

Figure 3 EMax monitoring of Wind Direction Compared to Location

Conclusions and Recommendations

The operation of the incinerator during the Vaquero et al Pembina 15-7-51-6 W5M well test was thoroughly monitored. Conclusions and recommendations can be summarized as:

1. Inlet monitoring indicated that the H_2S concentration did not exceed the permit limit of 20.5%. Sampling of the inlet gas minimized the amount of sour gas purged to the atmosphere, thus reducing odours.
2. The average flow rate of 9.7 $10^3 m^3/d$ of sour gas incinerated was below permit limit of 15 $10^3 m^3/d$. The choke had to be changed several times when the flow rate exceeded the limit.

3. The volume of sour gas incinerated of 16.4 $10^3 m^3$ was below permit limit of 80 $10^3 m^3$.
4. Material and energy balances of the incinerator showed reasonable agreement with observations. The heat loss from incinerators may be closer to the 25% used for flares than the 10% normally used for incinerators.
5. The incinerator was effective at converting the hydrocarbons to carbon dioxide and the hydrogen sulphide to sulphur dioxide. Measured sulphur destruction efficiencies were in excess of the manufactures claim of 99.99% and the carbon destruction efficiency approached the claim.
6. Mobile monitoring depends on locating the unit downwind of the source. The operator of the mobile monitoring unit did a reasonable job of moving the unit to be down wind of the incinerator. Improvements have to be made to the EUB requirements to ensure that the unit is located in a reasonable position for the available access. An anemometer tower on site may be required to indicate the plume direction.
7. Mobile downwind monitoring did not meet the EUB flaring permit requirement of rolling one hour averages every 15 minutes but does meet the AEnv clock hour average requirement. The EUB should consider setting requirements for mobile monitoring.
8. As required by the permit, the well was shut-in due to high wind speed conditions. Concurrent SO_2 readings were also increasing as the mobile monitoring unit was near the correct location. This validates the stack-tip downwash included in the dispersion modelling.

Please contact the undersigned if you have any questions.

Sincerely,

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Public Safety and Air Quality Management