Smith, Claudia

From: Brad Rogers <bradr@samson.com>
Sent: Thursday, January 08, 2015 9:10 AM
To: Smith, Claudia
Subject: RE: Spring Creek Compressor Station SMNSR Permit Questions

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Claudia,

I have reviewed this with our operations and we have no intentions at this time or near future of setting the 10th engine. Let's proceed with permitting of 9 engines.

Thanks,

Brad M. Rogers
Sr. Environmental Specialist
Samson Resources
370 17th Street, Suite 3000
Denver, CO 80202
(o) 720.239.4406
(c) 303.229.1228
bradr@samson.com

From: Smith, Claudia [mailto:Smith.Claudia@epa.gov]
Sent: Thursday, December 11, 2014 4:07 PM
To: Brad Rogers
Subject: RE: Spring Creek Compressor Station SMNSR Permit Questions

Thanks for the quick reply.

Do you still want the permit to cover a tenth engine, as contemplated in the Consent Agreement and the application? If so, we probably need to include some kind of qualitative air quality impact assessment in the least before proposing to approve what would technically be an emissions increase for an additional engine. Alternatively, we can permit the 9 engines now, and you could apply for a new permit for a minor modification at the time plans are made to install it, if at all. However, if you plan to terminate the Consent Agreement upon issuance of the SMNSR permit, the new permit would be required prior to installing the engine. Another thing to consider if we did end up permitting the tenth engine, you would need to commence construction within 18 months of permit issuance; otherwise the permit conditions for that engine would become invalid and a new permit would be required anyway.

I'm happy to set up a call if you'd like to discuss.

Thanks,

Claudia

From: Brad Rogers [mailto:bradr@samson.com]
Sent: Thursday, December 11, 2014 3:42 PM
To: Smith, Claudia
Subject: RE: Spring Creek Compressor Station SMNSR Permit Questions

Hi Claudia,

No the 10th engine has not been installed and currently there are no plans to do so at this time.

Thanks,

Brad M. Rogers
Sr. Environmental Specialist
Samson Resources
370 17th Street, Suite 3000
Denver, CO 80202
(o) 720.239.4406
(c) 303.229.1228
bradr@samson.com

From: Smith, Claudia [mailto:Smith.Claudia@epa.gov]
Sent: Thursday, December 11, 2014 3:39 PM
To: Brad Rogers
Subject: Spring Creek Compressor Station SMNSR Permit Questions
Importance: High

Hi, Brad,

We are getting close to putting the Proposed SMNSR permit for the Spring Creek Compressor Station out to public comment and I wanted to check first to see if the tenth engine has been installed/started up yet, so I can update language in the permit and technical support document if it has.

Thanks for your assistance,

Claudia

Claudia Young Smith
Environmental Scientist
US EPA Region 8 Air Program

Phone: (303) 312-6520
Fax: (303) 312-6064
http://www2.epa.gov/region8/air-permitting

****
US EPA Region 8
1595 Wynkoop Street
Mail Code 8P-AR
Denver, Colorado 80202
****

MEMO TO FILE

DATE: September 8, 2014

SUBJECT: Southern Ute Indian Reservation Natural Gas Production Facilities
Environmental Justice

FROM: Victoria Parker-Christensen, EPA Region 8 Air Program

TO: Source Files:
205c AirTribal SU Samson Spring Creek Compressor Station
SMNSR-SU-000053-2013.001
FRED # 105462

On February 11, 1994, the President issued Executive Order 12898, entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The Executive Order calls on each federal agency to make environmental justice a part of its mission by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations."

EPA defines "Environmental Justice" to include meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and polices.

On June 10, 2011, the EPA promulgated a final Clean Air Act (CAA) Federal Implementation Plan (FIP) that implements New Source Review (NSR) preconstruction air pollution control requirements in Indian country. The FIP includes two NSR rules for the protection of air quality in Indian country. One of those rules, known as the minor NSR Rule, applies to new industrial facilities or modifications at existing industrial facilities with the potential to emit (PTE) certain pollutants equal to or more than the minor NSR thresholds but less than the major NSR thresholds, generally 100 to 250 tons per year. The EPA permit issuance process includes public notice of a draft permit, opportunity for public comment, as well as administrative and judicial review provisions.

This memorandum describes EPA's efforts to identify environmental justice communities and assess potential effects in connection with issuing a CAA synthetic minor NSR permit in La Plata County within the exterior boundaries of the Southern Ute Indian Reservation.

Permit Request

On December 24, 2013, the EPA received an application from Samson Resources Company (Samson) requesting a synthetic minor permit for the Spring Creek Compressor Station in accordance the requirements of the MNSR Permit Program. This permit action applies to an existing facility operating on the Southern Ute Indian Reservation in Colorado. The Spring Creek Compressor Station is located at:

S23, T33N, R7W
Latitude 37.09241, Longitude -107.57601.

Spring Creek Compressor Station currently operates nine (9) natural gas-fired reciprocating internal combustion engines used for natural gas compression, with future planned expansion to 10 engines. The engines are operating under enforceable nitrogen oxide (NO_X) emission limits required by a May 1, 2014 Consent Agreement Final Order (CAFO) #CAA-08-2013-0015 between Samson and the EPA. These emission limits provide enforceable recognition of the air fuel ratio control (AFRC) systems installed on each of the engines reducing the emission of NO_X pollutants to synthetically minor levels.

This MNSR permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the facility or its operations. This permit is intended only to incorporate required and requested emission limits and provisions from the CAFO. Additionally, the CAFO requires testing, monitoring, recordkeeping, and reporting requirements to verify compliance with the emission limitations. The emissions, approved at present, from the existing facility will not increase due to the associated permit action and the emissions will continue to be well controlled at all times. This is an administrative action with no physical changes to the existing facility or surrounding area.

This permit reflects the incorporation of the requirements established in the CAFO. Samson requested these requirements in order to maintain the Spring Creek Compressor Station's status as a synthetic minor source of NO_X emissions with respect to the Prevention of Significant Deterioration (PSD) Permit Program at 40 CFR Part 52. Section 49.153(a)(3)(iv) of the MNSR rule provides the EPA with the authority to transfer such limits to a MNSR permit. The MNSR regulations at §§49.158(c)(2)(ii) and (iii) also provide the EPA with the discretion to require any additional requirements, including control technology requirements, based on the specific circumstances of the source.

Environmental Impacts to Potential Environmental Justice Communities

Air Emissions

This proposed permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the facility or its operations. This permit is intended only to incorporate required and requested emission limits and provisions from the CAFO. The emissions, approved at present, from the existing facility will not increase due to the associated permit action and the emissions will continue to be well controlled at all times. This is an administrative action with no physical changes to the existing facility or surrounding area.

Air Quality Review

The Federal Minor New Source Review Regulations at 40 CFR 49.154(d) require that an Air Quality Impact Assessment (AQIA) modeling analysis 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 PSD increment violation. If an AQIA reveals that the proposed construction could cause or contribute to a

NAAQS or PSD increment violation, such impacts must be addressed before a pre-construction permit can be issued.

The emissions, approved at present, from the existing facility will not be increasing due to this permit action and the emissions will continue to be well controlled at all times. This permit action will have no air quality impacts; therefore, the EPA has determined that an AQIA modeling analysis is not required for the proposed permit.

Furthermore, the permit contains a provision stating, "*The permitted source shall not cause or contribute to a National Ambient Air Quality Standard violation or a PSD increment violation.*" Noncompliance with this permit provision is a violation of the permit and is grounds for enforcement action and for permit termination or revocation. As a result, the EPA concludes that issuance of the aforementioned synthetic minor NSR permit will not have disproportionately high and adverse human health effects on communities in the vicinity of the SUIR.

Tribal Consultation and Public Participation

The EPA offers the Tribal Government Leaders an opportunity to consult on each proposed permit action. The Tribal Government Leaders are asked to respond to the EPA's offer to consult within 30 days and if no response is received within that time, the EPA notifies the Tribal Government Leaders that the consultation period has closed. The Chairman of the Southern Ute Tribe has been offered an opportunity to consult on this permit action via letter dated February 28, 2014. To date, the EPA has not received a response to our offer to consult on this permit action and the Chairman was notified when the consultation period closed.

All minor source applications (synthetic minor, modification to an existing facility, new true minor or general permit) are submitted to both the EPA and the Tribal Environmental Director per the application instructions (see http://epa.gov/region8/air/permitting/tmnsr.html). The Tribal Environmental Office has 10 business days to respond to the EPA with questions and comments on the application. In the event an Air Quality Impact Assessment (AQIA) is triggered, a copy of that document is emailed to the tribe within 5 business days of receipt by the EPA.

Given the presence of potential environmental justice communities in the vicinity of the facilities, the EPA is providing an enhanced public participation process for this permit. Interested parties can subscribe to an EPA listserve that notifies them of public comment opportunities on the Southern Ute Indian Reservation for draft air pollution control permits via email at http://epa.gov/region8/air/permitting/pubcomment.html.

Additionally, the Tribe's Environmental Director is notified of the public comment period for the proposed permit and provided copies of the notice of public comment opportunity to post in various locations on the Reservation that they deem fit. The Tribe is also notified of the issuance of the final permit.

MEMO TO FILE

DATE: September 8, 2014

SUBJECT: Southern Ute Indian Reservation Natural Gas Production Facilities
Endangered Species Act

FROM: Victoria Parker-Christensen, EPA Region 8 Air Program

TO: Source Files:
205c AirTribal SU Samson Spring Creek Compressor Stations
SMNSR-SU-000053-2013.001
FRED #105462

Pursuant to Section 7 of the Endangered Species Act (ESA), 16 U.S.C. §1536, and its implementing regulations at 50 CFR, part 402, the EPA is required to ensure that any action authorized, funded, or carried out by the Agency is not likely to jeopardize the continued existence of any Federally-listed endangered or threatened species or result in the destruction or adverse modification of such species' designated critical habitat. Under ESA, those agencies that authorize, fund, or carry out the federal action are commonly known as "action agencies." If an action agency determines that its federal action "may affect" listed species or critical habitat, it must consult with the U.S. Fish and Wildlife Service (FWS). If an action agency determines that the federal action will have no effect on listed species or critical habitat, the agency will make a "no effect" determination. In that case, the action agency does not initiate consultation with the FWS and its obligations under Section 7 are complete.

In complying with its duty under ESA, the EPA, as the action agency, examined the potential effects on listed species and designated critical habitat relating to issuing this Clean Air Act (CAA) synthetic minor New Source Review (NSR) permit.

Region 8 Air Program Determination

The EPA has concluded that the proposed synthetic minor NSR permit action will have "*No effect"* on listed species or critical habitat. These proposed permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the associated facility or its operations. This is an administrative action with no physical changes to the existing facility or surrounding area. Because the EPA has determined that the federal action will have no effect, the agency made a *"No effect"* determination, did not initiate consultation with the FWS and its obligations under Section 7 are complete.

Permit Request

On December 24, 2013, the EPA received an application from Samson Resources Company (Samson) requesting a synthetic minor permit for the Spring Creek Compressor Station in accordance the requirements of the MNSR Permit Program. This permit action applies to an existing facility operating on the Southern Ute Indian Reservation in Colorado. The Spring Creek Compressor Station is located at:

S23, T33N, R7W
Latitude 37.09241, Longitude -107.57601.

Spring Creek Compressor Station currently operates nine (9) natural gas-fired reciprocating internal combustion engines used for natural gas compression, with future planned expansion to 10 engines. The engines are operating under enforceable nitrogen oxide (NO_X) emission limits required by a May 1, 2014 Consent Agreement Final Order (CAFO) #CAA-08-2013-0015 between Samson and the EPA. These emission limits provide enforceable recognition of the air fuel ratio control (AFRC) systems installed on each of the engines reducing the emission of NO_X pollutants to synthetically minor levels.

This MNSR permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the facility or its operations. This permit is intended only to incorporate required and requested emission limits and provisions from the CAFO. Additionally, the CAFO requires testing, monitoring, recordkeeping, and reporting requirements to verify compliance with the emission limitations. The emissions, approved at present, from the existing facility will not increase due to the associated permit action and the emissions will continue to be well controlled at all times. This is an administrative action with no physical changes to the existing facility or surrounding area.

This permit reflects the incorporation of the requirements established in the CAFO. Samson requested these requirements in order to maintain the Spring Creek Compressor Station's status as a synthetic minor source of NO_X emissions with respect to the Prevention of Significant Deterioration (PSD) Permit Program at 40 CFR Part 52. Section 49.153(a)(3)(iv) of the MNSR rule provides the EPA with the authority to transfer such limits to a MNSR permit. The MNSR regulations at §§49.158(c)(2)(ii) and (iii) also provide the EPA with the discretion to require any additional requirements, including control technology requirements, based on the specific circumstances of the source.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service (FWS) maintains an internet resource, *Environmental Conservation Online System* (ECOS, http://ecos.fws.gov/ecos/indexPublic.do), that provides access to databases for threatened and endangered species that may be present within the proposed project area and designated critical habitat. A search of the databases was not undertaken because this is an administrative action with no physical changes to the existing facility or surrounding area.

Conclusion

The EPA has concluded that the proposed synthetic minor NSR permit action will have "*No effect"* on listed species or critical habitat. This proposed permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the associated facility or its operations. The emissions, approved at present, from the existing facility will not increase due to the associated permit action and the emissions will continue to be well controlled at all times. This is an administrative action with no physical changes to the existing facility or surrounding area. Because the EPA has determined that the federal action will have no effect, the agency will make a *"No effect"* determination. In that case, the EPA does not initiate consultation with the FWS and its obligations under Section 7 are complete.

MEMO TO FILE

DATE: September 8, 2014

SUBJECT: Southern Ute Indian Reservation Natural Gas Production Facilities
National Historic Preservation Act

FROM: Victoria Parker-Christensen, EPA Region 8 Air Program

TO: Source Files:
205c AirTribal SU Samson Spring Creek Compressor Station
SMNSR-SU-000053-2013.001
FRED #105462

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment with regard to such undertakings. Under the ACHP's implementing regulations at 36 C.F.R. Part 800, Section 106 consultation is generally with state and tribal historic preservation officials in the first instance, with opportunities for the ACHP to become directly involved in certain cases. An "undertaking" is "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval." 36 C.F.R. § 800.16(y).

Under the NHPA Section 106 implementing regulations, federal agencies consult with relevant historic preservation partners to determine the area of potential effect (APE) of the undertaking, to identify historic properties that may exist in that area, and to assess and address any adverse effects that may be caused on such properties by the undertaking. Specifically, 36 C.F.R. § 800.4(b)(1) of the regulations states that federal agency officials shall make a "reasonable and good faith effort" to identify historic properties.

If an undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the federal agency has no further obligations under 36 C.F.R. § 800.3(a)(1). Because this permit will not authorize new construction or modification or related activities at an existing site, this undertaking does not have the potential to cause effects on historic properties.

This memorandum describes EPA's efforts to assess potential effects in connection with issuing a draft synthetic minor New Source Review (NSR) permit for an existing oil and gas production facility located within the exterior boundaries of the Southern Ute Indian Reservation in La Plata County, Colorado.

Region 8, Air Program Determination

The EPA has reviewed the proposed action for potential impacts on historic properties in the APE. The proposed permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the associated facility or its operations. The emissions, approved at present, from the existing facility will not increase due to the associated permit action and the emissions will continue to be well controlled at all times. Because the EPA has determined that the federal action will have no effect, the agency is making the finding of "*No historic properties affected*" for the APE.

Area of Potential Effects (APE)

The APE for the existing facility is the location within the areas currently occupied by the facility.

Regulation 36 C.F.R. 800.16(d) defines "area of potential effects" - as:

> "… the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking."

Permit Request

On December 24, 2013, the EPA received an application from Samson Resources Company (Samson) requesting a synthetic minor permit for the Spring Creek Compressor Station in accordance the requirements of the MNSR Permit Program. This permit action applies to an existing facility operating on the Southern Ute Indian Reservation in Colorado. The Spring Creek Compressor Station is located at:

S23, T33N, R7W
Latitude 37.09241, Longitude -107.57601.

Spring Creek Compressor Station currently operates nine (9) natural gas-fired reciprocating internal combustion engines used for natural gas compression, with future planned expansion to 10 engines. The engines are operating under enforceable nitrogen oxide (NO_X) emission limits required by a May 1, 2014 Consent Agreement Final Order (CAFO) #CAA-08-2013-0015 between Samson and the EPA. These emission limits provide enforceable recognition of the air fuel ratio control (AFRC) systems installed on each of the engines reducing the emission of NO_X pollutants to synthetically minor levels.

This MNSR permit action does not authorize the construction of any new emission sources, or emission increases from existing units, nor does it otherwise authorize any other physical modifications to the facility or its operations. This permit is intended only to incorporate required and requested emission limits and provisions from the CAFO. Additionally, the CAFO requires testing, monitoring, recordkeeping, and reporting requirements to verify compliance with the emission limitations. The emissions, approved at present, from the existing facility will not increase due to the associated permit

action and the emissions will continue to be well controlled at all times. This is an administrative action with no physical changes to the existing facility or surrounding area.

This permit reflects the incorporation of the requirements established in the CAFO. Samson requested these requirements in order to maintain the Spring Creek Compressor Station's status as a synthetic minor source of NO_X emissions with respect to the Prevention of Significant Deterioration (PSD) Permit Program at 40 CFR Part 52. Section 49.153(a)(3)(iv) of the MNSR rule provides the EPA with the authority to transfer such limits to a MNSR permit. The MNSR regulations at §§49.158(c)(2)(ii) and (iii) also provide the EPA with the discretion to require any additional requirements, including control technology requirements, based on the specific circumstances of the source.

Registered Historic Places

The National Park Service maintains an internet resource that can be used to determine whether any registered historic places are within the area of potential effect. The resource is:

1. National Register of Historic Places database, http://www.nps.gov/history/nr/research/index.htm

An additional site is available to provide additional information on these historic places. The resource is:

2. National Register of Historic Places, http://www.nationalregisterofhistoricplaces.com/
    a. County information, http://www.nationalregisterofhistoricplaces.com/ut/Uintah/state.html
    b. Historic Districts within a county, http://www.nationalregisterofhistoricplaces.com/ut/Uintah/districts.html

A search of registered historic places or districts was not undertaken because this is an administrative action with no physical changes to the existing facility or surrounding area.

State and Tribal Consultation

Because this undertaking does not have the potential to cause effects on historic properties, assuming such historic properties were present, the EPA has no further obligations under 36 C.F.R. § 800.3(a)(1).

Permit # SmNSR-SU-000053-2013.001

SYNTHETIC MINOR PERMIT APPLICATION

SPRING CREEK COMPRESSOR STATION

Prepared for:

Samson Resources

Samson Plaza
Two West Second Street
Tulsa, Oklahoma 74103

Prepared by:

Compliance Partners™

4038 Timberline Road, Suite 100
Fort Collins, CO 80525

DECEMBER 2013

SYNTHETIC MINOR PERMIT APPLICATION
SPRING CREEK COMPRESSOR STATION
SAMSON RESOURCES

CONTENTS

SYNTHETIC MINOR PERMIT APPLICATION
SPRING CREEK COMPRESSOR STATION
SAMSON RESOURCES

CONTENTS CONTINUED

ADMINISTRATIVE AND PLANT-WIDE INFORMATION

OMB Control No. Pending
Approval expires Pending

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FEDERAL MINOR NEW SOURCE REVIEW PROGRAM IN INDIAN COUNTRY
40 CFR 49.151

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**
- ☐ **Proposed Modification of an Existing Source**
- ☒ **Other – Please Explain** – Synthetic Minor Permit Application

Use of this information request form is voluntary and not yet approved by the Office of Management and Budget. The following is a check list of the type of information that Region 8 will use to process information on your proposed project. While submittal of this form is not required, it does offer details on the information we will use to complete your requested approval and providing the information requested may help expedite the process. Use of application forms for this program is currently under Office of Management and Budget review and these information request forms will be replaced/updated after that review is completed.

Please submit information to following two entities:

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

For more information, visit:
http://www2.epa.gov/region8/tribal-minor-new-source-review-permitting

The Tribal Environmental Contact for the specific reservation:

If you need assistance in identifying the appropriate Tribal Environmental Contact and address, please contact:

R8airpermitting@epa.gov

A. GENERAL SOURCE INFORMATION

1. (a) **Company Name** **Samson Resources Company** (b) **Operator Name** **Samson Resources Company**		2. **Source Name** **Spring Creek Compressor Station**	
3. Type of Operation **Natural Gas Production**		4. Portable Source? ☐ Yes ☒ No 5. Temporary Source? ☐ Yes ☒ No	
6. NAICS Code **211111**		7. SIC Code **1311**	
8. Physical Address (home base for portable sources) **1000 County Road 324, Ignacio, CO** **About 5 miles southeast of Ignacio, CO**			
9. Reservation* **Southern Ute**	10. County* **La Plata**	11a. Latitude* **37° 5' 32.6" N**	11b. Longitude* **-107° 34' 33.7" W**
12a. Quarter Quarter Section* **SWNE**	12b. Section* **23**	12c. Township* **33 North**	12d. Range* **7 West**

*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
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

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

C. CONTACT INFORMATION

Company Contact **Brad Rogers**		Title **Senior Environmental Specialist**
Mailing Address **370 17th Street, Suite 3000**		
Email Address **bradr@samson.com**		
Telephone Number **(720) 239-4406**	Facsimile Number	
Operator Contact (if different from company contact)		Title
Mailing Address		
Email Address		
Telephone Number	Facsimile Number	
Source Contact **Lynn Davis**		Title **Superintendent**
Mailing Address **PO Box 9 Bayfield, CO 8112**		
Email Address **ldavis@samson.com**		
Telephone Number **(970) 884-5085**	Facsimile Number	
Compliance Contact **Brad Rogers**	Title **Senior Environmental Specialist**	
Mailing Address **370 17th Street, Suite 3000**		
Email Address **bradr@samson.com**		
Telephone Number **(720) 239-4406**	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.

☒ **Air Quality Review**

☒ **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	0	0	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 SO2 - 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}	0	0	
$PM_{2.5}$	0	0	
SO_2	0	0	
NO_x	211.3	211.3	
CO	196.3	196.3	
VOC	60.5	60.5	
Pb	0	0	
Fluorides	0	0	
H_2SO_4	0	0	
H_2S	0	0	
TRS	0	0	
RSC	0	0	

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	0	0	0	0
PM_{10}	0	0	0	0
$PM_{2.5}$	0	0	0	0
SO_2	0	0	0	0
NO_x	211.3	211.3	211.3	211.3
CO	196.3	196.3	196.3	196.3
VOC	60.5	60.5	60.5	60.5
Pb	0	0	0	0
Fluorides	0	0	0	0
H_2SO_4	0	0	0	0
H_2S	0	0	0	0
TRS	0	0	0	0
RSC	0	0	0	0

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
SO_2 - 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

The public reporting and recordkeeping burden for this collection of information is estimated to average 20 hours per response, unless a modeling analysis is required. If a modeling analysis is required, the public reporting and recordkeeping burden for this collection of information is estimated to average 60 hours per response .Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

OMB Control No. Pending
Approval expires Pending

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FEDERAL MINOR NEW SOURCE REVIEW PROGRAM IN INDIAN COUNTRY
40 CFR 49.151

Application For Synthetic Minor Limit

(Form SYNMIN)

Use of this information request form is voluntary and not yet approved by the Office of Management and Budget. The following is a check list of the type of information that Region 8 will use to process information on your proposed project. While submittal of this form is not required, it does offer details on the information we will use to complete your requested approval and providing the information requested may help expedite the process. Use of application forms for this program is currently under Office of Management and Budget review and these information request forms will be replaced/updated after that review is completed.

Please submit information to following two entities:

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

For more information, visit:
http://www2.epa.gov/region8/tribal-minor-new-source-review-permitting

The Tribal Environmental Contact for the specific reservation:

If you need assistance in identifying the appropriate Tribal Environmental Contact and address, please contact:

R8airpermitting@epa.gov

A. GENERAL INFORMATION

Company Name **Samson Resources Company**	**Source Name** **Spring Creek Compressor Station**
Company Contact or Owner Name **Brad Rogers**	Title **Senior Environmental Specialist**
Mailing Address **370 17th Street, Suite 3000**	
Email Address **bradr@samson.com**	
Telephone Number **(720) 239-4406**	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:

Description of Operations
Spring Creek Compressor Station
Section 23, Township 33N, Range 7W
La Plata County, Colorado

The Spring Creek Compressor Station is owned and operated by Samson Resources. The facility is located within the exterior boundaries of the Southern Ute Indian Reservation in the NE ¼ of Section 23, Township 33 North, Range 7 West in La Plata County, Colorado. A facility location map is included as Figure 1. Figure 2 contains a simplified facility plot plan. A process flow diagram is attached as Figure 3.

The Spring Creek Compressor Station receives coal-bed methane gas gathered from nearby sources and compresses the natural gas to transmission pipeline specifications. Gas entering the facility from the field is first fed to an inlet separator that gravimetrically removes water that may have condensed during transportation from the supplying gas wells. Separator overhead gas is fed to one of up to ten compressor engines from a common suction header. The compressors discharge gas to a common discharge header that feeds to scrubbers. The scrubbers separate and collect liquids that may have formed during compression. The compressed gas is then fed to a dehydration unit. Tri-ethylene glycol is circulated counter-currently and absorbs water in the wet gas. Rich glycol is circulated to a reboiler, where moisture is driven to the atmosphere by heating the glycol. Dry gas exits the contactors and is directed to the sales line, where it is metered and exits the facility. The gas processing capacity of the facility is approximately 60 MMscfd with ten compressor engines operating.

There are currently nine, with future expansion to ten, natural gas-fired 4-stroke lean burn 1340 horsepower Caterpillar G3516LE compressor engines operating at the facility. These units have a site rating of 1092 horsepower. The facility also contains one triethylene-glycol (TEG) dehydration unit with two 30 MMscfd contact towers and one 0.75 MMBtu/hr reboiler burner. The facility emission units are listed in Table 1. There are several insignificant emission units at this facility; these units are listed in Table 2. The facility potential to emit is contained in Table 3.

Table 1: Spring Creek Compressor Station Emission Units

Emission Unit ID	Description	Control Equipment
E1	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E2	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E3	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E4	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E5	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E6	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E7	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E8	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E9	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
E10	1092 hp Caterpillar G3516LE Compressor Engine	Oxidation Catalyst
D1	60 MMscfd PESCO Dehydration Unit Glycol Regenerator	None
FUG	Facility Fugitive Emissions	None

Table 2: Spring Creek Compressor Station Insignificant Emission Units

Emission Unit ID	Description
IEU1	10 – 500 gallon lubricating oil storage tanks
IEU2	10 – 500 gallon skid drain tanks
IEU3	2 – 500 gallon ethylene glycol storage tanks
IEU4	10 – 500 gallon waste oil/slop tanks
IEU5	1 – 750 bbl produced water storage tank
IEU6	5 – 1000 bbl produced water storage tanks
IEU7	1 – 500 bbl slop tank
IEU8	10 – Compressor blowdown emissions
IEU9	10 – Compressor starter emissions
IEU10	10 – Compressor cylinder rod packing vent emissions

This facility is subject to the National Emission Standard for Hazardous Air Pollutants (NESHAP) for reciprocating internal combustion engines (RICE) regulation 40 CFR 63, Subpart ZZZZ because it emits or has the potential to emit a single Hazardous Air Pollutant (HAP) at a rate greater than 10 tons per year. Per 40 CFR 63, Subpart ZZZZ §63.6640, an affected facility is required to develop a Startup, Shutdown and Malfunction Plan (SSMP). The Spring Creek Compressor Station operates in accordance with the current facility SSMP that was last revised in January 2009.

Unit E3 is subject to the requirements of 40 CFR Part 60, Subpart JJJJ. Performance test are conducted on Unit E3 in accordance with 40 CFR 60.4244 every 8760 hours of operating or every three years, whichever comes first.

Each of the Caterpillar G3516LE compressor engines is equipped with either a NO_X sensor or O_2 sensor as part of the air fuel ration controller system (AFRC) and an oxidation catalytic converter to reduce emissions in the exhaust stream. A continuous parameter monitoring system (CPMS) is used to record the catalyst inlet temperature of each engine to ensure that the inlet temperature remains between 450 °F and 1350 °F. The CPMS continuously monitors the catalyst inlet temperature and reduces the data to a 4-hour rolling average. The CPMS also logs the shutdown times and events and displays the unit process and fuel flows for each engine. The pressure drop across the catalyst is manually recorded at least once a month. Facility data is recorded in accordance with applicable parts of Section §63.6640.

The Spring Creek Compressor Station is an existing, constructed, and operating facility. There are no increases in emission rates or facility potential to emit with this application so an ambient impact analysis has not been included. In addition the facility will have no adverse effects with respect to the ESA or NHPA. ESA and NHPA reports are attached.

Table 3: Spring Creek Compressor Station Potential to Emit

Unit	Model	hp	NO_X			CO			VOC			Formaldehyde			Total HAP
			g/hphr	lb/hr	tpy	g/hphr	lb/hr	tpy	g/hphr	lb/hr	tpy	g/hphr	lb/hr	tpy	tpy
E1	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E2	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E3	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	1.00	2.4	10.5	0.14	0.3	1.5	1.5
E4	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E5	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E6	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E7	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E8	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E9	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
E10	Caterpillar G3516LE	1092	2.00	4.8	21.1	1.86	4.5	19.6	0.35	0.8	3.7	0.14	0.3	1.5	1.5
D1	TEG Dehydration Unit	60 MMscfd		0.07	0.3		0.06	0.3			13.1			0.0	9.9
FUG	Facility Fugitive Emissions				0.0			0.0			3.2			0.0	0.0
IEUs	Insignificant Emission Units				0.0			0.0			0.4			0.0	0.0
Total					211.3			196.3			60.5			15.0	24.9

Directions to the Facility

Spring Creek Compressor Station
Section 23, Township 33N, Range 7W
La Plata County, Colorado

The Spring Creek Compressor Station is located southeast of Ignacio, Colorado. To get to the Spring Creek Compressor Station from Ignacio at the intersection of Highway 172 and County Road 151 go east on County Road 151. Follow County Road 151 east for 3.3 miles and turn south onto County Road 324. Follow County Road 324 for approximately 0.9 miles. The facility is located on the east side of the road at 1000 County Road 324.

Regulatory Applicability Assessment
Spring Creek Compressor Station

40 CFR Part	Description	Applicable Requirement	Reason
Part 50	National Primary and Secondary Ambient Air Quality Standards	N	Ambient standards set forth by theses provisions are not directly enforceable upon a facility. The demonstration of the maintenance of an air quality standard is the responsibility of the Administrator and not that of a specific facility. It is recognized that the Administrator may incorporate requirements into a State or Federal Implementation Plan designed to mitigate an air quality violation which can apply to specific facilities, but the specific air quality standards are not direct applicable requirements to this facility.
Part 51	Requirements for Preparation, Adoption and submittal of Implementation Plans	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act.
Part 52	Approval of Promulgation of Implementation Plans		
52.21	Prevention of Significant Deterioration	N	The facility is not a major stationary source as defined at 40 CFR 52.21(b). The facility has a potential to emit criteria pollutants below the 250 tpy PSD threshold.
52.24	New Source Review	N	The facility is not located in a nonattainment area
Part 53	Ambient Air Monitoring Reference and Equivalent Methods	N	This part sets forth requirements for the monitoring of ambient air. The facility is not required and does not perform ambient air monitoring.
Part 54	Prior Notice of Citizen Suits	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act.
Part 55	Outer Continental Shelf Air Regulations	N	The facility is not located on the Outer Continental Shelf
Part 56	Regional Consistency	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act.
Part 57	Primary Nonferrous Smelter Orders	N	The facility is not a Nonferrous Smelter
Part 58	Ambient Air Quality Surveillance	N	This part sets forth requirements for the monitoring of ambient air. The facility is not required and does not perform ambient air monitoring.
Part 59	Not Promulgated--Reserved		
Part 60	Standards of Performance for New Stationary Sources	N	Most of the standards set forth by these regulations do not apply to the facility because no applicable units exist at the facility. Specific standards which may apply at the facility and may apply in general to natural gas transmission and/or processing facilities include:
Subpart K	VOL Storage Tanks	N	There are no storage tanks at this facility which were constructed prior to March 8, 1978
Subpart Ka	VOL Storage Tanks	N	There are no storage tanks at this facility which were constructed between May18, 1978 and July 23, 1984
Subpart Kb	VOL Storage Tanks	N	All tanks which contain VOL and which were constructed after July 23, 1984 either have capacities less than the applicability threshold of 40 m^3 (251.6 bbl) or have vapor pressures below the 15 kPa applicability threshold.
Subpart GG	Stationary Gas Turbines	N	There are no gas turbines located at this facility.
Subpart KKK	On-Shore Natural Gas Processing Facilities	N	This facility does not process natural gas to extract natural gas liquids.

Regulatory Applicability Assessment
Spring Creek Compressor Station

40 CFR Part	Description	Applicable Requirement	Reason
Subpart LLL	On-Shore Natural Gas Sweetening Plants	N	This facility does not process natural gas to remove sulfur compounds.
Subpart JJJJ	Standards of Performance for Ignition Internal Combustion Engines and National Emision Standrads for Hazardous Air Pollutants for Recipricating Internal Combustion Engines	Y	Unit E3 is subject to this Subpart. Future Internal Combustion Engines installed at this facility may be subject to this Subpart and will be in compliance.
Subpart KKKK	Standards of Performance for Stationary Gas Turbines	N	There are no gas turbines located at this facility.
Subpart OOOO	Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution	Currently N/Possible Future Applicability	All equipment at this facility potentially subject to this Subpart was installed prior to the August 23, 2011 applicability date and is not subject to this regulation. Future compressor installed at this facility may be subject to this Subpart and will be in compliance.
Part 61	National Emission Standards for Hazardous Air Pollutants	N	This facility is not part of any source category for which provisions set forth by these regulations apply.
Part 62	Approval and Promulgation of State Plans for Designated Facilities and Pollutants	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act. They do not directly apply to this facility.
Part 63	National Emission Standards for Hazardous Air Pollutants for Source Categories	Y	Most of the standards set forth by these regulations do not apply to the facility because no applicable units exist at the facility. Specific standards which apply at the facility and may apply in general to natural gas transmission and/or processing facilities include:
Subpart HH	National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities	Y	This facility is an area source of HAP with respect to this subpart. The dehydration unit operates under the optimum glycol circulation rate.
Subpart HHH	National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities	N	Facility is not a natural gas transmission or storage facility.
Subpart ZZZZ	National Emission Standards for Hazardous Air Pollutants for Recipricating Internal Combustion Engines	Y	This facility is subject to this subpart because potential emissions are above major source thresholds.
Part 64	Compliance Assurance Monitoring	N	No emission units at the facility are equipped with emission control technology or are limited by an applicable emission limitation.
Part 65	Not Promulgated--Reserved		
Part 66	Assessment and Collection of Noncompliance Penalties by EPA	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act. They do not directly apply to this facility.
Part 67	EPA Approval of State Noncompliance Penalty Program	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act. They do not directly apply to this facility.
Part 68	Chemical Accident Prevention Provisions	N	No substance listed by this regulations is stored on-site at the facility in quantities above applicable threshold values set forth by the regulation.
Part 69	Special Exemptions from the Requirements of the Clean Air Act	N	The facility is not located in an area covered by this regulation.
Part 70	State Operating Permit Programs	N	The facility is not located in an area under the jurisdiction of a regulatory authority which has an EPA-approved part 70 program.
Part 71	Federal Operating Permit Programs	Y	The facility is a major source subject to the provisions of this regulation.
Part 72	Permits Regulation	N	The facility is not an affected facility under the Acid Rain Program.
Part 73	Sulfur Dioxide Allowance System	N	The facility is not an affected facility under the Acid Rain Program.
Part 74	Sulfur Dioxide Opt-Ins	N	The facility has not elected to opt-in to the Acid Rain Program.
Part 75	Continuous Emissions Monitoring	N	The facility is not an affected facility under the Acid Rain Program.

Regulatory Applicability Assessment
Spring Creek Compressor Station

40 CFR Part	Description	Applicable Requirement	Reason
Part 76	Acid Rain Nitrogen Oxides Emission Reduction Program	N	The facility is not an affected facility under the Acid Rain Program.
Part 77	Excess Emissions	N	The facility is not an affected facility under the Acid Rain Program.
Part 78	Appeal Procedures for Acid Rain Program	N	The facility is not an affected facility under the Acid Rain Program.
Part 79	Registration of Fuels and Fuel Additives	N	The facility does not sell fuels or additives which are designated by this provision.
Part 80	Regulation of Fuels and Fuel Additives	N	The facility does not sell fuels or additives which are designated by this provision.
Part 81	Designation of Areas for Air Quality Planning Purposes	N	Provision of this part are administrative in nature and implement mandates of the Clean Air Act. They do not directly apply to his facility.
Part 82	Protection of Stratospheric Ozone	N	The Facility does not engage in the distribution or sale of controlled substances, and it does not produce, transform, destroy, import, or export products containing controlled substances.
Part 85	Control of Air Pollution from Mobile Sources	N	The facility does not engage in vehicle manufacturing activities.
Part 86	Control of Air Pollution from New and In-Use Motor Vehicles and New and In-use Motor Vehicle Engines: Certification and Test Procedures	N	The facility does not engage in the certification or testing of motor vehicle engines.
Part 87	Control of Air Pollution from Aircraft and Aircraft Engines	N	The facility does not engage in the use of aircraft or aircraft engines.
Part 88	Clean-fuel Vehicles	N	These provisions apply to vehicle fleets and not to stationary sources.
Part 89	Control of Emissions from new and in-use Nonroad Engines	N	The facility does not engage in the use of nonraod engines as define by these provisions.
Part 90	Control of Emissions from Nonroad Spark-ignition Engines	N	The facility does not engage in the use of nonroad spark-ignition engines as defined by these provisions.
Part 91	Control of Emissions from Marine Spark-ignition Engines	N	The facility does not engage in the use of marine spark-ignition engines.
Part 92	Control of Emissions from Locomotives and Locomotive Engine	N	The facility does not engage in the use of locomotives or locomotive engines.
Part 93	Determining Conformity of Federal Actions to State or Federal Implementation Plans	N	The facility operations are not federal actions.
Part 94	Not Promulgated--Reserved		
Part 95	Mandatory Patent Licenses	N	Provisions of this part are administrative in nature and implement mandates of the Clean Air Act. They do not directly apply to his facility.
Parts 96-99	Not Promulgated--Reserved		

Group	Name	Population	Status	Lead Office	Recovery Plan Name	Recovery Plan Stage
Birds	Yellow-billed Cuckoo (Coccyzus	Western U.S. DPS	Proposed Threatened	Sacramento Fish And Wildlife		
Birds	Mexican spotted owl (Strix	Entire	Threatened	Arizona Ecological Services	Final Recovery Plan for the	Final Revision 1
Birds	Southwestern willow flycatcher	Entire	Endangered	Arizona Ecological Services	Final Recovery Plan for the	Final
Flowering Plants	Knowlton's cactus (Pediocactus		Endangered	New Mexico Ecological Services	Knowlton's (=Hedgehog) Cactus	Final
Insects	Uncompahgre fritillary butterfly	Entire	Endangered	Western Colorado Ecological	Uncompahgre Fritillary Butterfly	Final
Mammals	Black-footed ferret (Mustela	U.S.A. (specific portions of AZ,	Experimental Population, Non-	Office Of The Regional Director		
Mammals	New Mexico meadow jumping		Proposed Endangered	New Mexico Ecological Services		
Mammals	North American wolverine (Gulo		Proposed Threatened	Montana Ecological Services		

nps.gov

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U.S. Department of the Interior

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⌄	Spring Creek Archeological District *[Image]*	8%
⌄	Ute Mountain Ute Mancos Canyon Historic District *[Image]*	8%

Prev#;#**1**#;#**Next**

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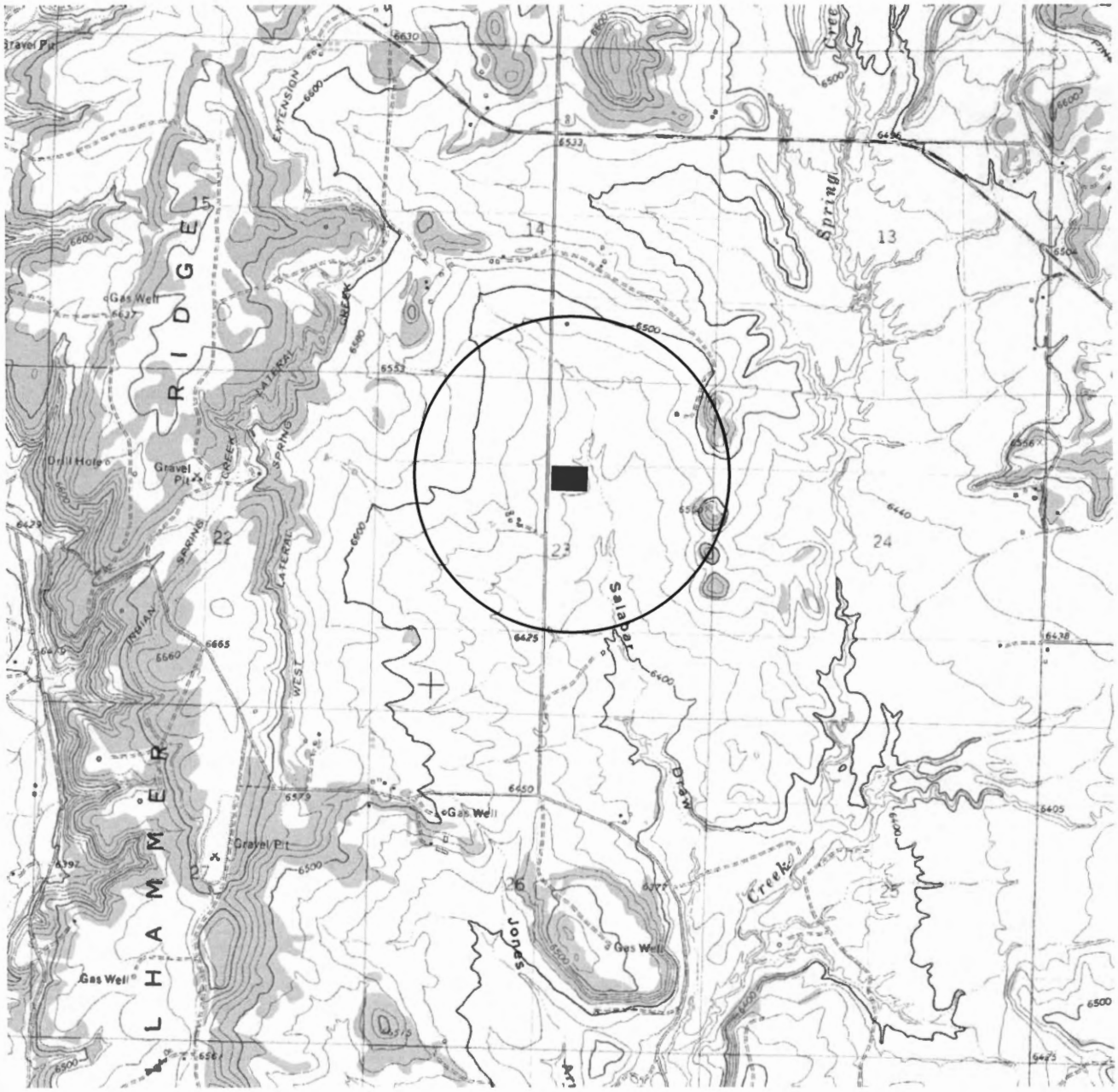
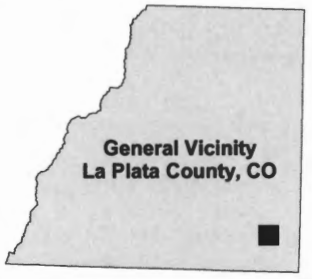
FIGURES





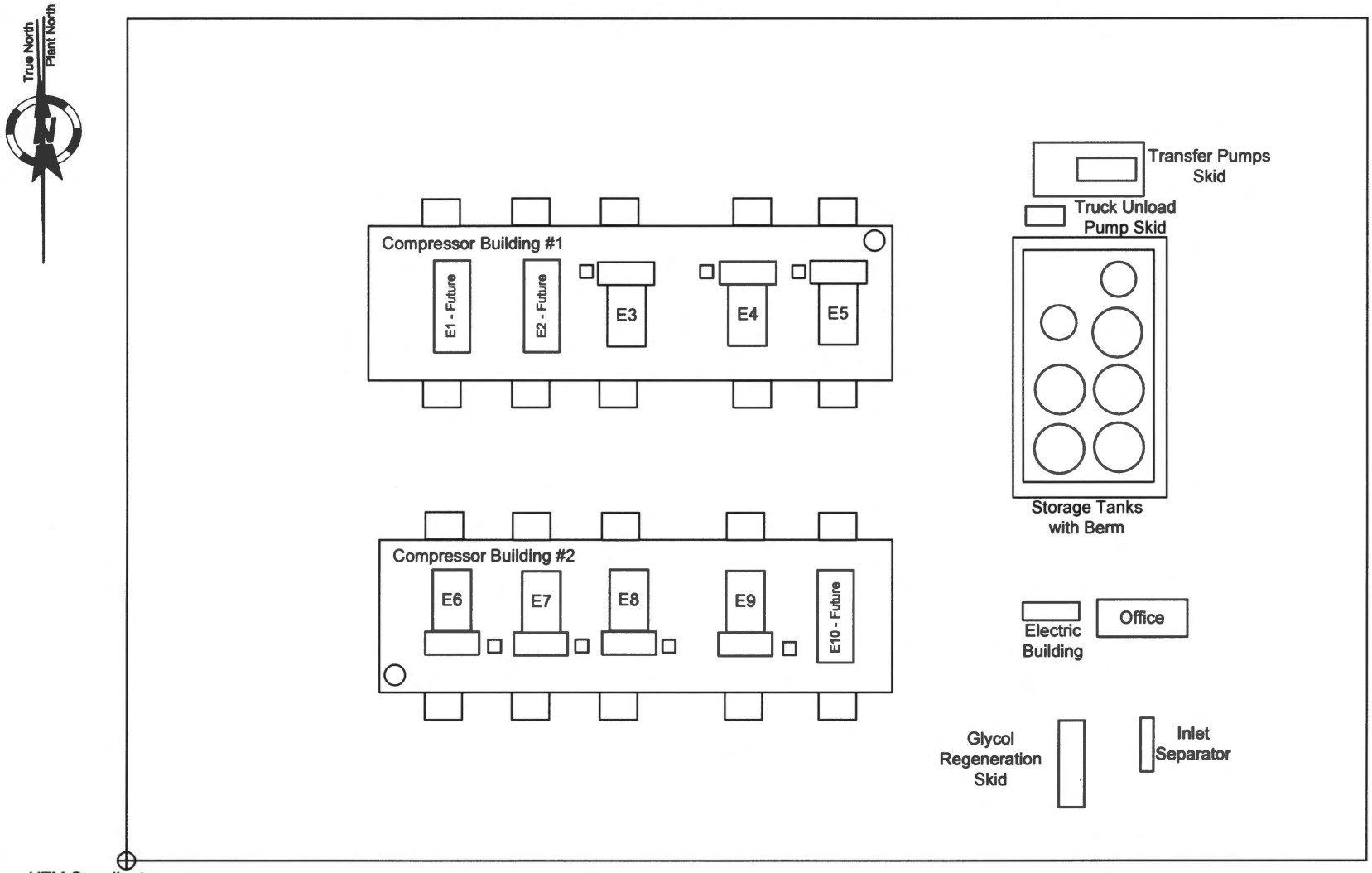
Compliance Partners Inc.
4038 Timberline Rd., Suite 100
Ft. Collins, CO 80525 (970) 206-4443
www.compliance-partners.com

Samson Resources

Spring Creek Compressor Station

General Facility Location
Section 23, Township 33N, Range 7W
La Plata County, Colorado

PROJECT NAME	FILENAME	SCALE	REVISED	FIGURE NUMBER
Samson: Spring Creek	Loc.srf	1 in = 2,500 ft	03/14/2013	1



UTM Coordinates
270957.06 E, 4107968.13 N
(NAD 27, Zone 13, meters)

Compliance Partners
4038 Timberline Rd. Suite 100
Fort Collins, CO 80525 970-206-4443
www.compliance-partners.com

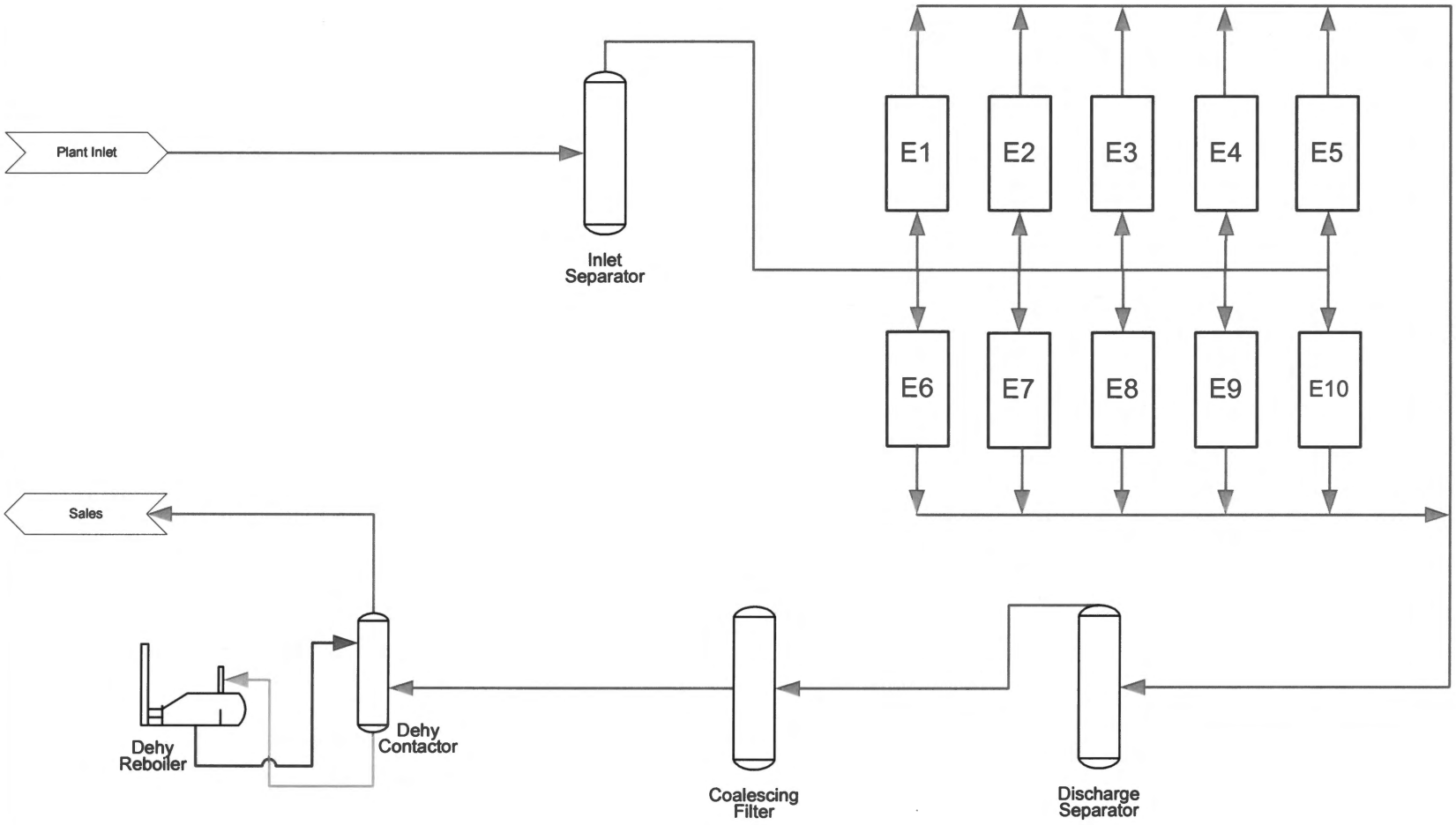
Samson Resources

Spring Creek Compressor Station

TITLE

Simplified Plot Plan

PROJECT NAME	FILE NAME	SCALE	REVISED	FIGURE NUMBER
Samson – Spring Creek	SimplePlot.vsd	1 in = 60 ft	3/14/2013	2



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Samson Resources

Spring Creek Compressor Station

TITLE

Simplified Process Flow Diagram

PROJECT NAME	FILE NAME	SCALE	REVISED	FIGURE NUMBER
Samson – Spring Creek	Pfd.vsd	None	03/14/2013	3

INSIGNIFICANT EMISSIONS

Insignificant Emission Justification
Spring Creek Compressor Station

Tanks

Emissions for the facility storage tanks were estimated using EPA Tanks 4.0.9d. Table 1 illustrates the emission units, the numbers of turnovers per year assumed when estimating emissions from the unit and the emissions from each unit. The Tanks output for each unit is attached. The produced water storage tanks are used to store produced water with very low VOC content, so emissions from these tanks are negligible. An analysis of this water is attached. The tanks at this facility are all insignificant emission units.

Table 1: Facility Tank Emissions

Unit ID	Description	Turnovers per Year	VOC Emissions per Tank	VOC Emissions per Unit
			lb/yr	lb/yr
IEU1[1]	10 – 500 gal lubricating oil storage tanks	18	0.12	1.20
IEU2[1]	10 – 500 gal used oil/waste oil storage tanks	6	0.10	0.6
IEU3[1]	2 – 500 gal ethylene glycol storage tanks	18	1.44	2.88
IEU4[2]	5 – 1000 gal produced water storage tanks 1 – 750 bbl produced water storage tank	6	<0.1	<0.1
IEU5[3]	1 – 500 bbl slop tank	12	3.77	3.77
IEU6[1]	10 – 500 gal skid drains tanks	12	0.12	1.20

[1] Low vapor pressure.
[2] Low VOC content.
[3] Low vapor pressure, mostly water with some lubricating oil.

Reciprocating Compressors

Reciprocating compressors are sources of VOC emissions from compressor blowdown, cylinder rod packing leaks and starter gas. Compressor blowdown, starter gas, and cylinder rod packing vent emissions for the compressors at this facility are insignificant.

Compressor Blowdown

Gas remaining in the compressor when shutdown will either remain pressurized in the compressor or it will be vented, usually to atmosphere. The total volume vented when the unit is blown down is a function of the compressor size and the size and pressure of the piping and vessels between the compressor suction and discharge isolation valves. The blowdown volume was based on equipment type and typical operating conditions, as well as the estimation of the VOC emissions from blowdown activities given the typical number of events per year. The facility's representative gas composition was used for these estimations. It should be noted that the number of blowdown events during a given year can change and Samson cannot commit to a limitation on the number of events that may occur. The blowdown emission calculation is illustrated below:

$$CBD=(40{,}927scf)\left(\frac{mole}{385scf}\right)\left(\frac{0.0172moles_{VOC}}{100moles}\right)\left(\frac{57.895lb_{VOC}}{mole_{VOC}}\right)\left(\frac{20events}{yr}\right)\left(\frac{ton}{2000lb}\right)=0.01\frac{ton_{VOC}}{yr}$$

Compressor blowdown VOC emissions are estimated to be 0.01 tpy for each compressor and 0.1 tpy VOC for all ten compressors at the facility.

Starter Gas

Compressor starter emissions were estimated using the starter's fuel usage at 110 psi and facility's representative gas composition. The example calculation for short term VOC emissions is presented below.

$$\frac{lb_{VOC}}{hr}=\left(1{,}100\frac{scf}{\min}\right)\left(\frac{mole}{385\,scf}\right)\left(\frac{0.0172\,moles_{VOC}}{100\,moles}\right)\left(\frac{57.895\,lb_{VOC}}{mole_{VOC}}\right)\left(\frac{60\min}{hr}\right)=1.7\frac{lb_{VOC}}{hr}$$

The starter was assumed to operate for 30 seconds per starting event resulting in 0.01 lbs of VOC emitted per starting event. It is estimated that there are 52 starting events per year for each engine. The VOC emissions are estimated at 0.0004 tpy for each compressor and 0.004 tpy VOC for all ten compressors.

Cylinder Rod Packing Vents

Compressor cylinder rod packing gas leakage is a continuous source of compressor emissions. Gas will leak from the packing and within the distance piece, and a vent is typically provided either at both the packing flange and distance piece, or just at the distance piece to direct this gas outside of any building the compressor may be housed within. EPA GasStar reports indicated vent rates of about 12 scfh for new state of the art best performing seals, and these rates can be as high as 900 scfh depending upon seal wear. Canadian/GRI research reports typical rod packing vent rates for standard seals of between 60 and 120 scfh. Vent rates are typically 30 percent higher when the compressor is idle and pressurized. The 60 scfh leakage rate along with a typical facility gas analysis was applied to determine VOC emissions from the facility gas compressor packing.

Assumptions:		
Gas VOC MW	57.895	lb/mole
Gas Molar Volume	385	scf/mole
Gas VOC Mole %	0.0172	%
Number of Cylinders	4	
Vent Volume	60	scf/cylinder
Vent Rate	240	scf/hr
Total Vent Volume	2102.4	Mscf/yr

$$\text{Compressor Packing Vent Emissions} = \frac{\left(60\frac{scf}{hr-cyl}\right)\left(4\frac{cyl}{comp}\right)\left(\frac{0.0172\,mole_{VOC}}{100\,mole}\right)\left(57.895\frac{lb_{VOC}}{mole_{VOC}}\right)\left(8{,}760\frac{hr}{yr}\right)}{\left(\frac{385\,scf}{mole}\right)\left(2{,}000\frac{lb}{ton}\right)} = 0.03\frac{ton}{yr-comp}$$

Annual VOC Emissions	0.03	ton VOC/year per compressor
	0.3	ton VOC/year for all compressors

TANKS 4.0.9D OUTPUT
LUBRICATING OIL STORAGE TANKS

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Lubricating Oil Storage Tanks
City:	Ignacio
State:	Colorado
Company:	Samson Resources
Type of Tank:	Horizontal Tank
Description:	Spring Creek 500 gallon lubricating oil tanks

Tank Dimensions

Shell Length (ft):	5.00
Diameter (ft):	4.00
Volume (gallons):	500.00
Turnovers:	18.00
Net Throughput(gal/yr):	9,000.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Alamosa, Colorado (Avg Atmospheric Pressure = 11.19 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Lubricating Oil Storage Tanks - Horizontal Tank
Ignacio, Colorado

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Lube Oil	All	51.76	37.44	66.07	44.16	0.0004	0.0002	0.0006	700.0000			0.01	

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Lubricating Oil Storage Tanks - Horizontal Tank
Ignacio, Colorado

Annual Emission Calcaulations	
Standing Losses (lb):	0.0795
Vapor Space Volume (cu ft):	40.0203
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.1066
Vented Vapor Saturation Factor:	1.0000
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	40.0203
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.0475
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Daily Avg. Liquid Surface Temp. (deg. R):	511.4276
Daily Average Ambient Temp. (deg. F):	41.0750
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	503.8250
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,667.4918
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1066
Daily Vapor Temperature Range (deg. R):	57.2610
Daily Vapor Pressure Range (psia):	0.0004
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0002
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0006
Daily Avg. Liquid Surface Temp. (deg R):	511.4276
Daily Min. Liquid Surface Temp. (deg R):	497.1123
Daily Max. Liquid Surface Temp. (deg R):	525.7428
Daily Ambient Temp. Range (deg. R):	35.4333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	1.0000
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0004
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.0450
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Annual Net Throughput (gal/yr.):	9,000.0000
Annual Turnovers:	18.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	0.7500
Total Losses (lb):	0.1245

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Lubricating Oil Storage Tanks - Horizontal Tank
Ignacio, Colorado

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Lube Oil	0.05	0.08	0.12

TANKS 4.0.9D OUTPUT
SKID DRAINS TANKS

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Skid Drains Tanks
City:	Ignacio
State:	Colorado
Company:	Samson Resources
Type of Tank:	Horizontal Tank
Description:	Spring Creek 500 gallon skid drains tanks

Tank Dimensions

Shell Length (ft):	5.00
Diameter (ft):	4.00
Volume (gallons):	500.00
Turnovers:	12.00
Net Throughput(gal/yr):	6,000.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Alamosa, Colorado (Avg Atmospheric Pressure = 11.19 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Skid Drains Tanks - Horizontal Tank
Ignacio, Colorado

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Skid Drains	All	51.76	37.44	66.07	44.16	0.0004	0.0002	0.0006	700.0000			0.00	

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Skid Drains Tanks - Horizontal Tank
Ignacio, Colorado

Annual Emission Calcaulations

Standing Losses (lb):	0.0795
Vapor Space Volume (cu ft):	40.0203
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.1066
Vented Vapor Saturation Factor:	1.0000
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	40.0203
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.0475
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Daily Avg. Liquid Surface Temp. (deg. R):	511.4276
Daily Average Ambient Temp. (deg. F):	41.0750
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	503.8250
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,667.4918
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1066
Daily Vapor Temperature Range (deg. R):	57.2610
Daily Vapor Pressure Range (psia):	0.0004
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0002
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0006
Daily Avg. Liquid Surface Temp. (deg R):	511.4276
Daily Min. Liquid Surface Temp. (deg R):	497.1123
Daily Max. Liquid Surface Temp. (deg R):	525.7428
Daily Ambient Temp. Range (deg. R):	35.4333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	1.0000
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0004
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.0400
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Annual Net Throughput (gal/yr.):	6,000.0000
Annual Turnovers:	12.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.1195

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Skid Drains Tanks - Horizontal Tank
Ignacio, Colorado

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Skid Drains	0.04	0.08	0.12

TANKS 4.0.9D OUTPUT
ETHYLENE GLYCOL STORAGE TANKS

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Ethylene Glycol Tanks
City:	Ignacio
State:	Colorado
Company:	Samson Resources
Type of Tank:	Horizontal Tank
Description:	Spring Creek 500 gallon Ethylene Glycol Tanks

Tank Dimensions

Shell Length (ft):	5.00
Diameter (ft):	4.00
Volume (gallons):	500.00
Turnovers:	18.00
Net Throughput(gal/yr):	9,000.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Alamosa, Colorado (Avg Atmospheric Pressure = 11.19 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Ethylene Glycol Tanks - Horizontal Tank
Ignacio, Colorado

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Triethylene Glycol	All	51.76	37.44	66.07	44.16	0.0193	0.0193	0.0193	150.2000			0.00	

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Ethylene Glycol Tanks - Horizontal Tank
Ignacio, Colorado

Annual Emission Calcaulations	
Standing Losses (lb):	0.8208
Vapor Space Volume (cu ft):	40.0203
Vapor Density (lb/cu ft):	0.0005
Vapor Space Expansion Factor:	0.1066
Vented Vapor Saturation Factor:	0.9980
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	40.0203
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.0475
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0005
Vapor Molecular Weight (lb/lb-mole):	150.2000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0193
Daily Avg. Liquid Surface Temp. (deg. R):	511.4276
Daily Average Ambient Temp. (deg. F):	41.0750
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	503.8250
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,667.4918
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1066
Daily Vapor Temperature Range (deg. R):	57.2610
Daily Vapor Pressure Range (psia):	0.0000
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0193
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0193
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0193
Daily Avg. Liquid Surface Temp. (deg R):	511.4276
Daily Min. Liquid Surface Temp. (deg R):	497.1123
Daily Max. Liquid Surface Temp. (deg R):	525.7428
Daily Ambient Temp. Range (deg. R):	35.4333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9980
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0193
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.6212
Vapor Molecular Weight (lb/lb-mole):	150.2000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0193
Annual Net Throughput (gal/yr.):	9,000.0000
Annual Turnovers:	18.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.4420

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Ethylene Glycol Tanks - Horizontal Tank
Ignacio, Colorado

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Triethylene Glycol	0.62	0.82	1.44

TANKS 4.0.9D OUTPUT
WASTE OIL/SLOP TANKS

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Waste Oil/Used Oil Storage Tank
City:	Ignacio
State:	Colorado
Company:	Samson Resources
Type of Tank:	Horizontal Tank
Description:	Spring Creek 500 gallon waste oil tanks

Tank Dimensions

Shell Length (ft):	5.00
Diameter (ft):	4.00
Volume (gallons):	500.00
Turnovers:	6.00
Net Throughput(gal/yr):	3,000.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Alamosa, Colorado (Avg Atmospheric Pressure = 11.19 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Waste Oil/Used Oil Storage Tank - Horizontal Tank
Ignacio, Colorado

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Used Oil	All	51.76	37.44	66.07	44.16	0.0004	0.0002	0.0006	700.0000			0.00	

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Waste Oil/Used Oil Storage Tank - Horizontal Tank
Ignacio, Colorado

Annual Emission Calcaulations	
Standing Losses (lb):	0.0795
Vapor Space Volume (cu ft):	40.0203
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.1066
Vented Vapor Saturation Factor:	1.0000
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	40.0203
Tank Diameter (ft):	4.0000
Effective Diameter (ft):	5.0475
Vapor Space Outage (ft):	2.0000
Tank Shell Length (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Daily Avg. Liquid Surface Temp. (deg. R):	511.4276
Daily Average Ambient Temp. (deg. F):	41.0750
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	503.8250
Tank Paint Solar Absorptance (Shell):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,667.4918
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1066
Daily Vapor Temperature Range (deg. R):	57.2610
Daily Vapor Pressure Range (psia):	0.0004
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0002
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0006
Daily Avg. Liquid Surface Temp. (deg R):	511.4276
Daily Min. Liquid Surface Temp. (deg R):	497.1123
Daily Max. Liquid Surface Temp. (deg R):	525.7428
Daily Ambient Temp. Range (deg. R):	35.4333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	1.0000
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0004
Vapor Space Outage (ft):	2.0000
Working Losses (lb):	0.0200
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Annual Net Throughput (gal/yr.):	3,000.0000
Annual Turnovers:	6.0000
Turnover Factor:	1.0000
Tank Diameter (ft):	4.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	0.0995

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Waste Oil/Used Oil Storage Tank - Horizontal Tank
Ignacio, Colorado

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Used Oil	0.02	0.08	0.10

TANKS 4.0.9D OUTPUT
SLOP TANK

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Slop Tank
City:	Ignacio
State:	Colorado
Company:	Samson Resources
Type of Tank:	Vertical Fixed Roof Tank
Description:	Spring Creek 400 bbl Slop Tank

Tank Dimensions

Shell Height (ft):	20.00
Diameter (ft):	12.50
Liquid Height (ft) :	19.00
Avg. Liquid Height (ft):	10.00
Volume (gallons):	17,442.02
Turnovers:	12.00
Net Throughput(gal/yr):	209,304.20
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Medium
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	1.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Alamosa, Colorado (Avg Atmospheric Pressure = 11.19 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Slop Tank - Vertical Fixed Roof Tank
Ignacio, Colorado

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Slop/Lube Oil	All	50.60	37.10	64.10	43.74	0.0004	0.0002	0.0006	700.0000			0.00	

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Slop Tank - Vertical Fixed Roof Tank
Ignacio, Colorado

Annual Emission Calcaulations

Standing Losses (lb):	2.3778
Vapor Space Volume (cu ft):	1,268.0908
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.1005
Vented Vapor Saturation Factor:	0.9998
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,268.0908
Tank Diameter (ft):	12.5000
Vapor Space Outage (ft):	10.3333
Tank Shell Height (ft):	20.0000
Average Liquid Height (ft):	10.0000
Roof Outage (ft):	0.3333
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.3333
Roof Height (ft):	1.0000
Roof Slope (ft/ft):	0.0000
Shell Radius (ft):	6.2500
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Daily Avg. Liquid Surface Temp. (deg. R):	510.2702
Daily Average Ambient Temp. (deg. F):	41.0750
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	503.4050
Tank Paint Solar Absorptance (Shell):	0.5400
Tank Paint Solar Absorptance (Roof):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,667.4918
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1005
Daily Vapor Temperature Range (deg. R):	53.9028
Daily Vapor Pressure Range (psia):	0.0004
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0002
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0006
Daily Avg. Liquid Surface Temp. (deg R):	510.2702
Daily Min. Liquid Surface Temp. (deg R):	496.7721
Daily Max. Liquid Surface Temp. (deg R):	523.7684
Daily Ambient Temp. Range (deg. R):	35.4333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9998
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0004
Vapor Space Outage (ft):	10.3333
Working Losses (lb):	1.3954
Vapor Molecular Weight (lb/lb-mole):	700.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0004
Annual Net Throughput (gal/yr.):	209,304.2036
Annual Turnovers:	12.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	17,442.0170
Maximum Liquid Height (ft):	19.0000
Tank Diameter (ft):	12.5000
Working Loss Product Factor:	1.0000
Total Losses (lb):	3.7732

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Slop Tank - Vertical Fixed Roof Tank
Ignacio, Colorado

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Slop/Lube Oil	1.40	2.38	3.77

FACILITY WATER ANALYSIS

CARDINAL LABORATORIES

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DURANGO, CO 81303
FAX TO: (970) 247-4227

Receiving Date: 06/24/10
Reporting Date: 07/01/10
Project Number: 1006-125-01
Project Name: LT ENVIRONMENTAL
Project Location: NOT GIVEN
Sample ID: SPRING CREEK TANK
Lab Number: H20199-1

Analysis Date: 06/28/10
Sampling Date: 06/22/10
Sample Type: WATER
Sample Condition: COOL & INTACT @ 5 °C
Sample Received By: JH
Analyzed By: ZL

VOLATILES - 8260		Sample Result H20199-1	Method Blank	QC Measured	QC True Value	QC Recovery
	Compound Name	mg/L				%
1	Dichlorodifluoromethane	<0.002	<0.002	0.009	0.010	90.0
2	Chloromethane	<0.002	<0.002	0.010	0.010	104
3	Vinyl chloride	<0.002	<0.002	0.010	0.010	102
4	Bromomethane	<0.002	<0.002	0.010	0.010	95.5
5	Chloroethane	<0.002	<0.002	0.008	0.010	80.7
6	Trichlorofluoromethane	<0.002	<0.002	0.011	0.010	111
7	1,1-Dichloroethene	<0.002	<0.002	0.010	0.010	97.9
8	Carbon Disulfide	ND	ND	NR	NR	NR
9	Iodomethane	ND	ND	NR	NR	NR
10	Acrolein	<0.200	<0.200	0.057	0.050	114
11	Methylene chloride	0.013	<0.002	0.009	0.010	88.0
12	Acetone	ND	ND	NR	NR	NR
13	trans-1,2-Dichloroethene	<0.002	<0.002	0.009	0.010	90.3
14	Methyl-t-butyl ether *	<0.002	<0.002	0.009	0.010	88.7
15	1,1-Dichloroethane	<0.002	<0.002	0.009	0.010	94.0
16	Vinyl Acetate	ND	ND	NR	NR	NR
17	cis-1,2-Dichloroethene	<0.002	<0.002	0.008	0.010	84.3
18	Acrylonitrile	<0.002	<0.002	0.056	0.050	111
19	2,2-Dichloropropane	<0.002	<0.002	0.012	0.010	120
20	Bromochloromethane	<0.002	<0.002	0.009	0.010	94.0
21	Chloroform	<0.002	<0.002	0.009	0.010	86.9
22	Carbon tetrachloride	<0.002	<0.002	0.011	0.010	114
23	1,1,1-Trichloroethane	<0.002	<0.002	0.009	0.010	86.2
24	1,1-Dichloropropene	<0.002	<0.002	0.009	0.010	90.8
25	2 Butanone	ND	ND	NR	NR	NR
26	Benzene	<0.002	<0.002	0.010	0.010	104
27	1,2-Dichloroethane	<0.002	<0.002	0.009	0.010	88.1
28	Trichloroethene	<0.002	<0.002	0.011	0.010	106
29	Dibromomethane	<0.002	<0.002	0.008	0.010	81.6

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
GREEN ANALYTICAL LABORATORIES, INC.
ATTN: DEBBIE ZUFELT
75 SUTTLE STREET
DURANGO, CO 81303
FAX TO: (970) 247-4227

Receiving Date: 06/24/10
Reporting Date: 07/01/10
Project Number: 1006-125-01
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Sample ID: SPRING CREEK TANK
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Analysis Date: 06/28/10
Sampling Date: 06/22/10
Sample Type: WATER
Sample Condition: COOL & INTACT @ 5 °C
Sample Received By: JH
Analyzed By: ZL

VOLATILES - 8260		Sample Result H20199-1	Method Blank	QC Measured	QC True Value	QC Recovery
	Compound Name	mg/L				%
30	1,2-Dichloropropane	<0.002	<0.002	0.009	0.010	87.7
31	Bromodichloromethane	<0.002	<0.002	0.008	0.010	81.9
32	cis-1,3-Dichloropropene	<0.002	<0.002	0.010	0.010	99.0
33	Toluene	<0.002	<0.002	0.010	0.010	96.9
34	4-Methyl-2-pentanone	ND	ND	NR	NR	NR
35	Tetrachloroethene	<0.002	<0.002	0.009	0.010	92.4
36	trans-1,3-Dichloropropene	<0.002	<0.002	0.012	0.010	120
37	1,1,2-Trichloroethane	<0.002	<0.002	0.012	0.010	120
38	Dibromochloromethane	<0.002	<0.002	0.011	0.010	112
39	1,3-Dichloropropane	<0.002	<0.002	0.011	0.010	110
40	1,2-Dibromoethane	<0.002	<0.002	0.010	0.010	96.6
41	2-Hexanone	ND	ND	NR	NR	NR
42	Chlorobenzene	<0.002	<0.002	0.010	0.010	99.1
43	Ethylbenzene	<0.002	<0.002	0.009	0.010	92.8
44	1,1,1,2-Tetrachloroethane	<0.002	<0.002	0.011	0.010	108
45	m+p - Xylene	0.117	<0.002	0.019	0.020	94.5
46	o-Xylene	0.007	<0.004	0.009	0.010	89.3
47	Bromoform	<0.002	<0.002	0.009	0.010	86.6
48	Styrene	<0.002	<0.002	0.009	0.010	88.5
49	Isopropylbenzene	<0.002	<0.002	0.009	0.010	92.6
50	Bromobenzene	<0.002	<0.002	0.008	0.010	82.2
51	n-Propylbenzene	<0.002	<0.002	0.009	0.010	91.6
52	1,1,2,2-Tetrachloroethane	<0.002	<0.002	0.009	0.010	85.0
53	2-Chlorotoluene	<0.002	<0.002	0.009	0.010	89.9
54	1,2,3-Trichloropropane	<0.002	<0.002	0.010	0.010	95.1
55	1,3,5-Trimethylbenzene	<0.002	<0.002	0.009	0.010	93.8
56	trans-1,4-Dichloro-2-butene	ND	ND	NR	NR	NR
57	4-Chlorotoluene	<0.002	<0.002	0.009	0.010	86.5
58	tert-Butylbenzene	<0.002	<0.002	0.009	0.010	88.6

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Sample Received By: JH
Analyzed By: ZL

VOLATILES - 8260		Sample Result H20199-1	Method Blank	QC Measured	QC True Value	QC Recovery
	Compound Name	mg/L				%
59	1,2,4-Trimethylbenzene	<0.002	<0.002	0.009	0.010	88.5
60	sec-Butylbenzene	<0.002	<0.002	0.009	0.010	88.3
61	p-Isopropyltoluene	<0.002	<0.002	0.009	0.010	88.3
62	1,3-Dichlorobenzene	<0.002	<0.002	0.008	0.010	84.7
63	1,4 Dichlorobenzene	<0.002	<0.002	0.010	0.010	101
64	n-Butylbenzene	<0.002	<0.002	0.010	0.010	101
65	1,2-Dichlorobenzene	<0.002	<0.002	0.010	0.010	95.3
66	1,2-Dibromo-3-chloropropane	<0.002	<0.002	0.008	0.010	80.0
67	Hexachlorobutadiene	<0.002	<0.002	0.011	0.010	108
68	1,2,4-Trichlorobenzene	<0.002	<0.002	0.009	0.010	85.6
69	Naphthalene	0.006	<0.002	0.008	0.010	80.0
70	1,2,3-Trichlorobenzene	<0.002	<0.002	0.009	0.010	91.0

Surrogates	% Recovery
Dibromodifluoromethane	92.9
Toluene-d8	102
4-Bromofluorobenzene	84.8

METHODS: EPA SW-846-8260. Reported on wet weight.
ND - Not detected
NR - Not reported.
* MTBE WAS ANALYZED SEPERATELY

Chemist

07/09/10
Date

EMISSIONS UNITS

CATERPILLAR G3516LE COMPRESSOR ENGINES

Emission Unit Description
Caterpillar G3516LE Compressor Engines
Spring Creek Compressor Station

There are currently nine, with future expansion to ten, 1340 horsepower Caterpillar G3516LE compressor engines installed at the Spring Creek Compressor Station. These engines are natural gas-fired 4-stroke lean burn internal combustion engines. These units have a site rating of 1092 horsepower. The fuel for the engines is pipeline quality natural gas. All of the engines are equipped with oxidation catalysts. Detailed emission calculations are attached for each unit. The manufacturer's specification sheet is also attached. Table 5 lists the serial number, manufacture date and installation/startup date for each of the engines at the Spring Creek Compressor Station.

Table 5: Spring Creek Compressor Station Engine Information

Unit ID	Serial Number	Manufacture Date	Installation/Commence Construction Date	Startup Date
E1	WPW1905	12/19/2007	06/20/2011	06/20/2011
E2	WPW1778	10/30/2007	06/23/2011	06/23/2011
E3	WPW02104	03/11/2008	09/15/2010	09/15/2010
E4	WPW00797	03/09/2007	02/23/2010	02/23/2010
E5	WPW00938	05/16/2007	02/23/2010	02/23/2010
E6	WPW00174	05/19/2006	02/25/2010	02/25/2010
E7	WPW00177	05/22/2006	02/25/2010	02/25/2010
E8	WPW00178	05/22/2006	02/24/2010	02/24/2010
E9	WPW00724	02/05/2007	02/23/2010	02/23/2010
E10	TBD	TBD	TBD	TBD

This facility is subject to the National Emission Standard for Hazardous Air Pollutants (NESHAP) for reciprocating internal combustion engines (RICE) regulation 40 CFR 63, Subpart ZZZZ because it emits or has the potential to emit a single Hazardous Air Pollutant (HAP) at a rate greater than 10 tons per year. Per 40 CFR 63, Subpart ZZZZ §63.6640, an affected facility is required to develop a Startup, Shutdown and Malfunction Plan (SSMP). The Spring Creek Compressor Station operates in accordance with the current facility SSMP that was last revised in January 2009.

Unit E3 is subject to the requirements of 40 CFR Part 60, Subpart JJJJ. Performance test are conducted on Unit E3 in accordance with 40 CFR 60.4244 every 8760 hours of operating or every three years, whichever comes first.

Each of the Caterpillar G3516LE compressor engines is equipped with either a NO_X sensor or O_2 sensor as part of the air fuel ration controller system (AFRC) and an oxidation catalytic converter to reduce emissions in the exhaust stream. A continuous parameter monitoring system (CPMS) is used to record the catalyst inlet temperature of each engine to ensure that the inlet temperature remains between 450 °F and 1350 °F. The CPMS continuously monitors the catalyst inlet temperature and reduces the data to a 4-hour rolling average. The CPMS also logs the shutdown times and events and displays the unit process and fuel flows for each engine. The pressure drop across the catalyst is manually recorded at least once a month. Facility data is recorded in accordance with applicable parts of Section §63.6640.

Performance tests are conducted on the engines at the Spring Creek Compressor Station to demonstrate compliance with the NO_X emission limit. The NO_X emissions from each engine are limited to 2.0 g/bhp-hr or 21.1 tpy. All engines at the facility are tested semi-annually to assess NO_X emissions. The performance tests for NO_X are conducted in accordance with the test methods specified in 40 CFR Part 60, Appendix A. EPA Reference Method 7E is used to measure NO_X emissions. The VOC performance tests required on Unit E3 are conducted in accordance with EPA Reference Method 25A and 18 of 40 CFR Part 63, Appendix A. All tests are performed at a maximum operating rate, 90% to 110% of engine design capacity. Each source test consists of at least three 1-hour or longer valid test runs. Emission results are reported as the arithmetic average of all valid test runs. During each test run data is collected on all parameters necessary to document how formaldehyde emissions were measured or calculated.

Exhaust NO_X ceiling monitoring and O_2 concentration floor monitoring values shall be established for each engine equipped with NO_X and O_2 sensors as part of the AFRC during the performance tests. The NO_X emissions of all operating engines will be monitored with one 20 minute portable analyzer test quarterly to confirm that the unit's respective set points are adequate to achieve compliance with the NO_X emissions limits.

Reference method performance tests will be conducted for all replacement catalysts and engines to measure NO_X emissions to demonstrate compliance with the engine emission limits. The performance tests will be conducted within 90 calendar days of catalyst change out or startup of the replacement engine. A portable analyzer test will be conducted to establish the new set-point for replacement NO_X and O_2 sensors to ensure that NO_X emissions remain within permitted limits.

Spring Creek Compressor Station Engine Emission Calculations

Basis

Unit(s)	E1, E2, E4-E10
Type	Caterpillar G3516LE
Control	Oxidation Catalyst
Horsepower	1340 hp
Site Rated Horsepower	1092 hp
Hours of Operation	8760 hrs
Fuel Usage	7500 BTU/hp-hr
Fuel Heat Content	975.0 BTU/SCF
Annual Fuel Consumption	73.58 MMscf
Fuel Use Rate	8400 scf/hr

Emissions Estimate (per engine)

	Uncontrolled					Controlled					Reduction Efficiency
	Emissions Factor		Emissions			Emissions Factor		Emissions			
Pollutant	(lb/MMbtu)	(g/hp-hr)	(lb/hr)	(lb/yr)	(tpy)	(lb/MMbtu)	(g/hp-hr)	(lb/hr)	(lb/yr)	(tpy)	
NO_X	0.5874	2.000	4.81	---	21.07	0.5874	2.000	4.81	---	21.07	0%
CO	0.5463	1.860	4.47	---	19.60	0.5463	1.860	4.47	---	19.60	0%
VOC	0.1028	0.350	0.84	---	3.69	0.1028	0.350	0.84	---	3.69	0%
Formaldehyde	0.0816	0.278	0.67	5858	2.93	0.0411	0.140	0.34	2950	1.47	50%
SO_2	0.0006	0.002	0.00	---	0.02	0.0006	0.002	0.00	---	0.02	0%
TSP	0.0100	0.034	0.08	---	0.36	0.0100	0.034	0.08	---	0.36	0%
PM_{10}	0.0001	0.000	0.00	---	0.00	0.0001	0.000	0.00	---	0.00	0%
$PM_{2.5}$	0.0001	0.000	0.00	---	0.00	0.0001	0.000	0.00	---	0.00	0%
Acetaldehyde	0.0084	0.028	0.07	600	0.30	0.0017	0.006	0.01	120	0.06	80%
Acrolein	0.0051	0.018	0.04	369	0.18	0.0010	0.004	0.01	74	0.04	80%
Benzene	0.0004	0.001	0.00	32	0.02	0.0001	0.000	0.00	6	0.00	80%
Toluene	0.0004	0.001	0.00	29	0.01	0.0001	0.000	0.00	6	0.00	80%
Xylene	0.0002	0.001	0.00	13	0.01	0.0000	0.000	0.00	3	0.00	80%
n-Hexane	0.0011	0.004	0.01	80	0.04	0.0002	0.001	0.00	16	0.01	80%
Methanol	0.0025	0.009	0.02	179	0.09	0.0005	0.002	0.00	36	0.02	80%

Emission Factors from Manufacturer's Specifications or
AP-42 Table 3.2-2 Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines

Spring Creek Compressor Station Engine Emission Calculations

Basis

Unit(s)	E3	
Type	Caterpillar G3516LE	
Control	Oxidation Catalyst	
Horsepower	1340	hp
Site Rated Horsepower	1092	hp
Hours of Operation	8760	hrs
Fuel Usage	7500	BTU/hp-hr
Fuel Heat Content	975.0	BTU/SCF
Annual Fuel Consumption	73.58	MMscf
Fuel Use Rate	8400	scf/hr

Emissions Estimate (per engine)

	Uncontrolled					Controlled					Reduction Efficiency
	Emissions Factor		Emissions			Emissions Factor		Emissions			
Pollutant	(lb/MMbtu)	(g/hp-hr)	(lb/hr)	(lb/yr)	(tpy)	(lb/MMbtu)	(g/hp-hr)	(lb/hr)	(lb/yr)	(tpy)	
NO_X	0.5874	2.000	4.81	---	21.07	0.5874	2.000	4.81	---	21.07	0%
CO	0.5463	1.860	4.47	---	19.60	0.5463	1.860	4.47	---	19.60	0%
VOC	0.2937	1.000	2.41	---	10.54	0.2937	1.000	2.41	---	10.54	0%
Formaldehyde	0.0816	0.278	0.67	5858	2.93	0.0411	0.140	0.34	2950	1.47	50%
SO_2	0.0006	0.002	0.00	---	0.02	0.0006	0.002	0.00	---	0.02	0%
TSP	0.0100	0.034	0.08	---	0.36	0.0100	0.034	0.08	---	0.36	0%
PM_{10}	0.0001	0.000	0.00	---	0.00	0.0001	0.000	0.00	---	0.00	0%
$PM_{2.5}$	0.0001	0.000	0.00	---	0.00	0.0001	0.000	0.00	---	0.00	0%
Acetaldehyde	0.0084	0.028	0.07	600	0.30	0.0017	0.006	0.01	120	0.06	80%
Acrolein	0.0051	0.018	0.04	369	0.18	0.0010	0.004	0.01	74	0.04	80%
Benzene	0.0004	0.001	0.00	32	0.02	0.0001	0.000	0.00	6	0.00	80%
Toluene	0.0004	0.001	0.00	29	0.01	0.0001	0.000	0.00	6	0.00	80%
Xylene	0.0002	0.001	0.00	13	0.01	0.0000	0.000	0.00	3	0.00	80%
n-Hexane	0.0011	0.004	0.01	80	0.04	0.0002	0.001	0.00	16	0.01	80%
Methanol	0.0025	0.009	0.02	179	0.09	0.0005	0.002	0.00	36	0.02	80%

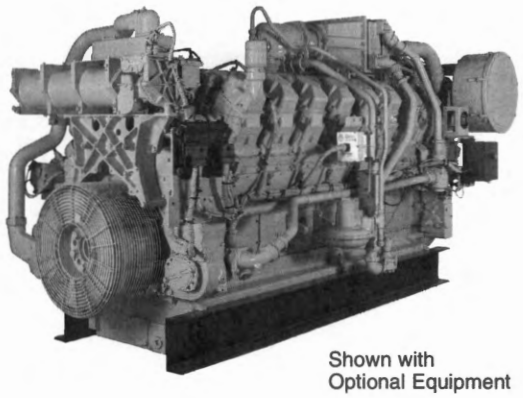
Emission Factors from Manufacturer's Specifications or
AP-42 Table 3.2-2 Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines

CATERPILLAR®

Gas Petroleum Engine

G3516

809-1000 bkW
1085-1340 bhp
1200-1400 rpm



Shown with Optional Equipment

CATERPILLAR® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle
Bore — mm (in) 170 (6.7)
Stroke — mm (in)..... 190 (7.5)
Displacement — L (cu in)..... 69 (4,210)
Aspiration..... Turbocharged-Aftercooled
Capacity for Liquids — L (U.S. gal)
  Cooling System[1]..... 205 (54)
  Lube Oil System (refill)..... 423 (112)
Package Shipping Weight
  (Dry) — kg (lb)..... 8015 (17,670)

[1]Engine only.

FEATURES

- Advisor Panel
  Compact, remote-mounted advisor gauge panel with fully electronic display
- Expanded monitoring features:
  - Unfiltered oil pressure
  - Filtered oil pressure
  - Coolant (water) temperature
  - Oil temperature
  - Engine speed
  - Battery voltage
  - Service hours
  - Oil filter differential pressure
  - Detonation
  - Manifold inlet air pressure
  - Coolant (JW) outlet pressure
  - Coolant (JW) inlet pressure
  - Left turbocharger inlet temperature
  - Right turbocharger inlet temperature
  - Cylinder port temperature
  - Cylinder port temperature deviation from average (high or low)
  - Engine oil to engine coolant differential temperature
  - Improper gas control valve response
  - O_2 level sensor
- Expanded alarm and shutdown capability
- Full range of diagnostics for troubleshooting electrical or electronic faults
- Advisor panel standard containing digital display of electronic control unit (ECU) parameters, diagnostic codes, engine start/stop switch, prelube and postlube integrated into ADEM™ A3 ECU with control switch mounted in Advisor panel
- Remote speed input 4-20 ma or 0-5 volts
- Integrated governing, AFRC, safeties, start/stop logic and ignition
- The standard ignition and control system is certified by the Canadian Standards Association (CSA) for use in Class I, Division 2, Group D hazardous locations
- Modular wiring concept
- PL1000E provides direct translation of engine operating parameters from Cat Data Link to Modbus, with an available mounting location for the PL1000E in the Advisor panel

Factory-designed systems built at Caterpillar ISO 9001:2000 certified facilities.

BENEFITS

- **Reliable and durable product**
  - Components are proven and reliable based upon experience with G3600, G3500B, and diesel engine platforms
  - Performance and system validation completed via lab and field test
- **Serviceable product**
  - Common ADEM A3 ECU with G3600, G3500B, and diesel C280 and 3500 products
  - Improved access to engine sides due to removal of mechanical gauge panel
  - Expanded diagnostics which are linked to troubleshooting procedures
  - One common serviceable engine harness reducing parts stocking requirements and reducing repair time
  - One common Advisor panel, reducing parts stocking requirements
- **Easy to use**
  - Engine monitoring parameters communicated via MODBUS or ethernet by optional PL1000E
  - Engine monitoring parameters and exhaust temperatures displayed and alarmed on Advisor panel

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

STANDARD EQUIPMENT

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

Control System
ADEM™ 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
ADEM 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 — Caterpillar 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 intertia weight
Guard removal
Engine barring group
Premium 8:1 pistons
Premium cylinder heads

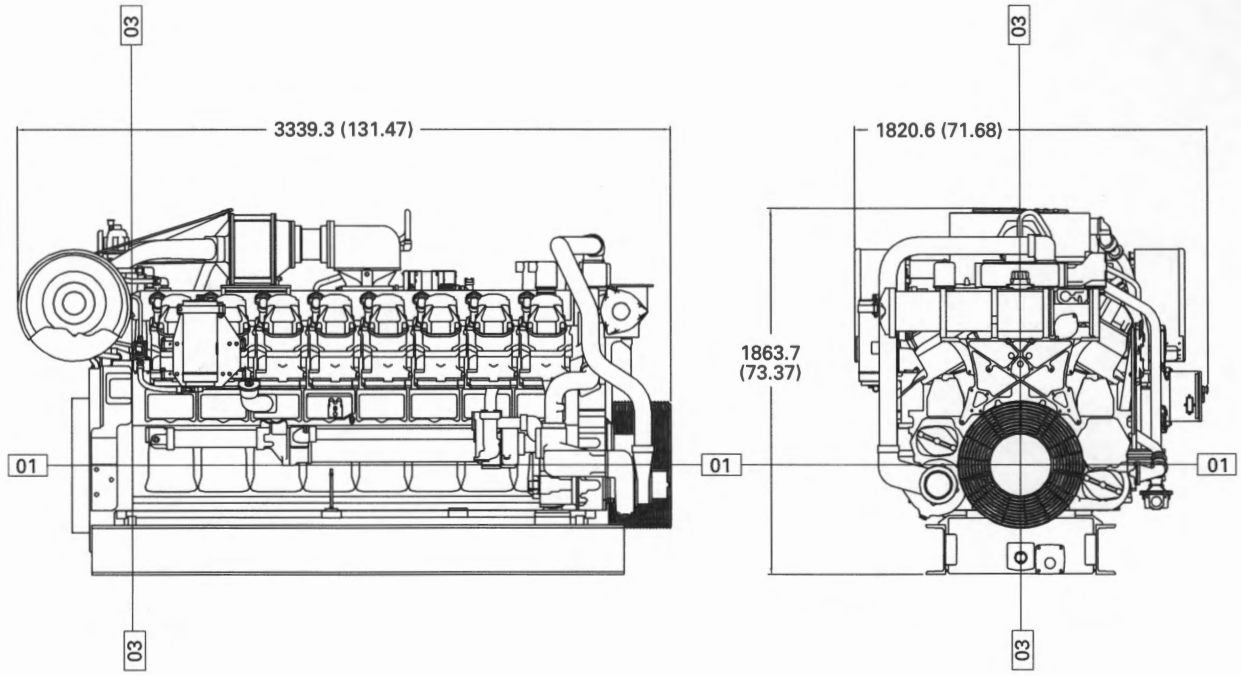
TECHNICAL DATA

G3516 Gas Petroleum Engine — 1400 rpm

		DM8540-00	DM8541-00	DM8542-00	DM8543-00
Fuel System		w/o AFRC	w/o AFRC	with AFRC	w/o AFRC
Engine Power					
@ 100% Load	bkW (bhp)	969 (1300)	943 (1265)	999 (1340)	999 (1340)
@ 75% Load	bkW (bhp)	727 (975)	707 (949)	749 (1005)	749 (1005)
Engine Speed	rpm	**1400**	**1400**	**1400**	**1400**
SCAC Temperature	°C (°F)				
Compression Ratio		8:1	8:1	8:1	8:1
Emissions*					
NO_X	mg/N•m³ dry (g/bhp-hr)	829 (2.0)	824 (2.0)	604 (1.5)	837 (2.0)
CO	mg/N•m³ dry (g/bhp-hr)	772 (1.86)	777 (1.89)	759 (1.89)	767 (1.83)
Total Hydrocarbons	mg/N•m³ dry (g/bhp-hr)				
Fuel Consumption					
@ 100% Load	MJ/bkW-hr (Btu/bhp-hr)	10.45 (7392)	10.48 (7407)	10.47 (7401)	10.43 (7377)
@ 75% Load	MJ/bkW-hr (Btu/bhp-hr)	10.69 (7561)	10.70 (7564)	10.83 (7657)	10.69 (7558)
Heat Balance					
Heat Rejection to Jacket Water					
@ 100% Load	bkW (Btu/mn)	711 (40,443)	708 (40,277)	725 (41,216)	719 (40,893)
@ 75% Load	bkW (Btu/mn)	464 (26,402)	602 (34,223)	606 (34,469)	325 (18,476)
Heat Rejection to Aftercooler					
@ 100% Load	bkW (Btu/mn)	175 (9976)	145 (8276)	183 (10,426)	206 (11,752)
@ 75% Load	bkW (Btu/mn)	138 (7829)	90 (5115)	124 (7047)	195 (11,086)
Heat Rejection to Exhaust					
@ 100% Load (LHV to 77°) (LHV to 77° F / 25° C)	bkW (Btu/mn)	794 (45,180)	782 (44,486)	833 (47,381)	807 (45,870)
@ 75% Load (LHV to 77°) (LHV to 77° F / 25° C)	bkW (Btu/mn)	707 (40,232)	557 (31,677)	631 (35,910)	856 (48,690)
Exhaust System					
Exhaust Gas Flow Rate					
@ 100% Load	N•m³/bkW-hr (cfm)	4.69 (7283)	4.71 (7151)	4.80 (7651)	4.67 (7416)
@ 75% Load	N•m³/bkW-hr (cfm)	5.68 (6579)	4.56 (5171)	4.96 (5853)	6.72 (7970)
Exhaust Stack Temperature					
@ 100% Load	°C (°F)	460 (860)	465 (868)	457 (854)	455 (852)
@ 75% Load	°C (°F)	456 (854)	461 (862)	449 (840)	452 (845)
Intake System					
Air Inlet Flow Rate					
@ 100% Load	N•m³/bkW-hr (scfm)	4.39 (2732)	4.40 (2666)	4.50 (2886)	4.36 (2798)
@ 75% Load	N•m³/bkW-hr (scfm)	5.37 (2506)	4.24 (1929)	4.64 (2232)	6.40 (3084)
Gas Pressure	kPag (psig)	242-276 (35-40)	242-276 (35-40)	242-276 (35-40)	242-276 (35-40)

*at 100% load and speed

DIMENSIONS



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.

CATERPILLAR®

LEHW6046-00 (4-06)

Emission Estimates
Emission Unit E1
Spring Creek Compressor Station

Unit E1 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E2
Spring Creek Compressor Station

Unit E2 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E3
Spring Creek Compressor Station

Unit E3 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	1.00 g/hp-hr	(40 CFR 60, Subpart JJJJ Limitation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(1.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 10.5\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E4
Spring Creek Compressor Station

Unit E4 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E5
Spring Creek Compressor Station

Unit E5 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E6
Spring Creek Compressor Station

Unit E6 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E7
Spring Creek Compressor Station

Unit E7 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E8
Spring Creek Compressor Station

Unit E8 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E9
Spring Creek Compressor Station

Unit E9 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

Emission Estimates
Emission Unit E10
Spring Creek Compressor Station

Unit E10 is a 1,340 horsepower Caterpillar G3516LE, a 4-stroke lean burn internal combustion engine. The engine is equipped with an oxidation catalyst for the control of formaldehyde. Potential to emit calculations are presented below.

Potential to Emit: Uncontrolled Configuration
Lean-burn Engine with Oxidation Catalyst for formaldehyde control

Estimated Emission Factors

NO_X	2.00 g/hp-hr	(Manufacturer Quotation)
CO	1.86 g/hp-hr	(Manufacturer Quotation)
VOC	0.35 g/hp-hr	(Manufacturer Quotation)
Formaldehyde	13.6 ppmvd ≈ 0.14 g/hp-hr	(40 CFR 63, Subpart ZZZZ Limitation, Engineering Estimate)

Site-Rated Horsepower: 1,092 hp

$$NO_X = \frac{(2.00\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 21.1\ tpy$$

$$CO = \frac{(1.86\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 19.6\ tpy$$

$$VOC = \frac{(0.35\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 3.7\ tpy$$

$$CH_2O = \frac{(0.14\ g/hp\text{-}hr)(1{,}092\ hp)(8{,}760\ hr/yr)}{(454\ g/lb)(2{,}000\ lb/ton)} = 1.5\ tpy$$

EMISSION UNIT D1
TEG DEHYDRATION UNIT

Emission Estimates
Emission Unit D1
60 MMscfd Dehydration Unit
Spring Creek Compressor Station

VOC and HAP emissions may occur when triethylene glycol is regenerated. The emission model GRI-GLYCalc, a thermodynamic-based process simulator for dehydration units, was utilized to estimate emissions from this unit. A facility inlet gas analysis with the highest sampled VOC content and maximum anticipated benzene concentration was input to the model. Following is a summary of other worse-case operating parameter model input values:

Parameter	Value	
Inlet Gas Throughput	60	MMscfd
Inlet Gas Temperature	60	°F
Inlet Gas Pressure	120	psig
Inlet Benzene Concentration	2	ppm
Glycol Circulation	15	gpm
Flash Vessel Temperature	140	°F
Flash Vessel Pressure	40	psig

Model Results (Output Follows)

VOC Emissions	8.7	tpy
Benzene Emissions	0.9	tpy
Total HAP Emissions	6.6	tpy

D1 PTE (150% of modeled emissions)

VOC Emissions	13.1	tpy
HAP Emissions	9.9	tpy

Emission Estimates
Dehydration Unit Reboiler
Spring Creek Compressor Station

Reboilers and Heaters
Type <100 MMBtu/hr

Operation	8760 hrs
Heat Content	975 Btu/SCF

Pollutant	Emission Factor* (lb/MMSCF)
NO_X	100
CO	84
VOC	5.5
Formaldehyde	0.075
SO2	0.6
PM	7.6

*Emission factors obtained from AP-42 Tables 1.4-1, 1.4-2 and 1.5-2.

Reboilers

Unit	Description	Heater Size (MMBtu/hr)	NO_X		CO		VOC		Formaldehyde		SO_2		PM_{10}	
			(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
D1	Dehy Reboiler	0.75	0.07	0.31	0.06	0.26	0.004	0.02	0.00	0.00	0.00	0.00	0.005	0.02

QUESTAR APPLIED TECHNOLOGY

1210 D. Street, Rock Springs, Wyoming 82901

(307) 352-7292

LIMS ID:	N/A		Description:	Spring Creek CDP Inlet
Analysis Date/Time:	1/7/2013	4:43 PM	Field:	La Plata
Analyst Initials:	ABK		ML#:	Lease# 038105
Instrument ID:	Instrument 1		GC Method:	Quesbtex
Data File:	QPC16.D			
Date Sampled:	1/1/2013			

Component	Mol%	Wt%	LV%
Methane	95.3680	88.6938	95.3255
Ethane	0.2304	0.4017	0.3644
Propane	0.0094	0.0241	0.0153
Isobutane	0.0016	0.0053	0.0030
n-Butane	0.0012	0.0042	0.0023
Neopentane	0.0004	0.0018	0.0010
Isopentane	0.0019	0.0078	0.0040
n-Pentane	0.0005	0.0020	0.0010
2,2-Dimethylbutane	0.0002	0.0010	0.0005
2,3-Dimethylbutane	0.0002	0.0010	0.0005
2-Methylpentane	0.0000	0.0000	0.0000
3-Methylpentane	0.0002	0.0009	0.0004
n-Hexane	0.0002	0.0009	0.0005
Heptanes	0.0005	0.0033	0.0014
Octanes	0.0000	0.0000	0.0000
Nonanes	0.0003	0.0018	0.0007
Decanes plus	0.0006	0.0046	0.0020
Nitrogen	0.3667	0.5955	0.2372
Carbon Dioxide	4.0177	10.2503	4.0403
Oxygen	0.0000	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000	0.0000
Total	100.0000	100.0000	100.0000

Global Properties		Units
Gross BTU/Real CF	972.2	BTU/SCF at 60°F and14.73 psia
Sat.Gross BTU/Real CF	956.4	BTU/SCF at 60°F and14.73 psia
Gas Compressibility (Z)	0.9979	
Specific Gravity	0.5969	air=1
Avg Molecular Weight	17.250	gm/mole
Propane GPM	0.002576	gal/MCF
Butane GPM	0.000900	gal/MCF
Gasoline GPM	0.001502	gal/MCF
26# Gasoline GPM	0.001880	gal/MCF
Total GPM	0.791064	gal/MCF
Base Mol%	100.221	%v/v

Sample Temperature:	39	°F
Sample Pressure:	32	psig
H2SLength of Stain Tube	N/A	ppm

Component	Mol%	Wt%	LV%
Benzene	0.0000	0.0000	0.0000
Toluene	0.0002	0.0011	0.0004
Ethylbenzene	0.0001	0.0006	0.0002
M&P Xylene	0.0001	0.0006	0.0002
O-Xylene	0.0000	0.0000	0.0000
2,2,4-Trimethylpentane	0.0000	0.0000	0.0000
Cyclopentane	0.0000	0.0000	0.0000
Cyclohexane	0.0000	0.0000	0.0000
Methylcyclohexane	0.0002	0.0014	0.0006
Description:	Spring Creek CDP Inlet		

GRI GlyCalc Information

Component	Mol%	Wt%	LV%
Carbon Dioxide	4.0177	10.2503	4.0403
Hydrogen Sulfide	0.0000	0.0000	0.0000
Nitrogen	0.3667	0.5955	0.2372
Methane	95.3680	88.6938	95.3255
Ethane	0.2304	0.4017	0.3644
Propane	0.0094	0.0241	0.0153
Isobutane	0.0016	0.0053	0.0030
n-Butane	0.0012	0.0042	0.0023
Isopentane	0.0023	0.0096	0.0050
n-Pentane	0.0005	0.0020	0.0010
Cyclopentane	0.0000	0.0000	0.0000
n-Hexane	0.0002	0.0009	0.0005
Cyclohexane	0.0000	0.0000	0.0000
Other Hexanes	0.0006	0.0029	0.0014
Heptanes	0.0001	0.0008	0.0004
Methylcyclohexane	0.0002	0.0014	0.0006
2,2,4 Trimethylpentane	0.0000	0.0000	0.0000
Benzene	0.0000	0.0000	0.0000
Toluene	0.0002	0.0011	0.0004
Ethylbenzene	0.0001	0.0006	0.0002
Xylenes	0.0001	0.0006	0.0002
C8+ Heavies	0.0007	0.0052	0.0023
Subtotal	100.0000	100.0000	100.0000
Oxygen	0.0000	0.0000	0.0000
Total	100.0000	100.0000	100.0000

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Spring Creek Dehy
File Name: C:\Work\Projects\Samson\Spring Creek\Permit Work\March 2013\dehy.ddf
Date: March 15, 2013

DESCRIPTION:

Description: Samson Resources
Spring Creek Compressor Station
Dehydration Unit with 60 MMSCFD capacity

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.3334	32.003	5.8405
Ethane	0.0518	1.243	0.2268
Propane	0.0097	0.233	0.0426
Isobutane	0.0042	0.101	0.0185
n-Butane	0.0047	0.112	0.0205
Isopentane	0.0146	0.349	0.0638
n-Pentane	0.0044	0.105	0.0192
n-Hexane	0.0048	0.114	0.0208
Other Hexanes	0.0099	0.238	0.0434
Heptanes	0.0071	0.170	0.0310
Methylcyclohexane	0.0348	0.835	0.1523
Benzene	0.1952	4.684	0.8549
Toluene	0.4096	9.830	1.7940
Ethylbenzene	0.3970	9.528	1.7388
Xylenes	0.4950	11.880	2.1682
C8+ Heavies	0.3852	9.245	1.6871
Total Emissions	3.3613	80.670	14.7223
Total Hydrocarbon Emissions	3.3613	80.670	14.7223
Total VOC Emissions	1.9760	47.425	8.6550
Total HAP Emissions	1.5015	36.037	6.5767
Total BTEX Emissions	1.4968	35.923	6.5559

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	2.5751	61.803	11.2791
Ethane	0.0300	0.719	0.1312
Propane	0.0026	0.061	0.0112
Isobutane	0.0008	0.018	0.0033
n-Butane	0.0006	0.016	0.0028
Isopentane	0.0018	0.043	0.0078
n-Pentane	0.0004	0.010	0.0019
n-Hexane	0.0003	0.006	0.0012
Other Hexanes	0.0007	0.018	0.0032
Heptanes	0.0002	0.005	0.0009

Methylcyclohexane	0.0004	0.010	0.0018
Benzene	0.0004	0.010	0.0018
Toluene	0.0006	0.014	0.0025
Ethylbenzene	0.0003	0.008	0.0014
Xylenes	0.0003	0.007	0.0012
C8+ Heavies	0.0013	0.030	0.0055
Total Emissions	2.6157	62.777	11.4569
Total Hydrocarbon Emissions	2.6157	62.777	11.4569
Total VOC Emissions	0.0106	0.255	0.0466
Total HAP Emissions	0.0019	0.044	0.0081
Total BTEX Emissions	0.0016	0.038	0.0069

EQUIPMENT REPORTS:

ABSORBER

Specified Absorber Stages:	2.11	
Calculated Dry Gas Dew Point:	2.99	lbs. H2O/MMSCF
Temperature:	60.0	deg. F
Pressure:	120.0	psig
Dry Gas Flow Rate:	60.0000	MMSCF/day
Glycol Losses with Dry Gas:	0.0373	lb/hr
Wet Gas Water Content:	Saturated	
Calculated Wet Gas Water Content:	94.28	lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	3.94	gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.17%	96.83%
Carbon Dioxide	99.92%	0.08%
Nitrogen	100.00%	0.00%
Methane	100.00%	0.00%
Ethane	99.98%	0.02%
Propane	99.96%	0.04%
Isobutane	99.92%	0.08%
n-Butane	99.88%	0.12%
Isopentane	99.85%	0.15%
n-Pentane	99.80%	0.20%
n-Hexane	99.56%	0.44%
Other Hexanes	99.69%	0.31%
Heptanes	98.90%	1.10%
Methylcyclohexane	97.28%	2.72%
Benzene	81.00%	19.00%
Toluene	66.22%	33.78%
Ethylbenzene	43.20%	56.80%
Xylenes	29.19%	70.81%
C8+ Heavies	95.08%	4.92%

FLASH TANK

Flash Control:	Vented to atmosphere	
Flash Temperature:	140.0	deg. F
Flash Pressure:	40.0	psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.99%	0.01%
Carbon Dioxide	85.11%	14.89%
Nitrogen	33.15%	66.85%
Methane	34.12%	65.88%
Ethane	63.35%	36.65%
Propane	79.14%	20.86%
Isobutane	84.80%	15.20%
n-Butane	87.84%	12.16%
Isopentane	89.10%	10.90%
n-Pentane	91.02%	8.98%
n-Hexane	94.66%	5.34%
Other Hexanes	93.19%	6.81%
Heptanes	97.23%	2.77%
Methylcyclohexane	98.90%	1.10%
Benzene	99.80%	0.20%
Toluene	99.87%	0.13%
Ethylbenzene	99.93%	0.07%
Xylenes	99.95%	0.05%
C8+ Heavies	99.71%	0.29%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	35.65%	64.35%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.56%	99.44%
n-Pentane	0.55%	99.45%
n-Hexane	0.53%	99.47%
Other Hexanes	1.07%	98.93%
Heptanes	0.51%	99.49%
Methylcyclohexane	4.04%	95.96%
Benzene	5.01%	94.99%
Toluene	7.91%	92.09%
Ethylbenzene	10.41%	89.59%
Xylenes	12.91%	87.09%
C8+ Heavies	12.06%	87.94%

STREAM REPORTS:

WET GAS STREAM

Temperature: 60.00 deg. F
Pressure: 134.70 psia
Flow Rate: 2.51e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.99e-001	2.36e+002
Carbon Dioxide	4.01e+000	1.17e+004
Nitrogen	3.66e-001	6.77e+002
Methane	9.52e+001	1.01e+005
Ethane	2.30e-001	4.57e+002
Propane	9.38e-003	2.73e+001
Isobutane	1.60e-003	6.13e+000
n-Butane	1.20e-003	4.60e+000
Isopentane	2.30e-003	1.09e+001
n-Pentane	4.99e-004	2.38e+000
n-Hexane	2.00e-004	1.14e+000
Other Hexanes	5.99e-004	3.41e+000
Heptanes	9.98e-005	6.60e-001
Methylcyclohexane	2.00e-004	1.29e+000
Benzene	2.00e-004	1.03e+000
Toluene	2.00e-004	1.21e+000
Ethylbenzene	9.98e-005	7.00e-001
Xylenes	9.98e-005	7.00e-001
C8+ Heavies	6.99e-004	7.86e+000
Total Components	100.00	1.14e+005

DRY GAS STREAM

Temperature: 60.00 deg. F
Pressure: 134.70 psia
Flow Rate: 2.50e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.31e-003	7.49e+000
Carbon Dioxide	4.01e+000	1.16e+004
Nitrogen	3.67e-001	6.77e+002
Methane	9.54e+001	1.01e+005
Ethane	2.30e-001	4.56e+002
Propane	9.40e-003	2.73e+001
Isobutane	1.60e-003	6.12e+000
n-Butane	1.20e-003	4.59e+000
Isopentane	2.30e-003	1.09e+001
n-Pentane	4.99e-004	2.37e+000
n-Hexane	1.99e-004	1.13e+000
Other Hexanes	5.98e-004	3.40e+000
Heptanes	9.89e-005	6.53e-001
Methylcyclohexane	1.95e-004	1.26e+000
Benzene	1.62e-004	8.34e-001
Toluene	1.32e-004	8.04e-001
Ethylbenzene	4.32e-005	3.02e-001
Xylenes	2.92e-005	2.04e-001
C8+ Heavies	6.66e-004	7.47e+000
Total Components	100.00	1.14e+005

LEAN GLYCOL STREAM

Temperature: 60.00 deg. F
Flow Rate: 1.50e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	8.32e+003
Water	1.50e+000	1.27e+002
Carbon Dioxide	1.13e-011	9.53e-010
Nitrogen	3.04e-014	2.57e-012
Methane	1.56e-018	1.31e-016
Ethane	4.57e-010	3.86e-008
Propane	5.92e-012	5.00e-010
Isobutane	1.77e-012	1.49e-010
n-Butane	1.56e-012	1.32e-010
Isopentane	9.73e-007	8.22e-005
n-Pentane	2.86e-007	2.42e-005
n-Hexane	2.99e-007	2.52e-005
Other Hexanes	1.27e-006	1.08e-004
Heptanes	4.33e-007	3.66e-005
Methylcyclohexane	1.74e-005	1.47e-003
Benzene	1.22e-004	1.03e-002
Toluene	4.17e-004	3.52e-002
Ethylbenzene	5.46e-004	4.62e-002
Xylenes	8.69e-004	7.34e-002
C8+ Heavies	6.26e-004	5.28e-002
Total Components	100.00	8.45e+003

RICH GLYCOL STREAM

Temperature: 60.00 deg. F
Pressure: 134.70 psia
Flow Rate: 1.55e+001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.57e+001	8.31e+003
Water	4.09e+000	3.55e+002
Carbon Dioxide	1.10e-001	9.53e+000
Nitrogen	2.95e-004	2.57e-002
Methane	4.50e-002	3.91e+000
Ethane	9.41e-004	8.17e-002
Propane	1.41e-004	1.23e-002
Isobutane	5.74e-005	4.98e-003
n-Butane	6.12e-005	5.32e-003
Isopentane	1.89e-004	1.64e-002
n-Pentane	5.56e-005	4.83e-003
n-Hexane	5.81e-005	5.05e-003
Other Hexanes	1.24e-004	1.08e-002
Heptanes	8.42e-005	7.32e-003
Methylcyclohexane	4.22e-004	3.66e-002
Benzene	2.37e-003	2.06e-001
Toluene	5.13e-003	4.45e-001
Ethylbenzene	5.11e-003	4.43e-001
Xylenes	6.55e-003	5.69e-001
C8+ Heavies	5.06e-003	4.39e-001

Total Components	100.00	8.69e+003

FLASH TANK OFF GAS STREAM

Temperature: 140.00 deg. F
Pressure: 54.70 psia
Flow Rate: 7.42e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.31e-001	1.87e-002
Carbon Dioxide	1.65e+001	1.42e+000
Nitrogen	3.13e-001	1.72e-002
Methane	8.21e+001	2.58e+000
Ethane	5.09e-001	3.00e-002
Propane	2.97e-002	2.56e-003
Isobutane	6.66e-003	7.57e-004
n-Butane	5.69e-003	6.47e-004
Isopentane	1.27e-002	1.79e-003
n-Pentane	3.07e-003	4.34e-004
n-Hexane	1.60e-003	2.70e-004
Other Hexanes	4.34e-003	7.32e-004
Heptanes	1.03e-003	2.03e-004
Methylcyclohexane	2.09e-003	4.02e-004
Benzene	2.67e-003	4.08e-004
Toluene	3.14e-003	5.66e-004
Ethylbenzene	1.57e-003	3.26e-004
Xylenes	1.36e-003	2.82e-004
C8+ Heavies	3.76e-003	1.25e-003
Total Components	100.00	4.07e+000

FLASH TANK GLYCOL STREAM

Temperature: 140.00 deg. F
Flow Rate: 1.55e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.58e+001	8.31e+003
Water	4.09e+000	3.55e+002
Carbon Dioxide	9.34e-002	8.11e+000
Nitrogen	9.80e-005	8.51e-003
Methane	1.54e-002	1.33e+000
Ethane	5.96e-004	5.18e-002
Propane	1.12e-004	9.72e-003
Isobutane	4.87e-005	4.22e-003
n-Butane	5.38e-005	4.67e-003
Isopentane	1.69e-004	1.46e-002
n-Pentane	5.06e-005	4.40e-003
n-Hexane	5.51e-005	4.78e-003
Other Hexanes	1.15e-004	1.00e-002
Heptanes	8.19e-005	7.11e-003
Methylcyclohexane	4.17e-004	3.62e-002
Benzene	2.37e-003	2.05e-001
Toluene	5.12e-003	4.45e-001
Ethylbenzene	5.10e-003	4.43e-001
Xylenes	6.55e-003	5.68e-001

Component	Conc. (vol%)	Loading (lb/hr)
C8+ Heavies	5.05e-003	4.38e-001
Total Components	100.00	8.68e+003

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 4.93e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.78e+001	2.29e+002
Carbon Dioxide	1.42e+000	8.11e+000
Nitrogen	2.34e-003	8.51e-003
Methane	6.40e-001	1.33e+000
Ethane	1.33e-002	5.18e-002
Propane	1.70e-003	9.72e-003
Isobutane	5.60e-004	4.22e-003
n-Butane	6.19e-004	4.67e-003
Isopentane	1.55e-003	1.46e-002
n-Pentane	4.67e-004	4.37e-003
n-Hexane	4.25e-004	4.75e-003
Other Hexanes	8.86e-004	9.91e-003
Heptanes	5.44e-004	7.08e-003
Methylcyclohexane	2.73e-003	3.48e-002
Benzene	1.92e-002	1.95e-001
Toluene	3.42e-002	4.10e-001
Ethylbenzene	2.88e-002	3.97e-001
Xylenes	3.59e-002	4.95e-001
C8+ Heavies	1.74e-002	3.85e-001
Total Components	100.00	2.40e+002

EMISSION UNIT FUG
FUGITIVE EMISSIONS

Emission Estimates
Emission Unit FUG
Spring Creek Compressor Station

Service	Component	Count	Emission factor (lb/component/hr)	VOC	
				(lb/hr)	(tpy)
VOC Wt. % = 0.06					
Gas	Valves	258	0.00992	0.00	0.01
	Connectors	86	0.00044	0.00	0.00
	Flanges	40	0.00086	0.00	0.00
	Other	116	0.01940	0.00	0.01
	Open End	0	0.00441	0.00	0.00
	Pump Seals	0	0.00529	0.00	0.00
VOC Wt. % = 100.00					
Slop/Oil	Valves	76	0.00551	0.42	1.83
	Connectors	14	0.00046	0.01	0.03
	Flanges	2	0.00024	0.00	0.00
	Other	2	0.01653	0.03	0.14
	Open End	0	0.00309	0.00	0.00
	Pump Seals	0	0.02866	0.00	0.00
VOC Wt. % = 100.00					
Glycol	Valves	33	0.00551	0.18	0.80
	Connectors	10	0.00046	0.00	0.02
	Flanges	0	0.00024	0.00	0.00
	Other	2	0.01653	0.00	0.00
	Open End	0	0.00309	0.00	0.00
	Pump Seals	2	0.02866	0.06	0.25
VOC Wt. % = 50.00					
Water	Valves	65	0.000216	0.01	0.03
	Connectors	40	0.000243	0.00	0.02
	Flanges	2	0.000006	0.00	0.00
	Other	19	0.000053	0.00	0.00
	Open End	0	0.030865	0.00	0.00
	Pump Seals	1	0.000551	0.00	0.00
		768		**0.72**	**3.15**

GREENHOUSE GAS EMISSIONS

Total Greenhouse Gas PTE
Samson Resources Company
Spring Creek Compressor Station

Source ID	Description	Green House Gases Emissions			Total GHG PTE	CO_2e PTE
		CO_2	Methane	N_2O		
		tpy	tpy	tpy	tpy	tpy
E1	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E2	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E3	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E4	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E5	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E6	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E7	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E8	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E9	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
E10	Caterpillar G3516LE	4199.8	58.1	0.01	4257.9	5423.0
D1	0.75 MMBtu/hr Reboiler	369.4	0.0	0.01	369.4	372.5
	Glycol Process Vents	41.7	17.1	0.00	58.8	400.8
FUG	Fugitive Leaks	2.2	18.9	0.00	21.1	399.1
Total		42411.3	617.0	0.11	43,028.4	55,402.4
CO_2e		42411.3	12957.0	34.1		

Total GHG PTE **43,028.4 tpy**
Total CO_2e **55,402.4 tpy**

Compressor Engine GHG Emission Estimate
Samson Resources Company
Spring Creek Compressor Station

Basis

Units	Caterpillar G3516LE Compressor Engines	
Combustion	4 Stroke Lean Burn	
Rating	1092	hp
Operating Hours	8760	hours/year
Fuel Consuption	7500	Btu/hp-hr
Fuel Heat Content	975	Btu/scf
Blowdown Volume	40927	scf
Blowdown Events	20	per year
Packing Vent Volume	60	scf/cylinder
Number of cylinders	4	cylinders/engine
Starter Gas Usage	1100	scfm
Start Time	0.167	min
Starting Events	52	per year

Emissions Estimate (per engine)

Pollutant	Exhaust			Rod Packing Vents Emissions		Blowdowns Emissions		Starter Emissions		Totals	Emission Factor Source
	Emission Factor	Emissions									
	(lb/MMBtu)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/event)	(tpy)	(lb/event)	(tpy)	(tpy)	
CO_2	116.889	957	4,193	1.10	4.83	187.92	1.88	0.84	0.02	4,199.79	40 CFR Part 98, Subpart C, Table C-1
Methane	0.002	0.016	0.072	9.51	41.66	1622.08	16.22	7.28	0.19	58.14	40 CFR Part 98, Subpart C, Table C-2
N_2O	0.0002	0.002	0.008	0	0	0	0	0	0	0.01	40 CFR Part 98, Subpart C, Table C-2

Glycol Dehydration Process Vents GHG Emission Estimate
Samson Resources Company
Spring Creek Compressor Station

Basis

Unit	Dehydration Unit	
Annual Throughput	60	MMscfd
Hours of Operation	8760	hrs

Emissions Based on GLYCalc 3.0 Model

Emissions Estimate

Pollutant	lb/hr	tpy
CO_2	9.53	41.74
Methane	3.91	17.13
N_2O	0.0	0

Natural Gas Fired Burner GHG Emission Estimate
Samson Resources Company
Spring Creek Compressor Station

Basis

Units	Dehydration Unit Reboiler
Hours of Operation	8760 hrs
Fuel Heat Content	975 Btu/scf
Heat Input Rate	0.75 MMBtu/hr

Emissions

Pollutant	Emission Factor (lb/MMscf)	Emissions		Emission Factor Source
		(lb/hr)	(tpy)	
CO_2	120,000	84.34	369.42	AP-42 Table 1.4-2
Methane	2.3	0.00	0.01	AP-42 Table 1.4-2
N_2O	2.2	0.00	0.01	AP-42 Table 1.4-2

Fugitive GHG Emission Estimate
Samson Resources Company
Spring Creek Compressor Station

Basis

Units	Fugitive Emissions
CO_2	10.273 wt%
CH_4	88.671 wt%

Emissions Estimate

Component	Count	Emission Factor (kg/component-hr)	CO2		Methane	
			(lb/hr)	(tpy)	(lb/hr)	(tpy)
Flanges	40	3.90E-04	0.00	0.02	0.03	0.13
Valves	258	4.50E-03	0.26	1.15	2.27	9.93
Connectors	86	2.00E-04	0.00	0.02	0.03	0.15
Press Relief	0	2.00E-03	0.00	0.00	0.00	0.00
Pump Seals	0	2.40E-03	0.00	0.00	0.00	0.00
Other	116	8.80E-03	0.23	1.01	1.99	8.73
Total			**0.50**	**2.19**	**4.33**	**18.95**

Emission factors obtained from the 1995 Protocol for Equipment Leak Emission Estimates Document EPA-453/R-95-017 Table 2-4: Oil and Gas Production

Example GHG Emission Calculations
Spring Creek Compressor Station

Exhaust/Combustion

$$1092\ hp * \frac{7500\ Btu}{hp\ hr} * \frac{MMBtu}{1{,}000{,}000\ Btu} * \frac{116.889\ lb\ CO_2}{MMBtu} = 957\ \frac{lb\ CO_2}{hr}$$

$$957\ \frac{lb\ CO_2}{hr} * \frac{ton}{2000\ lb} * \frac{8760\ hr}{yr} = 4{,}193\ tpy\ CO_2$$

$$1092\ hp * \frac{7500\ Btu}{hp\ hr} * \frac{MMBtu}{1{,}000{,}000\ Btu} * \frac{0.002\ lb\ CH_4}{MMBtu} = 0.016\ \frac{lb\ CH_4}{hr}$$

$$0.016\ \frac{lb\ CH_4}{hr} * \frac{ton}{2000\ lb} * \frac{8760\ hr}{yr} = 0.072\ tpy\ CH_4$$

$$1092\ hp * \frac{7500\ Btu}{hp\ hr} * \frac{MMBtu}{1{,}000{,}000\ Btu} * \frac{0.0002\ lb\ N_2O}{MMBtu} = 0.002\ \frac{lb\ N_2O}{hr}$$

$$0.002\ \frac{lb\ N_2O}{hr} * \frac{ton}{2000\ lb} * \frac{8760\ hr}{yr} = 0.008\ tpy N_2O$$

Cylinder Rod Packing Vents

$$\frac{60\ scf}{hr * cylinder} * \frac{4\ cylinder}{compressor} * \frac{mole}{385\ scf} * \frac{4.0177\ mole\ CO_2}{100\ mole} * \frac{44\ lb\ CO_2}{mole\ CO_2} = 1.10\ \frac{lb\ CO_2}{hr}$$

$$1.10\ \frac{lb\ CO_2}{hr} * \frac{ton}{2000\ lb} * \frac{8760\ hr}{yr} = 4.83\ tpy\ CO_2$$

$$\frac{60\ scf}{hr * cylinder} * \frac{4\ cylinder}{compressor} * \frac{mole}{385\ scf} * \frac{95.368\ mole\ CH_4}{100\ mole} * \frac{16\ lb\ CH_4}{mole\ CH_4} = 9.51\ \frac{lb\ CH_4}{hr}$$

$$9.51\ \frac{lb\ CH_4}{hr} * \frac{ton}{2000\ lb} * \frac{8760\ hr}{yr} = 41.66\ tpy\ CH_4$$

Blowdown Emissions

$$\frac{40{,}927\ scf}{event} * \frac{mole}{385\ scf} * \frac{4.0177\ mole\ CO_2}{100\ mole} * \frac{44\ lb\ CO_2}{mole\ CO_2} = 187.92\ \frac{lb\ CO_2}{event}$$

$$187.92\ \frac{lb\ CO_2}{event} * \frac{20\ events}{yr} * \frac{ton}{2000\ lb} = 1.88\ tpy\ CO_2$$

$$\frac{40{,}927\ scf}{event} * \frac{mole}{385\ scf} * \frac{95.368\ mole\ CH_4}{100\ mole} * \frac{16\ lb\ CH_4}{mole\ CH_4} = 1622.08\ \frac{lb\ CH_4}{event}$$

$$1622.08\ \frac{lb\ CH_4}{event} * \frac{20\ events}{yr} * \frac{ton}{2000\ lb} = 16.22\ tpy\ CH_4$$

Starter Emissions

$$\frac{1100\ scf}{min} * \frac{mole}{385\ scf} * \frac{4.0177\ mole\ CO_2}{100\ mole} * \frac{44\ lb\ CO_2}{mole\ CO_2} * \frac{0.167\ min}{event} = 0.84\ \frac{lb\ CO_2}{event}$$

$$0.84\ \frac{lb\ CO_2}{event} * \frac{52\ events}{yr} * \frac{ton}{2000\ lb} = 0.02\ tpy\ CO_2$$

$$\frac{1100\ scf}{min} * \frac{mole}{385\ scf} * \frac{95.368\ mole\ CH_4}{100\ mole} * \frac{16\ lb\ CH_4}{mole\ CH_4} * \frac{0.167\ min}{event} = 7.28\ \frac{lb\ CH_4}{event}$$

$$7.28\ \frac{lb\ CH_4}{event} * \frac{52\ events}{yr} * \frac{ton}{2000\ lb} = 0.19\ tpy\ CH_4$$