Received
May 14, 2025
WV DEP/Div of Air Quality

Division of Air Quality Permit Application Submittal

Please find attached a permit application for : TransGas Development Systems, LLC
[Company Name; Facility Location]

- DAQ Facility ID (for existing facilities only): New Facility
- Current 45CSR13 and 45CSR30 (Title V) permits associated with this process (for existing facilities only): New Facility

- Type of NSR Application (check all that apply):
  - ☑ Construction
  - ☐ Modification
  - ☐ Class I Administrative Update
  - ☐ Class II Administrative Update
  - ☐ Relocation
  - ☐ Temporary
  - ☐ Permit Determination

- Type of 45CSR30 (TITLE V) Application:
  - ☐ Title V Initial
  - ☐ Title V Renewal
  - ☐ Administrative Amendment**
  - ☐ Minor Modification**
  - ☐ Significant Modification**
  - ☐ Off Permit Change

****If the box above is checked, include the Title V revision information as ATTACHMENT S to the combined NSR/Title V application.**

- Payment Type:
  - ☑ Credit Card (Instructions to pay by credit card will be sent in the Application Status email.)
  - ☐ Check (Make checks payable to: WVDEP – Division of Air Quality)
    Mail checks to:
    WVDEP – DAQ – Permitting
    Attn: NSR Permitting Secretary
    601 57th Street, SE
    Charleston, WV 25304

Please wait until DAQ emails you the Facility ID Number and Permit Application Number. Please add these identifiers to your check or cover letter with your check.

- If the permit writer has any questions, please contact (all that apply):
  - ☑ Responsible Official/Authorized Representative
    - Name: Adam Victor
    - Email: adam@tgds.com
    - Phone Number: (917) 816-3700
  - ☑ Company Contact
    - Name: Adam Victor, Jr.
    - Email: avj@adamsforkenergy.com
    - Phone Number: (917) 816-3700
  - ☑ Consultant
    - Name: Patrick Ward
    - Email: PEWard@potesta.com
    - Phone Number: (304) 342-1400

REGULATION 13 PERMIT APPLICATION FOR THE CONSTRUCTION OF ADAMS FORK DATA CENTER ENERGY CAMPUS MINGO COUNTY, WEST VIRGINIA

REDACTED VERSION

Prepared for:

TransGas Development Systems, LLC
630 First Avenue, Suite 30C
New York, New York 10016-3799

Prepared by:

Potesta & Associates, Inc.
7012 MacCorkle Avenue, SE
Charleston, West Virginia 25304
Phone: (304) 342-1400 Fax: (304) 343-9031
Email: potesta@potesta.com

Project No. 0101-22-0132-003A

March 24, 2025

POTESTA

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Attachments not applicable to this submission: Attachment R, Authority Forms and Attachment S, Title V Permit Revision Information.

SECTION I - III

APPLICATION FOR NSR PERMIT

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF AIR QUALITY

601 57th Street, SE
Charleston, WV 25304
(304) 926-0475
www.dep.wv.gov/daq

APPLICATION FOR NSR PERMIT AND TITLE V PERMIT REVISION (OPTIONAL)

PLEASE CHECK ALL THAT APPLY TO **NSR (45CSR13)** (IF KNOWN):

☒ **CONSTRUCTION** ☐ **MODIFICATION** ☐ **RELOCATION**
☐ **CLASS I ADMINISTRATIVE UPDATE** ☐ **TEMPORARY**
☐ **CLASS II ADMINISTRATIVE UPDATE** ☐ **AFTER-THE-FACT**

PLEASE CHECK TYPE OF **45CSR30 (TITLE V)** REVISION (IF ANY):

☐ **ADMINISTRATIVE AMENDMENT** ☐ **MINOR MODIFICATION**
☐ **SIGNIFICANT MODIFICATION**

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS **ATTACHMENT S** TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant *(as registered with the WV Secretary of State's Office):*
TransGas Development Systems, LLC

2. Federal Employer ID No. ***(FEIN):***
20343110

3. Name of facility *(if different from above):*
Adams Fork Data Center Energy Campus

4. The applicant is the:
☐ **OWNER** ☐ **OPERATOR** ☒ **BOTH**

5A. Applicant's mailing address:
630 First Avenue, Suite 30C
New York, New York 10016-3799

5B. Facility's present physical address:
2002 Twisted Gun Road
Wharncliffe, WV 25651

6. **West Virginia Business Registration.** Is the applicant a resident of the State of West Virginia? ☒ **YES** ☐ **NO**

➪ If **YES,** provide a copy of the **Certificate of Incorporation/Organization/Limited Partnership** (one page) including any name change amendments or other Business Registration Certificate as **Attachment A.**

➪ If **NO,** provide a copy of the **Certificate of Authority/Authority of L.L.C./Registration** (one page) including any name change amendments or other Business Certificate as **Attachment A.**

7. If applicant is a subsidiary corporation, please provide the name of parent corporation: No

8. Does the applicant own, lease, have an option to buy or otherwise have control of the *proposed site?* ☐ **YES** ☐ **NO**

➪ If **YES,** please explain: Applicant has an option on the site with the current owner.

➪ If **NO,** you are not eligible for a permit for this source.

9. Type of plant or facility (stationary source) to be **constructed, modified, relocated, administratively updated** or **temporarily permitted** (e.g., coal preparation plant, primary crusher, etc.): Off-grid Power Generation

10. North American Industry Classification System **(NAICS)** code for the facility:
221112

11A. DAQ Plant ID No. (for existing facilities only):
New Facility

11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only):
New Facility

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

12A.

- ➪ For **Modifications, Administrative Updates** or **Temporary permits** at an existing facility, please provide directions to the *present location* of the facility from the nearest state road;
- ➪ For **Construction** or **Relocation permits,** please provide directions to the *proposed new site location* from the nearest state road. Include a **MAP** as **Attachment B**.

The facility will be located on the property currently occupied by the Twisted Gun Golf Course near Wharncliffe, West Virginia. The site can be accessed from WV Route 52 headed toward Gilbert. Turn right onto Gilbert Creek Road, then right onto Right Fork Bens Creek Road to Twisted Gun Road. Proceed to the end of Twisted Gun Road for the site.

12.B. New site address (if applicable):	12C. Nearest city or town:	12D. County:
Not Applicable	Wharncliffe	Mingo
12.E. UTM Northing (KM): 4,161.72229	12F. UTM Easting (KM): 415.70631	12G. UTM Zone: 17

13. Briefly describe the proposed change(s) at the facility:
This application is for the construction of the facility.

14A. Provide the date of anticipated installation or change: 01/01/2026 ➪ If this is an **After-The-Fact** permit application, provide the date upon which the proposed change did happen: / /	14B. Date of anticipated Start-Up if a permit is granted: 01/01/2027

14C. Provide a **Schedule** of the planned **Installation** of/**Change** to and **Start-Up** of each of the units proposed in this permit application as **Attachment C** (if more than one unit is involved).

15. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application:
24 Hours Per Day 7 Days Per Week Weeks Per Year 52

16. Is demolition or physical renovation at an existing facility involved? ☐ **YES** ☒ **NO**

17**. Risk Management Plans.** If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your **Risk Management Plan (RMP)** to U. S. EPA Region III.

18**. Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process *(if known).* A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance *(if known).* Provide this information as **Attachment D.**

Section II. Additional attachments and supporting documents.

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13).

20. Include a **Table of Contents** as the first page of your application package.

21. Provide a **Plot Plan,** e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to ***Plot Plan Guidance***) **.**

➪ Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F.**

23. Provide a **Process Description** as **Attachment G.**

➪ Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as **Attachment H.**

➪ For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the **Emission Units Table** and provide it as **Attachment I.**

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J.**

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K.**

28. Check all applicable **Emissions Unit Data Sheets** listed below:

☐ Bulk Liquid Transfer Operations	☐ Haul Road Emissions	☐ Quarry
☐ Chemical Processes	☐ Hot Mix Asphalt Plant	☐ Solid Materials Sizing, Handling and Storage Facilities
☐ Concrete Batch Plant	☐ Incinerator	☒ Storage Tanks
☐ Grey Iron and Steel Foundry	☐ Indirect Heat Exchanger	

☒ General Emission Unit, specify Engines 1 through 117.

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L.**

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

☐ Absorption Systems	☐ Baghouse	☒ Flare
☐ Adsorption Systems	☐ Condenser	☐ Mechanical Collector
☐ Afterburner	☐ Electrostatic Precipitator	☐ Wet Collecting System

☒ Other Collectors, specify Control System

Fill out and provide the **Air Pollution Control Device Sheet(s)** as **Attachment M.**

30. Provide all **Supporting Emissions Calculations** as **Attachment N,** or attach the calculations directly to the forms listed in Items 28 through 31.

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O.**

➢ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and ***Example Legal Advertisement*** for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33**. Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

☒ **YES** ☐ **NO**

➢ If **YES,** identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's ***"Precautionary Notice – Claims of Confidentiality"*** guidance found in the ***General Instructions*** as **Attachment Q.**

Section III. Certification of Information

34. **Authority/Delegation of Authority.** Only required when someone other than the responsible official signs the application. Check applicable **Authority Form** below: Not Required

☐ Authority of Corporation or Other Business Entity	☐ Authority of Partnership
☐ Authority of Governmental Agency	☐ Authority of Limited Partnership

Submit completed and signed **Authority Form** as **Attachment R.**

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

35A. **Certification of Information.** To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned ☒ **Responsible Official** / ☐ **Authorized Representative,** hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE _____ DATE: 3/24/25

(Please use blue ink) *(Please use blue ink)*

35B. Printed name of signee: Adam Victor		35C. Title: President
35D. E-mail: adam@tgds.com	36E. Phone: (917) 816-3700	36F. FAX: Use Email
36A. Printed name of contact person (if different from above): Same as above		36B. Title:
36C. E-mail:	36D. Phone:	36E. FAX:

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

- ☒ **Attachment A: Business Certificate**
- ☒ **Attachment B: Map(s)**
- ☒ **Attachment C: Installation and Start Up Schedule**
- ☒ **Attachment D: Regulatory Discussion**
- ☒ **Attachment E: Plot Plan**
- ☒ **Attachment F: Detailed Process Flow Diagram(s)**
- ☒ **Attachment G: Process Description**
- ☒ **Attachment H: Material Safety Data Sheets (MSDS)**
- ☒ **Attachment I: Emission Units Table**
- ☒ **Attachment J: Emission Points Data Summary Sheet**
- ☒ **Attachment K: Fugitive Emissions Data Summary Sheet**
- ☒ **Attachment L: Emissions Unit Data Sheet(s)**
- ☒ **Attachment M: Air Pollution Control Device Sheet(s)**
- ☒ **Attachment N: Supporting Emissions Calculations**
- ☒ **Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans**
- ☒ **Attachment P: Public Notice**
- ☒ **Attachment Q: Business Confidential Claims**
- ☐ **Attachment R: Authority Forms**
- ☐ **Attachment S: Title V Permit Revision Information**
- ☒ **Application Fee**

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

- ☐ ***Forward 1 copy of the application to the Title V Permitting Group and:***
- ☐ ***For Title V Administrative Amendments:***
  - ☐ ***NSR permit writer should notify Title V permit writer of draft permit,***
- ☐ ***For Title V Minor Modifications:***
  - ☐ ***Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,***
  - ☐ ***NSR permit writer should notify Title V permit writer of draft permit.***
- ☐ ***For Title V Significant Modifications processed in parallel with NSR Permit revision:***
  - ☐ ***NSR permit writer should notify a Title V permit writer of draft permit,***
  - ☐ ***Public notice should reference both 45CSR13 and Title V permits,***
  - ☐ ***EPA has 45 day review period of a draft permit.***

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

ATTACHMENT A

BUSINESS CERTIFICATE

WEST VIRGINIA
STATE TAX DEPARTMENT
BUSINESS REGISTRATION CERTIFICATE

ISSUED TO:
TRANSGAS DEVELOPMENT SYSTEMS, LLC
630 1ST AVE APT 30G
NEW YORK, NY 10016-3799

BUSINESS REGISTRATION ACCOUNT NUMBER: **2218-0756**

This certificate is issued on: 06/29/2010

This certificate is issued by
the West Virginia State Tax Commissioner
in accordance with W.Va. Code § 11-12.

The person or organization identified on this certificate is registered to conduct business in the State of West Virginia at the location above.

This certificate is not transferrable and must be displayed at the location for which issued.

This certificate shall be permanent until cessation of the business for which the certificate of registration was granted or until it is suspended, revoked or cancelled by the Tax Commissioner.

Change in name or change of location shall be considered a cessation of the business and a new certificate shall be required.

TRAVELING/STREET VENDORS: Must carry a copy of this certificate in every vehicle operated by them. CONTRACTORS, DRILLING OPERATORS, TIMBER/LOGGING OPERATIONS: Must have a copy of this certificate displayed at every job site within West Virginia.

atL006 v.1
L1333508864

ATTACHMENT B

SITE LOCATION MAP

Potesta & Associates, Inc.
7012 MacCorkle Avenue, SE, Charleston, WV 25304
Phone: (304) 342-1400 Fax: (304) 343-9031
E-Mail: potesta@potesta.com

TransGas Development Systems, LLC
Adams Fork Data Center Energy Campus
Wharncliffe, West Virginia
Project No. 0101-22-0132-003A

ATTACHMENT C

INSTALLATION AND STARTUP SCHEDULE

ATTACHMENT C

INSTALLATION AND START UP SCHEDULE

Construction of the facility will begin after receipt of Construction Permit from West Virginia Department of Environmental Protection, Division of Air Quality, and other necessary regulatory approvals on or near January 1, 2026. Operations will commence approximately 12 months after the beginning of construction.

ATTACHMENT D

REGULATORY DISCUSSION

ATTACHMENT D

REGULATORY DISCUSSION

The facility proposed herein, or portions of the facility, may be subject to the following regulations based on a review of potential air quality regulations (see No. 1 and 2). Additionally, there are a few regulations which the source may not be subject to which are also listed below in No. 3.

1. State Regulations

   A. 45CSR4 – "To Prevent and Control the Discharge of Air Pollutants into the Open Air Which Causes or Contributes to an Objectionable Odor or Odors"

   B. 45CSR13 – "Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits, and Procedures for Evaluation"

   C. 45CSR16 – "Standards of Performance for New Stationary Sources"

   D. 45CSR20 – "Good Engineering Practice as Applies to Stack Heights"

   E. 45SCR30 – "Requirements for Operation Permits"

   F. 45CSR31 – "Confidential Information"
   This application contains confidential information. This claim of confidentiality is made in accordance with the requirements of 45CSR31.

   G. 45CSR34 – "Emission Standards for Hazardous Air Pollutants"

2. Federal Regulations

   A. 40CFR60 Subpart A – General Provisions

   B. 40CFR60 Subpart IIII - Standard of Performance for Stationary Compression Ignition Internal Combustion Engines

   C. 40CFR63, Subpart ZZZZ – National Emissions Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

3. Non-Applicable Regulations or Exemptions Apply

A. 45CSR40 – Contol of Ozone Season Nitrogen Oxide Emissions
The reciprocating internal combustion engines proposed for this facility do not appear to be considered as a unit per the definition contained in section 2.30 where a unit is defined as a stationary fossil fuel-fired boiler, combustion turbine, or combined cycle system. The engines also have a maximum heat input of less than 250 MMBtu/hr as stated in Section 4.1. Furthermore, the units do not appear to be subject to 40CFR97.

B. 40CFR97, Subpart DDDDD - CSAPR SO2 Group 2 Trading Program and Subpart EEEEE – CSAPR Nox Ozone Season Group 2 Trading Program. The nameplate capacity of the generators attached to each unit is 25 MWe. Also, the units (reciprocating internal combustion engines) do not appear to be regulated by the rule.

C. 45CSR33 – Acid Rain Provisions and Permits
This rule does not appear to apply due to the New Unit Exemption in 40CFR72.

D. 40CFR72, Acid Rain Program, Subpart A, Section 72.7, New Unit Exemption, appears to exempt the units from applicability based on serving a generator of 25 MWe or less, not burning coal or coal-derived fuel, and burns fuel with sulfur of 0.05 percent or less by weight.

E. 40CFR60 Subpart Kc – Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for which Construction, Reconstruction, or Modification Commenced After October 4, 2023. Does not apply due to low vapor pressure of diesel.

ATTACHMENT E

PLOT PLANS

ENGINES			
Power House	**Engine IDs**	**Emission ID**	**Control ID**
1	ENG1, ENG2, ENG3	E1, E2, E3	C1, C2, C3
2	ENG4, ENG5, ENG6	E4, E5, E6	C4, C5, C6
3	ENG7, ENG8, ENG9	E7, E8, E9	C7, C8, C9
4	ENG10, ENG11, ENG12	E10, E11, E12	C10, C11, C12
5	ENG13, ENG14, ENG15	E13, E14, E15	C13, C14, C15
6	ENG16, ENG17, ENG18	E16, E17, E18	C16, C17, C18
7	ENG19, ENG20, ENG21	E19, E20, E21	C19, C20, C21
8	ENG22, ENG23, ENG24	E22, E23, E24	C22, C23, C24
9	ENG25, ENG26, ENG27	E25, E26, E27	C25, C26, C27
10	ENG28, ENG29, ENG30	E28, E29, E30	C28, C29, C30
11	ENG31, ENG32, ENG33	E31, E32, E33	C31, C32, C33
12	ENG34, ENG35, ENG36	E34, E35, E36	C34, C35, C36
13	ENG37, ENG38, ENG39	E37, E38, E39	C37, C38, C39
14	ENG40, ENG41, ENG42	E40, E41, E42	C40, C41, C42
15	ENG43, ENG44, ENG45	E43, E44, E45	C43, C44, C45
16	ENG46, ENG47, ENG48	E46, E47, E48	C46, C47, C48
17	ENG49, ENG50, ENG51	E49, E50, E51	C49, C50, C51
18	ENG52, ENG53, ENG54	E52, E53, E54	C52, C53, C54
19	ENG55, ENG56, ENG57	E55, E56, E57	C55, C56, C57
20	ENG58, ENG59, ENG60	E58, E59, E60	C58, C59, C60
21	ENG61, ENG62, ENG63	E61, E62, E63	C61, C62, C63
22	ENG64, ENG65, ENG66	E64, E65, E66	C64, C65, C66
23	ENG67, ENG68, ENG69	E67, E68, E69	C67, C68, C69
24	ENG70, ENG71, ENG72	E70, E71, E72	C70, C71, C72
25	ENG73, ENG74, ENG75	E73, E74, E75	C73, C74, C75
26	ENG76, ENG77, ENG78	E76, E77, E78	C76, C77, C78
27	ENG79, ENG80, ENG81	E79, E80, E81	C79, C80, C81
28	ENG82, ENG83, ENG84	E82, E83, E84	C82, C83, C84
29	ENG85, ENG86, ENG87	E85, E86, E87	C85, C86, C87
30	ENG88, ENG89, ENG90	E88, E89, E90	C88, C89, C90
31	ENG91, ENG92, ENG93	E91, E92, E93	C91, C92, C93
32	ENG94, ENG95, ENG96	E94, E95, E96	C94, C95, C96
33	ENG97, ENG98, ENG99	E97, E98, E99	C97, C98, C99
34	ENG100, ENG101, ENG102	E100, E101, E102	C100, C101, C102
35	ENG103, ENG104, ENG105	E103, E104, E105	C103, C104, C105
36	ENG106, ENG107, ENG108	E106, E107, E108	C106, C107, C108
37	ENG109, ENG110, ENG111	E109, E110, E111	C109, C110, C111
38	ENG112, ENG113, ENG114	E112, E113, E114	C112, C113, C114
39	ENG115, ENG116, ENG117	E115, E116, E117	C115, C116, C117

TANKS

1. Ultra Low Sulfur Diesel will be stored in 40 tanks located on the property near each powerhouse. The tanks are uncontrolled. The tank identification numbers are TK1 – TK40 (118S through 157S with emission points 118E through 157E).
2. Each powerhouse 1 through 39 will have one set of emission control fluid tanks for Hydrous Ammonia, Caustic Soda, Sulfuric Acid, Sodium Chloride, and Sodium Hydrosulfide. These tanks are de minimis.

POTESTA
Engineers and Environmental Consultants
7012 MacCorkle Avenue, SE
Charleston, West Virginia 25304
Phone: (304) 342-1400
Fax: (304) 343-9031

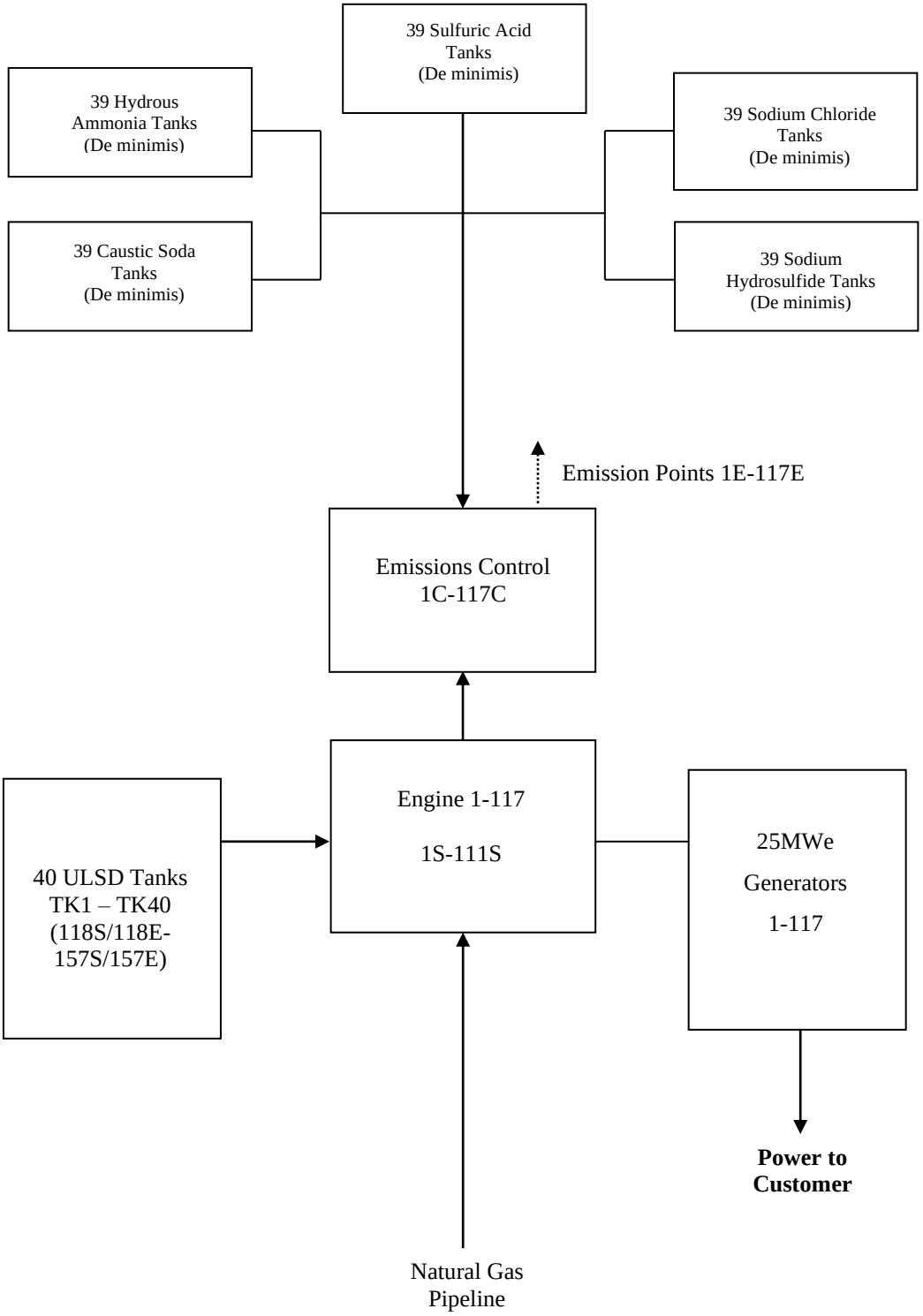
PLOT PLAN

TransGas Development Systems, LLC

Adams Fork Data Center Energy Campus
Wharncliffe, West Virginia
Project No. 0101-22-0132-003A

ATTACHMENT F

PROCESS FLOW DIAGRAM(S)



Potesta & Associates, Inc.
7012 MacCorkle Avenue, SE, Charleston, WV 25304
Phone: (304) 342-1400 Fax: (304) 343-9031
E-Mail: potesta@potesta.com

TransGas Development Systems, LLC
Adams Fork Data Center Energy Campus
Wharncliffe, West Virginia
Project No. 0101-22-0132-003A

ATTACHMENT G

PROCESS DESCRIPTION

ATTACHMENT G

PROCESS DESCRIPTION

The facility proposed herein is a unique, off-grid, electric generating facility designed to provide power to adjacent data center operations. The facility encompasses 117 engines (Source Numbers 1S through 117S) with 114 engines operating full-time and 3 engines in reserve. Each engine has a proposed control strategy (Control Numbers 1C through 117C) and vent through their own exhaust stack (Emissions Point 1E through 117E). The facility will contain 39 powerhouses with each containing 3 generator setups with each generator having a nameplate capacity of 25 MWe. Actual power generation will depend on the operating mode of the engines. The operating modes of the engines are more fully described in Attachment L. The control systems for each engine are described in Attachment M.

The engines will operate on ultra-low sulfur diesel and natural gas depending on the operating status. Ultra-low sulfur diesel will be stored in 40 tanks (TK1 through TK40, 118S-157S, 118E-157E) on the property. Natural gas will be delivered via pipeline. Tanks for control device liquids will be located at each powerhouse so there will be 39 tanks of each of hydrous ammonia, caustic soda, sulfuric acid, sodium chlorite, and sodium hydrosulfide. These tanks are considered de minimis. Liquids and supplies will be trucked to the site.

There is no steam-power production at the site. Cooling will be provided by mine pool water as needed; therefore, there is no requirement for cooling towers.

ATTACHMENT H

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

Sodium hydrosulfide solution

MSDS Number 8000TDC (Revised: 1/23/04) 6 Pages

Section 1: CHEMICAL PRODUCT and COMPANY IDENTIFICATION

1.1 Product Name .....**Sodium hydrosulfide solution**
Chemical Family ..... Inorganic salt solution
Synonyms ..... KI-300 depressant, NaHS, sodium hydrogen sulfide
Formula ..... NaHS

1.2 Manufacturer .....Tessenderlo Davison Chemicals, LLC.
1916 Farmerville Highway
Ruston, Louisiana 71270
Information ..... (318) 242-5305

1.3 Emergency Contact ..... (800) 877-1737 (Tessenderlo Kerley)
(800) 424-9300 (CHEMTREC)

Section 2: COMPOSITION, INFORMATION ON INGREDIENTS

2.1 Chemical Ingredients (% by wt.)

Sodium hydrosulfide	CAS #:16721-80-5	20-45%
Water	CAS #:7732-18-5	55-80%

(See Section 8 for exposure guidelines)

Section 3: HAZARDS IDENTIFICATION

NFPA: Health - 3 Flammability - 2 Reactivity - 1

EMERGENCY OVERVIEW

Warning: Solution is highly alkaline
Contains hydrogen sulfide , a highly toxic gas.
Eye contact will cause marked eye irritation and possibly severe corneal damage. Skin contact will result in irritation and possible corrosion of the skin. Ingestion will irritate/burn mouth, throat and gastrointestinal tract. Contact with stomach acid will cause hydrogen sulfide vapors to be released. Heating or acid will cause hydrogen sulfide gas to evolve. Dilution of NaHS with water will also cause increased evolution of hydrogen sulfide.

Section 3: HAZARDS IDENTIFICATION, Cont.

3.1 POTENTIAL HEALTH EFFECTS

EYE: Contact with the eyes will cause marked eye irritation and possibly severe corneal damage.

SKIN CONTACT: Contact with the skin will cause skin irritation or burning sensation. Prolonged contact will result in corrosion of the skin.

SKIN ABSORPTION: Absorption is unlikely to occur.

INGESTION: Ingestion will result in severe burning and corrosion of mouth, throat and the gastrointestinal tract. If the ingested material contacts stomach acid, highly toxic hydrogen sulfide gas will be evolved.

INHALATION: Product solution and vapors contain highly toxic hydrogen sulfide gas. Exposure to this gas causes, headaches, nausea, dizziness and vomiting. Continued exposure can lead to loss of consciousness and death..

CHRONIC EFFECTS/CARCINOGENICITY: Not listed as a carcinogen by NTP, IARC or OSHA.

Section 4: FIRST AID MEASURES

4.1 EYES: Immediately flush with large quantities of water for 15 minutes. Hold eyelids apart during irrigation to insure thorough flushing of the entire area of the eye. Obtain immediate medical attention.

4.2 SKIN: Immediately flush with large quantities of water. Remove contaminated clothing under a safety shower. Obtain immediate medical attention

4.3 INGESTION: DO NOT INDUCE VOMITING. If victim is conscious, immediately give 2 to 4 glasses of water. If vomiting does occur, repeat fluid administration. Obtain immediate medical attention.

4.4 INHALATION: Remove victim from contaminated atmosphere. If breathing is labored, administer oxygen. If breathing has ceased, clear airway and start mouth to mouth resuscitation. If heart has stopped beating, external heart massage should be applied. Obtain immediate medical attention.

Section 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

FLASH POINT: Not flammable **METHOD USED:** NA

5.2 FLAMMABLE LIMITS **Hydrogen sulfide** **LFL**: 4% **UFL**: 44%

5.3 EXTINGUISHING MEDIA: Water spray or foam or as appropriate for combustibles involved in fire.

5.4 FIRE & EXPLOSIVE HAZARDS: Solution is non-flammable. However if these solutions are exposed to heat or acids, hydrogen sulfide will be released and may form explosive mixtures with air (see above).

Keep containers/storage vessels in fire area cooled with water spray. Heating may cause the release of hydrogen sulfide vapors.

Section 5: FIRE FIGHTING MEASURES (Cont.)

5.5 FIRE FIGHTING EQUIPMENT: Because of the possible presence of toxic gases and the corrosive nature of the product, wear self-contained breathing apparatus, pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

Section 6: ACCIDENTAL RELEASE MEASURES

6.1 Small releases: Confine and absorb small releases on sand earth or other inert absorbent. Oxidize residual reactive sulfides with a weak (3-5%) hydrogen peroxide solution.

6.2 Large releases: Wear proper protective equipment. Confine area to qualified personnel. Shut off release if safe to do so. Dike spill area to prevent runoff into sewers, drains (potential explosive mixtures of hydrogen sulfide in confined spaces) or surface waterways (potential aquatic toxicity). Recover as much of the solution as possible. Treat remaining material as a small release (above).

Section 7: HANDLING and STORAGE

7.1 Handling: Wear proper protective equipment (See Section 8). Avoid breathing product vapors. Avoid contact with skin and eyes. Use only in a well ventilated area. Dilute product only in enclosed containers. Wash thoroughly after handling.

7.2 Storage: Store in well ventilated areas. Do not store combustibles in the area of storage vessels. Keep away from any sources of heat or flame. Store tote and smaller containers out of direct sunlight at moderate temperatures [<80º F (27º C)]. (See Section 10.4 for materials of construction)

Section 8: EXPOSURE CONTROLS, PERSONAL PROTECTION

8.1 RESPIRATORY PROTECTION: If working near open container or storage vessel opening or open tank truck dome cover, wear self-contained breathing apparatus, pressure demand, MSHA/NIOSH (approved or equivalent).

8.2 SKIN PROTECTION: Neoprene rubber gloves, chemical suit and boots should be worn to prevent contact with the liquid. Wash contaminated clothing prior to reuse. Contaminated leather shoes cannot be cleaned and should be discarded.

8.3 EYE PROTECTION: Chemical goggles and a full face shield.

8.4 EXPOSURE GUIDELINES:

	OSHA		ACGIH	
	TWA	STEL	TLV	STEL
Hydrogen sulfide	20 ppm (ceiling)		10 ppm (ceiling)	

8.5 ENGINEERING CONTROLS: Use adequate exhaust ventilation to prevent inhalation of product vapors. Where feasible scrub process or storage vessel vapors with caustic solution.
Maintain eyewash/safety shower in areas where chemical is handled.

Section 9: PHYSICAL and CHEMICAL PROPERTIES

9.1 APPEARANCE:	Yellow to dark green liquid.
9.2 ODOR:	Strong hydrogen sulfide (rotten egg) odor.
9.3 BOILING POINT:	253 °F(122.8 °C) - 269 °F (131.7 °C)
9.4 VAPOR PRESSURE:	17 mm Hg @ 68 °F (20 °C)
9.5 VAPOR DENSITY: (Air = 1.0)	1.17
9.6 SOLUBILITY IN WATER:	Complete
9.7 SPECIFIC GRAVITY:	1.152 - 1.303 (9.6 - 10.9 lbs/gal)
9.8 FREEZING POINT:	0° F (-17.8° C) - 20% 56º F (13.3º C) - 45%
9.9 pH:	11.5 - 12.5
9.10 VOLATILE:	Not applicable

Section 10: STABILITY and REACTIVITY

10.1 STABILITY: This is a stable material

10.2 HAZARDOUS POLYMERIZATION: Will not occur.

10.3 HAZARDOUS DECOMPOSITION PRODUCTS: Heating this product will evolve hydrogen sulfide. Fire conditions will also cause the production of sulfur dioxide. Hydrogen sulfide (4-44%) may form flammable mixtures with air.

10.4 INCOMPATIBILITY: Acids will cause the release of highly toxic hydrogen sulfide. Sodium hydrosulfide solution is not compatible with copper, zinc, aluminum or their alloys (i.e. bronze, brass, galvanized metals, etc.). Corrosive to steel above 150º F (65.5º C). These materials of construction should not be used in handling systems or storage containers for this product (SEE Section 7.2, Storage). Dilution of NaHS with water will increase the evolution of hydrogen sulfide. Dilution should be done in an enclosed container.

Section 11: TOXICOLOGICAL INFORMATION

11.1 ORAL: Data not available

11.2 DERMAL: Data not available

11.3 INHALATION: INH-RAT LC_{50}: 444 ppm (hydrogen sulfide)
INH-MOUSE LC_{50}: 1,500 mg/m^3 18 minutes
INH-RAT LC_{50}: 1,500 mg/m^3 14 minutes

11.4 CHRONIC/CARCINOGENICITY: No evidence available

11.5 TERATOLOGY: Data not available

11.6 REPRODUCTION: Data not available

11.7 MUTAGENICITY: Data not available

Section 12: ECOLOGICAL INFORMATION

Static acute 96 hour-LC_{50} for mosquito fish is 206 mg/L. (Tl_m - fresh water)
LC_{50} fly inhalation 1,500 mg/m^3, 7 minutes
TL_m Gammarus 0.84 mg/L, 96 hours (hydrogen sulfide)
TL_m Ephemera 0.316 mg/L, 96 hours (hydrogen sulfide)
TL_m Flathead minnow 0.071 – 0.55 mg/L @ 6-24ºC, 96 hour flow through bioassay (hydrogen sulfide)
TL_m Bluegill 0.0090 – 0.0140 mg/L @ 20-22ºC, 96 hour flow through bioassay (hydrogen sulfide)
TL_m Brook trout 0.0216 – 0.0308 mg/L @ 8-12.5ºC, 96 hour flow through bioassay (hydrogen sulfide)

Section 13: DISPOSAL CONSIDERATIONS

If released to the environment for other than its intended purpose, this product contains some reactive sulfides which may be in sufficient quantity to meet the definition of a D003, hazardous waste.

Section 14: TRANSPORT INFORMATION

14.1 DOT Shipping Name:	Corrosive liquids, toxic, n.o.s.
14.2 DOT Hazard Class:	8
14.3 UN/NA Number:	UN2922 UN2949 (IMDG - over water)
14.4 Packing Group:	II
14.5 DOT Placard:	Corrosive
14.6 DOT Label(s):	Corrosive Toxic
14.7 IMO Shipping Name:	Sodium hydrosulphide solution
14.8 RQ (Reportable Quantity):	5,000 lbs (2268 Kg) 100% basis [2,604 gal (20%) 1,019 gal (45%)]
14.9 RR STCC Number:	28-123-33/49-352-04 (international)

Section 15: REGULATORY INFORMATION

15.1 OSHA: This product is listed as a hazardous material under criteria of the Federal OSHA Hazard Communication Standard, 29 CFR 1910.1200.

15.2 SARA TITLE III: a. **EHS** (Extremely Hazardous Substance) List: No

Section 15: REGULATORY INFORMATION (Cont.)

b.	Section 311/312, (Tier I,II) Categories:	Immediate (acute)	Yes
		Fire	Yes
		Sudden release	No
		Reactivity	Yes
		Delayed (chronic)	No
c.	Section 313 (Toxic Release Report-Form R):		No
d.	**TPQ** (Threshold Planning Quantity):		No

15.3 CERCLA/SUPERFUND: RQ (Reportable Quantity) 5,000 lbs (2270 Kg)

15.4 TSCA (Toxic Substance Control Act) Inventory List: Yes

15.5 RCRA (Resource Conservation and Recovery Act) Status: D003 (See Section 13)

15.6 WHMIS (Canada) Hazard Classification: E, D1

15.7 DOT Hazardous Material: (See Section 14) Yes

15.8 CAA Hazardous Air Pollutant (HAP) No

Section 16: OTHER INFORMATION

REVISIONS: The entire MSDS was reformatted to comply to ANSI Standard Z400.1-1993.

Revised Sections 1.1, 8.3, 11, 12, 5/7/02
Revised pH range in Section 8, 6/19/02
Revised shipping info & RQ data, 1/15/03
Revised Section 3, Emergency Overview & Section 10.4 to include dilution caution. 1/23/04

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006

Version 7.11
Revision Date 15.10.2024
Print Date 16.10.2024
GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name	:	Sodium chlorite (25% solution in water) for synthesis
Product Number	:	8.14815
Catalogue No.	:	814815
Brand	:	Millipore
UFI	:	CW60-J6H9-Q99X-S01A
REACH No.	:	This product is a mixture. REACH Registration Number see section 3.

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Chemical for synthesis

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Chemical Pvt Limited Industrial Area, Anekal Taluka Plot No 12, 12 Bommasandra - Jigani Link Road 560100 BANGALORE INDIA

1.4 Emergency telephone

Emergency Phone #	:	000 800 1007 141 (CHEMTREC)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Corrosive to Metals, (Category 1)	H290: May be corrosive to metals.
Acute toxicity, (Category 4)	H302: Harmful if swallowed.
Acute toxicity, (Category 3)	H311: Toxic in contact with skin.
Skin corrosion, (Category 1)	H314: Causes severe skin burns and eye damage.
Serious eye damage, (Category	H318: Causes serious eye damage.

1)

Specific target organ toxicity - repeated exposure, (Category 2), spleen	H373: May cause damage to organs through prolonged or repeated exposure.
Short-term (acute) aquatic hazard, (Category 1)	H400: Very toxic to aquatic life.
Long-term (chronic) aquatic hazard, (Category 1)	H410: Very toxic to aquatic life with long lasting effects.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008

Pictogram

Signal Word	Danger
Hazard Statements	
H290	May be corrosive to metals.
H302	Harmful if swallowed.
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H373	May cause damage to organs (spleen) through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary Statements	
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P314	Get medical advice/ attention if you feel unwell.
Supplemental Hazard information (EU)	
EUH032	Contact with acids liberates very toxic gas.
EUH071	Corrosive to the respiratory tract.

Reduced Labeling (<= 125 ml)

Pictogram

Signal Word	Danger
Hazard Statements	
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
Precautionary Statements	
P280	Wear protective gloves/ protective clothing/ eye protection/ face

protection.

P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Supplemental Hazard information (EU)

EUH032	Contact with acids liberates very toxic gas.
EUH071	Corrosive to the respiratory tract.

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Ecological information:
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.
Toxicological information:
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Component		Classification	Concentration
sodium chlorite			
CAS-No. EC-No.	7758-19-2 231-836-6 *	Ox. Sol. 1; Acute Tox. 3; Acute Tox. 2; Skin Corr. 1B; Eye Dam. 1; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H271, H301, H310, H314, H318, H373, H400, H410	>= 25 - < 30 %

*A registration number is not available for this substance as the substance or its use are exempted from registration according to Article 2 REACH Regulation (EC) No 1907/2006, or the annual tonnage does not require a registration.

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Hydrogen chloride gas
Sodium oxides
Not combustible.
Fire may cause evolution of:
Hydrogen chloride gas
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

No metal containers. No metal containers.
Protected from light.Tightly closed. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.
Do not store near acids.

Recommended storage temperature see product label.

Storage class

Storage class (TRGS 510): 6.1D: Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

8.2 Exposure controls

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0,11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0,11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter B-(P3)

The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Physical state	liquid
b)	Color	colorless
c)	Odor	weak
d)	Melting point/freezing point	Melting point: < -3 °C
e)	Initial boiling point and boiling range	ca.>= 100 °C at 1.013 hPa
f)	Flammability (solid, gas)	No data available
g)	Upper/lower flammability or explosive limits	No data available
h)	Flash point	Not applicable
i)	Autoignition temperature	Not applicable
j)	Decomposition temperature	No data available
k)	pH	ca.12 - 13 at 20 °C

l)	Viscosity	Viscosity, kinematic: No data available Viscosity, dynamic: No data available
m)	Water solubility	at 20 °C soluble
n)	Partition coefficient: n-octanol/water	Not applicable
o)	Vapor pressure	ca.20 hPa at 20 °C
p)	Density	ca.1,2 g/cm3 at 20 °C
	Relative density	No data available
q)	Relative vapor density	No data available
r)	Particle characteristics	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	Oxidizing potential

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
explosible after loss of solvent content.
Contact with acids liberates very toxic gas.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Generates dangerous gases or fumes in contact with:
Acids
Release of:
chlorine dioxide
Violent reactions possible with:
combustible substances
Cyanides
sulfur
ammonium compounds
phosphorus
Organic Substances
oxidisable substances
Chlorine
Metals
in powder form
Violent reactions possible with:
Generates dangerous gases or fumes in contact with:
Acids
The generally known reaction partners of water.

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Contact with metals liberates hydrogen gas.Metals

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Mixture

Acute toxicity
Acute toxicity estimate Oral - 1.114 mg/kg
(Calculation method)
Symptoms: If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the esophagus and the stomach.
Symptoms: Possible symptoms:, mucosal irritations, Cough, Shortness of breath, Possible damages:, damage of respiratory tract
Acute toxicity estimate Dermal - 525,49 mg/kg
(Calculation method)

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
Remarks: Mixture causes serious eye damage.
Risk of blindness!

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Mixture may cause damage to organs through prolonged or repeated exposure.
- spleen

Aspiration hazard
No data available

11.2 Additional Information

Endocrine disrupting properties

Product:

Assessment	The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article

57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Other dangerous properties can not be excluded.

Handle in accordance with good industrial hygiene and safety practice.

Components

sodium chlorite

Acute toxicity
LD50 Oral - Rat - male and female - 284 mg/kg
(OECD Test Guideline 401)
Acute toxicity estimate Oral - 284 mg/kg
(ATE value derived from LD50/LC50 value)
Inhalation: No data available
LD50 Dermal - Rabbit - male and female - 134 mg/kg
(US-EPA)
Acute toxicity estimate Dermal - 134 mg/kg
(ATE value derived from LD50/LC50 value)

Skin corrosion/irritation
Skin - Rabbit
Result: Corrosive after 3 minutes to 1 hour of exposure - 4 h
(US-EPA)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Irreversible effects on the eye
Remarks: Aqueous solution
(ECHA)

Respiratory or skin sensitization
Maximization Test - Guinea pig
Result: Does not cause skin sensitization.
(OECD Test Guideline 406)

Germ cell mutagenicity
Method: OECD Test Guideline 475
Species: Mouse - male and female - Bone marrow
Result: negative

Carcinogenicity
No data available

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.
- spleen

Aspiration hazard
No data available

SECTION 12: Ecological information

12.1 Toxicity

Mixture
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Endocrine disrupting properties
Product:

Assessment	:	The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7 Other adverse effects
No data available

Components

sodium chlorite

Toxicity to fish	flow-through test LC50 - Cyprinodon variegatus (sheepshead minnow) - 105 mg/l - 96 h (US-EPA)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - < 1 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	static test ErC50 - Pseudokirchneriella subcapitata (green algae) - 21,5 mg/l - 72 h (OECD Test Guideline 201)
	static test EC10 - Pseudokirchneriella subcapitata (green algae) - 4,8 mg/l - 72 h (OECD Test Guideline 201)
Toxicity to bacteria	Respiration inhibition EC50 - activated sludge - > 100 mg/l - 3 h (OECD Test Guideline 209)

SECTION 13: Disposal considerations

13.1 Waste treatment methods
No data available

SECTION 14: Transport information

14.1 UN number
ADR/RID: 1908 IMDG: 1908 IATA: 1908

14.2 UN proper shipping name
ADR/RID: CHLORITE SOLUTION
IMDG: CHLORITE SOLUTION
IATA: Chlorite solution

14.3 Transport hazard class(es)
ADR/RID: 8 IMDG: 8 IATA: 8

14.4 Packaging group
ADR/RID: II IMDG: II IATA: II

14.5 Environmental hazards
ADR/RID: no IMDG Marine pollutant: no IATA: no

14.6 Special precautions for user
Tunnel restriction code : (E)

Further information : No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
This material safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006.

National legislation

Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances.	E1	ENVIRONMENTAL HAZARDS

Other regulations

Observe work restrictions regarding maternity protection in accordance to Dir 92/85/EEC or stricter national regulations where applicable.

Take note of Dir 94/33/EC on the protection of young people at work.

15.2 Chemical Safety Assessment
For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements

H271	May cause fire or explosion; strong oxidizer.
H301	Toxic if swallowed.

H310	Fatal in contact with skin.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
EUH032	Contact with acids liberates very toxic gas.
EUH071	Corrosive to the respiratory tract.

Full text of other abbreviations

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Classification of the mixture		**Classification procedure:**
Met. Corr.1	H290	Based on product data or assessment
Acute Tox.4	H302	Calculation method
Acute Tox.3	H311	Calculation method
Skin Corr.1	H314	Based on product data or assessment
Eye Dam.1	H318	Based on product data or assessment

STOT RE2	H373	Calculation method
Aquatic Acute1	H400	Calculation method
Aquatic Chronic1	H410	Calculation method

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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COLUMBUS CHEMICAL INDUSTRIES

Safety Data Sheet

Sulfuric Acid 36-37% (w/w)

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sulfuric Acid 36-37% (w/w)

Synonyms/Generic Names: Battery Acid, Dihydrogen Sulfate, Oil of Vitriol

Product Number: 9624

Product Use: Industrial, Manufacturing or Laboratory use

Manufacturer: Columbus Chemical Industries, Inc.
N4335 Temkin Rd.
Columbus, WI. 53925

For More Information: 920-623-2140 (Monday-Friday 8:00-4:30)
www.columbuschemical.com

In Case of Emergency Call: CHEMTREC - 800-424-9300 or 703-527-3887 (24 Hours/Day, 7 Days/Week)

2. HAZARDS IDENTIFICATION

Hazard Not Otherwise Classified (HNOC): None

Signal Words: Danger

Pictograms:

GHS Classification:

Skin corrosion	Category 1A
Serious eye damage	Category 1
Acute aquatic toxicity	Category 3

GHS Label Elements, including precautionary statements:

Hazard Statements:

H314	Causes severe skin burns and eye damage.
H402	Harmful to aquatic life.

Precautionary Statements:

P260	Do not breathe mists.
P264	Wash hands thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P330+P331	IF SWALLOWED: Rinse mouth. Do not induce vomiting.

P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER/doctor/physician.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local regulations.

Potential Health Effects

Eyes	Causes severe eye burns.
Inhalation	May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
Skin	Causes skin burns.
Ingestion	May be harmful if swallowed.

NFPA Ratings

Health	3
Flammability	0
Reactivity	2
Specific hazard	W

HMIS Ratings

Health	3
Fire	0
Reactivity	2

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Weight %	CAS #	EINECS# / ELINCS#	Formula	Molecular Weight
Sulfuric Acid	36-37	7664-93-9	231-939-5	H_2SO_4	98.08 g/mol
Water	Balance	7732-18-5	231-791-2	H_2O	18.00 g/mol

4. FIRST-AID MEASURES

Eyes	Immediately rinse with plenty of water for at least 15 minutes and get medical attention immediately.
Inhalation	Move casualty to fresh air and keep at rest. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention immediately.
Skin	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and wash using soap. Get medical attention immediately.
Ingestion	**Do Not Induce Vomiting!** Never give anything by mouth to an unconscious person. If conscious, wash out mouth with water. Get medical attention immediately.

5. FIRE-FIGHTING MEASURES

Suitable (and unsuitable) extinguishing media	Product is not flammable. Use appropriate media for adjacent fire. Cool unopened containers with water.
Special protective equipment and precautions for firefighters	Wear self-contained, approved breathing apparatus and full protective clothing, including eye protection and boots.
Specific hazards arising from the chemical	Emits toxic fumes (sulfur oxides, hydrogen sulfide gas) under fire conditions. (See also Stability and Reactivity section).

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	See section 8 for recommendations on the use of personal protective equipment.
Environmental precautions	Prevent spillage from entering drains. Any release to the environment may be subject to federal/national or local reporting requirements.
Methods and materials for containment and cleaning up	Neutralize spill with sodium bicarbonate or lime. Absorb spill with noncombustible absorbent material, then place in a suitable container for disposal. Clean surfaces thoroughly with water to remove residual contamination. Dispose of all waste and cleanup materials in accordance with regulations.

7. HANDLING AND STORAGE

Precautions for safe handling
See section 8 for recommendations on the use of personal protective equipment. Use with adequate ventilation. Wash thoroughly after using. Keep container closed when not in use. Avoid formation of aerosols.

Conditions for safe storage, including any incompatibilities
Store in a cool, dry, well ventilated area. Keep away from incompatible materials (see section 10 for incompatibilities).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational exposure controls:

Component	Exposure Limits	Basis	Entity
Sulfuric Acid	0.2 mg/m^3	TLV	ACGIH
	1 mg/m^3	PEL	OSHA
	1 mg/m^3`	REL	NIOSH
	15 mg/m^3	IDLH	OSHA

TWA: Time Weighted Average over 8 hours of work.
TLV: Threshold Limit Value over 8 hours of work.
REL: Recommended Exposure Limit
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit during x minutes.
IDLH: Immediately Dangerous to Life or Health
WEEL: Workplace Environmental Exposure Levels
CEIL: Ceiling

Personal Protection

Eyes	Wear chemical safety glasses or goggles, and face shield.
Inhalation	Provide local exhaust, preferably mechanical. If exposure levels are excessive, use an approved respirator.
Skin	Wear nitrile or rubber gloves, and full body suit. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Other	Not Available

Other Recommendations
Provide eyewash stations, quick-drench showers and washing facilities accessible to areas of use and handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance (physical state, color, etc.)	Clear, colorless liquid.
Odor	Odorless.
Odor threshold	Not Available
pH	~1
Melting point/freezing point	Not Available
Initial boiling point and boiling range	Not Available
Flash point	Not Flammable
Evaporation rate	Not Available
Flammability (solid, gas)	Not Flammable
Upper/lower flammability or explosive limit	Not Explosive
Vapor pressure	Not Available
Vapor density	Not Available
Specific gravity	1.2720
Solubility (ies)	Soluble in water.
Partition coefficient: n-octanol/water	Not Available
Auto-ignition temperature	Not Available
Decomposition temperature	Not Available

10. STABILITY AND REACTIVITY

Chemical Stability	Stable
Possibility of Hazardous Reactions	Will not occur.
Conditions to Avoid	Moisture.
Incompatible Materials	Bases, halides, organic material, carbides, chlorates, fulminates, nitrates, picrates, cyanides, cyclopentadiene, cyclopentanone oxime, nitroaryl amines, hexalithium disilicide, phosphorus (III) oxide, powdered metals.
Hazardous Decomposition Products	Sulfur oxides, hydrogen sulfide gas.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Skin	Not Available
Eyes	Not Available
Respiratory	Not Available
Ingestion	Not Available

Carcinogenicity

IARC	1: Carcinogenic to humans (sulfuric acid aerosol).
ACGIH	A2: Suspected human carcinogen (sulfuric acid aerosol).
NTP	No components of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA	No components of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Signs & Symptoms of Exposure

Skin	Burning, itching, redness, inflammation upon exposed tissue.
Eyes	Eye burns, watering eyes.
Respiratory	Burning, choking, coughing, shortness of breath.
Ingestion	Nausea, vomiting, diarrhea, burning, severe pain.

Chronic Toxicity	May cause bleeding of nose and gums, nasal and oral mucosal ulceration, conjunctivitis, yellowing of teeth and erosion of tooth enamel.
Teratogenicity	Not Available
Mutagenicity	Not Available
Embryotoxicity	Not Available
Target Organ(s)	Teeth, Lungs
Reproductive Toxicity	Not Available
Respiratory/Skin Sensitization	Not Available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Aquatic Vertebrate	Not Available
Aquatic Invertebrate	Not Available
Terrestrial	Not Available

Persistence and Degradability	Not Available
Bioaccumulative Potential	Does not accumulate.
Mobility in Soil	Not Available
PBT and vPvB Assessment	Not Available
Other Adverse Effects	Not Available

13. DISPOSAL CONSIDERATIONS

Waste Product or Residues	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product or residue.
Product Containers	Users should review their operations in terms of the applicable federal/national or local regulations and consult with appropriate regulatory agencies if necessary before disposing of waste product container.

The information offered in section 13 is for the product as shipped. Use and/or alterations to the product may significantly change the characteristics of the material and alter the waste classification and proper disposal methods.

14. TRANSPORTATION INFORMATION

US DOT	UN2796, Sulfuric acid, 8, pg II
TDG	UN2796, SULFURIC ACID, 8, PG II
IMDG	UN2796, SULFURIC ACID, 8, PG II
Marine Pollutant	No
IATA/ICAO	UN2796, Sulfuric acid, 8, pg II

15. REGULATORY INFORMATION

TSCA Inventory Status	All ingredients are listed on the TSCA Active inventory.
DSL / NDSL	All ingredients are listed on the DSL inventory.
California Proposition 65	Not Listed
Rhode Island: Hazardous Substance List	Listed: Sulfuric Acid

Massachusetts: Toxic or Hazardous Substance List, Right to Know	Not Listed
Pennsylvania: Hazardous Substance List	Listed: Sulfuric Acid
New Jersey: Right to Know Hazardous Substance List	Listed: Sulfuric Acid
SARA 302	Listed: Sulfuric Acid
SARA 304	Listed: Sulfuric Acid
SARA 311	Acute Health Hazard.
SARA 312	Acute Health Hazard.
SARA 313	Listed: Sulfuric Acid (aerosol forms only)
WHMIS Canada	Class D1A: Poisonous and infectious material – Immediate and serious effects – Very toxic. Class E: Corrosive material.

16. OTHER INFORMATION

Revision	Date
Original	03/27/2013
Revision 1	12/13/2016
Revision 2	11/29/2021

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer:	**Shintech Louisiana, LLC** 3 Greenway Plaza, Suite 1150 Houston, TX 77046 (713) 965-0713
PRODUCT NAME:	Sodium Hydroxide Solution, 50%
CAS#:	1310-73-2
CHEMICAL FOMULA:	NaOH(50)
Synonyms	Caustic Soda Liquid 50%, Soda Lye, Lye, Liquid Caustic, Sodium Hydrate
Product Use:	Neutralizing agent, industrial cleaner, pulping and bleaching, soap manufacturing

For information regarding a chemical emergency involving a spill or leak, call:

24 — Hour Emergency Contact:

U.S.: 1-800-424-9300 — CHEMTREC

SECTION 2 — HAZARDS IDENTIFICATION

Global Harmonization System (GHS) Classification:

Category 1	Corrosive to metals
Category 1	Skin corrosion/irritation
Category 1	Serious eye damage/eye irritation
Category 3	Hazardous to the aquatic environment, long-term (chronic) hazard
Category 4	Acute toxicity, inhalation
Category 4	Acute toxicity, oral

National Fire Protection Association (NFPA) Rating Hazardous Materials Identification Systems (HMIS) Rating

	NFPA	HMIS
Health	3	3
Fire	0	0
Reactivity	1	1

4 = Extreme/Severe
3 = High/Serious
2 = Moderate
1 = Slight
0 = Minimum

W – Water Reactive

DANGER! Causes severe eye burns. Causes severe skin burns. Avoid contact with skin and eyes. Causes burns of the mouth and throat. Causes respiratory tract irritation. Avoid breathing vapors or mist. Aspiration hazard. Can enter lungs and cause damage. May react with water. Keep upwind of spill and use in adequate ventilation.

Emergency Overview:

Color:	Colorless
Odor:	Odorless
Physical State	Liquid above freezing point
Signal Word	DANGER

GHS Label Elements:

GHS Hazard Statements:

H290 - May be corrosive to metals

H314 – Causes severe skin burns and eye

H318 – Causes serious eye damage

H412 – Harmful to aquatic life with long lasting effects

H332 – Harmful if inhaled

H302 – Harmful if swallowed

GHS Precautionary Statements:

Storage:	Keep container closed. Keep in original container. Store in a secure manner.
Ventilation Controls:	Do not breathe (dust, vapor or spray mist).
Hygiene Measures:	When using, do not smoke, eat, or drink. Wash thoroughly after handling. Avoid contact with skin and eyes.
Personal Protective Equipment:	Wear suitable protective clothing, gloves, and eye/face protection.
Spills:	**NEVER** direct water jet on liquid. Dike the area to contain the spill. Collect in suitable and properly labeled containers. Attempt to neutralize by adding material such as Acetic acid.
First Aid (See Section 4):	In case of accident by inhalation, move person to fresh air. If swallowed, do not induce vomiting: seek medical advice immediately and show label to doctor. After contact with skin, immediately take off all contaminated clothing and wash immediately with plenty of water. In case of contact with eyes, rinse immediately with plenty of water. In all cases, if irritation develops and persists, get medical attention. In all cases, call a poison control center or doctor for further treatment advice.
Environmental Protection:	Use appropriate containment to avoid environmental contamination.
Disposal:	Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations.

POTENTIAL HEALTH EFFECTS:

EYE CONTACT	May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. Mist may cause eye irritation.
Short Term Exposure	
Long Term Exposure:	
SKIN CONTACT	Brief contact may cause severe skin burns. Symptoms may include pain, severe local redness and tissue damage.
SKIN ABSORPTION	Prolonged skin contact is unlikely to result in absorption of harmful amounts.
INHALATION:	Mist may cause severe irritation of upper respiratory tract (nose and throat). May cause chemical burns to the respiratory tract.
INGESTION	Swallowing may result in burns of the mouth and throat. Swallowing may result in gastrointestinal irritation, ulceration, nausea and/or vomiting. Aspiration into the lungs may occur during ingestion or vomiting, causing tissue damage or lung injury.
CONDITIONS AGGRAVATED BY EXPOSURE	Respiratory disorders, pre-existing skin disorders, eye/vision disorders.
TARGET ORGANS EFFECTED:	Skin, Eyes, Respiratory System.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous ingredients (specific)	Typical %	CAS Number	EC Number
Water	50	7732-18-5	7732-18-5
Sodium Hydroxide	50	1310-73-2	7732-18-5
Sodium Chloride	< 1	7647-14-5	231-598-3

Common Names/Synonyms: Caustic Soda Liquid 50%, Soda Lye, Lye, Liquid Caustic, Sodium Hydrate

SECTION 4 – FIRST AID MEASURES

Eye Contact: Immediately flush eyes with water for at least 30 minutes, and up to 60 minutes if necessary. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY. Do not transport victim until the recommended flushing period is completed unless flushing can be continued during transport.

Skin Contact: Immediately flush skin with water for at least 30 minutes, and up to 60 minutes if necessary. Under water remove contaminated clothing, jewelry, and shoes. If irritation persists, repeat flushing. Obtain medical attention immediately. Handle contaminated clothing and shoes in a manner which limits further exposure.

Ingestion: DO NOT INDUCE VOMITING. If victim is alert and not convulsing, rinse mouth and give as much water as possible to dilute material (8 to 10 oz. or 240 to 300 mL). If spontaneous vomiting occurs, have victim lean forward with head down, rinse mouth and administer more water. IMMEDIATELY transport victim to an emergency facility. Do not give anything to an unconscious person.

Inhalation: Move victim to fresh air. If breathing is difficult, oxygen may be beneficial if administered by trained personnel, preferably on a doctor's advice. Give artificial respiration ONLY if breathing has stopped. Do not use mouth-to-mouth method if victim ingested or inhaled the substance: induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Obtain medical attention IMMEDIATELY. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure.

SECTION 5 – FIRE FIGHTING MEASURES

Extinguishing Media: This material does not burn. If exposed to fire from another source, use suitable extinguishing agent for that fire. Do not use water jet.

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Remove containers from fire, if possible, and cool containers with water. When material comes in contact with water, large amounts of heat may be generated and ignite adjacent combustible materials. **This material does not burn.** Fight fire for other material that is burning.

Special Protective Equipment for Firefighters:	Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.
Unusual Fire and Explosion Hazards:	Product reacts with water. Reaction may produce heat and/or gases. This reaction may be violent. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.
Hazardous Combustion Products:	Not applicable.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Steps to be taken if material is released or spilled:	Contain spilled material if possible. Small spills: Dilute with water and neutralize with dilute acid; absorb and collect. Large spills: Dike the area to contain the spill. Collect in suitable and properly labeled containers. Attempt to neutralize by adding material such as Acetic acid. See Section 13, Disposal Considerations, for additional information.
Personnel Precautions:	Evacuate area. Only trained and properly protected personnel must be involved in clean-up operations. Refer to Section 7, Handling, for additional precautionary measures. Keep upwind of spill. Ventilate area of leak or spill. See Section 10 for more specific information. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.
Environmental Precautions:	Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

SECTION 7 – HANDLING AND STORAGE

Handling:

Do not get in eyes. Do not get on skin or clothing. Do not swallow. Avoid breathing mist. Keep container closed. Use with adequate ventilation.

1. ALWAYS add caustic soda solution to water with constant agitation. NEVER add water to the caustic soda solution.
2. The water should be lukewarm (27°-38°C or 80°-100°F). NEVER start with hot or cold water. The addition of the caustic soda to liquid will cause a rise in temperature. If caustic soda becomes concentrated in one area, is added too rapidly, or is added to hot or cold liquid, a rapid temperature increase can result in DANGEROUS mists, boiling or spattering which may cause an immediate VIOLENT ERUPTION. See Section 8, Exposure Controls and Personal Protection.

Storage:

Keep container closed. Do not store in: Zinc, Aluminum, Brass, or Tin. See Section 10 for more specific information.

Storage temperature: >16°C

Shelf life: Use within 24 months

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Preventive Measures:

Recommendations listed in this section indicate the type of equipment which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

Engineering Controls:

Local exhaust ventilation should be applied wherever there is an incidence of point source emissions or dispersion of regulated contaminants in the work area. Ventilation control of the contaminant as close to its point of generation is both the most economical and safest method to minimize personnel exposure to airborne contaminants. The most effective measures are the total enclosure of processes and the mechanization of handling procedures to prevent all personal contact.

Personal Protective Equipment:	Maintain eye wash station and safety shower facilities in work area. Detailed requirements for personal protective equipment should be established on a site-specific basis.
Eye/Face Protection:	Wear full face-shield and chemical safety goggles when there is potential for contact.
Skin/Body Protection:	Wear appropriate personal protective clothing to prevent skin contact that is chemically resistant to this material. Wear rubber boots and chemical resistant gloves. Remove contaminated clothing immediately, wash skin area with soap and water and launder clothing before reuse or dispose of properly.
Respiratory Protection:	Up to 10mg/m³: Supplied Air Respirator (SAR) operated in a continuous-flow mode, eye protection needed; or full face-piece respirator with high-efficiency particulate filter(s); or powered air-purifying respirator with dust and mist filter(s), eye protection needed; or full face-piece Self-Contained Breathing Apparatus (SCBA); or full face-piece SAR. Emergency or Planned Entry into Unknown Concentrations of IDLH Conditions: Positive pressure, full face-piece SAR; or positive pressure, full face-piece SAR with an auxiliary positive pressure SAR.
Guidelines for Sodium Hydroxide Solutions, 30-70%:	**RECOMMENDED** (resistance to breakthrough longer than 8 hours): Butyl rubber; natural rubber, neoprene rubber, nitrile rubber, polyethylene, polyvinyl chloride, Teflon(TM), Viton(TM), Saranex(TM), 4H(TM), Barricade(TM), CPF 3(TM), Responder(TM), Trellchem HPS(TM), Tychem 10000(TM). **NOT RECOMMENDED** for use (resistance to breakthrough less than 1 hour): Polyvinyl alcohol.
Escape:	Full face-piece respirator with high-efficiency particulate filter(s); or escape-type SCBA.
Exposure Guidelines:	
PRODUCT:	**Sodium hydroxide** ACGIH Ceiling Exposure Limit (TLV-C): 2mg/m³ OSHA PEL-TWA & PEL-C: 2mg/m³ NIOSH IDLH: 10mg/m³ NIOSH REL-C: 2mg/m³

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid above freezing point
Physical Form	Liquid
Color	Colorless
Odor	Odorless
Odor Threshold	No data available
Flash Point – Closed Cup	None
Flammable Limits in Air	Lower: Not applicable Upper: Not applicable
Autoignition Temperature	Not applicable
Vapor pressure	1.5 mmHg @ 20°C *Literature*
Boiling Point (760 mmHg)	145°C (293°F) *Literature*
Vapor Density (air=1)	Not applicable
Specific Gravity (H20=1)	1.52 *Literature*
Liquid Density	1.5 g/cm3 @ 20°C *Literature*
Freezing Point	14°C (57°F) *Literature*
Melting Point	14°C (57°F) *Literature*
Solubility in Water (by weight)	Water solution
pH	Strong Basic
Evaporation Rate	No data available
Partition Coefficient n-octanol/water	No data available
Decomposition Temperature	No data available
Molecular Weight	40 g/mol
Volatility	No data available
Kinematic Viscosity	0.35 St @ 25° *Calculated*

* This data is based on 50% Caustic

SECTION 10 – STABILITY AND REACTIVITY

Stability/Instability: Stable under recommended storage conditions. See Storage, Section 7.

Conditions to avoid: Avoid moisture. Product absorbs carbon dioxide from the air. Avoid mixing with water, strong acids, or other incompatible materials. Will react with some metals and create a flammable hydrogen gas.

Incompatible Materials: Heat is generated when mixed with water. Spattering and boiling can occur. Caustic soda solution reacts readily with various reducing sugars (i.e. fructose, galactose, maltose, dry whey solids) to produce CO. Take precautions including monitoring the tank atmosphere for CO to ensure safety of personnel before vessel entry. Avoid contact with:

acids, glycols and halogenated organics. Organic nitro compounds. Flammable hydrogen may be generated from contact with metals such as: Zinc, Aluminum, Tin, or Brass.

Hazardous Polymerization: Will not occur.

Thermal Decomposition: Does not decompose.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity:

Ingestion: Single dose oral LD50 has not been determined.

Skin Absorption: The dermal LD50 has not been determined.

The severity of injury depends on the concentration and duration of exposure to the substance. This material is toxic to the skin, eyes, and mucous membranes. It may cause destructive effects on tissues that it contacts. Inhalation will cause irritation to the respiratory tract and difficulty breathing. Eye contact will cause irritation and may cause severe burns and possible blindness. Contact with skin will cause irritation and may cause corrosion of the tissue.

Repeated Dose Toxicity: Based on available data, repeated exposures are not anticipated to cause additional significant adverse effects.

Genetic Toxicology: For the major component(s): In vitro genetic toxicity studies were negative.

Carcinogenicity: Not a known carcinogen.

SECTION 12 – ECOLOGICAL INFORMATION

Fate and Transport:

Sodium Hydroxide:

Movement No bioconcentration is expected because of the relatively high water solubility. Potential for mobility in soil is very high (Koc between 0 and 50).

Persistence and Degradability		Biodegradation is not applicable.
Sodium Chloride:	**Movement**	No bioconcentration is expected because of the relatively high water solubility. Potential for mobility in soil is very high (Koc between 0 and 50).
Persistence and Degradability		Biodegradation is not applicable.

Ecotoxicity:

Sodium Hydroxide:	Material is slightly toxic to aquatic organisms on an acute basis (LC50/EC50 between 10 and 100 mg/L in the most sensitive species tested). May increase pH of aquatic systems to >pH 10 which may be toxic to aquatic organisms.
Fish Acute & Prolonged Toxicity	LC50, rainbow trout (Oncorhynchus mykiss), 96h: 45.5 mg/L
Aquatic Invertebrate Acute Toxicity	LC50, water flea Daphnia magna: 40-240 mg/L
Sodium Chloride:	Material is practically non-toxic to aquatic organisms on an acute basis (IC50/EC50>100 mg/L in the most sensitive species tested).
Fish Acute & Prolonged Toxicity	LC50, fathead minnow (Pimephales promelas): 10,610 mg/L
Aquatic Invertebrate Acute Toxicity	LC50, water flea Daphnia magna: 4,571 mg/L

SECTION 13 – DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable Federal, State/Provincial and local laws and regulations. Waste characterization and compliance with applicable laws and regulations are the responsibility of the waste generator. Do not dispose of waste with normal garbage, or to sewer systems.

SHINTECH LOUISIANA, LLC HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR

USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN SDS SECTION.

SECTION 14 – TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

	BULK / NON BULK
Shipping Name	SODIUM HYDROXIDE SOLUTION
Hazard Class/Division	8
Identification No.	UN1824
Packing Group	PG II
DOT RQ (lbs)	RQ 1000 lbs. (Sodium Hydroxide)

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

SECTION 15 – REGULATORY INFORMATION

USA Classification

OSHA Hazard Communication Standard: This product is a “Hazardous Chemical” as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	Yes
Sudden Release of Pressure Hazard	No
OSHA Process Safety (29CFR1910.119)	No
CERCLA Section 103 (40CFR302.4)	Yes

Reportable Quantity (RQ) under CERCLA	1,000 lbs. (454kg)
TSCA Inventory Status	Yes

This product does not contain nor is it manufactured with ozone depleting substances

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List and/or Pennsylvania Environmental Hazardous Substance List:

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
Sodium Hydroxide	1310-73-2	<=51.0%

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986):

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

US Toxic Substances Control Act:

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 710.30.

CEPA – Domestic Substances List (DSL):

All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	No
Fire Hazard	No
Reactive Hazard	Yes
Sudden Release of Pressure Hazard	No
OSHA Process Safety (29CFR1910.119)	No
CERCLA Section 103 (40CFR302.4)	Yes
Reportable Quantity (RQ) under CERCLA	1,000 lbs. (454kg)
TSCA Inventory Status	Yes

This product does not contain nor is it manufactured with ozone depleting substances.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

The following product components are cited in the Pennsylvania Hazardous Substance List and/or the Pennsylvania Environmental Substance List, and are present at levels which require reporting.

Component	CAS #	Amount
Sodium Hydroxide	1310-73-2	<=51.0%

Pennsylvania (Worker and Community Right-To-Know Act): Pennsylvania Hazardous Substances List:

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this statute.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986):

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

US Toxic Substances Control Act:

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 710.30

CEPA – Domestic Substances List (DSL):

All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

SECTION 16 – OTHER INFORMATION

IMPORTANT: The information presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANT ABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, IS MADE REGARDING PERFORMANCE, SUITABILITY, STABILITY OR OTHERWISE. The information included herein is not intended to be all-inclusive as to the appropriate manner and/or conditions of use, handling and/or storage. Factors pertaining to certain conditions of storage, handling, or use of this product may involve other or additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, safe handling and use remains the responsibility of the customer. No suggestions for use are intended to, and nothing herein shall be construed as a recommendation to, infringe any existing patents or violate any laws, rules, regulations or ordinances of any governmental entity.

Shintech Louisiana, LLC urges each customer or recipient of this SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as to the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product.

Revisions:

- **January 2011 - no information changed in this MSDS. This MSDS was reviewed for accuracy.**
- **April 2014 – The MSDS was updated to follow new Global Harmonization Guidelines. The MSDS are now called Safety Data Sheets (SDS).**
- **January 2016 – Corrections to improve nomenclature and technical data.**
- **February 2020 – No information changed in this SDS. This SDS was reviewed for accuracy.**
- **July 2022 – Section 2 was updated to include the GHS Classification Category 1 – Corrosive to Metals and Category 4 – Acute toxicity - inhalation. Section 2 - GHS Hazard Statements have been revised to indicate that this material is harmful if inhaled.**
- **November 2022 – Section 2 GHS Classifications and Hazard Statements updated.**
- **January 2023 – Removal of health hazard pictogram based on updated hazard statements.**

SDS Status: *Revision Date:* *1/25/2023*

Supersedes: *11/15/2022*

Aqua Ammonia 19%

Safety Data Sheet

Classified according to the UN-GHS as adopted in the US Hazard Communication Standard (HCS 2012), the Canada Hazardous Products Regulations (WHMIS 2015) and Mexico NOM-018-STPS-2015.

Revision Date: 4 June 2024 Date of issue: 4 June 2024 Supersedes Date: 23 June 2023 Version: 3.1

SECTION 1: IDENTIFICATION

1.1. Product Identifier

Product Name: Aqua Ammonia 19%

CAS No: 1336-21-6

Synonyms: Ammonia water, Aqueous ammonia, Household ammonia, Ammonium hydrate, Ammonium hydroxide

STCC: 4935280

1.2. Intended Use of the Product

Uses of the substance/mixture: Fertilizer

Uses advised against: Consumer use

1.3. Name, Address, and Telephone of the Responsible Party

Company

CF Industries
2375 Waterview Drive
Northbrook, Illinois, USA
847-405-2400
www.cfindustries.com

1.4. Emergency Telephone Number

Emergency Number : 800-424-9300
For Chemical Emergency, Spill, Leak, Fire, Exposure, or Accident, call CHEMTREC – Day or Night

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the Substance or Mixture

Classification (GHS-US)

Acute Tox. 4 (Oral)	H302
Acute Tox. 4 (Inhalation:gas)	H332
Skin Corr. 1A	H314
Eye Dam. 1	H318
STOT SE 3	H335
Aquatic Acute 1	H400
Aquatic Chronic 3	H412

Full text of H-phrases: see section 16

2.2. Label Elements

GHS-US Labeling

Hazard Pictograms (GHS-US) :

GHS05 GHS07 GHS09

Signal Word (GHS-US) : Danger

Hazard Statements (GHS-US) : H302+H332 - Harmful if swallowed or if inhaled.
H314 - Causes severe skin burns and eye damage.
H318 - Causes serious eye damage.
H335 - May cause respiratory irritation.
H400 - Very toxic to aquatic life.
H412 - Harmful to aquatic life with long lasting effects.

Precautionary Statements (GHS-US) : P260 - Do not breathe mist, spray, vapors, gas.
P261 - Avoid breathing vapors, mist, or spray.
P264 - Wash hands, forearms, and exposed areas thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P271 - Use only outdoors or in a well-ventilated area.
P273 - Avoid release to the environment.
P280 - Wear eye protection, protective clothing, protective gloves, face protection.

P301+P330+P331+P310 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a poison center or doctor.
P303+P361+P353+P310 - IF ON SKIN (OR HAIR): Take off immediately all contaminated clothing. Rinse skin with water/shower. Immediately call a poison center or doctor.
P304+P340+P310 - IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing. Immediately call a poison center or doctor.
P305+P351+P338+P310 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor.
P363 - Wash contaminated clothing before reuse.
P391 - Collect spillage.
P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
P405 - Store locked up.
P501 - Dispose of contents/container in accordance with local, regional, provincial, territorial, national, and international regulations.

2.3. Other Hazards
Ammonium hydroxide is very volatile and may release ammonia as a gas. Ammonia vapor, in concentrations of 16-25% volume by weight in air, is flammable, toxic by inhalation and corrosive. Take all appropriate precautions.

2.4. Unknown Acute Toxicity (GHS-US)
No data available.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances
Not applicable

3.2. Mixture

Name	Product Identifier	% (w/w)	Classification (GHS-US)
Ammonium hydroxide	(CAS No) 1336-21-6	100	Acute Tox. 4 (Oral), H302 Skin Corr. 1B, H314 Eye Dam. 1, H318 Aquatic Acute 1, H400
Contains	**Product Identifier**	**% (w/w)**	**Classification (GHS-US)**
Water	(CAS No) 7732-18-5	80.5-81.5	Not classified
Ammonia	(CAS No) 7664-41-7	18.5-19.5	Flam. Gas 2, H221 Compressed gas, H280 Acute Tox. 3 (Inhalation:gas), H331 Skin Corr. 1B, H314 Eye Dam. 1, H318 Aquatic Acute 1, H400 Aquatic Chronic 2, H411

Full text of H-phrases: see section 16

SECTION 4: FIRST AID MEASURES

4.1. Description of First Aid Measures
General: Never give anything by mouth to an unconscious person. Seek medical attention immediately. Show label if possible.
Inhalation: When symptoms occur: go into open air and ventilate suspected area. Immediately call a POISON CENTER or doctor/physician.
Skin Contact: Immediately flush skin with plenty of water for at least 60 minutes. Remove/Take off immediately all contaminated clothing. Immediately call a POISON CENTER or doctor/physician. Wash contaminated clothing before reuse.
Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing for at least 60 minutes. Immediately call a POISON CENTER or doctor/physician.
Ingestion: Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor/physician.

4.2. Most Important Symptoms and Effects Both Acute and Delayed
General: Harmful if swallowed. Corrosive to eyes, respiratory system and skin. Harmful if inhaled.

Inhalation: Symptoms may include: Sneezing, coughing, burning sensation of throat with constricting sensation of the larynx and difficulty in breathing. Damage to lungs. Harmful if inhaled.

Skin Contact: Corrosive. Causes burns. Symptoms may include: Redness. Pain. Serious skin burns. Blisters.

Eye Contact: Causes serious eye damage. Symptoms may include: Redness. Pain. Blurred vision. Severe burns. Causes permanent damage to the cornea, iris, or conjunctiva.

Ingestion: Harmful if swallowed. May cause burns or irritation of the linings of the mouth, throat, and gastrointestinal tract.

Chronic Symptoms: None known.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention.

SECTION 5: FIRE-FIGHTING MEASURES

5.1. Extinguishing Media

Suitable Extinguishing Media: Water spray, fog.

Unsuitable Extinguishing Media: Do not use a heavy water stream. Use of heavy stream of water may spread fire.

5.2. Special Hazards Arising From the Substance or Mixture

Fire Hazard: Ammonia vapor concentrations in the range of 16-25% by volume in air can be ignited if heated to the auto-ignition temperature. Oil or other combustible materials increases the fire hazard. Emits toxic fumes under fire conditions.

Explosion Hazard: Forms explosive compounds with calcium hypochlorite, bleaches, gold, mercury, silver, chlorine and other halogens. Contact with strong oxidizers can result in fires and explosions.

Reactivity: Corrosive to copper, brass, silver, zinc and galvanized steel.

5.3. Advice for Firefighters

Precautionary Measures Fire: Exercise caution when fighting any chemical fire.

Firefighting Instructions: Stop leak if safe to do so. Use water spray or fog for cooling exposed containers. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

Protection During Firefighting: Firefighters must use full bunker gear including NIOSH-approved positive-pressure self-contained breathing apparatus to protect against potential hazardous combustion and decomposition products.

Hazardous Combustion Products: Nitrogen oxides. Ammonia.

Reference to Other Sections

Refer to section 9 for flammability properties.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Keep away from open flames, hot surfaces and sources of ignition. No smoking. Avoid all contact with skin, eyes, or clothing. Do NOT breathe vapor, mist, spray.

6.1.1. For Non-Emergency Personnel

Protective Equipment: Use appropriate personal protection equipment (PPE).

Emergency Procedures: Evacuate unnecessary personnel. Eliminate ignition sources.

6.1.2. For Emergency Personnel

Protective Equipment: Equip cleanup crew with proper protection.

Emergency Procedures: Stop leak if safe to do so. Ventilate area.

6.2. Environmental Precautions

Prevent entry to sewers and public waters. Notify authorities if product enters sewers or public waters.

6.3. Methods and Material for Containment and Cleaning Up

For Containment: Stop the flow of material, if this is without risk. Ventilate area. Contain any spills with dikes or absorbents.

Methods for Cleaning Up: Clear up spills immediately and dispose of waste safely. Never neutralize spill with acid. Absorb and/or contain spill with inert material, then place in suitable container. Use only non-sparking tools. After cleaning, flush traces away with water.

6.4. Reference to Other Sections

See heading 8, Exposure Controls and Personal Protection. See Section 13, Disposal Considerations.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Additional Hazards When Processed: Do NOT enter (storage areas, confined spaces) unless adequately ventilated. Emits ammonia vapors. Flammable gas. Ammonium hydroxide reacts with many heavy metals and their salts forming explosive compounds. It may attack metals forming flammable/explosive gas. The solution in water is a strong base, it reacts violently with acids.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work.

7.2. Conditions for Safe Storage, Including Any Incompatibilities

Technical Measures: Any proposed use of this product in elevated-temperature processes should be thoroughly evaluated to assure that safe operating conditions are established and maintained. Ensure adequate ventilation. Comply with applicable regulations.

Storage Conditions: Store in a dry, cool and well-ventilated place. Detached outside storage is preferable. Keep in fireproof place. Store away from oxidizers, combustible materials, and all ignition sources. Store in corrosive resistant container with a resistant inner liner. Storage containers should have safety relief valves. Store locked up.

Incompatible Materials: Forms explosive compounds with calcium hypochlorite, bleaches, gold, mercury, silver, chlorine and other halogens. Contact with strong oxidizers can result in fires and explosions. Corrosive to copper, brass, silver, zinc and galvanized steel.

Storage Area: Post readily visible warning signs in the storage area listing emergency measures. Water hoses should be readily available to disperse vapors in case of a spill.

7.3. Specific End Use(s)

Fertilizer

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control Parameters

For substances listed in section 3 that are not listed here, there are no established Exposure limits from the manufacturer, supplier, importer, or the appropriate advisory agency including: ACGIH (TLV), NIOSH (REL), OSHA (PEL), Canadian provincial governments, or the Mexican government.

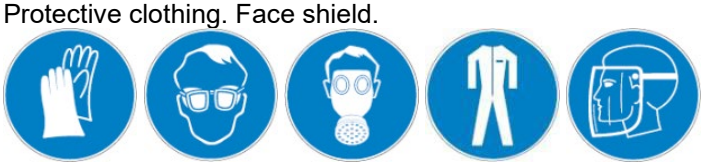
Ammonia (7664-41-7)		
Mexico	OEL TWA (mg/m³)	18 mg/m³
Mexico	OEL TWA (ppm)	25 ppm
Mexico	OEL STEL (mg/m³)	27 mg/m³
Mexico	OEL STEL (ppm)	35 ppm
USA ACGIH	ACGIH TWA (ppm)	25 ppm
USA ACGIH	ACGIH STEL (ppm)	35 ppm
USA OSHA	OSHA PEL (TWA) (mg/m³)	35 mg/m³
USA OSHA	OSHA PEL (TWA) (ppm)	50 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m³)	18 mg/m³
USA NIOSH	NIOSH REL (TWA) (ppm)	25 ppm
USA NIOSH	NIOSH REL (STEL) (mg/m³)	27 mg/m³
USA NIOSH	NIOSH REL (STEL) (ppm)	35 ppm
USA IDLH	US IDLH (ppm)	300 ppm
Alberta	OEL STEL (mg/m³)	24 mg/m³
Alberta	OEL STEL (ppm)	35 ppm
Alberta	OEL TWA (mg/m³)	17 mg/m³
Alberta	OEL TWA (ppm)	25 ppm
British Columbia	OEL STEL (ppm)	35 ppm
British Columbia	OEL TWA (ppm)	25 ppm
Manitoba	OEL STEL (ppm)	35 ppm
Manitoba	OEL TWA (ppm)	25 ppm
New Brunswick	OEL STEL (mg/m³)	24 mg/m³
New Brunswick	OEL STEL (ppm)	35 ppm
New Brunswick	OEL TWA (mg/m³)	17 mg/m³
New Brunswick	OEL TWA (ppm)	25 ppm
Newfoundland &	OEL STEL (ppm)	35 ppm

Labrador		
Newfoundland & Labrador	OEL TWA (ppm)	25 ppm
Nova Scotia	OEL STEL (ppm)	35 ppm
Nova Scotia	OEL TWA (ppm)	25 ppm
Nunavut	OEL STEL (mg/m³)	24 mg/m³
Nunavut	OEL STEL (ppm)	35 ppm
Nunavut	OEL TWA (mg/m³)	17 mg/m³
Nunavut	OEL TWA (ppm)	25 ppm
Northwest Territories	OEL STEL (mg/m³)	24 mg/m³
Northwest Territories	OEL STEL (ppm)	35 ppm
Northwest Territories	OEL TWA (mg/m³)	17 mg/m³
Northwest Territories	OEL TWA (ppm)	25 ppm
Ontario	OEL STEL (ppm)	35 ppm
Ontario	OEL TWA (ppm)	25 ppm
Prince Edward Island	OEL STEL (ppm)	35 ppm
Prince Edward Island	OEL TWA (ppm)	25 ppm
Québec	VECD (mg/m³)	24 mg/m³
Québec	VECD (ppm)	35 ppm
Québec	VEMP (mg/m³)	17 mg/m³
Québec	VEMP (ppm)	25 ppm
Saskatchewan	OEL STEL (ppm)	35 ppm
Saskatchewan	OEL TWA (ppm)	25 ppm
Yukon	OEL STEL (mg/m³)	30 mg/m³
Yukon	OEL STEL (ppm)	40 ppm
Yukon	OEL TWA (mg/m³)	18 mg/m³
Yukon	OEL TWA (ppm)	25 ppm

8.2. Exposure Controls

Appropriate Engineering Controls: Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Gas detectors should be used when toxic gases may be released. Use explosion-proof equipment.

Personal Protective Equipment: Gloves. Protective goggles. Insufficient ventilation: wear respiratory protection. Protective clothing. Face shield.



Materials for Protective Clothing: Chemically resistant materials and fabrics.

Hand Protection: Wear chemically resistant protective gloves.

Eye Protection: Chemical safety goggles and face shield.

Skin and Body Protection: Wear suitable protective clothing.

Respiratory Protection: If exposure limits are exceeded or irritation is experienced, approved respiratory protection should be worn.

Other Information: When using, do not eat, drink, or smoke.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on Basic Physical and Chemical Properties

Physical State : Liquid

Appearance : Colorless

Odor : Pungent

Odor Threshold : 1 - 50 ppm

pH : 10.6 - 11.6 (0.02-1.7% aqueous ammonia solution)

Evaporation Rate : Not available

Melting Point : - 77 °C (-106 °F) (< 44% NH_3)

Freezing Point	:	-38 °C (-36 °F)
Boiling Point	:	37.4 °C (99.3°F) (25% NH_3)
Flash Point	:	Not available
Auto-ignition Temperature	:	651 °C (1,204°F) (ammonia vapor)
Decomposition Temperature	:	Not available
Flammability (solid, gas)	:	Not available
Lower Flammable Limit	:	16 % (ammonia vapor)
Upper Flammable Limit	:	25 % (ammonia vapor)
Vapor Pressure	:	49642.2 Pa at 68°F (20°C)
Relative Vapor Density at 20 °C	:	0.6 (for ammonia vapor over aqua ammonia at 0°C and 760 mm Hg)
Relative Density	:	Not available
Specific Gravity	:	0.90 at 60 °F (19% NH_3)
Solubility	:	Soluble in water.
Partition Coefficient: N-Octanol/Water	:	-1.14 at 25° C
Viscosity	:	Not available
Explosion Data – Sensitivity to Mechanical Impact	:	Not expected to present an explosion hazard due to mechanical impact.
Explosion Data – Sensitivity to Static Discharge	:	Not expected to present an explosion hazard due to static discharge.

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity
Forms explosive compounds with calcium hypochlorite, bleaches, gold, mercury, silver, chlorine and other halogens. Contact with strong oxidizers can result in fires and explosions. Corrosive to copper, brass, silver, zinc and galvanized steel.

10.2. Chemical Stability
Stable under recommended handling and storage conditions (see section 7).

10.3. Possibility of Hazardous Reactions
Hazardous polymerization will not occur.

10.4. Conditions to Avoid
Direct sunlight. Extremely high or low temperatures. Heat. Sources of ignition.

10.5. Incompatible Materials
Strong acids. Strong bases. Strong oxidizers. Hypochlorites.

10.6. Hazardous Decomposition Products
Thermal decomposition generates: Carbon oxides (CO, CO2). Nitrogen oxides. Emits ammonia vapors.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on Toxicological Effects - Product
Acute Toxicity: Oral: Harmful if swallowed. Inhalation:gas: Harmful if inhaled.

LD50 and LC50 Data:

Ammonium hydroxide 1336-21-6	
ATE US (oral)	350.00 mg/kg body weight
ATE US (gases)	10,256.41 ppmV/4h

Skin Corrosion/Irritation: Causes severe skin burns and eye damage.
pH: 10.6 - 11.6 (0.02-1.7% aqueous ammonia solution)
Serious Eye Damage/Irritation: Causes serious eye damage.
pH: 10.6 - 11.6 (0.02-1.7% aqueous ammonia solution)
Respiratory or Skin Sensitization: Not classified
Germ Cell Mutagenicity: Not classified
Teratogenicity: Not available
Carcinogenicity: Not classified
Specific Target Organ Toxicity (Repeated Exposure): Not classified
Reproductive Toxicity: Not classified
Specific Target Organ Toxicity (Single Exposure): May cause respiratory irritation.

Aspiration Hazard: Not classified

Symptoms/Injuries After Inhalation: Symptoms may include: Sneezing, coughing, burning sensation of throat with constricting sensation of the larynx and difficulty in breathing. Damage to lungs. Harmful if inhaled.

Symptoms/Injuries After Skin Contact: Corrosive. Causes burns. Symptoms may include: Redness. Pain. Serious skin burns. Blisters.

Symptoms/Injuries After Eye Contact: Causes serious eye damage. Symptoms may include: Redness. Pain. Blurred vision. Severe burns. Causes permanent damage to the cornea, iris, or conjunctiva.

Symptoms/Injuries After Ingestion: Harmful if swallowed. May cause burns or irritation of the linings of the mouth, throat, and gastrointestinal tract.

Chronic Symptoms: None known.

11.2. Information on Toxicological Effects - Ingredient(s)

LD50 and LC50 Data:

Ammonia (7664-41-7)	
LC50 Inhalation Rat	5.1 mg/l (Exposure time: 1 h)
LC50 Inhalation Rat	2000 ppm/4h (Exposure time: 4 h)

Water (7732-18-5)	
LD50 Oral Rat	> 90000 mg/kg

Ammonium hydroxide (1336-21-6)	
LD50 Oral Rat	350 mg/kg

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecology - General: Toxic to aquatic life. Harmful to aquatic life with long lasting effects.

Ammonia (7664-41-7)	
LC50 Fish 1	0.44 mg/l (Exposure time: 96 h - Species: Cyprinus carpio)
EC50 Daphnia 1	25.4 mg/l (Exposure time: 48 h - Species: Daphnia magna)
LC 50 Fish 2	0.26 - 4.6 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus)

Ammonium hydroxide (1336-21-6)	
LC50 Fish 1	8.2 mg/l (Exposure time: 96 h - Species: Pimephales promelas)
EC50 Daphnia 1	0.66 mg/l (Exposure time: 48 h - Species: water flea)
EC50 Daphnia 2	0.66 mg/l (Exposure time: 48 h - Species: Daphnia pulex)

12.2. Persistence and Degradability

Ammonium hydroxide (1336-21-6)	
Persistence and Degradability	Biodegradation of ammonia occurs in water under aerobic conditions.

12.3. Bioaccumulative Potential

Ammonium hydroxide (1336-21-6)	
Log Pow	-1.14
Bioaccumulative Potential	Not established.

Ammonia (7664-41-7)	
Log Pow	-1.14 (at 25 °C)

12.4. Mobility in Soil

Not available

12.5. Other Adverse Effects

Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Sewage Disposal Recommendations: Do not empty into drains; dispose of this material and its container in a safe way.

Waste Disposal Recommendations: Dispose of waste material in accordance with all local, regional, national, provincial, territorial and international regulations.

Additional Information: Prevent runoff from entering drains, sewers or waterways.

Ecology – Waste Materials: This material is hazardous to the aquatic environment. Keep out of sewers and waterways.

SECTION 14: TRANSPORT INFORMATION

14.1. In Accordance with DOT

Proper Shipping Name : AMMONIA SOLUTION (with more than 10% but not more than 35% ammonia)
Hazard Class : 8
Identification Number : UN2672
Label Codes : 8

Packing Group : III
ERG Number : 154
CERCLA RQ : Ammonium Hydroxide = 1,000 lbs
Additional Information : Marine Pollutant

14.2. In Accordance with IMDG

Proper Shipping Name : AMMONIA SOLUTION (with more than 10% but not more than 35% ammonia)
Hazard Class : 8
Identification Number : UN2672
Packing Group : III
Label Codes : 8 + MP(P)
EmS-No. (Fire) : F-A
EmS-No. (Spillage) : S-B

Additional Information : Marine Pollutant, Classified as HME per MARPOL Annex V

14.3. In Accordance with IATA

Proper Shipping Name : AMMONIA SOLUTION (with more than 10% but not more than 35% ammonia)
Hazard Class : 8
Identification Number : UN2672
Label Codes : 8
Packing Group : III

ERG Code (IATA) : 8L

14.4. In Accordance with TDG

Proper Shipping Name : AMMONIA SOLUTION (with more than 10% but not more than 35% ammonia)
Hazard Class : 8
Identification Number : UN2672
Label Codes : 8
Packing Group : III
Additional Information : Marine Pollutant

14.5. Classified in Accordance with MX-SCT

Proper Shipping Name : AMMONIA SOLUTION (with more than 10% but not more than 35% ammonia)
Hazard Class : 8
Identification Number : UN2672
Label Codes : 8
Additional Information : Marine Pollutant

SECTION 15: REGULATORY INFORMATION

15.1. US Federal Regulations

Ammonium hydroxide (1336-21-6)	
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard

Ammonia (7664-41-7)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on the United States SARA Section 302 Listed on United States SARA Section 313	
SARA Section 302 Threshold Planning Quantity (TPQ)	500
SARA Section 311/312 Hazard Classes	Fire hazard Immediate (acute) health hazard Sudden release of pressure hazard

SARA Section 313 - Emission Reporting	1.0 % (includes anhydrous Ammonia and aqueous Ammonia from water dissociable Ammonium salts and other sources, 10% of total aqueous Ammonia is reportable under this listing)

Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

Ammonium hydroxide (1336-21-6)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

15.2. US State Regulations

Ammonia (7664-41-7)
U.S. - California - SCAQMD - Toxic Air Contaminants - Non-Cancer Acute
U.S. - California - SCAQMD - Toxic Air Contaminants - Non-Cancer Chronic
U.S. - California - Toxic Air Contaminant List (AB 1807, AB 2728)
U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)
U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
U.S. - Connecticut - Water Quality Standards - Acute Freshwater Aquatic Life Criteria
U.S. - Connecticut - Water Quality Standards - Acute Saltwater Aquatic Life Criteria
U.S. - Connecticut - Water Quality Standards - Chronic Freshwater Aquatic Life Criteria
U.S. - Connecticut - Water Quality Standards - Chronic Saltwater Aquatic Life Criteria
U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities
U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities
U.S. - Delaware - Accidental Release Prevention Regulations - Toxic Endpoints
U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
U.S. - Florida - Essential Chemicals List
U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations
U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Emission Levels (ELs)
U.S. - Idaho - Occupational Exposure Limits - TWAs
U.S. - Louisiana - Reportable Quantity List for Pollutants
U.S. - Maine - Air Pollutants - Criteria Pollutants
U.S. - Massachusetts - Allowable Ambient Limits (AALs)
U.S. - Massachusetts - Allowable Threshold Concentrations (ATCs)
U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
RTK - U.S. - Massachusetts - Right To Know List
U.S. - Massachusetts - Threshold Effects Exposure Limits (TELs)
U.S. - Massachusetts - Toxics Use Reduction Act
U.S. - Michigan - Occupational Exposure Limits - STELs
U.S. - Michigan - Polluting Materials List
U.S. - Michigan - Process Safety Management Highly Hazardous Chemicals
U.S. - Minnesota - Chemicals of High Concern
U.S. - Minnesota - Hazardous Substance List
U.S. - Minnesota - Permissible Exposure Limits - STELs
U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - 24-Hour
U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - Annual
U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
U.S. - New Jersey - Environmental Hazardous Substances List
RTK - U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - New Jersey - Special Health Hazards Substances List
U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
U.S. - New Jersey - Water Quality - Ground Water Quality Criteria
U.S. - New Jersey - Water Quality - Practical Quantitation Levels (PQLs)
U.S. - New Mexico - Precursor Chemicals
U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

U.S. - North Carolina - Control of Toxic Air Pollutants
U.S. - North Dakota - Air Pollutants - Guideline Concentrations - 1-Hour
U.S. - North Dakota - Air Pollutants - Guideline Concentrations - 8-Hour
U.S. - Ohio - Accidental Release Prevention - Threshold Quantities
U.S. - Ohio - Extremely Hazardous Substances - Threshold Quantities
U.S. - Oregon - Permissible Exposure Limits - TWAs
U.S. - Oregon - Precursor Chemicals
RTK - U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
RTK - U.S. - Pennsylvania - RTK (Right to Know) List
U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 1-Hour
U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 24-Hour
U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - Annual
U.S. - Rhode Island - Water Quality Standards - Acute Freshwater Aquatic Life Criteria
U.S. - Rhode Island - Water Quality Standards - Acute Saltwater Aquatic Life Criteria
U.S. - Rhode Island - Water Quality Standards - Chronic Freshwater Aquatic Life Criteria
U.S. - Rhode Island - Water Quality Standards - Chronic Saltwater Aquatic Life Criteria
U.S. - Tennessee - Occupational Exposure Limits - STELs
U.S. - Texas - Effects Screening Levels - Long Term
U.S. - Texas - Effects Screening Levels - Short Term
U.S. - Vermont - Permissible Exposure Limits - STELs
U.S. - Virginia - Water Quality Standards - Acute Freshwater Aquatic Life
U.S. - Virginia - Water Quality Standards - Acute Saltwater Aquatic Life
U.S. - Virginia - Water Quality Standards - Chronic Freshwater Aquatic Life
U.S. - Virginia - Water Quality Standards - Chronic Saltwater Aquatic Life
U.S. - Virginia - Water Quality Standards - Public Water Supply Effluent Limits
U.S. - Virginia - Water Quality Standards - Surface Waters Not Used for the Public Water Supply Effluent Limits
U.S. - Washington - Permissible Exposure Limits - STELs
U.S. - Washington - Permissible Exposure Limits - TWAs
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 25 Feet to Less Than 40 Feet
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 40 Feet to Less Than 75 Feet
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 75 Feet or Greater
U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights Less Than 25 Feet
U.S. - Wyoming - Process Safety Management - Highly Hazardous Chemicals
U.S. - Alaska - Water Quality Standards - Acute Aquatic Life Criteria for Fresh Water
U.S. - Alaska - Water Quality Standards - Chronic Aquatic Life Criteria for Fresh Water
U.S. - Alaska - Water Quality Standards - Acute Aquatic Life Criteria for Marine Water
U.S. - Alaska - Water Quality Standards - Chronic Aquatic Life Criteria for Marine Water
U.S. - Alaska - Ambient Air Quality Standards

Ammonium hydroxide (1336-21-6)

U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities
U.S. - Louisiana - Reportable Quantity List for Pollutants
U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1
U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2
U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity
U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1
U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2
RTK - U.S. - Massachusetts - Right To Know List
U.S. - Massachusetts - Toxics Use Reduction Act
U.S. - Michigan - Polluting Materials List
U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances
RTK - U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - New Jersey - Special Health Hazards Substances List
U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

RTK - U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
RTK - U.S. - Pennsylvania - RTK (Right to Know) List
U.S. - Texas - Effects Screening Levels - Long Term
U.S. - Texas - Effects Screening Levels - Short Term

15.3. Canadian Regulations

Ammonium hydroxide (1336-21-6)	
WHMIS Classification	Class E - Corrosive Material Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects
 	

Ammonia (7664-41-7)	
Listed on the Canadian DSL (Domestic Substances List) Listed on the Canadian IDL (Ingredient Disclosure List)	
IDL Concentration 1 %	
WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class E - Corrosive Material

Water (7732-18-5)	
Listed on the Canadian DSL (Domestic Substances List)	
WHMIS Classification	Uncontrolled product according to WHMIS classification criteria

Ammonium hydroxide (1336-21-6)	
Listed on the Canadian DSL (Domestic Substances List) Listed on the Canadian IDL (Ingredient Disclosure List)	
IDL Concentration 1 %	
WHMIS Classification	Class E - Corrosive Material Class D Division 1 Subdivision B - Toxic material causing immediate and serious toxic effects

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all of the information required by CPR.

SECTION 16: OTHER INFORMATION, INCLUDING DATE OF PREPARATION OR LAST REVISION

Revision Date : 4 June 2024

Revision Comments : This version contains updates/revisions to the following sections:

- Updated company address

GHS Full Text Phrases:

Acute Tox. 3 (Inhalation:gas)	Acute toxicity (inhalation:gas) Category 3
Acute Tox. 4 (Inhalation:gas)	Acute toxicity (inhalation:gas) Category 4
Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Aquatic Chronic 2	Hazardous to the aquatic environment - Chronic Hazard Category 2
Aquatic Chronic 3	Hazardous to the aquatic environment - Chronic Hazard Category 3
Compressed gas	Gases under pressure Compressed gas

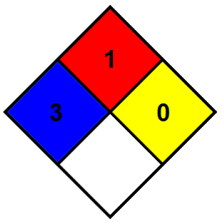
Eye Dam. 1	Serious eye damage/eye irritation Category 1
Flam. Gas 2	Flammable gases Category 2
Skin Corr. 1A	Skin corrosion/irritation Category 1A
Skin Corr. 1B	Skin corrosion/irritation Category 1B
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H221	Flammable gas
H280	Contains gas under pressure; may explode if heated
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H331	Toxic if inhaled
H332	Harmful if inhaled
H335	May cause respiratory irritation
H400	Very toxic to aquatic life
H411	Toxic to aquatic life with long lasting effects
H412	Harmful to aquatic life with long lasting effects

NFPA Rating

Health Hazard : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

Fire Hazard : 1 - Must be moderately heated or exposed to relatively high temperature before ignition can occur.

Reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given

Flammability : 1 Slight Hazard

Physical : 0 Minimal Hazard

Party Responsible for the Preparation of This Document

CF Industries, Corporate EHS Department, 847-405-2400

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

CF believes the information contained herein is accurate; however, CF makes no guarantees or warranties with respect to such accuracy and assumes no liability in connection with the use of the information contained herein by any party. The provision of the information contained herein by CF is not intended to be and should not be construed as legal advice or as ensuring compliance by other parties. Judgments as to the suitability of the information contained herein for the party's own use or purposes are solely the responsibility of that party. Any party handling, transferring, transporting, storing, applying or otherwise using this product should review thoroughly all applicable laws, rules, regulations, standards and good engineering practices. Such thorough review should occur before the party handles, transfers, transports, stores, applies or otherwise uses this product.

North America GHS US 2012 & WHMIS 2

ATTACHMENT I

EMISSION UNITS TABLE

Attachment I

Emission Units Table

(includes all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status)

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type[3] and Date of Change	Control Device[4]
1S-117S	1E-117E	Engine 1 through Engine 117	2026	28,194 HP	New	1C-117C
118S-157S	118E-157E	ULSD Tank TK1-TK40	2026	170,000 gal	New	NA
De minimis	De minimis	Hydrous Ammonia Tanks 1-39	2026	4,600 gal	New	NA
De minimis	De minimis	Caustic Soda Tanks 1-39	2026	4,600 gal	New	NA
De minimis	De minimis	Sulfuric Acid Tanks 1-39	2026	4,600 gal	New	NA
De minimis	De minimis	Sodium Chlorite Tanks 1-39	2026	4,600 gal	New	NA
De minimis	De minimis	Sodium Hydrosulfide Tanks 1-39	2026	4,600 gal	New	NA

[1] For Emission Units (or Sources) use the following numbering system: 1S, 2S, 3S, or other appropriate designation.
[2] For Emission Points use the following numbering system: 1E, 2E, 3E, or other appropriate designation.
[3] New, modification, removal
[4] For Control Devices use the following numbering system: 1C, 2C, 3C, or other appropriate designation.

ATTACHMENT J

EMISSION POINTS DATA SUMMARY SHEET

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 1: Emissions Data

Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type[1]	Emission Unit Vented Through This Point *(Must match Emission Units Table & Plot Plan)*		Air Pollution Control Device *(Must match Emission Units Table & Plot Plan)*		Vent Time for Emission Unit *(chemical processes only)*		All Regulated Pollutants - Chemical Name/CAS[3] *(Speciate VOCs & HAPS)*	Maximum Potential Uncontrolled Emissions [4]		Maximum Potential Controlled Emissions [5]		Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/ Vapor)*	Est. Method Used [6]	Emission Concentration [7] (ppmv or mg/m^4)
		ID No.	Source	ID No.	Device Type	Short Term[2]	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
Worst case yearly emissions all engines (with 5 startups and shutdowns)															
1E-117E	Vertical	1S to 117S	Engines 1 to 117	1C to 117C	Control System	NA	NA	NO_X	NA	13,494	NA	194.30	Gas	Manufacturer	NA
								PM/PM10/PM2.5	NA	248.69	NA	186.53	Solid		NA
								CO	NA	11,174	NA	205.62	Gas		NA
								VOC	NA	11,517	NA	116.59	Gas		NA
								SO2	NA	495	NA	9.93	Gas		NA
								Total HAPS	NA	85.77	NA	0.86	Gas		NA
Normal Operations Single Engine (See emission discussion in Attachment L for different operating scenarios)															
1E to 117E	Vertical	1S to 117S	Engine 1 to 117	1C to 117C	Control System	NA	NA	NO_X	13.89	60.83	0.14	0.61	Gas	Manufacturer	NA
								PM/PM10/PM2.5	0.45	1.99	0.34	1.49	Solid		NA
								CO	22.36	97.92	0.34	1.47	Gas		NA
								VOC	22.63	99.12	0.23	0.99	Gas		NA
								SO2	0.74	3.25	0.01	0.03	Gas		NA
								Total HAPS	1.31	0.75	0.54	0.01	Gas		NA

See Emissions Discussion in Attachment L and Emissions Estimate in Attachment N for other emissions scenarios.

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

[1] Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

[2] Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

[3] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. **DO NOT LIST** H_2, H_2O, N_2, O_2, and Noble Gases.

[4] Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[5] Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[6] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

[7] Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m^3) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO_2, use units of ppmv (See 45CSR10).

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 1: Emissions Data

Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type[1]	Emission Unit Vented Through This Point *(Must match Emission Units Table & Plot Plan)*		Air Pollution Control Device *(Must match Emission Units Table & Plot Plan)*		Vent Time for Emission Unit *(chemical processes only)*		All Regulated Pollutants - Chemical Name/CAS[3] *(Speciate VOCs & HAPS)*	Maximum Potential Uncontrolled Emissions [4]		Maximum Potential Controlled Emissions [5]		Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/ Vapor)*	Est. Method Used [6]	Emission Concentration [7] (ppmv or mg/m^4)
		ID No.	Source	ID No.	Device Type	Short Term[2]	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
118E to 157E	Vertical	118S to 157S	ULSD Tanks 1-40	None	None	NA	NA	VOC (per tank)	0.18	0.02	0.18	0.02	Gas	Tanks 4.09.d	

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

[1] Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

[2] Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

[3] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. **DO NOT LIST** H_2, H_2O, N_2, O_2, and Noble Gases.

[4] Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[5] Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[6] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

[7] Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m^3) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO_2, use units of ppmv (See 45CSR10).

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 2: Release Parameter Data								
Emission Point ID No. *(Must match Emission Units Table)*	Inner Diameter (ft.)	Exit Gas			Emission Point Elevation (ft)		UTM Coordinates (km)	
		Temp. (°F)	Volumetric Flow [1] (acfm) *at operating conditions*	Velocity (fps)	Ground Level *(Height above mean sea level)*	Stack Height [2] *(Release height of emissions above ground level)*	Northing	Easting
1E-117E	4.6	111	32,287	32.37	~1,718	98	4,161.72229	415.70631
118E-157E	NA	Ambient	NA	NA	~1,718	40	4,161.72229	415.70631

[1] Give at operating conditions. Include inerts.
[2] Release height of emissions above ground level.

ATTACHMENT K

FUGITIVE EMISSIONS DATA SUMMARY SHEET

FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions, which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS
1.) Will there be haul road activities? ☒ Yes ☐ No ☒ If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.) Will there be Storage Piles? ☐ Yes ☒ No ☐ If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.) Will there be Liquid Loading/Unloading Operations? ☐ Yes ☒ No ☐ If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? ☒ Yes ☐ No Leak Source Count is in Attachment N. ☒ If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.) Will there be General Clean-up VOC Operations? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.) Will there be any other activities that generate fugitive emissions? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants - Chemical Name/CAS [1]	Maximum Potential Uncontrolled Emissions [2]		Maximum Potential Controlled Emissions [3]		Est. Method Used [4]
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	PM/PM10/PM2.5	11.50/2.30/0.60	28.64/5.73/1.50	11.50/2.30/0.60	28.64/5.73/1.50	AP-42
Unpaved Haul Roads						
Storage Pile Emissions						
Loading/Unloading Operations						
Wastewater Treatment Evaporation & Operations						
Equipment Leaks (See fittings count in Attachment N)	VOC Hexane (C6+)	Does Not Apply	0.3120 0.0053	Does Not Apply	0.3120 0.0053	EE
General Clean-up VOC Emissions						
Other						

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, etc. DO NOT LIST CO_2, H_2, H_2O, N_2, O_2, and Noble Gases.

[2] Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[3] Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[4] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

ATTACHMENT L

EMISSION UNIT DATA SHEET(S)

REDACTED
Information Claimed Confidential by
TransGas Development Systems, LLC
March 24, 2025

Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): 1S-117S

1. Name or type and model of proposed affected source:

[redacted] 28,194 Horsepower Compression Ignition Engines. See attached engine details and emissions.

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

1. Name(s) and maximum amount of proposed process material(s) charged per hour:

Dual Fuel Modes
1. Natural Gas at 98% with Diesel at 2%.
2. Diesel at 100%.

Engine can be retrofit to burn other fuels.

4. Name(s) and maximum amount of proposed material(s) produced per hour:

25 MWe Generators

5. Give chemical reactions, if applicable, that will be involved in the generation of air Pollutants:

Not Applicable

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):

(a) Type and amount in appropriate units of fuel(s) to be burned:

See fuel use during different operating modes in the attached document and in Attachment N.

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

Natural gas will be pipeline quality natural gas.
Diesel fuel will be ultra-low sulfur diesel.

(c) Theoretical combustion air requirement (ACF/unit of fuel): NA

@ °F and psia.

(d) Percent excess air: NA

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

Compression Ignition Engines

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

NA

(g) Proposed maximum design heat input: 135.44 (Maximum) × 10^6 BTU/hr.

7. Projected operating schedule:

Hours/Day	24	Days/Week	7	Weeks/Year	52

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

See the attached document and Attachment N.

a.	NO_X	See Attached and Attachment N	lb/hr	See Attached and Attachment N	Ton/yr
b.	SO_2		lb/hr		Ton/yr
c.	CO		lb/hr		Ton/yr
d.	PM_{10}		lb/hr		Ton/yr
e.	Hydrocarbons		lb/hr		Ton/yr
f.	VOCs (Ethane & Methane)		lb/hr		Ton/yr
g.	Pb		lb/hr		Ton/yr
h.	Specify other(s)				
	Total HAPS	See Attached and Attachment N	lb/hr	See Attached and Attachment N	Ton/yr
			lb/hr		Ton/yr
			lb/hr		Ton/yr
			lb/hr		Ton/yr

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
Monitoring as required by 40CFR60, Subpart IIII.	Recordkeeping as required by 40CFR60, Subpart IIII.
REPORTING	TESTING
Reporting as required by 40CFR60, Subpart IIII.	Testing as required by 40CFR60, Subpart IIII.

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

The engines are designed to run as proposed. Procedures will be provided upon delivery of the engines.

Engine Model and Manufacturer

The engines deployed will be [redacted]. These are [redacted] dual fuel engines. The engines will be built in license by the following engine builders:

[redacted]

Performance Data

The [redacted] offers very high, single-cycle efficiency. In the selected configuration and rating, one engine will produce a maximum 21,000 kW (or 28,194 HP) mechanical power at the shaft. The engines are Dual-Fuel capable, for maximum flexibility. The advantage of these engines among high efficiency and reliability is that they can be upgraded to ammonia engines, increasing the power output to 26,000 kW each, and minimizing the CO_2 per kWh to 66 g, once the fuel is available.

[redacted]

Figure 1: Picture of an [redacted]

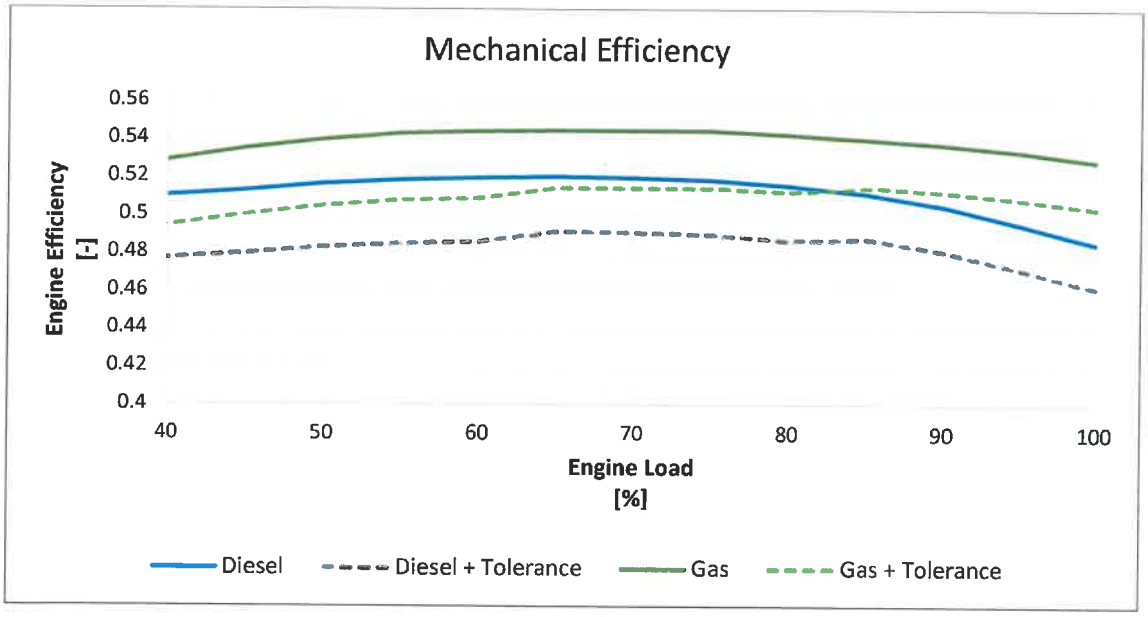


Figure 2: Efficiency of the engine as a function of the load

Power

On the permitting site there will be a total of 117 engines. With the maximum power output of 21 MW per engine, the installed theoretical power output is 2,457 MW. The effective and continuously delivered power output will be 1,795 MW, for 8,760 hours per year.

Fuel Types

In their Dual-Fuel configuration, the engines operate on natural gas and on diesel fuels or can be operated on diesel fuel only, in backup mode. Under normal operation the engines consume gas as their primary fuel with a pilot injection of Ultra-Low Sulfur Diesel. For this application the gas has the following properties (lower heat rate 976.94 BTU/ft³):

Date	BTU	SG	CO2	N2	Methane	Ethane	Propane	I-Butane	N-Butane	I-Pentane	N-Pentane	c6+
Average	1082.2	0.61	0.20	0.44	90.33	8.44	0.52	0.02	0.03	0.01	0.00	0.01
STD in % of average	0.66	0.78	11.09	5.04	0.85	8.17	57.48	20.82	24.96	33.90	55.06	63.08

Under gas operation, 2% of the energy comes from the pilot fuel, which can be increased to 100% for emergency operation. The fuel used in this application will be Ultra-Low Sulfur Diesel (ULSD), with a sulfur Content: ≤ 15 parts per million (ppm) and a heat rate of 130,613 BTU/gal.

Operational profiles

Normal Operation

To ensure peak operation conditions, the engines will be regularly serviced. With 1-2 weeks of downtime per engine per year, 3 engines are going to be off-line at any time of the year. Under normal operations, the engines will be run at 75% power only. Therefore, the continuously delivered power will be 1,796 MW.

Compensation Mode

In case of one or – in the unrealistic, but foreseen case of - up to 29 engines out of service, the rest of the field will compensate, increasing their power output to 100%. For the calculation of the yearly emissions the worst case is assumed, when 29 engines go offline and the remaining 85 are operated at 100%.

Emergency Mode

In case the pipeline is down, or the gas cannot be delivered for any other reason, the engines can switch to *diesel fuel mode* immediately and are then operated on diesel fuel only. Apart from the different fuel type, the engines are controlled in the same way as in *Normal Operation*.

Startup Mode

To start an engine and bring power production online, several steps are necessary. In the first phase the emission control system is not operational temperature, therefore the control rate is not optimal. The following is a simplification and a representation of the worst case for emissions emission-wise. The different steps can be reduced to four main sub-modes:

- Speed up
- Fuel Switch
- Generator switched on
- Load up cold control

Speed up

Bring the engine from stand still to nominal speed (89 rpm). This is done in diesel mode. The emission control system is still offline at this point, as it is not at optimal temperature. Once nominal speed is set and the minimum load for a fuel switch is reached (less than 5 minutes), the system initiates the next sub mode: Fuel Changeover

Fuel Changeover
For about two minutes the load is kept constant, and the fuel is changed from 100% diesel to 98% gas & 2% diesel.

Generator switched on
On gas operation, the load is further increased until the generator can by energized and synchronized with the rest of the engine fleet. This takes no more than 5 minutes. For the emissions calculation of all these steps the emission control system is looked at as non-operational, even though the exhaust gases will have heated it already and some abatement is taking place, even at a reduced level.

Load up cold control
Once the generator is online and synchronized, then the engine is powered up to its set point (75% in normal operation mode). For reasons of simplicity and to ensure a conservative view on the problem, during engine load up the control system is looked at as cold and operational at 25% only. This even though in reality the system was heated up constantly by the exhaust gases and reaching operational condition during the load up.

Shut Down

The shut down procedure consists of three phases:

- Ramp down
- Min Load
- Spin out

Ramp down
The load is constantly reduced to a minimum load.

Min Load
At minimum load the generator is decoupled from the grid and the engine's load and speed setting are zero.

Spin out
Due to the zero-load setting the injection systems are turned off and the engine is spun out until full stop. In this entire sequence the emission control system is still operational due to its thermal inertia. Therefore, until the injection is stopped the emissions are treated.

All these steps are represented in Figure 3.

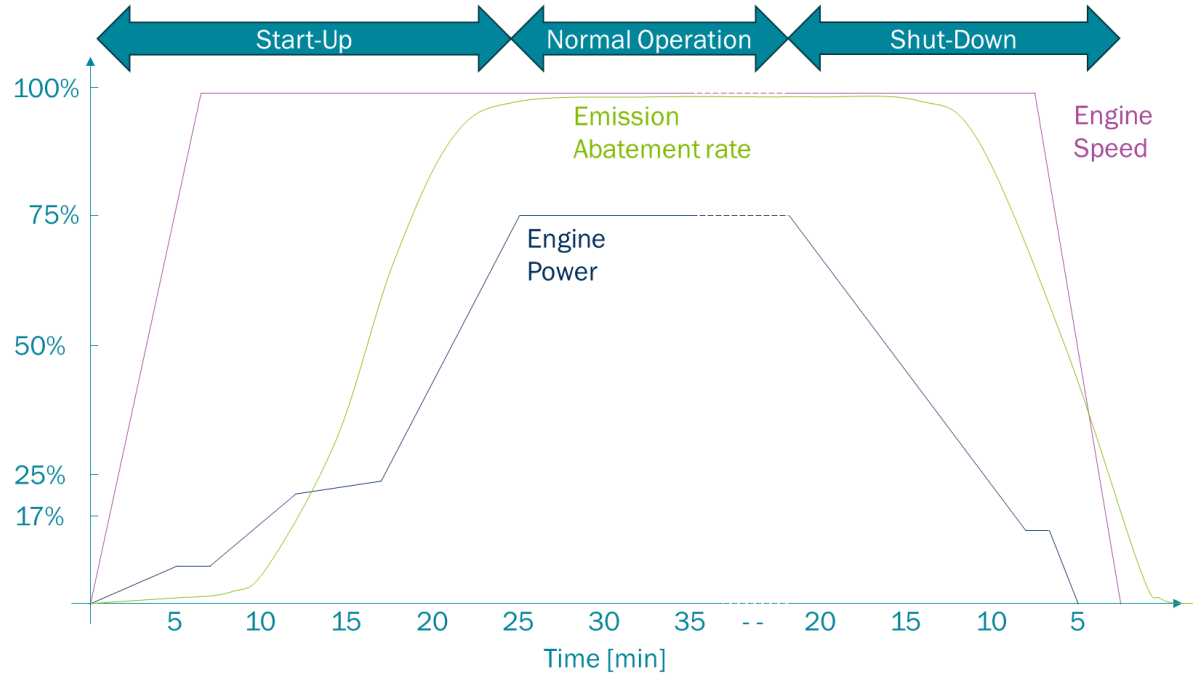


Figure 3: Simplified representation of the Start-Up and Shut-Down phases. Purple: Speed, dark blue: Power and green the efficiency of the emission control system

Emission Levels

For this application the engines are operated in two fuel modes, *Gas mode*, and Diesel mode, where 100% of the energy come from diesel. In Gas mode, where 98% of the energy comes from Natural Gas and 2% from diesel fuel injection (Ultra Low Sulfur Diesel), the engine's raw emissions going into the emission control system are listed in Table 1.

Gas mode		100	75	50	25	20	10
NOx	g/kWh	1.0	0.4	0.4	0.8	0.9	1.0
PM (Filterable)	mg/Nm3	5.7	4.2	5.3	8.6	9.3	10.6
PM10 (Filterable + Condensable)	mg/Nm3	5.4	4.1	5.1	8.1	8.8	10.1
PM2.5 (Filterable + Condensable)	mg/Nm3	5.4	4.1	5.1	8.1	8.8	10.1
CO	ppm	180	166	178	154	149	139
VOC	ppm	79	76	78	88	90	94
N2O	ppm	2	1	1	1	1	1
CH4	ppm	644	616	638	732	750	788
CO2	g/kWh	383	373	377	400	405	416
SO2	g/kWh	0.025	0.023	0.021	0.021	0.021	0.022

Table 1: Engine raw emissions in Gas mode

For redundancy the engine can switch to *Diesel mode* as a backup, with 100% of the energy coming from diesel fuel (ULSD), in case there is a problem with the gas supply system. The corresponding emissions are listed in Table 2.

Diesel mode		100	75	50	25	20	10
NOx	g/kWh	11.6	14.9	17.1	18.5	18.8	19.3
PM (Filterable)	mg/Nm3	8.4	12.1	11.6	8.6	8.0	6.8
PM10 (Filterable + Condensable)	mg/Nm3	8.4	12.1	11.6	8.6	8.0	6.8
PM2.5 (Filterable + Condensable)	mg/Nm3	8.0	11.7	11.3	8.1	7.6	6.5
CO	ppm	83	36	36	39	40	41
VOC	ppm	91	103	119	171	181	202
N2O	ppm	4	2	1	1	1	1
CO2	g/kWh	439	426	430	454	460	471
SO2	g/kWh	0.353	0.330	0.330	0.336	0.401	0.440

Table 2: Engine raw emissions in Diesel mode

[redacted] Emission Control System

A detailed description of the system can be found in document *21801.24.0.TGT-PL TGT Process description.pdf*

On a high level the emission abatement, or control system, consists of two main systems, the dry system on the high pressure side of the engine (before the turbocharger) and the wet system on the low pressure side, downstream the turbocharger.

The dry system consists of an oxydation catalyst and and an SCR catalyst. The catalytic reduction of **CO** has an **efficiency** of over **99%**. The same system oxidises **VOC** emission with a conversion **efficiency** of **99%** The de-NOx unit is a classic, urea-based **SCR**-technology, the **efficiency** is expected to be higher than **90%**. Doing so the dry system **consumes 13.2 l/h of NH_3** (aq).

The wet system consists of 4 stages, which take further care of the **NOx with 90.9%** efficiency and the **SOx with 70% efficiency**. The four stages consume the following chemicals:

Chemical	%w	lb/gal	[gal/h]	[lb/h]
NH_3 (aq.)	19%	7.51	3.49	26.2
NaOH	50%	12.52	29.91	374.5
NaHS (reducing agent)	45%	10.85	0.11	1.1
NaClO2 (oxidizing agent)	25%	10.01	0.40	4.0
H_2SO_4	36%	10.68	0.10	1.1

Table 3: Use of chemicals for the emission control system

Normal Operation

Under normal circumstances the engines operate on gas at 75% load, at their peak efficiency, hence with lowest specific fuel consumption. They are stopped once a year for servicing, while another engine takes up this load. In *Normal Operation* mode one single engine consumes 4,574.1 lb/h of gas (98,924 ft^3/h) and 27.8 lb/h (3.91 gal/h) of ULSD.

Doing so, it produces the following raw emissions:

NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]
13.89	0.45	22.36	22.63	0.74	12,634	47.60	0.25	14,035

Table 4: Emissions of a single engine in Normal Operation
** with Global Warming Potential of 28 for Methane and 265 for laughing gas*

While one individual engine never sees a total run time of 8760 hours per year, there are 114 engines that do experience this as a collective. One single engine of the operated collective therefore consumes 20,035 short tons of gas per year (866,574,112 ft^3/a) and 122 tons (34,273 gal/a) of ULSD per year and produces the following raw emissions:

NOx [t/a]	PM [t/a]	CO [t/a]	VOC [t/a]	SOx [t/a]	CO2 [t/a]	Methane [t/a]	N2O [t/a]	CO2_eq [t/a]
60.83	1.99	97.92	99.12	3.25	55,339	208	1.1	61,472

Table 5: Emissions of 1 engine under Normal Operation (8760 hours)

The abatement system reduces the emissions the following:

	NOx [%]	PM [%]	CO [%]	VOC [%]	SO2 [%]
Speed up	0%	0%	0%	0%	95%
Fuel Changeover	0%	0%	0%	0%	99%
Generator switched on	0%	0%	0%	0%	99%
Load up cold control	25%	0%	25%	25%	99%
Normal Operation	99%	25%	99%	99%	99%
Compensation Mode	99%	25%	95%	99%	99%
Ramp down	99%	25%	94%	99%	99%
Min load	70%	0%	50%	70%	70%
Spin out	40%	0%	35%	40%	40%
Emergency Mode	98%	25%	91%	99%	99%

Table 6: Emission abatement efficiency for each individual emission type

Resulting in the total yearly emissions per engine of:

NOx [t/a]	PM [t/a]	CO [t/a]	VOC [t/a]	SOx [t/a]	CO2 [t/a]	Methane [t/a]	N2O [t/a]	CO2_eq [t/a]
0.61	1.49	1.47	0.99	0.03	55,339	208	1.1	61,472

Table 7: Total yearly emissions of a single engine after emission treatment

Start up and Shut down operation

Additionally, one start up and shut down is foreseen. During the individual sequences one engine produces the following emissions:

	Load [%]	Abat.* [%]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]
Speed up	10%	0.00%	89.54	0.34	2.50	19.49	0.10	3,217	0	0.12	3,274
Fuel Switch	10%	0.00%	4.81	0.53	8.65	13.07	0.00	1,807	28.03	0.12	2,740
Generator on	20%	0.00%	8.15	0.46	9.25	12.48	0.00	3,535	26.7	0.12	4,529
Load up	25%	25%	9.26	0.43	9.54	12.19	0.00	4,370	26.03	0.12	5,386
Ramp down	40%	100%	10.37	0.32	13.79	14.95	0.00	6,777	31.74	0.15	8,063
Min load	20%	70%	8.15	0.46	9.25	12.48	0.07	3,535	26.7	0.12	4,529
Spin out	10%	40%	4.81	0.53	8.65	13.07	0.07	1,807	28.03	0.12	2,740

Table 8: Emission during the different stages of Startup and Shut down phase
**of the efficiencies mentioned above in Table 6.*

In total during one startup and a shutdown sequence one single engine emits the following:

NOx [t]	PM [t]	CO [t]	VOC [t]	SOx [t]	CO2 [t]	Methane [t]	N2O [t]	CO2_eq [t]
0.0049	0.0002	0.0016	0.0026	0.0000	1.9675	0.0104	0.0001	2.2724
[lb]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]
9.74	0.31	3.22	5.12	0.02	3,935	20.77	0.11	4,545

Table 9: Emissions during a startup and shutdown sequence for one single engine.

Normal Operation Scenario

Therefore, under normal circumstances the 117 engines emit the following over one year, including one startup and shutdown sequence, each:

NOx [t/a]	PM [t/a]	CO [t/a]	VOC [t/a]	SOx [t/a]	CO2 [t/a]	Methane [t/a]	N2O [t/a]	CO2_eq [t/a]
69.9	169.9	167.6	113.3	3.7	6,308,872	23,768	127.1	7,008,055

Table 10: Entire yearly emissions for the entire plant und normal circumstances.

To do so, the entire plant consumes 2,284,014.5 tons of natural gas (98,792,705,589 ft^3) coming in a pipeline and 13,876 tons of diesel (3,908,687 gal) which will be shipped on site.

Emergency Mode

In case when no gas is available, the engines can be operated in so called emergency mode and the power comes from diesel. In this mode a single engine consumes 5666.8 lb/h (798 gal/h) and emits the following:

NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]
10.35	1.29	0.58	0.29	0.11	17,896	0.00	0.67	18,073

Table 11: Controlled hourly emissions per engine in Emergency Mode

Compensation Mode

In case some engines should for any reason fail, the remaining engines will compensate for the loss of power, by increasing their power output. Here the worst case, of each engine ramping up to 100% load, is looked at. Under such conditions the engines consume 6,386 lb of natural gas per hour (138,112 ft³) and 27.8 lb/h of ULSD (3.91 gal/h). The following emissions result from this kind of operation:

NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]
0.46	0.20	1.41	0.27	0.01	17,605	57.73	0.59	19,378

Table 12: Controlled hourly emissions per engine in Compensation Mode

Worst case scenario

As shown earlier, under Normal Operation conditions the engines stay well below the 250 t/year limit for all the regulated emissions. But to ensure that the power plant can be operated under worst case conditions, the following, unrealistic but not impossible scenario was looked at:

The pipeline is out for 8 days (192 hours); hence the power plant is operated on diesel. In the same year an unforeseeable event takes down 31 engines (26% of the entire plant) and the remaining 86 engines will compensate for by delivering the full power, increasing their output to 99.4% load. This situation lasts 24 days (567 hours). Additionally, the engines have to be started up and shut down 5 times, instead of once per year.

The engines are therefore for the following number of hours operated in the corresponding mode:

Speed up	0.42
Fuel Switch	0.17
Generator switched on	0.42
Load up cold control	0.83
Normal Operation	7996.80
Compensation Mode	567.20
Ramp down	1.67
Min load	0.42
Spin out	0.08
Emergency Mode	192.00
Total operational time	**8760**

Table 13: Operational time in hours for each engine mode under worst case scenario

Under this scenario and the consequent operational profiles, the entire plant will emit the following emissions per year:

	Gas	Diesel	NOx	PM	CO	VOC	SO2	CO2_e
	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]
Speed up	0.00	24.19	2.13	0.01	0.06	0.46	0.00	77
Fuel Switch	6.56	0.10	0.05	0.01	0.08	0.12	0.00	25
Generator switched on	32.02	0.40	0.19	0.01	0.22	0.30	0.00	102
Load up cold control	79.11	0.88	0.33	0.02	0.34	0.43	0.00	244
Normal Operation	213,6163	12,661	63.31	155.11	152.86	103.15	3.38	6397261
Compensation Mode	208,133	898	14.97	17.22	45.53	8.84	0.33	626484
Ramp down	244.63	2.11	0.01	0.03	0.08	0.01	0.00	732
Min load	32.02	0.40	0.06	0.01	0.11	0.09	0.00	102
Spin out	3.28	0.05	0.01	0.00	0.03	0.04	0.00	12
Emergency Mode	0.00	61,751	113.24	14.11	6.31	3.15	6.22	197796
Total	**2,291,799**	**75,605**	**194**	**187**	**206**	**117**	**10**	**7,222,837**

Table 14: Total yearly emissions of the entire power plant under worst case scenario

Hazardous emissions

The hazardous emissions are calculated based on the distribution described in EPA AP-42, Table 3.2-1, 3.2-3 and 3.2-4.
The emissions are calculated as a percentage of the VOC (NMHC) emissions.

NMHC	Benzene	Toluene	Xylenes	Formaldehyde	Acrolein	Acetaldehyde	Naphthalene
0.2	0.000776	0.000281	0.000193	0.0000789	0.00000788	0.0000225	0.00013
100%	**0.388%**	**0.141%**	**0.097%**	**0.039%**	**0.004%**	**0.011%**	**0.065%**

Table 15: Hazardous emission according to EPA AP-42 in lb/MMBtu and as a percentage of the Non-Methane Hydrocarbons

With a reduction factor of 99% the Benzene emissions on an hourly basis per engine, and on a yearly basis for the entire plant are the following:

Benzene, 0.388% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.07564	0.00036	0.0%	0.07564	0.00036
Fuel Switch	0.03	13.07	0.05070	0.00010	0.0%	0.05070	0.00010
Generator switched	0.08	12.48	0.04844	0.00023	0.0%	0.04844	0.00023
Load up cold control	0.17	12.19	0.04731	0.00045	25.0%	0.03548	0.00034
Normal Operation	8000	22.63	0.08780	40.03794	99.0%	0.00088	0.40038
Compensation Mode	567	27.34	0.10608	3.42968	99.0%	0.00106	0.03430
Ramp down	0.33	14.95	0.05802	0.00110	99.0%	0.00058	0.00001
Min load	0.08	12.48	0.04844	0.00023	70.0%	0.01453	0.00007
Spin out	0.02	13.07	0.05070	0.00005	0.0%	0.05070	0.00005
Emergency Mode	192	28.75	0.11156	1.22087	99.0%	0.00112	0.01221

Table 16: Calculation of the Benzene hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Benzene emissions of 896 pounds per year.

Toluene, 0.141% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.02739	0.00013	0.0%	0.02739	0.00013
Fuel Switch	0.03	13.07	0.01836	0.00003	0.0%	0.01836	0.00003
Generator switched	0.08	12.48	0.01754	0.00008	0.0%	0.01754	0.00008
Load up cold control	0.17	12.19	0.01713	0.00016	25.0%	0.01285	0.00012
Normal Operation	8000	22.63	0.03179	14.49827	99.0%	0.00032	0.14498
Compensation Mode	567	27.34	0.03841	1.24193	99.0%	0.00038	0.01242
Ramp down	0.33	14.95	0.02101	0.00040	99.0%	0.00021	0.00000
Min load	0.08	12.48	0.01754	0.00008	70.0%	0.00526	0.00002
Spin out	0.02	13.07	0.01836	0.00002	0.0%	0.01836	0.00002
Emergency Mode	192	28.75	0.04040	0.44209	99.0%	0.00040	0.00442

Table 17: Calculation of the Toluene hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Toluene emissions of 325 pounds per year.

Xylenes, 0.097% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.01881	0.00009	0.0%	0.01881	0.00009
Fuel Switch	0.03	13.07	0.01261	0.00002	0.0%	0.01261	0.00002
Generator switched	0.08	12.48	0.01205	0.00006	0.0%	0.01205	0.00006
Load up cold control	0.17	12.19	0.01177	0.00011	25.0%	0.00882	0.00008
Normal Operation	8000	22.63	0.02184	9.95789	99.0%	0.00022	0.09958
Compensation Mode	567	27.34	0.02638	0.85300	99.0%	0.00026	0.00853
Ramp down	0.33	14.95	0.01443	0.00027	99.0%	0.00014	0.00000
Min load	0.08	12.48	0.01205	0.00006	70.0%	0.00361	0.00002
Spin out	0.02	13.07	0.01261	0.00001	0.0%	0.01261	0.00001
Emergency Mode	192	28.75	0.02775	0.30364	99.0%	0.00028	0.00304

Table 18: Calculation of the formaldehyde hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Xylenes emissions of 223 pounds per year.

Formaldehyde, 0.039% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.00769	0.00004	0.0%	0.00769	0.00004
Fuel Switch	0.03	13.07	0.00515	0.00001	0.0%	0.00515	0.00001
Generator switched	0.08	12.48	0.00492	0.00002	0.0%	0.00492	0.00002
Load up cold control	0.17	12.19	0.00481	0.00005	25.0%	0.00361	0.00003
Normal Operation	8000	22.63	0.00893	4.07087	99.0%	0.00009	0.04071
Compensation Mode	567	27.34	0.01079	0.34871	99.0%	0.00011	0.00349
Ramp down	0.33	14.95	0.00590	0.00011	99.0%	0.00006	0.00000
Min load	0.08	12.48	0.00492	0.00002	70.0%	0.00148	0.00001
Spin out	0.02	13.07	0.00515	0.00000	0.0%	0.00515	0.00000
Emergency Mode	192	28.75	0.01134	0.12413	99.0%	0.00011	0.00124

Table 19: Calculation of the formaldehyde hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Formaldehyde emissions of 92 pounds per year.

Acrolein, 0.004% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.00077	0.000004	0.0%	0.00077	0.000004
Fuel Switch	0.03	13.07	0.00051	0.000001	0.0%	0.00051	0.000001
Generator switched	0.08	12.48	0.00049	0.000002	0.0%	0.00049	0.000002
Load up cold control	0.17	12.19	0.00048	0.000005	25.0%	0.00036	0.000003
Normal Operation	8000	22.63	0.00089	0.406571	99.0%	0.00001	0.004066
Compensation Mode	567	27.34	0.00108	0.034827	99.0%	0.00001	0.000348
Ramp down	0.33	14.95	0.00059	0.000011	99.0%	0.00001	0.000000
Min load	0.08	12.48	0.00049	0.000002	70.0%	0.00015	0.000001
Spin out	0.02	13.07	0.00051	0.000000	0.0%	0.00051	0.000000
Emergency Mode	192	28.75	0.00113	0.012397	99.0%	0.00001	0.000124

Table 20: Calculation of the formaldehyde hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Acrolein emissions of 9 pounds per year.

Acetaldehyde, 0.011% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.00219	0.000010	0.0%	0.00219	0.000010
Fuel Switch	0.03	13.07	0.00147	0.000003	0.0%	0.00147	0.000003
Generator switched	0.08	12.48	0.00140	0.000007	0.0%	0.00140	0.000007
Load up cold control	0.17	12.19	0.00137	0.000013	25.0%	0.00103	0.000010
Normal Operation	8000	22.63	0.00255	1.160894	99.0%	0.00003	0.011609
Compensation Mode	567	27.34	0.00308	0.099443	99.0%	0.00003	0.000994
Ramp down	0.33	14.95	0.00168	0.000032	99.0%	0.00002	0.000000
Min load	0.08	12.48	0.00140	0.000007	70.0%	0.00042	0.000002
Spin out	0.02	13.07	0.00147	0.000001	0.0%	0.00147	0.000001
Emergency Mode	192	28.75	0.00323	0.035399	99.0%	0.00003	0.000354

Table 21: Calculation of the Acetaldehyde hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Acetaldehyde emissions below 26 pounds per year.

Naphthalene, 0.065% of NMHC

Mode	Time	NMHC	Uncontrolled		Abatement	Controlled	
[-]	[h/a]	[lb/h]	[lb/h]	[t/a]	[%]	[lb/h]	[t/a]
Speed up	0.08	19.49	0.01267	0.00006	0.0%	0.01267	0.00006
Fuel Switch	0.03	13.07	0.00849	0.00002	0.0%	0.00849	0.00002
Generator switched	0.08	12.48	0.00811	0.00004	0.0%	0.00811	0.00004
Load up cold control	0.17	12.19	0.00793	0.00008	25.0%	0.00594	0.00006
Normal Operation	8000	22.63	0.01471	6.70739	99.0%	0.00015	0.06707
Compensation Mode	567	27.34	0.01777	0.57456	99.0%	0.00018	0.00575
Ramp down	0.33	14.95	0.00972	0.00018	99.0%	0.00010	0.00000
Min load	0.08	12.48	0.00811	0.00004	70.0%	0.00243	0.00001
Spin out	0.02	13.07	0.00849	0.00001	0.0%	0.00849	0.00001
Emergency Mode	192	28.75	0.01869	0.20453	99.0%	0.00019	0.00205

Table 22: Calculation of the Acetaldehyde hourly emissions for each engine and yearly basis for the entire plant per operation mode

Resulting in Acetaldehyde emissions below 150 pounds per year.

Liquid and fuel handling

Figure 4: Liquid Storage in front of a set of power houses:
Yellow: Diesel tanks,
Greenish: Water tanks
White: Oil and component tanks

On-site Water Storage

For fire protection and supplementary cooling, the facility maintains an on-site water storage capacity of 2,641,721 gallons, distributed over the entire plant in 14 tanks with 26 feet in diameter and 44 feet in height.

Ultra Low Sulfur Diesel

The engines consume 13,876 tons of ULSD per year (10,704 gal/day) which will be transported on site. To ensure fire safety and to protect the valuable hardware within the data center, the volume of flammable liquids stored on-site will be minimized. For emergency preparedness, a three-day supply of 25,000 tons will be maintained in multiple smaller storage tanks. The rest will be in strategic locations nearby.

The diesel will be stored in 40 tanks distributed across the entire plant, 26 feet in diameter and 44 feet in height.

Lubrication Oil

The engines consume about 2,025 tons of lubrication oil per year (1563 gal/day), which will be shipped on site. Additionally, about 20 tons will be stored on site, in tanks of 160 gallon in each power house.

Natural Gas

The gaseous fuel will be transported by pipeline.

Emission Control Components

For the emission abatement system liquids are transported to the site. A 3-day storage will be kept on site.

Component	Consumption		Storage
-	[t/a]	[gal/h]	[t]
NH_3 (aq)	13’078	3.49	108
NaOH	186’984	29.91	1537
NaHS (reducing agent)	572	0.11	5
NaClO2 (oxidizing agent)	1’995	0.40	17
H_2SO_4	535	0.10	5

Table 23: List of chemicals yearly used, and amount stored on site

The Storage will be in the corresponding standard tanks for these liquids, horizontally arranged tanks of 16 feet length and 7 feet diameter.

Chemicals in Use

- Hydrous Ammonia
- Caustic Soda NaOH
- Sulfuric Acid H2SO4
- NaClO2 (oxidizing agent)
- NaHS (reducing agent)

ANNEX

The 117 engines will be arranged according to the plan on Figure 5. It shows the map of the site, with 7 pods. Every pod holds two large buildings on the outer side, housing the data centers and 6 power houses in the middle (magenta/pink). A powerhouse holds three engine-generator setups (genset), auxiliaries and parts of the emission control systems. This gives theoretically space for 7 x 6 x 3 = 126 gensets. The remaining three buildings will be used for logistical and storage purposes though (spare parts, fluid preparation etc.)

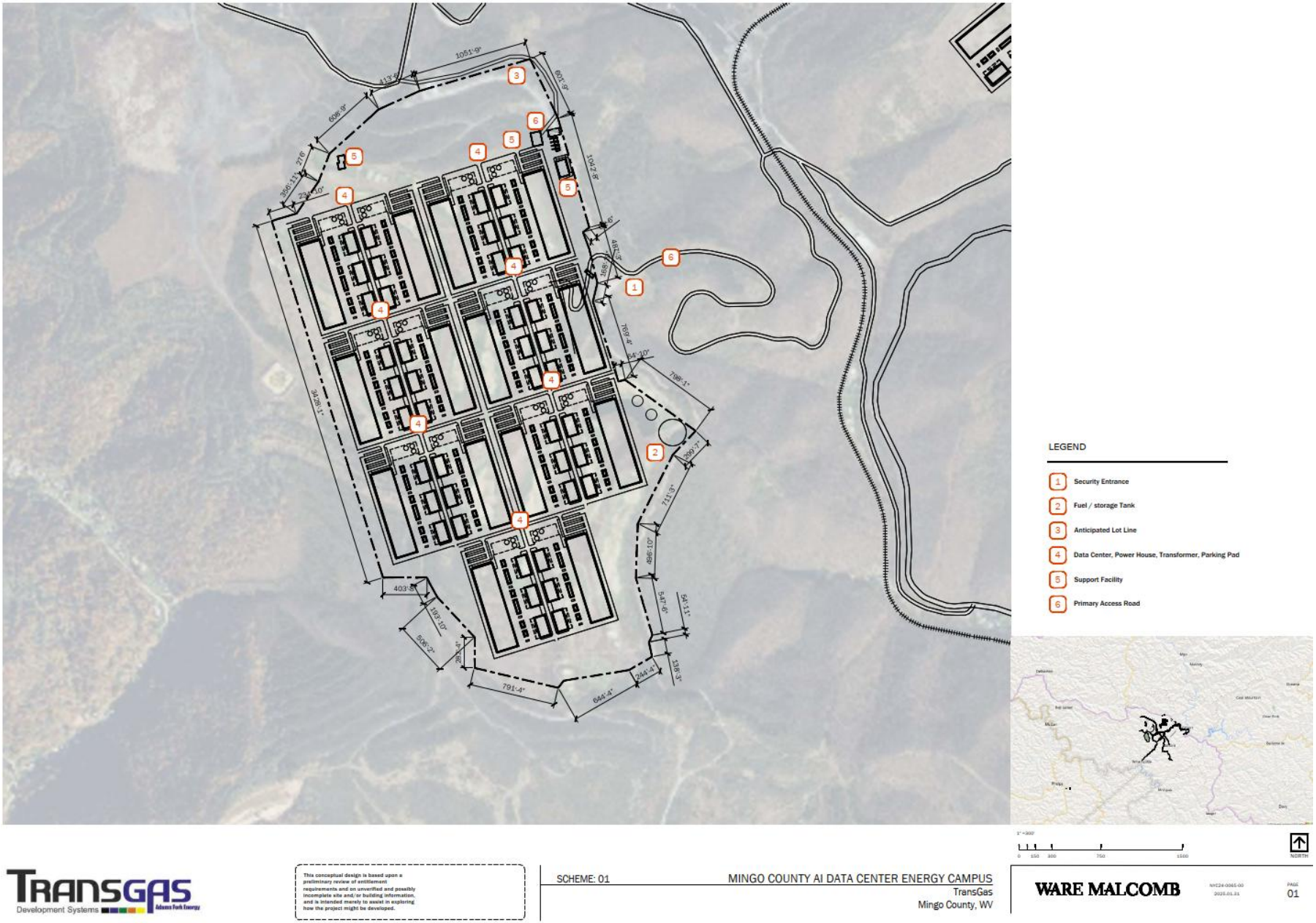


Figure 5: Site plan showing the 7 pods

Attachment L
EMISSIONS UNIT DATA SHEET
STORAGE TANKS

Provide the following information for each new or modified bulk liquid storage tank as shown on the *Equipment List Form* and other parts of this application. A tank is considered modified if the material to be stored in the tank is different from the existing stored liquid.

IF USING US EPA'S TANKS EMISSION ESTIMATION PROGRAM (AVAILABLE AT **www.epa.gov/tnn/tanks.html**), APPLICANT MAY ATTACH THE SUMMARY SHEETS IN LIEU OF COMPLETING SECTIONS III, IV, & V OF THIS FORM. HOWEVER, SECTIONS I, II, AND VI OF THIS FORM MUST BE COMPLETED. US EPA'S AP-42, SECTION 7.1, "ORGANIC LIQUID STORAGE TANKS," MAY ALSO BE USED TO ESTIMATE VOC AND HAP EMISSIONS (**http://www.epa.gov/tnn/chief/**).

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name Fuel Storage - Site Wide	2. Tank Name 40
3. Tank Equipment Identification No. (as assigned on *Equipment List Form*) T1 through T40 (118S - 157S)	4. Emission Point Identification No. (as assigned on *Equipment List Form*)
5. Date of Commencement of Construction (for existing tanks) 2026	
6. Type of change ☒ New Construction ☐ New Stored Material ☐ Other Tank Modification	
7. Description of Tank Modification (if applicable) Not Applicable	
7A. Does the tank have more than one mode of operation? (e.g. Is there more than one product stored in the tank?) ☐ Yes ☒ No	
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode). Not Applicable	
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.): None	

II. TANK INFORMATION (required)

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 170,000 gallons	
9A. Tank Internal Diameter (ft) 26	9B. Tank Internal Height (or Length) (ft) 44
10A. Maximum Liquid Height (ft) 43 ft.	10B. Average Liquid Height (ft) NA
11A. Maximum Vapor Space Height (ft) 1 ft.	11B. Average Vapor Space Height (ft) NA
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights. 170,000 gallons	

13A. Maximum annual throughput (gal/yr) 3.907 MM gal/yr total for all tanks (Normal Operation)	13B. Maximum daily throughput (gal/day) 10,704 gal/day total all tanks
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume) Average of 4 turnover/tank per year	
15. Maximum tank fill rate (gal/min)	
16. Tank fill method ☐ Submerged ☐ Splash ☒ Bottom Loading	
17. Complete 17A and 17B for Variable Vapor Space Tank Systems ☒ Does Not Apply	
17A. Volume Expansion Capacity of System (gal)	17B. Number of transfers into system per year

18. Type of tank (check all that apply):

☒ Fixed Roof X vertical ___ horizontal ___ flat roof ___ cone roof X dome roof
___ other (describe)

☐ External Floating Roof ___ pontoon roof ___ double deck roof

☐ Domed External (or Covered) Floating Roof

☐ Internal Floating Roof ___ vertical column support ___ self-supporting

☐ Variable Vapor Space ___ lifter roof ___ diaphragm

☐ Pressurized ___ spherical ___ cylindrical

☐ Underground

☐ Other (describe)

III. TANK CONSTRUCTION & OPERATION INFORMATION (optional if providing TANKS Summary Sheets)

19. Tank Shell Construction: Tank construction not selected yet. See TANKS Summary Sheet attached.

☐ Riveted ☐ Gunite lined ☐ Epoxy-coated rivets ☐ Other (describe)

20A. Shell Color	20B. Roof Color	20C. Year Last Painted

21. Shell Condition (if metal and unlined):

☐ No Rust ☐ Light Rust ☐ Dense Rust ☐ Not applicable

22A. Is the tank heated? ☐ YES ☐ NO

22B. If YES, provide the operating temperature (°F)

22C. If YES, please describe how heat is provided to tank.

23. Operating Pressure Range (psig): to

24. Complete the following section for **Vertical Fixed Roof Tanks** ☐ Does Not Apply

24A. For dome roof, provide roof radius (ft)

24B. For cone roof, provide slope (ft/ft)

25. Complete the following section for **Floating Roof Tanks** ☐ Does Not Apply

25A. Year Internal Floaters Installed:

25B. Primary Seal Type: (check one)
☐ Metallic (Mechanical) Shoe Seal ☐ Liquid Mounted Resilient Seal
☐ Vapor Mounted Resilient Seal ☐ Other (describe):

25C. Is the Floating Roof equipped with a Secondary Seal? ☐ YES ☐ NO

25D. If YES, how is the secondary seal mounted? (check one) ☐ Shoe ☐ Rim ☐ Other (describe):

25E. Is the Floating Roof equipped with a weather shield? ☐ YES ☐ NO

25F. Describe deck fittings; indicate the number of each type of fitting:		
ACCESS HATCH		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
COLUMN WELL		
BUILT-UP COLUMN – SLIDING COVER, GASKETED:	BUILT-UP COLUMN – SLIDING COVER, UNGASKETED:	PIPE COLUMN – FLEXIBLE FABRIC SLEEVE SEAL:
LADDER WELL		
PIP COLUMN – SLIDING COVER, GASKETED:	PIPE COLUMN – SLIDING COVER, UNGASKETED:	
GAUGE-HATCH/SAMPLE PORT		
SLIDING COVER, GASKETED:	SLIDING COVER, UNGASKETED:	
ROOF LEG OR HANGER WELL		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)
VACUUM BREAKER		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
RIM VENT		
WEIGHTED MECHANICAL ACTUATION GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
DECK DRAIN (3-INCH DIAMETER)		
OPEN:	90% CLOSED:	
STUB DRAIN		
1-INCH DIAMETER:		
OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)		

26. Complete the following section for Internal Floating Roof Tanks ☐ Does Not Apply	
26A. Deck Type: ☐ Bolted ☐ Welded	
26B. For Bolted decks, provide deck construction:	
26C. Deck seam: ☐ Continuous sheet construction 5 feet wide ☐ Continuous sheet construction 6 feet wide ☐ Continuous sheet construction 7 feet wide ☐ Continuous sheet construction 5 × 7.5 feet wide ☐ Continuous sheet construction 5 × 12 feet wide ☐ Other (describe)	
26D. Deck seam length (ft)	26E. Area of deck (ft^2)
For column supported tanks: 26F. Number of columns:	26G. Diameter of each column:

IV. SITE INFORMANTION (optional if providing TANKS Summary Sheets)

27. Provide the city and state on which the data in this section are based. See TANKS Summary Sheet
28. Daily Average Ambient Temperature (°F)
29. Annual Average Maximum Temperature (°F)
30. Annual Average Minimum Temperature (°F)
31. Average Wind Speed (miles/hr)
32. Annual Average Solar Insulation Factor (BTU/(ft^2·day))
33. Atmospheric Pressure (psia)

V. LIQUID INFORMATION (optional if providing TANKS Summary Sheets)

34. Average daily temperature range of bulk liquid: See TANKS Summary Sheet	
34A. Minimum (°F)	34B. Maximum (°F)
35. Average operating pressure range of tank:	
35A. Minimum (psig)	35B. Maximum (psig)
36A. Minimum Liquid Surface Temperature (°F)	36B. Corresponding Vapor Pressure (psia)
37A. Average Liquid Surface Temperature (°F)	37B. Corresponding Vapor Pressure (psia)
38A. Maximum Liquid Surface Temperature (°F)	38B. Corresponding Vapor Pressure (psia)

39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.

39A. Material Name or Composition			
39B. CAS Number			
39C. Liquid Density (lb/gal)			
39D. Liquid Molecular Weight (lb/lb-mole)			
39E. Vapor Molecular Weight (lb/lb-mole)			

Maximum Vapor Pressure 39F. True (psia) 39G. Reid (psia)			
Months Storage per Year 39H. From 39I. To			

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply): ☒ Does Not Apply

- ☐ Carbon Adsorption[1]
- ☐ Condenser[1]
- ☐ Conservation Vent (psig)
  - Vacuum Setting — Pressure Setting
- ☐ Emergency Relief Valve (psig)
- ☐ Inert Gas Blanket of
- ☐ Insulation of Tank with
- ☐ Liquid Absorption (scrubber)[1]
- ☐ Refrigeration of Tank
- ☐ Rupture Disc (psig)
- ☐ Vent to Incinerator[1]
- ☐ Other[1] (describe):

[1] Complete appropriate Air Pollution Control Device Sheet.

41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).

Material Name & CAS No.	Breathing Loss (lb/hr)	Working Loss Amount	Working Loss Units	Annual Loss (lb/yr)	Estimation Method[1]
See TANKS Summary Sheet					

[1] EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

☐ Remember to attach emissions calculations, including TANKS Summary Sheets if applicable.

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

Identification

User Identification:	Tanks 1-40
City:	Charleston
State:	West Virginia
Company:	Transgas
Type of Tank:	Vertical Fixed Roof Tank
Description:	Diesel Tanks

Tank Dimensions

Shell Height (ft):	44.00
Diameter (ft):	26.00
Liquid Height (ft) :	43.00
Avg. Liquid Height (ft):	21.50
Volume (gallons):	170,000.00
Turnovers:	4.00
Net Throughput(gal/yr):	680,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	1.00
Radius (ft) (Dome Roof)	26.00

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meterological Data used in Emissions Calculations: Charleston, West Virginia (Avg Atmospheric Pressure = 14.25 psia)

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

Tanks 1-40 - Vertical Fixed Roof Tank
Charleston, West Virginia

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
Distillate fuel oil no. 2	All	56.67	51.31	62.04	55.00	0.0058	0.0048	0.0070	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

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

Tanks 1-40 - Vertical Fixed Roof Tank
Charleston, West Virginia

Annual Emission Calcaulations	
Standing Losses (lb):	25.2731
Vapor Space Volume (cu ft):	12,211.8942
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0417
Vented Vapor Saturation Factor:	0.9929
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	12,211.8942
Tank Diameter (ft):	26.0000
Vapor Space Outage (ft):	23.0010
Tank Shell Height (ft):	44.0000
Average Liquid Height (ft):	21.5000
Roof Outage (ft):	0.5010
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.5010
Dome Radius (ft):	26.0000
Shell Radius (ft):	13.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0058
Daily Avg. Liquid Surface Temp. (deg. R):	516.3441
Daily Average Ambient Temp. (deg. F):	54.9833
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	514.6733
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,250.5726
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0417
Daily Vapor Temperature Range (deg. R):	21.4567
Daily Vapor Pressure Range (psia):	0.0022
Breather Vent Press. Setting Range(psia):	0.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0058
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0048
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0070
Daily Avg. Liquid Surface Temp. (deg R):	516.3441
Daily Min. Liquid Surface Temp. (deg R):	510.9799
Daily Max. Liquid Surface Temp. (deg R):	521.7082
Daily Ambient Temp. Range (deg. R):	21.5333
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9929
Vapor Pressure at Daily Average Liquid:	
Surface Temperature (psia):	0.0058
Vapor Space Outage (ft):	23.0010
Working Losses (lb):	12.2809
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0058
Annual Net Throughput (gal/yr.):	680,000.0000
Annual Turnovers:	4.0000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	170,000.0000
Maximum Liquid Height (ft):	43.0000
Tank Diameter (ft):	26.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	37.5540

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

Emissions Report for: Annual

Tanks 1-40 - Vertical Fixed Roof Tank
Charleston, West Virginia

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	12.28	25.27	37.55

ATTACHMENT M

AIR POLLUTION CONTROL DEVICE(S)

REDACTED
Information Claimed Confidential by
TransGas Development Systems, LLC
March 24, 2025

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 1C – 117C

Equipment Information

1. Manufacturer: [redacted] Model No. NA	2. Control Device Name: Control System Type: Various
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: 100%	
8. Attached efficiency curve and/or other efficiency information. See Attached	
9. Design inlet volume: See Attached SCFM	10. Capacity: See Attached
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any. This emission abatement system is multi-phase and includes DeCO, $DeNO_x$, $DeSO_x$, and We-NO_x. The system controls VOC (VOC HAPs), NOx, PM, CO, and SO_x emissions. A description of the system and each stage is provided on the attachment to this form.	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment. See Attached	
13. Description of method of handling the collected material(s) for reuse of disposal. Spent catalyst and other discardable materials are removed from the site.	

Gas Stream Characteristics

14. Are halogenated organics present?	☐ Yes	☒ No
Are particulates present?	☒ Yes	☐ No
Are metals present?	☒ Yes	☐ No

15. Inlet Emission stream parameters:	Maximum	Typical
Pressure (mmHg):		
Heat Content (BTU/scf):	See Attached	
Oxygen Content (%):		
Moisture Content (%):		
Relative Humidity (%):		

16. Type of pollutant(s) controlled: ☒ SO_x ☐ Odor ☒ Particulate (type): Combustion Byproducts ☒ Other NO_x, VOC (VOC HAPs), CO	
17. Inlet gas velocity: See Attached ft/sec	18. Pollutant specific gravity: NA
19. Gas flow into the collector: See Attached ACF @ °F and PSIA	20. Gas stream temperature: See Attached Inlet: °F Outlet: °F
21. Gas flow rate: See Attached Design Maximum: ACFM Average Expected: ACFM	22. Particulate Grain Loading in grains/scf: See Attached Inlet: Outlet:

23. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN Pollutant		Emission Capture Efficiency %	OUT Pollutant		Control Efficiency %
	lb/hr	grains/acf		lb/hr	grains/acf	
A	See attached document for a description of each control stage.					
B						
C						
D						
E						

24. Dimensions of stack: Height ft. Diameter ft.

25. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 130 percent of design rating of collector.

Particulate Distribution

26. Complete the table:	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
Particulate Size Range (microns)	**Weight % for Size Range**	**Weight % for Size Range**
0 – 2		
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12	See Attached	
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

See Attached

28. Describe the collection material disposal system:

Spent or collected material is shipped offsite for disposal or regeneration/reuse.

29. Have you included ***Other Collectores Control Device*** in the Emissions Points Data Summary Sheet?

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**

Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING: Amount of emissions control fluids utilized.	RECORDKEEPING: Amount of emissions control fluids utilized.
REPORTING: None	TESTING: As requested by the permit.

MONITORING:	Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING:	Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.

31. Manufacturer's Guaranteed Control Efficiency for each air pollutant.

See Attached

32. Manufacturer's Guaranteed Control Efficiency for each air pollutant.

See Attached

33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

The controls are designed to operate within the operational ranges of the engines.

PROCESS DESCRIPTION for

POLLUTION CONTROL for

NATURAL GAS ENGINE EMISSIONS

Abatement system Package

Prepared for

Transgas – Adams Fork project
February 10, 2025
Rev. 03

1. Introduction

Below is a description of the basic concept on which the proposed system is based, together with some preliminary evaluations about the foreseen chemicals consumption.

The overall process scheme is presented in the **attachment 1 – OVERALL PROCESS SCHEME** and detailed below.

The configuration and equipment sizing has been studied for the maximum flow rate – corresponding to 100% load of the engine with iCER, 21.000 kW of mechanical power at shaft when engine runs in compensation mode, and the maximum load of pollutants.

The system described below will be installed individually for each engine.

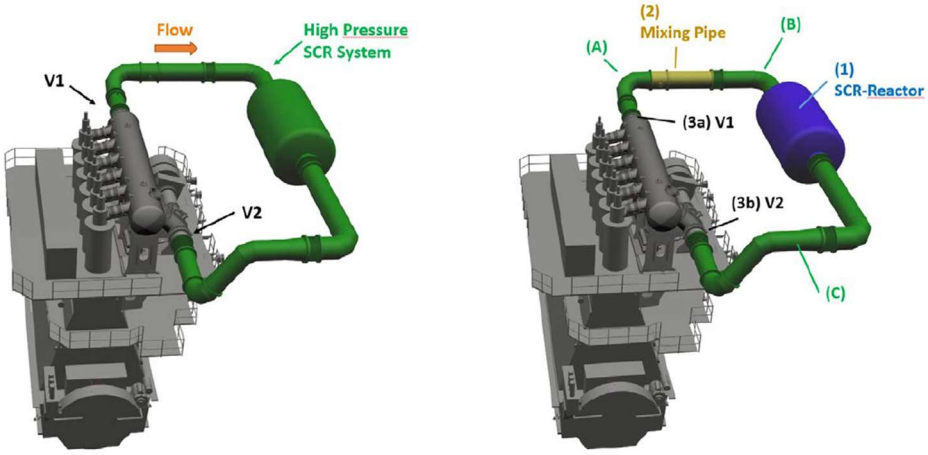
Attachment 2 rev 02– EMISSION ABATEMENT STEPS shows the pollutant flow at each stage (A to D), as indicated in the overall process scheme, with the target of reaching the maximum total emission level of:

- NOx < 250 tpy (short)
- CO < 250 tpy (short)
- SOx < 250 tpy (short)
- PM < 250 tpy (short)

for a total of 114 engines operating at the same time and continuously at maximum load.

2. Description of the dry deCO + deNOx system

Dry flue gas treatment system is installed before the turbocharger, so at high pressure. An example of such an installation is shown in the picture below (please note that the picture shows the deNOx reactor only and not the deCO).



The first stage of the dry deCO and deNOx system is the catalytic removal of CO in a dedicated deCO reactor.

Here the data at deCO reactor inlet when engine is in Normal Operation are summarized:

Data	unit	NORMAL OPERATION
Flow rate	kg/s kg/h	34.4 123,840
Gas density	kg/mc	1.27
Vol. flow rate	Am^3/h	241.878
Normalized flow	Nm^3/h	97,512
Static Pressure IN	barg	4,12
Temperature	°C	360
NOx Load	kg/hr	6.3
NOx Ratio	$NO:NO_2$	90:10
CO load	kg/hr	19.82
VOCs load	Kg/hr	39,5
H_2O	Vol%	7.8%
N_2	Vol%	77.1%
O_2	Vol%	4%
CO2	Vol%	6.8%
SO_2	Kg/h	0,74

Table 1 – Exhaust features at Genset outlet (before turbine)–

Flue gas is distributed to a layer of oxidation catalyst where CO is removed according to the following reaction:

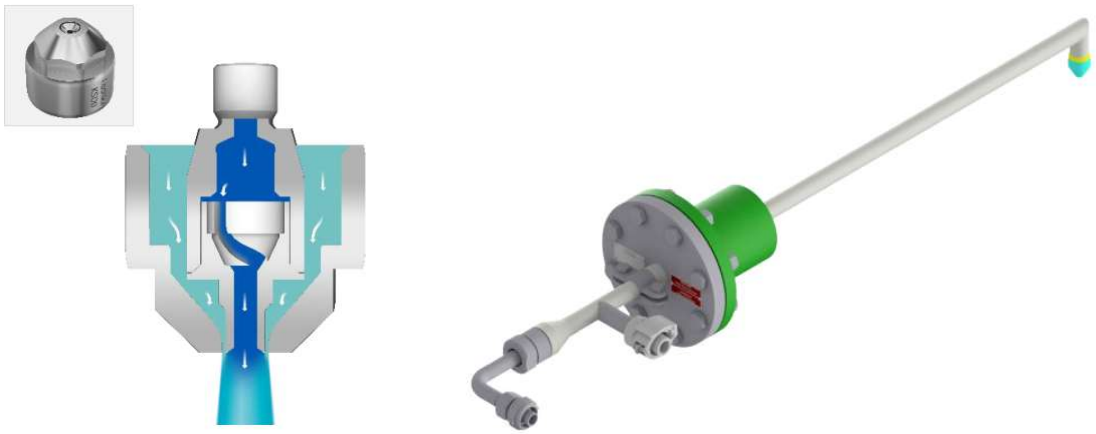
(1) $2CO + O_2 \rightarrow 2\ CO_2$

CO catalytic removal can reach efficiency close to 100%. In this case, the catalyst will be selected to reach up to 98% efficiency when running in Normal Operation mode with natural gas and iCER system.

DeCO reactor has also the function to oxidize VOCs to CO_2 and H_2O; in particular, formaldehyde, by far the most important VOC, will be removed with efficiency >99%.

After deCO reactor, flue gas flows to another reactor equipped with deNOx catalyst. In the space between deCO reactor and deNOx reactor, urea ($CO(NH_2)_2$) or ammonia solution is injected. The system for reagent injection is mainly composed by:

- *Flow Control Unit (FCU)* Complete Control skid to feed the injection lances with pneumatic control valve, MID flow meter, Manometers and valves complete mounted on a skid
- *Evaporator System* (if urea is used as reagent) with Ambient Air Blower, Pneumatic On-Off-Damper, Flowmeter, Pressure and Temperature Transmitter, Air Preheater and Spray Evaporator with Injection Lance. This is needed because for removing NO_x, urea must be heated to be converted to NH_3, CO_2 and H_2O.
- *Reagent / Compressed Air - Direct Injection Lances* (if ammonia solution is used as reagent) for installation into flue gas duct. Compressed air is used for generating very fine reagent droplet by means of specially design nozzles (see pictures of lance and nozzle below)

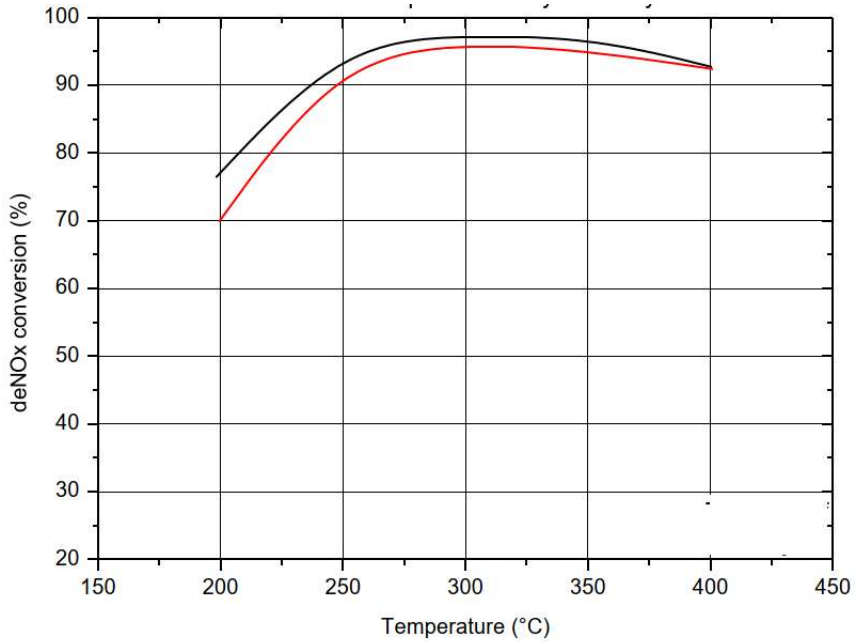


- *Detailed 3D CFD-Optimization* is needed for Complete flue gas ductwork design from deCO reactor exit till catalyst outlet including Reagent Direct Injection, Static Mixing System, and guide vanes (if required). Results of velocity, pressures NOx-NH_3 distribution values on top of first catalyst layer till all guarantees are met.
- *Static Mixer System* based on final CFD optimization to mix NH_3 and NO_x.

After reagent injection and mixing, in presence of catalyst based on vanadium pentoxide (V_2O_5) NOx are removed by NH_3 according to the following reactions (with several secondary and intermediate reactions), that occur at temperatures between 180°C and 500°C

(2) $2NO + 2NH_3 + ½\ O_2 \rightarrow 2N_2 + 3H_2O$
(3) $NO_2 + 2NH_3 + ½\ O_2 \rightarrow 3/2\ N_2 + 3H_2O$
(4) $NO + NO_2 + 2NH_3 + ½\ O_2 \rightarrow 2\ N_2 + 3H_2O$

Catalytic nitrogen oxides removal can achieve very high efficiency as shown in the graph below:



NO_x removal at Adam Forks occurs in the best temperature range, where efficiency higher that 90% is possible; anyway, it is assumed that maximum 90% removal is reached in deNO_x catalytic

reactor. A quantity of 13.2 lt/h of ammonia, in its typical aqueous solution at 19%, is needed to achieve the reaction when engine is running in Normal Operation.

After the deNOx, the gas is sent to the turbocharger and then it is split into two streams. One part, after being cooled, goes back to the engine, mixing with combustion air (flue gas recirculation); the remaining part, with a flow of 17.6 kg/s, represents the exhaust that is first quenched to 58°C, and then enters into the We-NOx system for SOx and NOx wet abatement.

3. Description of the wet system

The We-NOx system is a multistage plant:

- The first stage is designed for the removal of SOx and any other acids carried over by exhaust gases.
- The second and third stages are for the removal of NOx. These stages are based on an ORP process, an oxidation-reduction mechanism that converts NOx into gaseous nitrogen (N_2), achieving a "zero instrumental" concentration at the stack if required.
- The fourth stage serves as the finishing and control unit to complete the process.

For better understanding, we would like to refer to the case at hand and describe step by step the entire process of NOx removal from the exhaust:

3.1 AVAILABLE DATA (inlet data to the De-SOx/We-NOx, downstream the dry treatment):

Data	unit	Normal Operation – 75% gas
Flow rate	kg/s kg/h	17,6 63.360
Gas density	kg/Nmc	1,27
Vol. flow rate	ACMH	95.798
Normalized flow	Nmc/h	49.890
Static Pressure IN	mm.w.g	700
Temperature	°C	215
NOx Load	kg/hr	0,322
NOx Ratio	NO:NO_2	90:10
SO_2	Kg/h	0,380
H_2O	Vol %	17,87
N_2	Vol %	72.04
O_2	Vol %	3.74
CO_2	Vol %	6.35

Table 2 – Exhaust features at engine outlet–

All following data have been calculated based upon Normal Operation 75% gas.

3.2 REQUESTED EFFICIENCY AT NORMAL OPERATION

- NOx = 80,45% [$0,322_{IN}$; $0,063_{OUT}$]
- SOx = 70.0% [$0,380_{IN}$; $0,152_{OUT}$]

The above efficiencies have been evaluated in the worst-case scenario. Of course, the same results in terms of removal efficiency can be achieved also in any other scenario.

Anyway, real removal efficiency of wet deSOx system will be much higher than the requested one, to avoid elemental sulfur formation in the following steps on treatment process.

3.3 CHEMICALS IN USE

- Caustic NaOH
- Sulfuric Acid H_2SO_4
- $NaClO_2$ (oxidizing agent)
- NaHS (reducing agent)

4. Wet Stage 1 (De-SOx)

This is a chemical-physical absorption unit where the acidic pollutants carried out by the exhaust are removed. Sulfur oxides, hydrogen halides, and any other acidic components are removed. The chemical in use is Caustic. Just as an example let's analyze one of the several reactions that happen at this stage:

(5) $SO_2 + NaOH \rightarrow NaHSO_3$

Acting opportunely on the operation parameters also the following reaction may take place in this stage:

(6) $SO_2 + 2NaOH \rightarrow Na_2SO_3 + H_2O$

With a similar mechanism, the other acids are also neutralized and removed from the exhaust.

With such a mass transfer from Gas phase to Liquid phase a gaseous pollutant (SO_2) is changed into a dissolved solids and carried over from the system through the liquid waste of the stage.

4.1 Performance of the wet stage 1 (De-SOx/We-NOx)

Pollutant	Inlet load (kg/h)	Abatement efficiency (%)	Outlet (kg/h)	Outlet on a yearly basis (kg/y)
SO_2	0.38	* *	0.036	sent to stages 3 and 4
NO	NA	NA	NA	NA
NO_2	0.03	* *	0.027 (sent to stage 3 and 4)	sent to stages 3 and 4

Table 3 – Performance of stage 1 –

4.2 Expected consumption of chemicals in wet stage 1

Chemical	Consumption (liters/hour)	Consumption on a yearly basis (m^3/y)
NaOH (50% w) (*)	~~40,8~~ 4.16	~~358~~ 36

(**) Compare tabulated values in ATTACHMENT2

H_2SO_4 (36%% w)	0.0	0.0
$NaClO_2$ (20% w)	0.0	0.0
NaHS (45% w)	0.0	0.0

Table 4 – Expected consumption of chemicals in stage 1 –

(*) keeping the pH at low level 7.8 for lower absorption of CO2 (1.53 kg/hr only). With such pH value the neutralization is slower, but a much smaller consumption of caustic is ensured.

5. Wet stage 2

The main nitrogen oxides emitted during combustion processes are nitric oxide (NO), nitrogen dioxide (NO_2), and nitrous oxide (N_2O). Since the primary contribution in combustion processes comes from the first two, NOx is generally considered the sum of NO and NO_2. Other nitrogen oxides, such as NO_3 and N_2O_5, are present in much lower concentrations compared to the first two.

However, all the species mentioned above, when subjected to the We-NOx process, will be converted into atmospheric nitrogen. Specifically:

- NO and N_2O will be oxidized to NO_2.

This will occur through the following half-reactions:

(7) NO: $N^{2+} \rightarrow N^{4+} + 2e^-$
(8) N_2O: $N^{1+} \rightarrow N^{4+} + 3e^-$

To achieve the perfect completion of the reactions (7) and (8) a strong oxidizing agent must be used.

The kinetics of the reactions (7) and (8) are instantaneous so that at the exit of the second stage the residual NOx forms are: NO_2, NO_3, N_2O_5, which will be removed in the third stage.

5.1 Performance of wet stage 2

Pollutant	Inlet load (kg/h)	Abatement efficiency (%)	Outlet (kg/h)	Outlet on a yearly basis
SO_2	0.03	0	0.03	sent to stages 3 and 4
NO	0.29	* *	0.013	Sent to next stages
NO_2	0.027	NA	0.45(*)	Sent to stages 3 and 4

Table 5 – Performance of wet stage 2 –

(*) the increase is due to the conversion of NO to NO_2 in the reactor of stage 2

5.2 Expected chemical consumption in wet stage 2

Chemical	Consumption (liters/hour)	Consumption on a yearly basis (m^3/y)

(**) Compare tabulated values in ATTACHMENT2

NaOH (50% w)	0.0	0.0
H_2SO_4 (36%% w)	0.38	3.3
$NaClO_2$ (20% w)	1.51	13.3
NaHS (45% w)	0.0	0.0

Table 6 – Expected consumption of chemicals in stage 2 –

6. Wet stage 3

In the third stage the residual NOx forms NO_2, NO_3, N_2O_5 are chemically reduced to gaseous nitrogen N_2, through the following partial ionic reaction:

(9) $N^{4+} + 4e^- \rightarrow N^0$
(10) $N^{6+} + 6e^- \rightarrow N^0$
(11) $N^{5+} + 5e^- \rightarrow N^0$

N^0 is the oxidation state of gaseous nitrogen. At the completion of this stage the We-NOx process will have given nitrogen back to the atmosphere as before the combustion reaction of fuel with air excess in the NOx source (as an endothermic engine or a furnace or oven). To achieve the perfect completion of the reactions (9), (10) and (11), a strong reducing agent must be used.

NOTE: the oxidizing and reducing agents are fundamental and have been chosen with accuracy, to avoid any undesired by-product to be produced during the process. The We-NOx process is Ozone-free, and no ozone is developed or produced during the process.

6.1 Performance of wet stage 3

Pollutant	Inlet load (kg/h)	Abatement efficiency (%)	Outlet (kg/h)	Outlet on a yearly basis
SO_2	0.03	99.99	traces	End
NO	0.013	NA	0.013	Sent to next stages
NO_2	0.45	* *	0.018	sent to stage 4

Table 7 – Performance of wet stage 3 –

6.2 Expected chemicals consumption in wet stage 3

Chemical	Consumption (liters/hour)	Consumption on a yearly basis (m^3/y)
NaOH (50% w) (*)	~~223~~ 68.58	~~1953~~ 600.7
H_2SO_4 (36%% w)	0.0	0.0
$NaClO_2$ (20% w)	0.0	0.0
NaHS (45% w)	0.4	3.5

Table 8 – Expected chemicals consumption in wet stage 3 –

(*) Keeping the pH at 8.5 instead of 9 reduces the caustic consumption. The recommended value is pH = 9. However, it is possible to manage also with pH = 8.5 with a closer control.

(**) Compare tabulated values in ATTACHMENT2

7. Wet stage 4

This is a finishing stage where the eventual excess of reactants coming from the previous stages carried over by the exhaust (chemical mists, by-products etc.) is removed so to send the purified exhaust straight to the stack with no further pollutants except traces allowed by the regulations. The chemical in use in wet stage 4 is just caustic soda NaOH to keep the pH high enough to remove acidic traces carried over from the previous stages.

7.1 Performance of wet stage 4

Pollutant	Inlet load (kg/h)	Abatement efficiency (%)	Outlet (kg/h)	Outlet on a yearly basis
SO_2	<0,001	-	<0,001	<0,1
NO	0.013	NA	0.013	113,9
NO_2	0.018	* *	0.009	35,0

Table 9 – Performance of wet stage 4 –

7.2 Expected chemicals consumption in wet stage 4

Chemical	Consumption (liters/hour)	Consumption on a yearly basis (m^3/y)
NaOH (50% w)	40,5	354.7
H_2SO_4 (36%% w)	0.0	0.0
$NaClO_2$ (20% w)	0.0	0.0
NaHS (45% w)	0.0	0.0

Table 10 – Expected chemicals consumption in wet stage 4 –

8. Total chemicals consumption

In the case described by tables 1 and 2, the foreseen overall consumption of the chemicals for all stages will be:

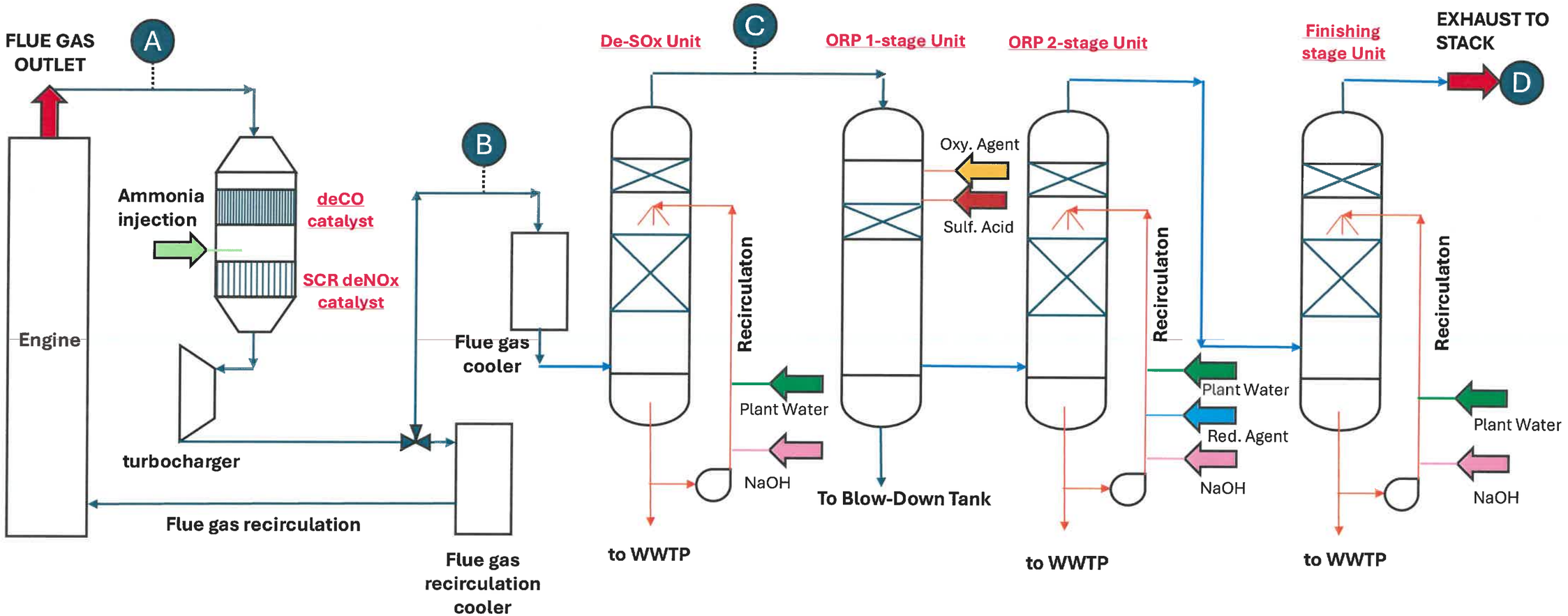
- Aqueous ammonia for SCR reaction: 13.2 lt/h
- Caustic soda (aqueous sol. 50% w): ~~304.3~~ 113.24 lt/h
- NaHS (aqueous sol. 45%): 0.4 lt/h
- $NaClO_2$ (aqueous sol. 25%): 1.51 lt/h
- Sulfuric acid (aqueous sol. 36%): 0.38 lt/h

Warning: the above figure is indicative for chemical consumption and is based upon the preliminary input data obtained. It may undergo modifications during the design phase of execution.

(**) Compare tabulated values in ATTACHMENT2

REDACTED
Information Claimed Confidential by
TransGas Development Systems, LLC
March 24, 2025

ATTACHMENT 1 – OVERALL PROCESS SCHEME



CO removed + 1st NOx removal → SOx removed → NO oxidized to NO_2 → NO_2 reduced to N_2 → Exhaust purification finishing

05/02/2025 *rev 02*

ATTACHMENT 2 – EMISSION ABATEMENT STEPS

Normal operation with natural gas **75% load =** **15750 kW** **(mechanical power at the engine shaft)** Operational 8000 h/y

Flow rate 34,4 kg/s - before recirculation 17,6 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	6,30	*90,0%*	0,32	*0,0%*	0,32	*80,45%*	0,063	*99,00%*
CO	19,82	*98,0%*	0,21	*0,0%*	0,21	*0,00%*	0,206	*98,96%*
SOx	0,74	*0,0%*	0,38	*90,5%*	0,04	*99,90%*	0,000	*99,99%*
VOC	39,50	*99,0%*	0,20	*0,0%*	0,20	*0,00%*	0,202	*99,49%*
PM	0,38	*25,0%*	0,10	*0,0%*	0,10	*0,00%*	0,098	*25,0%*

Speed up with Diesel fuel **10% load =** **2100 kW** **(mechanical power at the engine shaft)** Operational 0,4 h/y

Flow rate 15,1 kg/s - before recirculation 15,1 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	40,61	*0,0%*	40,61	*0,0%*	40,61	*0,0%*	40,614	*0,00%*
CO	2,14	*0,0%*	2,14	*0,0%*	2,144	*0,0%*	2,144	*0,00%*
SOx	0,93	*0,0%*	0,93	*90,5%*	0,09	*99,90%*	0,000	*99,99%*
VOC	18,21	*0,0%*	18,21	*0,0%*	18,21	*0,0%*	18,208	*0,00%*
PM	0,27	*0,0%*	0,27	*0,0%*	0,27	*0,0%*	0,274	*0,00%*

Fuel Switch **10% load =** **2100 kW** **(mechanical power at the engine shaft)** Operational 0,15 h/y

Flow rate 15,6 kg/s - before recirculation 8,1 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	2,18	*0,0%*	1,13	*0,0%*	1,13	*0,0%*	1,134	*48,08%*
CO	7,56	*0,0%*	3,92	*0,0%*	3,923	*0,0%*	3,923	*48,08%*
SOx	0,12	*0,0%*	0,06	*90,5%*	0,01	*99,90%*	0,000	*99,99%*
VOC	22,66	*0,0%*	11,77	*0,0%*	11,77	*0,0%*	11,766	*48,08%*
PM	0,44	*0,0%*	0,23	*0,0%*	0,23	*0,0%*	0,228	*0,0%*

Generator switched on **20% load =** **4200 kW** **(mechanical power at the engine shaft)** Operational 0,15 h/y

Flow rate 15,6 kg/s - before recirculation 8,1 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	2,18	*0,0%*	1,13	*0,0%*	1,13	*0,0%*	1,134	*48,08%*
CO	7,56	*0,0%*	3,92	*0,0%*	3,923	*0,0%*	3,923	*48,08%*
SOx	0,12	*0,0%*	0,06	*90,5%*	0,01	*99,90%*	0,000	*99,99%*
VOC	22,66	*50,0%*	5,88	*0,0%*	5,88	*0,0%*	5,883	*74,04%*
PM	0,44	*0,0%*	0,23	*0,0%*	0,23	*0,0%*	0,228	*0,0%*

Load up cold control **25% load =** **5250 kW** **(mechanical power at the engine shaft)** Operational 0,85 h/y

Flow rate 15,6 kg/s - before recirculation 8,1 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	4,20	*80,0%*	0,44	*0,0%*	0,44	*80,0%*	0,087	*97,92%*
CO	8,34	*25,0%*	3,25	*0,0%*	3,247	*0,0%*	3,247	*61,06%*
SOx	0,27	*0,0%*	0,14	*90,5%*	0,01	*99,90%*	0,000	*99,99%*
VOC	21,10	*99,0%*	0,11	*0,0%*	0,11	*0,0%*	0,110	*99,48%*
PM	0,36	*0,0%*	0,18	*0,0%*	0,18	*0,0%*	0,185	*0,0%*

Compensation mode **100% load =** **21000 kW** **(mechanical power at the engine shaft)** Operational 567 h/y

Flow rate 42,1 kg/s - before recirculation 20,4 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	4,20	*90,0%*	0,20	*0,0%*	0,20	*90,0%*	0,020	*99,52%*
CO	8,93	*90,0%*	0,43	*0,0%*	0,433	*0,0%*	0,433	*95,15%*
SOx	0,29	*0,0%*	0,14	*90,5%*	0,01	*99,90%*	0,000	*99,99%*
VOC	22,61	*99,0%*	0,11	*0,0%*	0,11	*0,0%*	0,110	*99,52%*
PM	0,38	*25,0%*	0,09	*0,0%*	0,09	*0,0%*	0,092	*25,0%*

Ramp down **40% load =** **8400 kW** **(mechanical power at the engine shaft)** Operational 1,65 h/y

Flow rate 20,8 kg/s - before recirculation 10,7 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	4,70	*90,0%*	0,24	*0,0%*	0,24	*90,0%*	0,024	*99,49%*
CO	12,16	*90,0%*	0,63	*0,0%*	0,625	*0,0%*	0,625	*94,86%*
SOx	0,42	*0,0%*	0,21	*90,5%*	0,02	*99,90%*	0,000	*99,99%*
VOC	26,06	*99,0%*	0,13	*0,0%*	0,13	*0,0%*	0,134	*99,49%*
PM	0,36	*25,0%*	0,09	*0,0%*	0,09	*0,0%*	0,094	*25,0%*

Min Load **20% load =** **4200 kW** **(mechanical power at the engine shaft)** Operational 0,4 h/y

Flow rate 15,6 kg/s - before recirculation 8,1 kg/s - after recirculation

	A	*removal efficiency*	**B**	*removal efficiency*	**C**	*removal efficiency*	**D**	*removal efficiency*
	kg/h	*on deCO/SCR deNOx unit*	kg/h	*De-SOx Unit*	kg/h	*Wet De-NOx Unit*	kg/h	*overall%*
NOx	3,70	*80,0%*	0,38	*0,0%*	0,38	*90,0%*	0,038	*98,96%*
CO	8,08	*25,0%*	3,15	*0,0%*	3,145	*0,0%*	3,145	*61,06%*
SOx	0,22	*0,0%*	0,12	*90,5%*	0,01	*99,90%*	0,000	*99,99%*
VOC	21,62	*70,0%*	3,37	*0,0%*	3,37	*0,0%*	3,368	*84,42%*
PM	0,38	*0,0%*	0,20	*0,0%*	0,20	*0,0%*	0,199	*0,0%*

Spin out **10% load =** **2100 kW** (mechanical power at the engine shaft) Operational 0,1 h/y

Flow rate 15,6 kg/s - before recirculation 8,1 kg/s - after recirculation

	A	removal efficiency	B	removal efficiency	C	removal efficiency	D	removal efficiency
	kg/h	on deCO/SCR deNOx unit	kg/h	De-SOx Unit	kg/h	Wet De-NOx Unit	kg/h	overall%
NOx	2,18	0,0%	1,13	0,0%	1,13	90,0%	0,113	94,81%
CO	7,56	0,0%	3,92	0,0%	3,923	0,0%	3,923	48,08%
SOx	0,12	0,0%	0,06	90,5%	0,01	99,90%	0,000	99,99%
VOC	22,66	0,0%	11,77	0,0%	11,77	0,0%	11,766	48,08%
PM	0,44	0,0%	0,23	0,0%	0,23	0,0%	0,228	0,0%

Emergency Mode **75% load with Diesel and iCER =** **15750 kW** (mechanical power at the engine shaft) Operational 192 h/y

Flow rate 37,8 kg/s - before recirculation 32,4 kg/s - after recirculation

	A	removal efficiency	B	removal efficiency	C	removal efficiency	D	removal efficiency
	kg/h	on deCO/SCR deNOx unit	kg/h	De-SOx Unit	kg/h	Wet De-NOx Unit	kg/h	overall%
NOx	234,68	90,0%	20,12	0,0%	20,12	80,5%	3,932	98,32%
CO	4,73	90,0%	0,41	0,0%	0,406	0,0%	0,406	91,43%
SOx	6,03	0,0%	5,17	90,5%	0,49	99,90%	0,000	99,99%
VOC	23,18	99,0%	0,20	0,0%	0,20	0,0%	0,199	99,14%
PM	1,21	25,0%	0,52	0,0%	0,52	0,0%	0,519	25,0%

Inlet pollutant data design basis:

File "PermittingProcess[redacted] on January 23rd

Efficiency on VOCs is valid considering VOCs to be composed minimum for 99.5% by formaldehyde

Pollutants mass flow decrease from Step A to Step B considers both removal efficiency of air pollution control system and pollutants mass flow reduction due to the fact that part of flue gas is recirculated

Overall efficiency takes into account also pollutants mass flow reduction due to partial flue gas recirculation when running with iCER

ATTACHMENT N

SUPPORTING EMISSIONS CALCULATIONS

By: PEW
Date: 3/20/2025

Checked By: KBK
Date: 03/21/2025

Facility Total

Emission Type	Uncontrolled	Controlled
	tpy	tpy
PM	277.33	215.17
PM10	254.42	192.26
PM2.5	250.19	188.03
SO2	495.46	9.93
NOx	13,493.81	194.30
CO	11,173.65	205.62
VOC	11,517.84	117.66
Total HAPS	85.78	0.87

Engines (Worst Case)

Emission Type	Uncontrolled	Controlled
	tpy	tpy
PM	248.69	186.53
PM10	248.69	186.53
PM2.5	248.69	186.53
SO2	495	9.93
NOx	13,494	194.30
CO	11,174	205.62
VOC	11,517	116.59
Total HAPS	85.77	0.86

Tanks

Emission Type	Uncontrolled	Controlled
	tpy	tpy
VOC	0.75	0.75

Haulroads and Fugitive Leaks

Emission Type	Uncontrolled	Controlled
	tpy	tpy
PM	28.64	28.64
PM10	5.73	5.73
PM2.5	1.50	1.50
VOC	0.31	0.31
Total HAPS	0.0053	0.0053

US! All tons are short tons!
907.18 kg/t_s
Pounds!
2.20 lb/kg
Convert lb=> t_s
2000 lb/t_s
Gas density
0.0462 lb/ft³
Diesel Density
7.10 lb/gal
MJ => MMBTU
0.00095 MMBTU/MJ

Number of engines operated	114	[-]
Engine Power	21,000	[kW]
Total mechanical Power (theoretic)	2,394	[MW]
Effective mech. Power	1,796	[MW]
Total Power electr.	2,298	[MW]
Effective electr. Power	1,724	[MW]
Yearly Produced Electricity	15,101	[GWh]

Fuel Choices
Diesel
Gas

Calculations provided by Engine Supplier with edits by POTESTA

weight Nm3 air
1.293 [kg/Nm3]

Single Engine

	Time	Time	Time	Load	Load	Electricity	Fuel type	Fuel Consumption Gas	Fuel Consumption Diesel	Enthalpy before Turbine Temp	Enthalpy before Turbine mass flow	Engine Out Temp	Engine Out mass flow	Oil consumption mass flow	NOx NOx_gas	NOx NOx_diesel	NOx NOx_engine	NOx Abat. Eff.	NOx NOx_stack	PM PM_gas	PM PM_diesel	PM PM_engine	PM Abat. Eff.	PM PM_stack
	[d]	[h]	[min]	[%]	[kW]	[GWh/a]	[-]	[kg/h]	[kg/h]	[°C]	[kg/s]	[°C]	[kg/s]	[kg/h]	[g/kWh]	[g/kWh]	[kg/h]	[%]	[kg/h]	[mg/Nm³]	[mg/Nm³]	[kg/h]	[%]	[kg/h]
Position in emiss. Abat. Schem										MP800	MP800	MP820A	MP820A		MP800				MP850			MP820A		MP850
Speed up	0	0.08	5	10%	2100	0	Diesel	0	462.0	187		15.1	172	8	0.37	1.04	19.34	40.614	**0.0%**	40.614	10.626	6.85	0.152486311	**0.0%**	0.152486311
Fuel Switch	0	0.03	2	10%	2100	0	Gas	294	4.6	194		15.6	172	8.1	0.37	1.04	19.34	2.184	**0.0%**	2.184	10.626	6.85	0.239639722	**0.0%**	0.239639722
Generator switched on	0	0.08	5	20%	4200	0	Gas	576	7.6	248		15.6	208	8.1	0.6	0.88	18.78	3.696	**0.0%**	3.696	9.282	8.02	0.209329559	**0.0%**	0.209329559
Load up cold control	0	0.17	10	25%	5250	0	Gas	713	8.4	275		15.6	226	8.1	0.73	0.80	18.50	4.2	**25.0%**	3.15	8.61	8.61	0.194174478	**0.0%**	0.194174478
Normal Operation	333	8000	480000	75.0%	15750	121	Gas	2075	12.6	360		34.4	215	17.6	1.84	0.40	14.90	6.3	**99.0%**	0.063	4.2	12.08	0.205809745	**25.0%**	0.154357309
Compensation Mode	24	567	34032	100%	21000	11	Gas	2897	12.6	406		42.1	231	20.4	2.4	1.00	11.60	21	**99.0%**	0.21	5.67	8.40	0.322045476	**25.0%**	0.241534107
Ramp down	0	0.33	20	40%	8400	0	Gas	1109	10.1	319		20.8	236	10.7	1.08	0.56	17.66	4.704	**99.0%**	0.04704	6.594	10.37	0.196443063	**25.0%**	0.147332297
Min load	0	0.08	5	20%	4200	0	Gas	576	7.6	248		15.6	208	8.1	0.6	0.88	18.78	3.696	**70.0%**	1.1088	9.282	8.02	0.209329559	**0.0%**	0.209329559
Spin out	0	0.02	1	10%	2100	0	Gas	294	4.6	194		15.6	172	8.1	0.37	1.04	19.34	2.184	**40.0%**	1.3104	10.626	6.85	0.239639722	**0.0%**	0.239639722
Emergency Mode	8	192	11520	75%	15750	3	Diesel	0	2570.4	351		38.5	198	23.2	1.84	0.40	14.90	234.675	**98.0%**	4.6935	4.2	12.08	0.779972158	**25.0%**	0.584979118
Operational time	365	**8760**																							

Start-Up / Shut-Down

Sulphur content

gas	diesel	lub oil
0.000143	0.002	0.008

Single Engine

	CO_dry CO_gas [ppm]	CO_gas [mg/Nm3]	CO_diesel [ppm]	CO_diesel [mg/Nm3]	CO_engine [kg/h]	Abat. Eff. [%]	CO_stack [kg/h]	VOC_wet THC_gas [ppm]	CH4_gas [ppm]	VOC_gas [mg/Nm3]	THC_diesel [ppm]	VOC_diesel [mg/Nm3]	VOC_engine [kg/h]	Abat. Eff. [%]	VOC_stack [kg/h]	SO2 gas [kg/h]	diesel [kg/h]	lub oil [kg/h]	Total [kg/h]	Abatement [%]	Total [kg/h]
Position in emiss. Abat. Schem					MP820A		MP850						MP820A		MP850				MP820A		MP850
Speed up	139	174.0	41	51.0	1.135658791	**0.0%**	1.135658791	921	788	262.8	202	397.0	8.842766514	**0.0%**	8.842766514	0	0.924	0.00296	0.92696	**95.0%**	0.046348
Fuel Switch	139	174.0	41	51.0	3.923033089	**0.0%**	3.923033089	921	788	262.8	202	397.0	5.92666448	**0.0%**	5.92666448	0.04197238	0.00924	0.00296	0.054172378	**99.0%**	0.000541724
Generator switched on	149	186.0	40	49.5	4.193587096	**0.0%**	4.193587096	878	750	251.1	181	356.2	5.662606142	**0.0%**	5.662606142	0.08235628	0.01512	0.0048	0.102276281	**99.0%**	0.001022763
Load up cold control	154	191.9	39	48.7	4.328864099	**25.0%**	3.246648074	856	732	245.2	171	335.8	5.530576973	**25.0%**	4.147932729	0.10195256	0.0168	0.00584	0.124592555	**99.0%**	0.001245926
Normal Operation	166	206.9	36	45.0	10.14076497	**98.5%**	0.152111475	722	616	209.5	103	201.9	10.26458552	**99.0%**	0.102645855	0.29669339	0.0252	0.01472	0.336613391	**99.0%**	0.003366134
Compensation Mode	180	224.9	83	103.1	12.7761614	**95.0%**	0.63880807	755	644	218.3	91	179.2	12.40156502	**99.0%**	0.12401565	0.41422521	0.0252	0.0192	0.458625213	**99.0%**	0.004586252
Ramp down	168	209.9	37	46.5	6.254473785	**94.0%**	0.375268427	791	675	227.7	140	274.7	6.782597194	**99.0%**	0.067825972	0.15860305	0.02016	0.00864	0.187403046	**99.0%**	0.00187403
Min load	149	186.0	40	49.5	4.193587096	**50.0%**	2.096793548	878	750	251.1	181	356.2	5.662606142	**70.0%**	1.698781843	0.08235628	0.01512	0.0048	0.102276281	**99.0%**	0.001022763
Spin out	139	174.0	41	51.0	3.923033089	**35.0%**	2.549971508	921	788	262.8	202	397.0	5.92666448	**40.0%**	3.555988688	0.04197238	0.00924	0.00296	0.054172378	**99.0%**	0.000541724
Emergency Mode	166	206.9	36	45.0	2.905950437	**91.0%**	0.261535539	722	616	209.5	103	201.9	13.04146662	**99.0%**	0.130414666	0	5.1408	0.01472	5.15552	**95.0%**	0.257776

Start-Up / Shut-Down

Hazardous emissions

Fraction of NMHC (AP-42, Table 3.4-3)

NMHC	Benzene	Toluene	Xylenes	Formaldehyde	Acrolein	Acetaldehyde	Naphthalene
0.2	0.000776	0.000281	0.000193	0.0000789	0.00000788	0.0000225	0.00013
100%	**0.388%**	**0.141%**	**0.097%**	**0.039%**	**0.004%**	**0.011%**	**0.065%**

CO2-Content: 2.743 | GHG-factor: 3.158 | 28 | 265

Single Engine

	CO2_equivalent CO2_gas [kg/h]	CO2_diesel [kg/h]	Methane [kg/h]	N2O [ppm]	N2O [kg/h]	CO2_eq [kg/h]	NMHC [lb/h]	Benzene Uncontrolled [lb/h]	Benzene Uncontrolled [t/a]	Benzene Abatement [%]	Benzene Controlled [lb/h]	Benzene Controlled [t/a]	Toluene Uncontrolled [lb/h]	Toluene Uncontrolled [t/a]	Toluene Abatement [%]	Toluene Controlled [lb/h]	Toluene Controlled [t/a]	Xylenes Uncontrolled [lb/h]	Xylenes Uncontrolled [t/a]	Xylenes Abatement [%]	Xylenes Controlled [lb/h]	Xylenes Controlled [t/a]	Formaldehyde Uncontrolled [lb/h]	Formaldehyde Uncontrolled [t/a]	Formaldehyde Abatement [%]	Formaldehyde Controlled [lb/h]	Formaldehyde Controlled [t/a]
Position in emiss. Abat. Schem								MP850			MP850		MP820A			MP850		MP850			MP850		MP820A			MP850	
Speed up	0.00	1459.00	0.00	1.20	0.05	1473	19.49	0.07564	0.00036	0.0%	0.07564	0.00036	0.02739	0.00013	0.0%	0.02739	0.00013	0.01881	0.00009	0.0%	0.01881	0.00009	0.00769	0.00004	0.0%	0.00769	0.00004
Fuel Switch	805.11	14.59	12.72	1.20	0.05	1190	13.07	0.05070	0.00010	0.0%	0.05070	0.00010	0.01836	0.00003	0.0%	0.01836	0.00003	0.01261	0.00002	0.0%	0.01261	0.00002	0.00515	0.00001	0.0%	0.00515	0.00001
Generator switched on	1579.74	23.87	12.11	1.20	0.05	1957	12.48	0.04844	0.00023	0.0%	0.04844	0.00023	0.01754	0.00008	0.0%	0.01754	0.00008	0.01205	0.00006	0.0%	0.01205	0.00006	0.00492	0.00002	0.0%	0.00492	0.00002
Load up cold control	1955.64	26.53	11.81	1.20	0.05	2327	12.19	0.04731	0.00045	25.0%	0.03548	0.00034	0.01713	0.00016	25.0%	0.01285	0.00012	0.01177	0.00011	25.0%	0.00882	0.00008	0.00481	0.00005	25.0%	0.00361	0.00003
Normal Operation	5691.12	39.79	21.59	1.20	0.12	6366	22.63	0.08780	40.03794	99.0%	0.00088	0.40038	0.03179	14.49827	99.0%	0.00032	0.14498	0.02184	9.95789	99.0%	0.00022	0.09958	0.00893	4.07087	99.0%	0.00009	0.04071
Compensation Mode	7945.59	39.79	26.19	2.40	0.27	8790	27.34	0.10608	3.42968	99.0%	0.00106	0.03430	0.03841	1.24193	99.0%	0.00038	0.01242	0.02638	0.85300	99.0%	0.00026	0.00853	0.01079	0.34871	99.0%	0.00011	0.00349
Ramp down	3042.29	31.83	14.40	1.20	0.07	3496	14.95	0.05802	0.00110	99.0%	0.00058	0.00001	0.02101	0.00040	99.0%	0.00021	0.00000	0.01443	0.00027	99.0%	0.00014	0.00000	0.00590	0.00011	99.0%	0.00006	0.00000
Min load	1579.74	23.87	12.11	1.20	0.05	1957	12.48	0.04844	0.00023	70.0%	0.01453	0.00007	0.01754	0.00008	70.0%	0.00526	0.00002	0.01205	0.00006	70.0%	0.00361	0.00002	0.00492	0.00002	70.0%	0.00148	0.00001
Spin out	805.11	14.59	12.72	1.20	0.05	1190	13.07	0.05070	0.00005	40.0%	0.03042	0.00003	0.01836	0.00002	40.0%	0.01101	0.00001	0.01261	0.00001	40.0%	0.00757	0.00001	0.00515	0.00000	40.0%	0.00309	0.00000
Emergency Mode	0.00	8117.32	0.00	2.40	0.30	8198	28.75	0.11156	1.22087	99.0%	0.00112	0.01221	0.04040	0.44209	99.0%	0.00040	0.00442	0.02775	0.30364	99.0%	0.00028	0.00304	0.01134	0.12413	99.0%	0.00011	0.00124
									Yearly Emissions	[t/a]	0.448016526			Yearly Emissions	[t/a]	0.162232789			Yearly Emissions	[t/a]	0.111426791			Yearly Emissions	[t/a]	0.045552196
									Yearly Emissions	[lb/a]	896.0330527			Yearly Emissions	[lb/a]	324.4655771			Yearly Emissions	[lb/a]	222.8535814			Yearly Emissions	[lb/a]	91.10439157

Start-Up / Shut-Down

Single Engine

	Acrolein Uncontrolled [lb/h]	Acrolein Uncontrolled [t/a]	Acrolein Abatement [%]	Acrolein Controlled [lb/h]	Acrolein Controlled [t/a]	Acetaldehyde Uncontrolled [lb/h]	Acetaldehyde Uncontrolled [t/a]	Acetaldehyde Abatement [%]	Acetaldehyde Controlled [lb/h]	Acetaldehyde Controlled [t/a]	Naphthalene Uncontrolled [lb/h]	Naphthalene Uncontrolled [t/a]	Naphthalene Abatement [%]	Naphthalene Controlled [lb/h]	Naphthalene Controlled [t/a]	Total HAPS Uncontrolled [lb/h] per engine	Uncontrolled [t/a] per engine	Uncontrolled [t/a] all engines	Controlled [lb/h] per engine	Controlled [t/a] per engine	Controlled [t/a] all engines
Position in emiss. Abat. Schem	MP820A	MP820A		MP850	MP850	MP820A	MP820A		MP850	MP850	MP820A	MP820A		MP850	MP850						
Speed up	0.00077	0.000004	0.0%	0.00077	0.000004	0.00219	0.000010	0.0%	0.00219	0.000010	0.01267	0.00006	0.0%	0.01267	0.00006	0.14517	0.00001	0.00069	0.14517	0.00001	0.00069
Fuel Switch	0.00051	0.000001	0.0%	0.00051	0.000001	0.00147	0.000003	0.0%	0.00147	0.000003	0.00849	0.00002	0.0%	0.00849	0.00002	0.09729	0.00000	0.00018	0.09729	0.00000	0.00018
Generator switched on	0.00049	0.000002	0.0%	0.00049	0.000002	0.00140	0.000007	0.0%	0.00140	0.000007	0.00811	0.00004	0.0%	0.00811	0.00004	0.09296	0.00000	0.00044	0.09296	0.00000	0.00044
Load up cold control	0.00048	0.000005	25.0%	0.00036	0.000003	0.00137	0.000013	25.0%	0.00103	0.000010	0.00793	0.00008	25.0%	0.00594	0.00006	0.09079	0.00001	0.00086	0.06809	0.00001	0.00065
Normal Operation	0.00089	0.406571	99.0%	0.00001	0.004066	0.00255	1.160894	99.0%	0.00003	0.011609	0.01471	6.70739	99.0%	0.00015	0.06707	0.16851	0.67403	76.83982	0.00169	0.00674	0.76840
Compensation Mode	0.00108	0.034827	99.0%	0.00001	0.000348	0.00308	0.099443	99.0%	0.00003	0.000994	0.01777	0.57456	99.0%	0.00018	0.00575	0.20359	0.05774	6.58215	0.00204	0.00058	0.06582
Ramp down	0.00059	0.000011	99.0%	0.00001	0.000000	0.00168	0.000032	99.0%	0.00002	0.000000	0.00972	0.00018	99.0%	0.00010	0.00000	0.11135	0.00002	0.00212	0.00111	0.00000	0.00002
Min load	0.00049	0.000002	70.0%	0.00015	0.000001	0.00140	0.000007	70.0%	0.00042	0.000002	0.00811	0.00004	70.0%	0.00243	0.00001	0.09296	0.00000	0.00044	0.02789	0.00000	0.00013
Spin out	0.00051	0.000000	40.0%	0.00031	0.000000	0.00147	0.000001	40.0%	0.00088	0.000001	0.00849	0.00001	40.0%	0.00510	0.00000	0.09729	0.00000	0.00009	0.05838	0.00000	0.00006
Emergency Mode	0.00113	0.012397	99.0%	0.00001	0.000124	0.00323	0.035399	99.0%	0.00003	0.000354	0.01869	0.20453	99.0%	0.00019	0.00205	0.21410	0.02055	2.34306	0.00214	0.00021	0.02343
		Yearly Emissions	[t/a]	0.004549446			Yearly Emissions	[t/a]	0.0129902			Yearly Emissions	[t/a]	0.075054315		**1.31**	**0.75**	**85.77**	**0.50**	**0.01**	**0.86**
		Yearly Emissions	[lb/a]	9.09889234			Yearly Emissions	[lb/a]	25.98034			Yearly Emissions	[lb/a]	150.10863							

Worst case

Entire Plant, worst case

Startups per year: 5 [-]

			Gas [t/a]	Diesel [t/a]	NOx [t/a]	PM [t/a]	CO [t/a]	VOC [t/a]	SO2 [t/a]	CO2_e [t/a]
Speed up	0	0.42	25	0.00	24.19	2.13	0.01	0.06	0.46	0.00	77
Fuel Switch	0	0.17	10	6.15	0.10	0.05	0.01	0.08	0.12	0.00	25
Generator switched on	0	0.42	25	30.15	0.40	0.19	0.01	0.22	0.30	0.00	102
Load up cold control	0	0.83	50	74.66	0.88	0.33	0.02	0.34	0.43	0.00	244
Normal Operation	333	7996.80	479808	2084957.39	12661.81	63.31	155.11	152.86	103.15	3.38	6397261
Compensation Mode	24	567.20	34032	206464.71	898.08	14.97	17.22	45.53	8.84	0.33	626484
Ramp down	0	1.67	100	232.29	2.11	0.01	0.03	0.08	0.01	0.00	732
Min load	0	0.42	25	30.15	0.40	0.06	0.01	0.11	0.09	0.00	102
Spin out	0	0.08	5	3.07	0.05	0.01	0.00	0.03	0.04	0.00	12
Emergency Mode	8	192.00	11520	0.00	62017.04	113.24	14.11	6.31	3.15	6.22	197796
Total		**8760.00**		**2,291,799**	**75,605**	**194**	**187**	**206**	**117**	**10**	**7,222,837**

Entire Plant, worst case UNCONTROLLED

Startups per year: 5 [-]

NOx [t/a]	PM [t/a]	CO [t/a]	VOC [t/a]	SO2 [t/a]	CO2_e [t/a]
2.13	0.01	0.06	0.46	0.05	77
0.05	0.01	0.08	0.12	0.00	25
0.19	0.01	0.22	0.30	0.01	102
0.44	0.02	0.45	0.58	0.01	244
6330.91	206.82	10190.51	10314.94	338.26	6397261
1496.80	22.95	910.64	883.94	32.69	626484
0.99	0.04	1.31	1.42	0.04	732
0.19	0.01	0.22	0.30	0.01	102
0.02	0.00	0.04	0.06	0.00	12
5662.10	18.82	70.11	314.66	124.39	197796
13,494	**249**	**11,174**	**11,517**	**495**	**7,222,837**

Raw Emissions [pounds/hour]

Hourly base

Single Engine raw emissions

	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]	Heat Input MMBtu/hr
Speed up	10%	0.0	0	1018.5	143.46	89.54	0.34	2.50	19.49	2.04	3,217	0.00	0.12	3,247	18.74
Fuel Changeover	10%	647.1	13994	10.2	1.43	4.81	0.53	8.65	13.07	0.12	1,807	28.03	0.12	2,623	13.86
Generator switched on	20%	1269.7	27459	16.7	2.35	8.15	0.46	9.25	12.48	0.23	3,535	26.70	0.12	4,314	27.13
Load up cold control	25%	1571.8	33993	18.5	2.61	9.26	0.43	9.54	12.19	0.27	4,370	26.03	0.12	5,130	33.55
	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]	
Normal Operation	75%	4574.1	98924	27.8	3.91	13.89	0.45	22.36	22.63	0.74	12,634	47.60	0.25	14,035	97.15
Compensation Mode	100%	6386.1	138112	27.8	3.91	46.30	0.71	28.17	27.34	1.01	17,605	57.73	0.59	19,378	135.44
	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]	
Ramp down	40%	2445.2	52882	22.2	3.13	10.37	0.43	13.79	14.95	0.41	6,777	31.74	0.15	7,707	52.07
Min load	20%	1269.7	27459	16.7	2.35	8.15	0.46	9.25	12.48	0.23	3,535	26.70	0.12	4,314	27.13
Spin out	10%	647.1	13994	10.2	1.43	4.81	0.53	8.65	13.07	0.12	1,807	28.03	0.12	2,623	13.86
	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	CO2_eq [lb/h]	
Emergency Mode	75%	0.0	0	5666.8	798.13	517.37	1.72	6.41	28.75	11.37	17,896	0.00	0.67	18,073	104.25

Emission Control [%]

	NOx [%]	PM [%]	CO [%]	VOC [%]	SO2 [%]	CO2 [%]	Methane [%]	N2O [%]	0 [%]
Speed up	0%	0%	0%	0%	95%	0%	0%	0%	0%
Fuel Changeover	0%	0%	0%	0%	99%	0%	0%	0%	0%
Generator switched on	0%	0%	0%	0%	99%	0%	0%	0%	0%
Load up cold control	25%	0%	25%	25%	99%	0%	0%	0%	0%
	NOx [%]	PM [%]	CO [%]	VOC [%]	SO2 [%]	CO2 [%]	Methane [%]	N2O [%]	0 [%]
Normal Operation	99%	25%	99%	99%	99%	0%	0%	0%	0%
Compensation Mode	99%	25%	95%	99%	99%	0%	0%	0%	0%
	NOx [%]	PM [%]	CO [%]	VOC [%]	SO2 [%]	CO2 [%]	Methane [%]	N2O [%]	0 [%]
Ramp down	99%	25%	94%	99%	99%	0%	0%	0%	0%
Min load	70%	0%	50%	70%	70%	0%	0%	0%	0%
Spin out	40%	0%	35%	40%	40%	0%	0%	0%	0%
	NOx [%]	PM [%]	CO [%]	VOC [%]	SO2 [%]	CO2 [%]	Methane [%]	N2O [%]	0 [%]
Emergency Mode	98%	25%	91%	99%	99%	0%	0%	0%	0%

Controlled Emissions [pounds/hour]

Hourly base

Single Engine controlled emissions

	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	0.00146993 [lb/h]
Speed up	10%	0.0		1018.5	143.46	89.54	0.34	2.50	19.49	0.10	3,217	0.00	0.12	3,247
Fuel Changeover	10%	647.1	13994	10.2	1.43	4.81	0.53	8.65	13.07	0.00	1,807	28.03	0.12	2,623
Generator switched on	20%	1269.7	27459	16.7	2.35	8.15	0.46	9.25	12.48	0.00	3,535	26.70	0.12	4,314
Load up cold control	25%	1571.8	33993	18.5	2.61	6.94	0.43	7.16	9.14	0.00	4,370	26.03	0.12	5,130
	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	0.00146993 [lb/h]
Normal Operation	75%	4574.1	98924	27.8	3.91	0.14	0.34	0.34	0.23	0.01	12,634	47.60	0.25	14,035
Compensation Mode	100%	6386.1	138112	27.8	3.91	0.46	0.53	1.41	0.27	0.01	17,605	57.73	0.59	19,378
	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	0.00146993 [lb/h]
Ramp down	40%	2445.2	52882	22.2	3.13	0.10	0.32	0.83	0.15	0.00	6,777	31.74	0.15	7,707
Min load	20%	1269.7	27459	16.7	2.35	2.44	0.46	4.62	3.75	0.07	3,535	26.70	0.12	4,314
Spin out	10%	647.1	13994	10.2	1.43	2.89	0.53	5.62	7.84	0.07	1,807	28.03	0.12	2,623
	Load [%]	Gas [lb/h]	[ft³/h]	Diesel [lb/h]	[gal/h]	NOx [lb/h]	PM [lb/h]	CO [lb/h]	VOC [lb/h]	SO2 [lb/h]	CO2 [lb/h]	Methane [lb/h]	N2O [lb/h]	0.00146993 [lb/h]
Emergency Mode	75%	0.0		5666.8	798.13	10.35	1.29	0.58	0.29	0.11	17,896	0.00	0.67	18,073

Raw Emissions [tons / year]

1

Yearly base															
Single Engine raw emissions	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	Methane	N2O	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Speed up	0.08	0	-	0.04	11.95	0.004	0.000	0.000	0.001	0.000	0.134	0.000	0.00000	0.135	
Fuel Changeover	0.03	0.01	466	0.00	0.05	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.00000	0.044	
Generator switched on	0.08	0.1	2,288	0.00	0.20	0.000	0.000	0.000	0.001	0.000	0.147	0.001	0.00000	0.180	
Load up cold control	0.17	0.1	5,666	0.00	0.43	0.001	0.000	0.001	0.001	0.000	0.364	0.002	0.00001	0.427	
	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	Methane	N2O	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Normal Operation	8760	20034.6	866,574,112	121.67	34273	60.83	1.99	97.92	99.12	3.25	55339	208	1.1	61472	
Compensation Mode	567	1811.1	78,336,919	7.88	2219	13.13	0.20	7.99	7.75	0.29	4993	16	0.2	5495	
	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	Methane	N2O	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Ramp down	0.33	0.4	17,627	0.00	1.04	0.002	0.000	0.002	0.002	0.000	1.130	0.005	0.00003	1.285	
Min load	0.08	0.1	2,288	0.00	0.20	0.000	0.000	0.000	0.001	0.000	0.147	0.001	0.00000	0.180	
Spin out	0.02	0.0	233	0.00	0.02	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.00000	0.022	
	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	Methane	N2O	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Emergency Mode	192.00	0.0	-	544.01	153242	49.67	0.17	0.62	2.76	1.09	1718	0	0.1	1735	

Start / Stop controlled

Yearly base															
Single Engine raw emissions	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	0	0	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Speed up	0.08	0	-	0.04	11.95	0.004	0.000	0.000	0.001	0.000	0.134	0.000	0.00000	0.135	
Fuel Changeover	0.03	0.01	466	0.00	0.05	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.00000	0.044	
Generator switched on	0.08	0.1	2,288	0.00	0.20	0.000	0.000	0.000	0.001	0.000	0.147	0.001	0.00000	0.180	
Load up cold control	0.17	0.1	5,666	0.00	0.43	0.001	0.000	0.001	0.001	0.000	0.364	0.002	0.00001	0.427	
	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	0	0	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Normal Operation	8000	20034.6	866,574,112	121.67	34273	0.608	1.491	1.469	0.991	0.033	55339.012	208.479	1.11498	61471.893	
Compensation Mode	567	1811.1	78,336,919	7.88	2219	0.131	0.151	0.399	0.078	0.003	4992.703	16.372	0.16736	5495.468	
	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	0	0	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Ramp down	0.33	0.4	17,627	0.00	1.04	0.000	0.000	0.000	0.000	0.000	1.130	0.005	0.00003	1.285	
Min load	0.08	0.1	2,288	0.00	0.20	0.000	0.000	0.000	0.000	0.000	0.147	0.001	0.00000	0.180	
Spin out	0.02	0.0	233	0.00	0.02	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.00000	0.022	
	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	0	0	CO2_eq	
	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Emergency Mode	192.00	0.0	-	544.01	153242	0.99	0.12	0.06	0.03	0.01	1718	0	0.1	1735	
TOTAL	8760.00	21846.31	944,939,599	673.60	189747.69	1.74	1.77	1.93	1.10	0.05	62052	225	1.3	68705	
						198.1163256									

Best case

Yearly base	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	0	0	CO2_eq	
Single Engine raw emissions	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	
Normal Operation	8760	20035	866574112	122	34273	60.83	1.99	97.92	99.12	3.25	55339	208	1.1	61472	
Normal Operation w. abatement						0.61	1.49	1.47	0.99	0.03	55339	208	1.1	61472	
Operation of 114 engines						69.35	169.92	167.45	112.99	3.71	6,308,647	23,767	127	7,007,796	

1 Start Up / Shut down	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	Methane	N2O	CO2_eq
all engines	[h]	[t]	[ft³]	[t]	[gal]	[t]	[t]	[t]	[t]	[t]	[t]	[t]	[t]	[t]
all engines	0.80	75.30	3256871	5.62	1584	0.5555	0.0177	0.1833	0.2917	0.0010	224.2974	1.1839	0.0060	259.0492
Single engine	[h]	[t]	[ft³]	[t]	[gal]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]	[lb]
Single engine	0.80	0.66	28569	0.05	14	9.74	0.31	3.22	5.12	0.02	3935.04	20.77	0.11	4544.72

Best case	Duration	Gas		Diesel		NOx	PM	CO	VOC	SOx	CO2	Methane	N2O	CO2_eq
8760h@75% plus 1 Start/Stop	[h/a]	[t/a]	[ft³/a]	[t/a]	[gal/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]	[t/a]
	8760.8	2,284,015	98,792,705,589	13,876	3,908,687	69.9	169.9	167.6	113.3	3.7	6308871.7	23767.8	127.1	7008054.9

By: PEW
Date: 3/20/2025

Checked By: KBK
Date: 03/21/2025

Tanks

Tank	I.D.	Volume	Turnovers	Yearly Throughput	Fixed Roof Losses		VOC Emissions				
					Working	Breathing	Uncontrolled			Controlled	
		(gal)	(No.)	(gal/yr)	(lbs/yr)	(lbs/yr)	(lbs/yr)	(lbs/hr)(1)	(tpy)	(lbs/hr)(1)	(tpy)
Diesel Tank	TK1-40	170,000	4	680,000	12.28	25.27	37.55	0.18	0.02	0.18	0.02
Total Emissions (40 tanks)					491.2	1,010.80	1,502.00	7.34	0.75	7.34	0.75
						Total VOC =		7.34	0.75	7.34	0.75

Notes:
1. Emissions based on breathing losses divided by 8,760 hours per year and working losses divided by total throughput multiplied by one truck delivery to the tanks of 10,000 gallons.
2. Number of USLD tanks at the site = 40

Natural Gas (Vapor Sources)

Source Type	Number of Sources	Emission Factor(1) (kg/hr/source)	TOC Emissions (lb/hr)	TOC Emissions (ton/yr)	Uncontrolled VOC Emissions (lb/hr)	Uncontrolled VOC Emissions (ton/yr)	Control Efficiency (%)	Controlled VOC Emissions (lb/hr)	Controlled VOC Emissions (ton/yr)
Valves	176	0.000131	0.050829	0.222632	0.0003	0.0013	0	0.0003	0.0013
Pressure Relief Valves	120	0.0447	11.825474	51.795578	0.0698	0.3056	0	0.0698	0.3056
Connectors (Flanges)	917	0.0000810	0.163751	0.717230	0.0010	0.0042	0	0.0010	0.0042
Compressor Seals	0	0.0894	0.000000	0.000000	0.0000	0.0000	0	0.0000	0.0000
Light Liquid Pumps	0	0.00187	0.000000	0.000000	0.0000	0.0000	0	0.0000	0.0000
Sample Connections (2)	1	0.0150	0.033069	0.144842	0.0002	0.0009	0	0.0002	0.0009
				Total VOC =	0.0712	0.3120		0.0712	0.3120

	Uncontrolled Hexane Emissions (lb/hr)	Uncontrolled Hexane Emissions (ton/yr)	Control Efficiency (%)	Controlled Hexane Emissions (lb/hr)	Controlled Hexane Emissions (ton/yr)
	0.000005	0.000022	0	0.000005	0.000022
	0.001183	0.005180	0	0.001183	0.005180
	0.000016	0.000072	0	0.000016	0.000072
	0.000000	0.000000	0	0.000000	0.000000
	0.000000	0.000000	0	0.000000	0.000000
	0.000003	0.000014	0	0.000003	0.000014
Total	0.001	0.0053		0.001	0.0053

Sample Natural Gas Composition							
Gas Composition Key		BTU	S.G.	Non-VOC	Non-VOC	Non-VOC	Non-VOC
				Carbon Dioxide	Nitrogen	Methane	Ethane
Gas Sample - TransCanada		1082.2	0.6100	0.2000	0.4400	90.3300	8.4400
						Total Non-VOC =	99.4100

Sample Natural Gas Composition							
Gas Composition Key	VOC	VOC	VOC	VOC	VOC	VOC	VOC/HAP
	Propane	N Butane	Iso Butane	Pentane	Iso Pentane	Neo Pentane	Hexane
Gas Sample - TransCanada	0.5200	0.0300	0.0200	0.0001	0.0100	0.0000	0.0100
Max value	0.5200	0.0300	0.0200	0.0001	0.0100	0.0000	0.0100
						Total VOC =	0.5901
						Total HAP =	0.0100

1. AP42, Chapter 5, Protocol for Equipment Leak Emission Estimates, Table 2-1 and 2-5.
2. Sight Glass lb/kg = 2.2046

By: PEW
Date: 3/20/2025

Checked By: KBK
Date: 03/21/2025

Vehicle Activity (VA)

Paved Roadway: Trucks delivering fluids, fuel, and miscellaneous deliveries and removal of materials (estimated).

Emission Factor Equation from AP-42 Section 13.2.1, Paved Roads (January 2011):
E = [k * (sL/2)^0.91 * (W)^1.02] * (1 - 1.2P/4N) = lb / Vehicle Mile Traveled (VMT)

	PM	PM10	PM2.5	
k =	0.011	0.0022	0.00054	dimensionless, particle size multiplier
sL =	9.7	9.7	9.7	surface material silt content (g/m^2)
W =	26.8	26.8	26.8	tons, mean vehicle weight
P =	157	157	157	no. days/year with 0.01 in of rain
e =	1.15	0.23	0.06	lb/VMT

Rounding to 2

Pollutant	No. of Vehicles		Miles Per Trip (1)	Control Device		Emissions			
						Uncontrolled		Controlled	
	Per Hour	Per Year	(mi)	Type	Effic(%)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
PM	2	9,963	5.00	N	0	11.50	28.64	11.50	28.64
PM10	2	9,963	5.00	N	0	2.30	5.73	2.30	5.73
PM2.5	2	9,963	5.00	N	0	0.60	1.50	0.60	1.50

Tankers/Trucks

Product	Empty Weight lbs	Loaded Weight lbs	Gallons Per Load	Average Weight tons	Gallons Per Hour	Gallons Per Year	Trucks Per Hour	Trucks Per Year
Delivery of Fluids	27,000	80,000	10,000	26.750	673	55,824,392	1	5,583
Miscellaneous Trucking							1	4,380
						Total =	2	9,963

1. Trip Distance - Bens Creek Road to Back of Property (miles one direction) = 2.5
2. Miscellaneous trucking is for deliveries and shipping of materials other than the fluid identified below. Trucking volume is assumed at one truck per hour and 4,380 trucks per year. Truck weighs are assumed to be the same mean weight as liquid trucking.

Estimated Delivery of Fluids			
Material	gal/hr	gal/day	gal/yr
ULSD	446.00	10,704.00	21,297,198.81
Lubricant Oil	65.13	1,563.00	570,495.00
NH3(aq)	16.57	397.58	3,482,822.90
NaOH	142.07	3,409.78	29,869,648.56
NaHS	0.50	12.04	105,437.79
NaClO2	1.90	45.50	398,601.40
H2SO4	0.48	11.44	100,187.27
Total	672.64	16,143.34	55,824,391.73

	kJ/BTU	m³/ft³
	1.055056	0.028317

Gas	49.15	MJ/kg	976.94	BTU/ft³
Diesel	42.7	MJ/kg	130613.5	BTU/gal

Information provided by Engine Supplier

For Export

Gas mode		100	75	50	25	20	10
NOx	g/kWh	1.0	0.4	0.4	0.8	0.9	1.0
PM (Filterable)	mg/Nm3	5.7	4.2	5.3	8.6	9.3	10.6
PM10 (Filterable + (	mg/Nm3	5.4	4.1	5.1	8.1	8.8	10.1
PM2.5 (Filterable +	mg/Nm3	5.4	4.1	5.1	8.1	8.8	10.1
CO	ppm	180	166	178	154	149	139
VOC	ppm	79	76	78	88	90	94
N2O	ppm	2	1	1	1	1	1
CH4	0	644	616	638	732	750	788
CO2	g/kWh	383	373	377	400	405	416
SO2	g/kWh	0.025	0.023	0.021	0.021	0.021	0.022

SO2 [g/kWh]			21000	15750	10500	5250	4200	2100
	Sulphur content		**100**	**75**	**50**	**25**	**20**	**10**
	gas	0.00014	0.02	0.02	0.02	0.02	0.02	0.02
	diesel	0.002	0.35	0.33	0.33	0.34	0.40	0.44
	lub oil	0.008	0.0050	0.0032	0.0018	0.0009	0.0006	0.0003
		Diesel	**0.353**	**0.330**	**0.330**	**0.336**	**0.401**	**0.440**
		Gas	**0.025**	**0.023**	**0.021**	**0.021**	**0.021**	**0.022**
	CO2 gas	2.743	383.32	372.74	376.79	399.75	405.09	415.76
	CO2 Diese	3.158	439.13	426.23	430.16	454.41	459.83	470.67

Diesel mode		100	75	50	25	20	10
NOx	g/kWh	11.6	14.9	17.1	18.5	18.8	19.3
PM (Filterable)	mg/Nm3	8.4	12.1	11.6	8.6	8.0	6.8
PM10 (Filterable + (	mg/Nm3	8.4	12.1	11.6	8.6	8.0	6.8
PM2.5 (Filterable +	mg/Nm3	8.0	11.7	11.3	8.1	7.6	6.5
CO	ppm	83	36	36	39	40	41
VOC	ppm	91	103	119	171	181	202
N2O	ppm	4	2	1	1	1	1
CO2	g/kWh	439	426	430	454	460	471
SO2	g/kWh	0.353	0.330	0.330	0.336	0.401	0.440

Gas, iCER, Tier III

						General					ISO									
NOx	PM	CO	THC	CH4	N2O	Power	Power	Speed	BMEP	Mps	Power	Power	Bypass	BSGC	BSPC	pExh	pExhRel	BSEF	tEaT	tEaTm
g/kWh	mg/Nm3	ppm	ppm	ppm	ppm	%	kW	rpm	bar	m/s	%	kW	%	g/kWh	g/kWh	bar	bar g	kg/kWh	°C	°C
1.00	**5.67**	**180**	**755**	**644**	**2**	**100**	21000	89	16.1	9.2	100	21000	0	137.937	0.6	3.97	2.97	7.22	231	231
0.88	5.38	177	749	638	2	95	19950	87.5	15.56	9	95	19950	0	136.208	0.6	3.81	2.81	7.34	226	226
0.76	5.08	174	742	633	2	90	18900	85.9	15	8.8	90	18900	0	134.885	0.7	3.65	2.65	7.47	222	222
0.64	4.79	171	735	627	2	**85**	17850	84.3	14.44	8.7	85	17850	0	133.665	0.7	3.48	2.48	7.6	219	219
0.64	4.78	171	735	627	2	84.9	17829	84.3	14.43	8.7	84.9	17829	0	133.665	0.7	3.47	2.47	7.6	219	219
0.52	4.49	168	729	621	1	80	16800	82.6	13.87	8.5	80	16800	0	132.648	0.7	3.31	2.31	7.73	217	217
0.40	**4.20**	**166**	**722**	**616**	**1**	**75**	15750	80.9	13.29	8.3	75	15750	0	131.732	0.8	3.14	2.14	7.86	215	215
0.40	4.41	168	727	620	1	70	14700	79	12.69	8.1	70	14700	0	131.122	0.8	2.97	1.97	8.01	215	215
0.40	4.55	170	731	623	1	66.6	13986	77.7	12.28	8	66.6	13986	0	130.613	0.9	2.86	1.86	8.12	215	215
0.40	4.62	170	732	624	1	65	13650	77.1	12.08	7.9	65	13650	0	130.41	0.9	2.8	1.8	8.17	216	216
0.40	4.83	173	737	629	1	60	12600	75.1	11.45	7.7	60	12600	0	129.901	0.9	2.63	1.63	8.32	217	217
0.40	5.04	175	742	633	1	55	11550	72.9	10.81	7.5	55	11550	0	129.596	1	2.46	1.46	8.47	221	221
0.40	**5.3**	**178**	**748**	**638**	**1**	**50**	10500	70.6	10.14	7.3	50	10500	0	129.698	1	2.28	1.28	8.63	224	224
0.48	5.92	173	769	656	1	45	9450	68.2	9.45	7	45	9450	0	130.613	1.1	2.1	1.1	8.77	230	230
0.56	6.59	168	791	675	1	40	8400	65.6	8.74	6.7	40	8400	0	132.037	1.2	1.92	0.92	8.91	236	236
0.64	7.27	163	813	694	1	35	7350	62.7	7.99	6.5	35	7350	0	133.258	1.3	1.73	0.73	9.02	246	246
0.72	7.94	158	834	713	1	30	6300	59.6	7.21	6.1	30	6300	0	134.479	1.4	1.59	0.59	9.51	244	244
0.80	**8.6**	**154**	**856**	**732**	**1**	**25**	5250	56.1	6.39	5.8	25	5250	0	135.801	1.6	1.5	0.5	10.71	226	226
0.88	9.28	149	878	750	1	**20**	4200							137.123	1.8				208	
0.96	9.95	144	900	769	1	15	3150							138.446	2				190	
1.04	10.63	139	921	788	1	**10**	2100							139.768	2.2				172	

BSEC	Tur Flov	EtaTC	tEbB	BSAC	tEbT	pScav	SAC LT	Cylinder	Lub. Oil	Radiation	SPP	tAaC	tScav	Com Flow	mScav	pScavRel	Cond. wate	TEaE	Steam	mEco	mEgr	EGR rate	Load	Oil Feed
kJ/kWh	kg/s	%	°C	kg/kWh	°C	bar	kW	kW	kW	kW	kW	°C	°C	kg/s	kg/s	bar g	kg/h	°C	kg/h	kg/s	kg/s	%	%	[kg/h]
6808	42.1	69.6	229	3.42857	406	4.22	8625	2300	1405	360	1150	218	34	41.7	41.3	3.22	1565	180	1640	20.4	21.3	51%	100	2.4
6744	40.7	69.9	224	3.55489	396	4.02	8075	2260	1390	350	1025	212	33.7	40.3	39.9	3.02	1450	180	1460	20.1	20.2	50%	95	2.29
6697	39.2	70	220	3.6381	386	3.85	7530	2235	1375	340	905	205	33.4	38.9	38.5	2.85	1360	180	1280	19.4	19.4	50%	90	2.18
6663	37.7	70	217	3.73109	377	3.68	6965	2210	1370	330	820	199	33.1	37.4	37	2.68	1250	180	1150	18.9	18.5	49%	85	2.06
6663	37.6	70	217	3.77587	377	3.67	6945	2215	1375	330	825	199	33.1	37.3	37	2.67	1240	180	1160	19	18.3	49%	84.9	2.06
6633	36.1	70	215	3.83571	368	3.5	6395	2170	1360	320	740	192	32.9	35.8	35.4	2.5	1145	180	1040	18.2	17.5	49%	80	1.95
6608	34.4	69.8	213	3.95429	360	3.32	5820	2135	1350	310	690	184	32.6	34.1	33.8	2.32	1035	180	960	17.6	16.5	48%	75	1.84
6608	32.7	69.6	213	4.06531	353	3.14	5270	2065	1320	300	660	177	32.3	32.4	32.2	2.14	930	180	920	16.9	15.6	48%	70	1.73
6608	31.5	69.5	213	4.1184	348	3.03	4905	2015	1310	290	640	172	32.1	31.3	31	2.03	865	180	900	16.3	15	48%	66.6	1.5452
6608	31	69.4	214	4.16703	346	2.97	4735	1995	1300	290	630	169	32	30.7	30.5	1.97	830	180	890	16	14.7	48%	65	1.62
6616	29.1	69	215	4.22857	340	2.79	4185	1920	1280	275	625	161	31.7	28.9	28.7	1.79	730	180	880	15	13.9	48%	60	1.5
6629	27.2	68.6	219	4.3013	335	2.61	3630	1850	1260	265	635	152	31.4	26.9	26.7	1.61	630	180	890	14	12.9	48%	55	1.39
6669	25.2	68.1	222	4.38857	329	2.42	3090	1770	1235	255	640	142	31.1	24.9	24.8	1.42	525	180	910	13	12	48%	50	1.27
6729	23	67.5	228	4.49524	324	2.23	2535	1670	1210	240	655	131	30.8	22.8	22.7	1.23	415	180	930	11.9	10.9	48%	45	1.18
6808	20.8	66.8	234	4.54286	319	2.03	2000	1575	1180	225	675	118	30.4	20.5	20.5	1.03	305	180	960	10.7	9.9	48%	40	1.08
6883	18.4	65.9	244	4.60408	316	1.83	1480	1465	1150	210	695	104	30	18.2	18.1	0.83	195	180	1000	9.5	8.7	48%	35	0.97
6961	16.6	65.2	242	4.85714	302	1.68	1100	1295	1070	195	610	92	29.6	16.4	16.4	0.68	110	180	880	8.6	7.9	48%	30	0.85
7045	15.6	64.6	224	5.48571	275	1.58	845	1065	940	180	415	82	29.3	15.4	15.4	0.58	45	180	590	8.1	7.4	48%	25	0.73
7129	15.6			6.42857	248										14.4					8.1	6.9		20	0.6
7213	15.6			8	221										13.4					8.1	6.4		15	0.51
7297	15.6			11.1429	194										12.4					8.1	5.9		10	0.37

Diesel, iCER, Tier III

						General					ISO									
						Power	Power	Speed	BMEP	Mps	Power	Power	Bypass	BSFC	BSPC	pExh	pExhRel	BSEF	tEaT	tEaTm
NOx	PM	CO	THC	CH4	N2O	%	kW	rpm	bar	m/s	%	kW	%	g/kWh	g/kWh	bar	bar g	kg/kWh	°C	°C
11.6	**8.4**	**82.5**	**91.08**		**3.6**	100	21000	89	16.1	9.2	100	21000	0	174.2	0.4	4.54	3.54	8.37	227	227
12.26	9.14	73.20	93.39		3.36	95	19950	87.5	15.56	9	95	19950	0	170.7	0.4	4.19	3.19	8.28	211	211
12.92	9.87	63.90	95.70		3.12	90	18900	85.9	15	8.8	90	18900	0	167.5	0.4	3.94	2.94	8.31	205	205
13.58	10.61	54.60	98.01		2.88	85	17850	84.3	14.44	8.7	85	17850	0	165.4	0.4	3.75	2.75	8.43	201	201
13.59	10.62	54.41	98.06		2.88	84.9	17829	84.3	14.43	8.7	84.9	17829	0	165.4	0.4	3.74	2.74	8.43	200	200
14.24	11.34	45.30	100.32		2.64	80	16800	82.6	13.87	8.5	80	16800	0	164.1	0.5	3.56	2.56	8.56	198	198
14.9	**12.1**	**36**	**102.63**		**2.4**	75	15750	80.9	13.29	8.3	75	15750	0	163.2	0.5	3.41	2.41	8.8	198	198
15.34	11.97	36.00	105.89		2.16	70	14700	79	12.69	8.1	70	14700	0	162.9	0.5	3.22	2.22	8.95	197	197
15.64	11.90	36.00	108.10		2.00	66.6	13986	77.7	12.28	8	66.6	13986	0	162.9	0.5	3.08	2.08	9.01	198	198
15.78	11.87	36.00	109.14		1.92	65	13650	77.1	12.08	7.9	65	13650	0	162.8	0.5	3.01	2.01	9.04	199	199
16.22	11.76	36.00	112.40		1.68	60	12600	75.1	11.45	7.7	60	12600	0	163	0.6	2.8	1.8	9.14	200	200
16.66	11.66	36.00	115.65		1.44	55	11550	72.9	10.81	7.5	55	11550	0	163.4	0.6	2.59	1.59	9.22	203	203
17.1	**11.6**	**36**	**118.91**		**1.2**	50	10500	70.6	10.14	7.3	50	10500	0	164.1	0.7	2.37	1.37	9.24	209	209
17.38	10.96	36.60	129.27		1.20	45	9450	68.2	9.45	7	45	9450	0	165.2	0.7	2.14	1.14	9.24	216	216
17.66	10.37	37.20	139.63		1.20	40	8400	65.6	8.74	6.7	40	8400	0	166.1	0.8	1.92	0.92	9.17	226	226
17.94	9.79	37.80	150.00		1.20	35	7350	62.7	7.99	6.5	35	7350	0	166.8	0.9	1.7	0.7	9.04	239	239
18.22	9.20	38.40	160.36		1.20	30	6300	59.6	7.21	6.1	30	6300	0	167.9	1	1.55	0.55	9.38	237	237
18.5	**8.6**	**39**	**170.72**		**1.2**	25	5250	56.1	6.39	5.8	25	5250	0	167.7	1.1	1.44	0.44	10.27	223	223
18.78	8.02	39.60	181.08		1.20	20	4200							200					206	
19.06	7.43	40.20	191.44		1.20	15	3150							210					189	
19.34	6.85	40.80	201.81		1.20	10	2100							220					172	

BSEC	Tur Flov	EtaTC	tEbB	BSAC	tEbT	pScav	SAC LT	Cylinder	Lub. Oil	Radiation	SPP	tAaC	tScav	Com Flow	mScav	pScavRel	Cond. wate	TEaE	Steam	mEco	mEgr	EGR rate
kJ/kWh	kg/s	%	°C	kg/kWh	°C	bar	kW	kW	kW	kW	kW	°C	°C	kg/s	kg/s	bar g	kg/h	°C	kg/h	kg/s	kg/s	%
7439	48.8	67.8	225	-	414	4.74	10265	2355	1435	360	1690	231	33.9	48.2	47.8	3.74	1230	180	2400	32.4	16.4	34%
7290	45.9	69.2	209	-	389	4.38	9195	2430	1475	350	1030	221	33.4	45.2	44.9	3.38	1115	180	1430	30.2	15.6	35%
7153	43.6	69.7	203	-	376	4.13	8430	2465	1490	340	770	213	33.1	43	42.7	3.13	1070	180	1050	28.1	15.5	36%
7064	41.8	70	199	-	365	3.93	7800	2450	1495	330	605	206	32.9	41.3	41	2.93	1020	180	810	26.5	15.3	37%
7062	41.8	70	198	-	365	3.93	7790	2435	1490	330	600	206	32.9	41.2	40.9	2.93	1020	180	800	26.5	15.3	37%
7008	39.9	70	196	-	357	3.74	7180	2385	1475	320	510	199	32.6	39.4	39.2	2.74	965	180	670	24.9	15	38%
6970	38.5	70	196	-	351	3.59	6730	2280	1430	310	460	193	32.5	38	37.8	2.59	955	180	600	23.2	15.2	40%
6957	36.5	69.9	195	-	342	3.39	6075	2220	1405	300	410	185	32.2	36.1	35.9	2.39	860	180	530	22.1	14.4	40%
6954	35	69.8	196	-	338	3.24	5615	2210	1415	290	415	179	32	34.6	34.4	2.24	810	180	550	20.9	14.1	41%
6953	34.3	69.7	197	-	336	3.17	5400	2205	1420	290	420	177	31.9	33.9	33.7	2.17	780	180	550	20.4	13.9	41%
6961	32	69.4	198	-	328	2.97	4720	2175	1420	275	420	167	31.6	31.6	31.4	1.97	675	180	560	19	13	41%
6978	29.6	68.9	201	-	322	2.74	4030	2125	1420	265	455	157	31.3	29.2	29	1.74	570	180	610	17.4	12.1	41%
7008	27	68.4	207	-	317	2.52	3340	2065	1415	255	500	145	30.9	26.6	26.5	1.52	460	180	690	15.7	11.2	42%
7055	24.3	67.7	214	-	312	2.28	2660	2005	1420	240	555	132	30.6	23.9	23.8	1.28	355	180	780	13.9	10.3	43%
7093	21.4	66.8	224	-	308	2.04	2005	1935	1420	225	615	118	30.2	21.1	21	1.04	250	180	870	12.1	9.3	44%
7123	18.5	65.8	237	-	306	1.8	1395	1860	1425	210	665	102	29.8	18.2	18.1	0.8	140	180	960	10.2	8.2	45%
7170	16.4	65	235	-	292	1.65	990	1690	1360	195	565	88	29.4	16.1	16.1	0.65	60	180	810	8.9	7.4	46%
7162	15	64.3	221	-	267	1.53	710	1465	1245	180	385	77	29.1	14.7	14.7	0.53	5	180	540	8	6.9	47%
	15.1				241															8		
	15.1				214															8		
	15.1				187															8		

ATTACHMENT O

MONITORING, RECORDKEEPING, REPORTING, TESTING PLANS

ATTACHMENT O

MONITORING, RECORDKEEPING, REPORTING, AND TESTING PLANS

TransGas Development Systems, LLC will work with the Division of Air Quality to identify and address Monitoring, Recordkeeping, Reporting, and Testing Plans. Requirements that are identified in the permit will be implemented.

ATTACHMENT P

PUBLIC NOTICE

ATTACHMENT P

AIR QUALITY PERMIT NOTICE

Notice of Application

Notice is given that TransGas Development Systems, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Construction Permit for the Adams Fork Data Center Energy Campus located on Twisted Gun Road near Wharncliffe in Mingo County, West Virginia. The latitude and longitude coordinates are: 37.593717 and -81.954906.

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be: NO_x of 194.30 tons per year (tpy), SO2 of 9.93 tpy, CO of 205.62, tpy, VOC of 117.66 which includes fugitives of 0.31 tpy, PM of 215.17 tpy which includes fugitives of 28.64 tpy, PM10 of 192.26 which includes fugitives of 5.73 tpy, PM2.5 of 188.03 tpy which includes fugitives of 1.50 tpy, and total HAPS of 0.87 tpy.

Startup of operations is planned to begin on or about the 1st day of January 2027. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice. Written comments will also be received via email at DEPAirQualityPermitting@WV.gov.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, Extension 41281, during normal business hours.

Dated this the **(Insert Date)** day of March 2025.

By: TransGas Development Systems, LLC
Adam Victor
President
630 First Avenue, Suite 30C
New York, New York 10016-3799

ATTACHMENT Q

BUSINESS CONFIDENTIAL CLAIMS

Cover Document
Confidential Information

This sample form contains each of the required elements for the cover document required under 45CSR31. The person submitting this form may wish to attach an additional page(s) to provide adequate justification under the "Rationale" section of the form.

Company Name	TransGas Development Systems, LLC	Responsible Official		Adam Victor, President
Company Address	630 First Avenue, Suite 30C New York, NY 10016-3799	Confidential Information Designee in State of WV	Name	Patrick Ward
			Title	Senior Engineer
			Address	7012 MacCorkle Ave, SE Charleston, WV 25304
Person/Title *Submitting* Confidential Information	Adam Victor			
	President		Phone	(304) 342-1400
			Fax	(304) 343-9031

Reason for Submittal of Confidential Information: Initial permitting.

Identification of Confidential Information	Rationale for Confidential Claim	Confidential Treatment Time Period
All Marked Confidential Information.	Provide justification that the criteria set forth in § 45CSR31-4.1.a - e have been met. The information contained within the application is fully protected under non-disclosure and confidentiality agreements by all parties involved in the application process and design of the facility. See Page Q2 of Q2.	This information is to be maintained confidential. There is no timeframe for expiration of confidential treatment.

Responsible Official Signature:	
Responsible Official Title:	President
Date Signed:	3/24/25

NOTE: Must be signed and dated in **BLUE INK**.

Precautionary Notice — Claims of Confidentiality
WVDEP-DAQ: Revised March 23, 2020

Provide justification that the criteria set forth in § 45CSR31-4.1.a - e have been met.

4.1.a. The claim of confidentiality has not expired by its terms, nor been waived or withdrawn;

The confidentiality agreements do not have an expiration date due to the nature of the information contained in the application.

4.1.b. The person asserting the claim of confidentiality has satisfactorily shown that it has taken reasonable measures to protect the confidentiality of the information, and that it intends to continue to take such measures;

The information contained within the application is fully protected under non-disclosure and confidentiality agreements by all parities involved in the original development of the processes, the design of the facility, and the permit application process.

4.1.c. The information claimed confidential is not, and has not been, reasonably obtainable without the person's consent by other persons (other than governmental bodies) by use of legitimate means (other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding);

The information available herein is not available and is not to be made available to outside parties.

4.1.d. No statute specifically requires disclosure of the information; and

Applicant believes there are no statutes that require disclosure of the information.

4.1.e. Either--

4.1.e.1. The person has satisfactorily shown that disclosure of the information is likely to cause substantial harm to the business's competitive position; or

This is a unique facility with many parties involved in preparing and providing information on the systems. Release of this information could cause substantial harm to Applicant's competitive position in the market.

4.1.e.2. The information is voluntarily submitted information, and its disclosure would likely to impair the State's ability to obtain necessary information in the future.

The State should not disclose this information to anyone.