March 16, 2019

Air Permits Initial Review Team (APIRT)
Texas Commission on Environmental Quality
Mail Code 161
12100 Park 35 Circle
Building C, Third Floor, Room 300W
Austin, Texas 78753

RE: 30 TAC 106.224 PI-7 Registration for Rocket Development Testing Program
SpaceX Texas Launch Site – Brownsville, Cameron County, Texas
Space Exploration Technologies Corporation
CN: 602867657
RN: 107697088

Dear APIRT,

On behalf of Space Exploration Technologies Corporation (SpaceX), please find enclosed a PI-7 Registration for Permit By Rule (PBR) 30 TAC 106.224 for the SpaceX Texas Launch Site located in Brownsville, Cameron County, Texas. SpaceX would like to authorize operations related to their rocket development testing program under 30 TAC 106.224, Aerospace Equipment and Parts Manufacturing. Operations will involve the assembly and disassembly of aerospace engine components and testing of those components.

This submittal contains a Form PI-7, PBR applicability checklists, process description, process flow diagram, emissions calculations, and other supporting information.

SpaceX would like to request James Nolan as the TCEQ permit engineer on this project. He has worked on previous SpaceX submittals and is familiar with SpaceX's unique operations.

Should you have any questions or require additional information, please contact me at 512-900-1911 or Matthew Thompson at 310-970-3611.

Thank You,
Greenthink Consulting, L.L.C.

Rajiv Y. Patel, P.E.
Managing Engineer

Attachment: **30 TAC 106.224 PI-7 Registration**

Greenthink Consulting, L.L.C.
120 Archipelago Trl, Austin, TX 78717
512.596.7929

Cc: Matthew Thompson – Space Exploration Technologies
Katy Smith – Space Exploration Technologies
TCEQ – Region 15, Harlingen

Greenthink Consulting, L.L.C.
120 Archipelago Trl, Austin, TX 78717
512.596.7929

SPACEX

30 TAC §106.224 Permit by Rule Registration

For:

Texas Launch Site – Rocket Development Testing Program

Space Exploration Technologies
Brownsville, Texas

March 2019

Prepared by:

Greenthink Consulting, L.L.C.

greenthink CONSULTING
www.greenthinkconsulting.com

Table of Contents

1.0 INTRODUCTION

Space Exploration Technologies Corporation (SpaceX; CN602867657) owns and operates the SpaceX Texas Launch Site (RN107697088) located in Brownville, Texas of Cameron County. SpaceX would like to authorize operations related to their rocket development testing program under 30 TAC 106.224, Aerospace Equipment and Parts Manufacturing. Operations will involve the assembly and disassembly of aerospace engine components and testing of those components.

The remainder of this application includes a completed PI-7 and all required supporting information.

2.0 FORM PI-7

This section contains the completed Form PI-7.

Texas Commission on Environmental Quality
Registration for Permits by Rule (PBR)
Form PI-7

(Page 1)

I. Registrant Information		
A. Company or Other Legal Customer Name: **Space Exploration Technologies Corp.**		
B. Company Official Contact Information (☒ Mr. ☐ Mrs. ☐ Ms. ☐ Other:) _____		
Name: **Matthew Thompson**		
Title: **Director, Environmental Health & Safety**		
Mailing Address: **1 Rocket Road**		
City: **Hawthorne**	State: **CA**	ZIP Code: **90250-6844**
Phone: **310-970-3611**	Fax:	
E-mail Address: **matthew.thompson@spacex.com**		
All PBR registration responses will be sent via e-mail.		
C. Technical Contact Information (☒ Mr. ☐ Mrs. ☐ Ms. ☐ Other:) _____		
Name: **Rajiv Y. Patel, PE**		
Title: **Managing Engineer**		
Company Name: **Greenthink Consulting, L.L.C.**		
Mailing Address: **120 Archipelago Trail**		
City: **Austin**	State: **TX**	ZIP Code: **78717**
Phone: **512-900-1911**	Fax:	
E-mail: **rajiv@greenthinkconsulting.com**		
II. Facility and Site Information		
A. Name and Type of Facility		
Facility Name: **SpaceX Texas Launch Site – Rocket Development Testing Program**		
Type of Facility: ☒ Permanent ☐ Temporary		
For portable units, please provide the serial number of the equipment being authorized below.		
Serial No:	Serial No:	

II. Facility and Site Information *(continued)*		
B. Facility Location Information		
Street Address: **1 Rocket Road**		
If there is no street address, provide written driving directions to the site and provide the closest city or town, county, and ZIP code for the site (attach description if additional space is needed).		
City: **Brownsville**	County: **Cameron**	ZIP Code: **78521**
C. TCEQ Core Data Form		
Is the Core Data Form (TCEQ Form Number 10400) attached?		☐ YES ☒ NO
If "NO," provide customer reference number (CN) and regulated entity number (RN) below.		
Customer Reference Number (CN): **CN602867657**		
Regulated Entity Number (RN): **RN107697088**		
D. TCEQ Account Identification Number (if known):		
E. Type of Action		
☒ Initial Application ☐ Change to Registration		
For Change to Registration provide the Registration Number:		
F. PBR number(s) claimed under 30 TAC Chapter 106		
(List all the individual rule number(s) that are being claimed.)		
106.**224**	106.	
106.	106.	
106.	106.	
G. Historical Standard Exemption or PBR		
Are you claiming a historical standard exemption or PBR?		☐ YES ☒ NO
If "YES," enter rule number(s) and associated effective date in the spaces provided below.		
Rule Number(s)	Effective Date	

II. Facility and Site Information *(continued)*	
H. Previous Standard Exemption or PBR Registration Number	
Is this authorization for a change to an existing facility previously authorized under a standard exemption or PBR?	☐ YES ☒ NO
If "YES," enter previous standard exemption number(s) and PBR registration number(s), and associated effective date in the spaces provided below.	
Standard Exemption and PBR Registration Number(s)	Effective Date
I. Other Facilities at this Site Authorized by Standard Exemption, PBR, or Standard Permit	
Are there any other facilities at this site that are authorized by an Air Standard Exemption, PBR, or Standard Permit?	☒ YES ☐ NO
If "YES," enter standard exemption number(s), PBR registration number(s), and Standard Permit registration number(s), and associated effective date in the spaces provided below.	
Standard Exemption, PBR Registration, and Standard Permit Registration Number(s)	Effective Date
PBR Registration No: 155544	**March 15, 2019**
J. Other Air Preconstruction Permits	
Are there any other air preconstruction permits at this site?	☐ YES ☒ NO
If "YES," enter permit number(s) in the spaces provided below.	
K. Affected Air Preconstruction Permits	
Does the PBR being claimed directly affect any permitted facility?	☐ YES ☒ NO
If "YES," enter the permit number(s) in the spaces provided below.	

II. Facility and Site Information *(continued)*	
L. Federal Operating Permit (FOP) Requirements (30 TAC Chapter 122 Applicability)	
Is this facility located at a site that is required to obtain an FOP pursuant to 30 TAC Chapter 122?	☐ YES ☒ NO ☐ To Be Determined
If the site currently has an existing FOP, enter the permit number:_____	
1. Check the requirements of 30 TAC Chapter 122 that will be triggered if this claim is accepted *(check all that apply)*.	
☐ Initial Application for an FOP ☐ Significant Revision for an SOP ☐ Minor Revision for an SOP ☐ Operational Flexibility/Off Permit Notification for an SOP ☐ Revision for a GOP ☐ To be Determined ☐ None	
2. Identify the type(s) of FOP issued and/or FOP application(s) submitted/pending for the site. (*check all that apply*)	
☐ SOP ☐ GOP ☐ GOP application/revision (submitted or under APD review) ☐ N/A ☐ SOP application/revision (submitted or under APD review)	
III. Fee Information *(see Section VII. for address to send fee or go to www.tceq.texas.gov/epay to pay online)*	
A. Fee Requirements	
Is a fee required per 30 TAC § 106.50?	☒ YES ☐ NO
If "NO," specify the exception. There are three exceptions to paying a PBR fee.	*(check all that apply)*
1. Registration is solely to establish a federally enforceable emission limit.	☐
2. Registration is within six months of an initial PBR review, and is addressing deficiencies, administrative changes, or other allowed changes.	☐
3. Registration is for a remediation project (30 TAC § 106.533).	☐
B. Fee Amount	
1. A $100 fee is required if *any* of the answers in III.B.1 are "YES."	
This business has less than 100 employees.	☐ YES ☒ NO
This business has less than 6 million dollars in annual gross receipts.	☐ YES ☒ NO
This registration is submitted by a governmental entity with a population of less than 10,000.	☐ YES ☒ NO
This registration is submitted by a non-profit organization.	☐ YES ☒ NO
2. A $450 fee is required for all other registrations.	

III. Fee Information *(see Section VII. for address to send fee or go to www.tceq.texas.gov/epay to pay online)* ***(continued)***		
C. Payment Information		
Check/money order/transaction or voucher number: **TBD**		
Individual or company name on check: **TBD**		
Fee Amount: $ 450		
Was fee paid online?		☒ YES ☐ NO
IV. Selected Facility Reviews and Voluntary Registrations *Only*		
Note: If registering any of the PBRs listed in IV.B., or if voluntarily registering any other PBR(s), complete this section, then skip to Section VI. below:		
A. List any PBRs that are being voluntarily registered.		
106.	106.	106.
106.	106.	106.
B. PBR Checklists		
If you are registering any of the following PBRs, did you attach the applicable PBR checklists that shows your facility meets all general and specific requirements? • *Animal Feeding Operations § 106.161, Livestock Auction Facilities § 106.162, Saw Mills § 106.223, Grain Handling, Storage and Drying § 106.283, Auto Body Refinishing Facilities § 106.436,* or *Air Curtain Incinerator § 106.496* (If "NO" then you ***must*** provide ***all*** technical information outlined in Section V.)		☐ YES ☐ NO
C. Distances to Property Line and Nearest Off-Property Structure		
Distance from this facility's emission release point to the nearest property line:		feet
Distance from this facility's emission release point to the nearest off-property structure:		feet

V. Technical Information Including State and Federal Regulatory Requirements **Check the appropriate box to indicate what is included in your submittal.** ***NOTE:*** *Any technical or essential information needed to confirm that facilities are meeting the requirements of the PBR must be provided. Not providing key information could result in an automatic deficiency and voiding of the project.*	
A. PBR requirements (Checklists are optional; however, your review will go faster if you provide applicable checklists.)	
Did you demonstrate that the general requirements in 30 TAC § 106.4 are met?	☒ YES ☐ NO
Did you demonstrate that the individual requirements of the specific PBR are met?	☒ YES ☐ NO
B. Confidential Information Included (If confidential information is submitted with this registration, all confidential pages must be properly marked "CONFIDENTIAL.")	☒ YES ☐ NO
C. Process Flow Diagram	☒ YES ☐ NO
D. Process Description	☒ YES ☐ NO
E. Maximum Emissions Data and Calculations	☒ YES ☐ NO
Note: *If the facilities listed in this registration are subject to the Mass Emissions Cap & Trade program under* ***30 TAC Chapter 101****,* ***Subchapter H, Division 3****, the owner/operator of these facilities must possess NO_x allowances equivalent to the actual NO_x emissions from these facilities.*	
F. Distance from Property Line and Nearest Off-Property Structure	
Distance from this facility's emission release point to the nearest property line:	**~60** feet
Distance from this facility's emission release point to the nearest off-property structure:	**~400** feet
G. Project Status	
Has the company implemented the project or waiting on a response from TCEQ?	☐ Implemented ☒ Waiting
H. Projected Start of Construction and Projected Start of Operation Dates: **Upon approval**	
Projected Start of Construction (provide date): **Upon approval**	
Project Start of Operation (provide date): **Upon approval**	
VI. Delinquent Fees and Penalties	
This form **will not be processed** until all delinquent fees and/or penalties owed to the TCEQ or the Office of the Attorney General on behalf of the TCEQ is paid in accordance with the Delinquent Fee and Penalty Protocol. For more information regarding Delinquent Fees and Penalties, go to the TCEQ website at www.tceq.texas.gov/agency/delin/index.html.	

VII. Copies of the Registration		
Processing delays may occur if copies are not sent as noted. Copies must be sent as listed below:		
Who	***Where***	***What***
Air Permits Initial Review Team (APIRT)	Regular, Certified, Priority Mail MC 161, P.O. Box 13087 Austin, Texas 78711-3087 Hand Delivery, Overnight Mail MC 161, 12100 Park 35 Circle, Building C, Third Floor Austin, Texas 78753	Originals of Form PI-7, Core Data Form, and all attachments. Not required if using ePermits[1]
Revenue Section, TCEQ	Regular, Certified, Priority Mail MC 214, P.O. Box 13088 Austin, Texas 78711-3088 Hand Delivery, Overnight Mail MC 214, 12100 Park 35 Circle, Building A, Third Floor Austin, Texas 78753	Original Money Order or Check, Copy of Form PI-7, and Core Data Form. Not required if fee was paid using ePay[2].
Appropriate TCEQ Regional Office	To find your Regional Office address, go to the TCEQ website at www.tceq.texas.gov/publications/gi/gi-002.html or call (512) 239-1250.	Copy of Form PI-7, Core Data Form, and all attachments. Not required if using ePermits[1].
Appropriate Local Air Pollution Control Program(s)	To Find your local or Regional Air Pollution Control Programs go to the TCEQ, APD website at www.tceq.texas.gov/permitting/air/local_programs.html or call (512) 239-1250	Copy of Form PI-7, Core Data Form, and all attachments

[1] ePermits located at www3.tceq.texas.gov/steers/
[2] ePay located at www.tceq.texas.gov/epay/

3.0 30 TAC §106.4 and §106.224 APPLICABILITY CHECKLISTS

This section contains the completed checklists demonstrating compliance with 30 TAC §106.4 and §106.224 requirements.

Permits by Rule 30 TAC Chapter 106, Section 106.4
"Quick-Check" Applicability Checklist
Instructions and Guidance for Using the "Quick-Check" Checklist

This checklist is designed to help owners/operators of very insignificant sources confirm that their proposed project meets the rules for using permits by rule. **This checklist should only be used if the total maximum emissions from all facilities at the site will be less than 25 tons per year of any contaminant.** If the site's emissions are greater than this amount, the standard Title 30 Texas Administrative Code § 106.4 (30 TAC § 106.4) Checklist should be used.

In addition to this checklist, it is the responsibility of the owner/operator to document and submit information on how the facility equipment and operations will meet all of the requirements of each specific permit by rule being claimed. Please forward this completed form and all documentation to for the verification of your permit by rule claim. Before starting the checklist, please calculate all new emissions associated with this project, including fugitives, as well as upstream and downstream increases in emissions caused by the facilities added or modified by the permit by rule claim. Attach this information to the completed permit by rule claim.

For additional assistance with your application, including resources to help calculate your emissions, please visit the Small Business and Local Government Assistance (SBLGA) webpage at the following link: www.TexasEnviroHelp.org

Page	Title	Details
1	General Instructions and Guidance	Do not return
2	General Requirements of 30 TAC § 106.4(short form)	Complete for all permit by rule claims

Easy Reference:	
Contaminant	Includes all criteria pollutant categories
VOC	Volatile organic compounds
NO_x	Nitrogen oxides
TPY	Tons per year
SO_2	Sulfur dioxide
NAAQS	National Ambient Air Quality Standards
CO	Carbon monoxide
PSD	Prevention of Significant Deterioration
PM	Suspendable particulate matter, including PM_{10}
Nonattainment	Areas designated by EPA as not meeting the NAAQS for a particular contaminant
PM_{10}	PM less than 10 microns in size
Attainment	Areas designated as meeting the NAAQS for a particular contaminant

After completing this checklist, attach all documentation needed to verify your claim and forward to all of the following:

Air Permits Division, MC 162 P.O. Box 13087 Austin, Texas 78711 Fax (512) 239-1300	Any appropriate Local Air Pollution Control Programs at: www.tceq.state.tx.us/cgi-bin/permitting/air/tps-ost/localprograms/localprograms.pl

If you have any questions regarding this checklist, applicable requirements, or the permit by rule registration process, please feel free to call the Air Permits Division at (512) 239-1250.

Permits by Rule 30 TAC Chapter 106, Section 106.4
"Quick-Check" Applicability Checklist
Instructions and Guidance for Using the "Quick-Check" Checklist

List the maximum annual emission rates, in **TONS PER YEAR (TPY)**, for this project:		
CO **1.87**	NO_X **0.22**	VOC **0.14**
PM	SO_2	Other

The following questions require a "Yes," or "No," answer to be indicated for this permit by rule claim:

A. Title 30 TAC § 106.4(a)(5): Current Permit by Rule Requirements

Have you checked to determine if this exempt project is being claimed under the current version of 30 TAC 106? ☒YES ☐NO

If "Yes," continue to next question

If "No," please contact the Air Permits Division for a copy of the current permit by rule to be claimed.

***B.* Title 30 TAC § 106.4(a)(7): Permit by rule prohibition check**

Are there any air permits under the same account containing permit conditions which prohibit or restrict the use of permits by rule? ☐YES ☒ NO

If "No," continue to next question

If "Yes," permits by rule may not be used or their use must meet the restrictions of the permit.

A new permit or permit amendment may be required.

List permits number(s):

C. Title 30 TAC § 106.4(b): Circumvention check

Title 30 TAC § 106.4(b) states "No person shall circumvent by artificial limitations the requirements of § 116.110 of this title (covering permitting)." Circumvention by artificial limitations may include but is not limited to:

(1.) *A. dividing a complete project into separate segments to circumvent §106.4(a)(1) limits;*

(2.) *claiming feed or production rates below the physical capacity of the project's equipment in order to begin constructing facilities before a permit or permit amendment is approved for full scale operations, particularly when the unit will not be economically viable at less than permitted capacity;*

(3.) *claiming a limited chemical list in order to begin constructing facilities before a permit or permit amendment is approved for additional chemicals, particularly when the unit will not be economically viable until the additional chemicals are authorized.*

Does your project meet any of the criteria listed above? ☐YES ☒ NO

If "No," continue to next rule question.

If "Yes," a permit by rule may not be claimed.

***D.* Title 30 TAC § 106.4(c) and (d): Compliance with all Rules**

Will the facility comply with all rules and regulations of the, the intent of the Texas Clean Air Act, and any local permitting or registration requirements? ☒YES ☐ NO

If "Yes," continue to next rule question

If "No," a permit by rule may not be claimed

Permits by Rule 30 TAC Chapter 106, Section 106.4
"Quick-Check" Applicability Checklist
Instructions and Guidance for Using the "Quick-Check" Checklist

E. Title 30 TAC § 106.4(a)(1): Emission limits check		
The maximum emissions from all facilities at the site, including this permit by rule claim, are less than 25 tpy of any contaminant ☒ YES ☐ NO *If the answer to these questions is "Yes," no further review is needed to complete this checklist.* *Forward all information needed to verify your permit by rule claim.* *If "No," this checklist cannot be used. Please complete the standard 30 TAC § 106.4 Applicability Checklist.*		
Name: **Mr**. **Matthew Thompson**		
Company: **Space Exploration Technologies Corp.**		
Title: **Director, Environmental Health & Safety**		
Facility Name: **SpaceX Texas Launch Site – Rocket Development Testing Program**		
Phone No.: **310-970-3611**	Fax No.:	
Email Address: **matthew.thompson@spacex.com**	Account ID No.:	
Location: **1 Rocket Road, Brownville, Texas 78521**		
Signature of Company Officer:		Date:

Texas Commission on Environmental Quality
Title 30 Texas Administrative Code § 106.224 Checklist
(Previously Standard Exemption 123)
Aerospace Equipment and Parts Manufacturing

The following checklist has been developed by the Texas Commission on Environmental Quality (TCEQ) to provide verification that the basic requirements of Title 30 Texas Administrative Code (TAC) Section 106.224, previously Standard Exemption 123, are met. The questions below are derived from § 106.4 and the permit by rule (PBR). Please read all of the questions and check each answer "YES" or "NO," or provide specific information as applicable to the facility. Total plant site emissions cannot exceed 25 tons per year. If all conditions of a specific PBR are not met, the facility will not be allowed to operate under that PBR and an application for a construction permit will be required pursuant to § 116.110 prior to construction.

For additional assistance with your application, including resources to help calculate your emissions, please visit the Small Business and Local Government Assistance (SBLGA) webpage at the following link: www.TexasEnviroHelp.org.

Please Provide the Information Requested Below						
Facility Type: Rocket Development Testing Program						
Operating Schedule:	24	hours/day	7	days/week	52	weeks/year
Production Rate: 337.80 kg/day of methane						units/time
Description						
Emission points are located at least 100 feet from any off-plant receptor*.						☒ YES ☐ NO
Note: *Off-plant receptor means any recreational area or residence or other structure not occupied or used solely by the owner or operator of the aerospace equipment and parts manufacturing plant or the owner of the property upon which the aerospace plant is located. Controlled access recreational areas owned by the property owner or the owner or operator of the aerospace plant are not off-plant receptors.*						
List the increase in the emissions of the following air contaminants authorized under this exemption, on a cumulative basis, from the entire aerospace manufacturing plant (tpy):						
Particulate matter (<5 tpy):			VOC(<15 tpy): 0.14			
Acid gases or vapors(<5 tpy):			Nonvolatile hydrocarbons(<10 tpy):			
Total of all air contaminants (< 25 tpy): 2.09 tpy (NOx and CO)						
The increases are less than the limits shown in parenthesis.						☒ YES ☐ NO
Hourly emissions of total new or increased emissions will not exceed the hourly emission rate defined by the equation E=L/K. The compound specific values of L (mg/m^3) are listed in Table 118(A) of TCEQ Standard Exemption 118. Values of K are listed in Table 123A of this exemption. You may calculate the value(s) of E or complete the following section.						☒ YES ☐ NO
The facility will be registered with the TCEQ central office using an exemption application, Form PI-7, before construction of the facility is begun. This registration will include a project description, emissions calculations, and a description of pollution control equipment to be used.						☒ YES ☐ NO

Texas Commission on Environmental Quality
Title 30 Texas Administrative Code § 106.224 Checklist
(Previously Standard Exemption 123)
Aerospace Equipment and Parts Manufacturing

Please Provide the Information Requested Below		
Emissions data will include all process emission sources at the plant, both existing and proposed, and shall be the maximum allowed emissions for permitted units, the actual emissions for existing grandfathered or exempted units, and the projected maximum allowable emissions for proposed units.		☒ YES ☐ NO
Emissions will be speciated by chemical compound and stack parameters, as appropriate, for each emission source provided.		☒ YES ☐ NO
If "YES", please fill in the following table:		
Compound	**Distance (ft)**	**Proposed Emission Rate (lb/hr)**
See Calculations		
Repeat This Section for All Emission Points:		
Distance from emission point to nearest off-plant receptor: See Calculations		
An emissions inventory will be compiled and/or updated on an annual basis for all process emission sources on the property, and be maintained on a two-year rolling retention cycle.		☒ YES ☐ NO
Note: *Inventory records should include the basis for all emissions estimates, sample calculations, and material usage records. Material and solvent usage records should be maintained in sufficient detail to document compliance.*		
There are/will be no visible emissions from this facility.		☒ YES ☐ NO
The facility will handle or store any of the chemicals listed below as a liquid or a compressed gas in a compound mixture of a concentration greater than 10% by weight or an aqueous solution of any of these same chemicals greater than 50% by weight.		☐ YES ☒ NO
Chemical List: Acrolein, Ammonia, Bromine, Carbon Disulfide, Chlorine, Ethyl Mercaptan, Hydrogen Chloride, Hydrogen Bromide, Hydrogen Cyanide, Hydrogen Fluoride, Hydrogen Sulfide, Phosphine, SO_2, Methyl Bromide, Methyl Isocyanate, Methyl Mercaptan, Nickel Carbonyl, and Phosgene.		
If "YES", answer the following:		
The facility shall be located at least 300 feet from the nearest property line and 600 feet from any off-plant receptor.		☐ YES ☐ NO
The cumulative amount of any one of the chemicals listed above resulting from one or more authorizations under this PBR shall not exceed 500 pounds on the plant property.		☐ YES ☐ NO
Any chemical listed above shall be handled, contained and transported, in compliance with U.S. Department of Transportation regulations (49 CFR Parts 171 through 178).		☐ YES ☐ NO

Texas Commission on Environmental Quality
Title 30 Texas Administrative Code § 106.224 Checklist
(Previously Standard Exemption 123)
Aerospace Equipment and Parts Manufacturing

Please Complete the Following Section:	
Name: Matthew Thompson	
Company: Space Exploration Technologies Corp.	
Title: Director, Environmental Health & Safety	
Facility Name: SpaceX Texas Launch Site - Rocket Development Testing Program	
Phone No.: 310-970-3611	Fax No.:
Email Address: matthew.thompson@spacex.com	
Account ID No.: CN602867657; RN107697088	
Location: 1 Rocket Road, Brownsville, Texas 76657	
Signature of Company Officer:	
Date:	

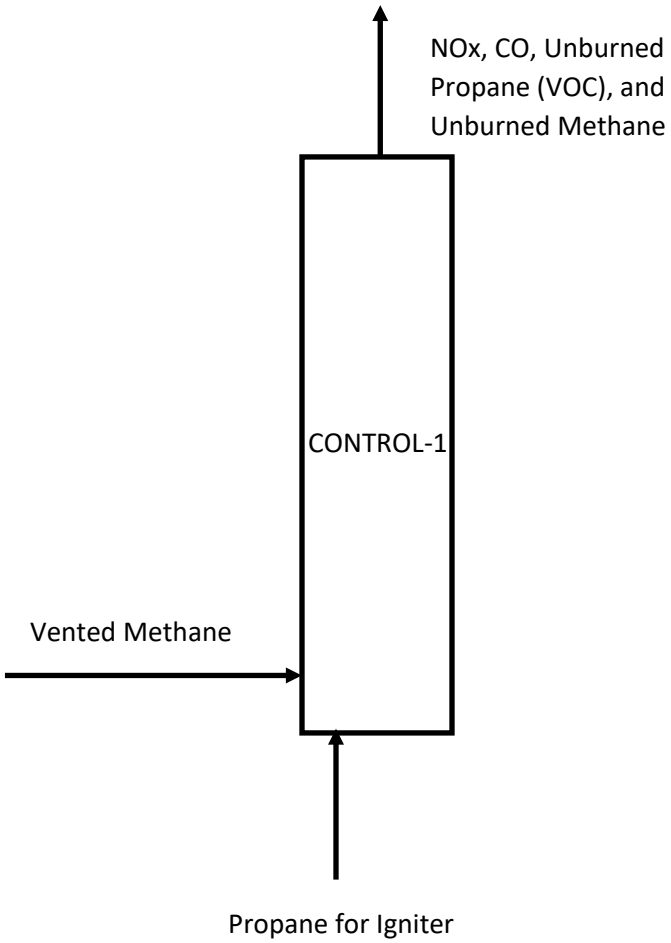
Reset Form

4.0 PROCESS DESCRIPTION

Operations related the SpaceX Texas Launch Site rocket development testing program involve the assembly and disassembly of aerospace engine components and testing of those components. During development, methane is used to fuel the engine components during testing. Methane vented during storage and fueling of the engine components is routed to a 12-inch x 30-foot single point control device (EPN CONTROL-1). Propane is used as for the igniter gas. Combustion of the methane and propane in the control device results in emissions of carbon monoxide (CO; authorized by this registration), oxides of nitrogen (NOx; authorized by this registration), volatile organic compounds (VOC, unburned propane), and unburned methane (non-VOC; unregulated). The control device is used to voluntarily reduce methane emissions for health and safety purposes and will have an estimated destruction efficiency of 98% or greater.

5.0 PROCESS FLOW DIAGRAM

This section contains the process flow diagram.



6.0 TABLE 1(a) / MAXIMUM EMISSIONS DATA AND CALCULATIONS

This section contains maximum emissions data and calculations.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	March 2019	**Permit No.:**	TBD	**Regulated Entity No.:**	RN107697088
Area Name:	SpaceX Texas Launch Site - Rocket Development Testing Program			**Customer Reference No.:**	CN602867657

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(A) POUND**	**(B) TPY**
CONTROL-1	RDTP	Rocket Development Testing Program Control Device	NOx	0.10	0.22
			CO	0.88	1.87
			VOC (Unburned Propane)	0.79	0.14

EPN = Emission Point Number
FIN = Facility Identification Number

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	March 2019	**Permit No.:**	TBD	**Regulated Entity No.:**	RN107697088
Area Name:	SpaceX Texas Launch Site - Rocket Development Testing Program			**Customer Reference No.:**	CN602867657

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA			**EMISSION POINT DISCHARGE PARAMETERS**										
1. Emission Point			**4. UTM Coordinates of Emission Point**			**Source**							
						5. Building	**6. Height Above**	**7. Stack Exit Data**			**8. Fugitives**		
EPN (A)	**FIN (B)**	**Name (C)**	**Zone**	**East (Meters)**	**North (Meters)**	**Height (Ft.)**	**Ground (Ft.)**	**Diameter (Ft.) (A)**	**Velocity (FPS) (B)**	**Temperature (°F) (C)**	**Length (Ft.) (A)**	**Width (Ft.) (B)**	**Axis Degrees (C)**
CONTROL-1	RDTP	Rocket Development Testing Program Control Device	14R	646095.33	3475816.62	N/A	30.0	0.5	722.3	TBD			

EPN = Emission Point Number
FIN = Facility Identification Number

Space Exploration Technologies, Corp.
SpaceX Texas Launch Site

Site: SpaceX Texas Launch Site - Rocket Development Testing Program
EPN: CONTROL-1
Name: Rocket Development Testing Program Control Device

Description:
Operations related the SpaceX Texas Launch Site rocket development testing program involve the assembly and disassembly of aerospace engine components and testing of those components. During development, methane is used to fuel the engine components during testing. Methane vented during storage and fueling of the engine components is routed to a 12-inch x 30-foot single point control device (EPN CONTROL-1). Propane is used as for the igniter gas. Combustion of the methane and propane in the control device results in emissions of carbon monoxide (CO; authorized by this registration), oxides of nitrogen (NOx; authorized by this registration), volatile organic compounds (VOC, unburned propane), and unburned methane (non-VOC; unregulated). The control device is used to voluntarily reduce methane emissions for health and safety purposes and will have an estimated destruction efficiency of 98% or greater.

Operational Data:

Methane Flow Rate (kg/day)[1]	337.80
Hourly Methane Flow Rate (lb/hr)	31.03
Annual Methane Flow Rate (lb/yr)	271,823.03
Propane Ignitor Flow Rate (kg/s)[2]	0.005
Hourly Propane Igniter Flow Rate (lb/hr)	39.68
Annual Propane Igniter Flow Rate (lb/yr)[3]	14,484.35
Control Device Destruction Efficiency (%)[4]	98

1 Provided by Katy Market of SpaceX via e-mail on February 28, 2019.
2 Provided by Katy Market of SpaceX via e-mail on January 23, 2019.
3 Assumes a conservative one hour of ignition time per day.
4 Destruction efficiency will be greater than allowed by BACT for traditional flares meeting 40 CFR 60.18.

Methane, Exhaust Gas, and Propane Properties:

Property	Methane[1]	Propane[1]
Heats of Combustion (BTU/lb)	23,861	21,646

1 Heats of Combustion for methane and propane from Perry's Chemical Engineering Handbook, 6th Edition, Table 3-207.

Flow Rates:

Process	Fuel	Flow Rate[1]			
		(lb/hr)	(MMBtu/hr)[1]	(lb/yr)	(MMBtu/yr)2
Methane Flow Rate	Methane	31.03	0.74	271,823.03	6,485.97
Pilot Propane Flow Rate	Propane	39.68	0.8590	14,484.35	313.53

1 Max Flow Rate (lb/time) = Max Flow Rate (lb/time) x Heat of Combustion (BTU/lb) / 1,000,000 BTU/MMBTU

Emissions Factors:

Pollutant	Emission Factor [1]
	(lb/MMBtu)
NOx	0.0641
CO	0.5496

1 Emission factors from TCEQ Document (RG-360/17), Appendix A - Technical Supplement 4: Flares, Table A-7 for Unassisted, Low BTU flares.

Component Testing Emissions:

Pollutant	Emissions[4]		Distance to Nearest Off-Site Receptor
	(lb/hr)	(tpy)	(ft)
NOx[1]	0.10	0.22	400
CO[1]	0.88	1.87	400
Unburned Propane (VOC)[2]	0.79	0.14	400
Unburned Methane[3]	0.62	2.72	400

1 CO/NOx Emissions (lb/time) = Total Gas Flow Rate (MMBtu/time) x Emissions Factor (lb/MMBtu).
2 Unburned Propane (lb/time) = Propane Flow Rate (lb/time) * (100%-DRE%)
3 Unburned Methane (lb/time) = Methane Flow Rate (lb/time) * (100%-DRE%)
4 There is no sulfur in the methane streams, therefore no SOx emissions. Per AP-42 (Section 13) waste gases containing methane/light hydrocarbons burn without smoke.

PBR Registration 155544 Emissions and Distances (EPN GEN1):

Property	Emissions (lb/hr)	Distance to Nearest Off-Site Receptor (ft)
VOC (NMHC)	0.1299	436
NOx	4.0261	436
CO	1.1689	436
PM/PM10/PM2.5	0.0909	436
SO2	0.0079	436
Benzene	0.0047	436
Toluene	0.0021	436
Xylenes	0.0015	436
1,3-Butadiene	0.0002	436
Formaldehyde	0.0061	436
Acetaldehyde	0.0039	436
Acrolein	0.0005	436
Naphthalene	0.0004	436

7.0 SUPPORTING INFORMATION

This section contains supporting information including Safety Data Sheets

SAFETY DATA SHEET

Methane

Section 1. Identification

GHS product identifier : Methane

Chemical name : methane

Other means of identification : Methane or natural gas; Marsh gas; Methyl hydride; CH4; Fire Damp;

Product use : Synthetic/Analytical chemistry.

Synonym : Methane or natural gas; Marsh gas; Methyl hydride; CH4; Fire Damp;

SDS # : 001033

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Approach suspected leak area with caution.

Prevention : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : methane

Other means of identification : Methane or natural gas; Marsh gas; Methyl hydride; CH4; Fire Damp;

CAS number/other identifiers

CAS number : 74-82-8

Product code : 001033

Ingredient name	%	CAS number
methane	100	74-82-8

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash contaminated skin with soap and water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
methane	Oxygen Depletion [Asphyxiant]

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Molecular weight : 16.05 g/mole

Molecular formula : C-H4

Boiling/condensation point : -161.48°C (-258.7°F)

Melting/freezing point : -187.6°C (-305.7°F)

Critical temperature : -82.45°C (-116.4°F)

Odor : Odorless.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: -188.15°C (-306.7°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 5%
Upper: 15%

Vapor pressure : Not available.

Vapor density : 0.55 (Air = 1) Liquid Density@BP: 26.5 lb/ft3 (424.5 kg/m3)

Specific Volume (ft ^{3}/lb) : 24.3956

Gas Density (lb/ft ^{3}) : 0.040991 (25°C / 77 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.0244 g/l

Partition coefficient: n-octanol/water : 1.09

Auto-ignition temperature : 287°C (548.6°F)

Decomposition temperature : Not available.

SADT : Not available.

Section 9. Physical and chemical properties

Viscosity : Not applicable.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Section 11. Toxicological information

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
methane	1.09	-	low

Mobility in soil

Section 12. Ecological information

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1971	UN1971	UN1971	UN1971	UN1971
UN proper shipping name	Methane, compressed	Methane, compressed or Methane or Natural gas, compressed (with high methane content)	Methane, compressed	Methane, compressed	Methane, compressed
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	-	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2). **Explosive Limit and Limited Quantity Index** 0.125 **ERAP Index** 3000 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** Forbidden	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 0 Forbidden **Cargo Aircraft Only** Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Section 14. Transport information

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act (CAA) 112 regulated flammable substances: methane

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Sudden release of pressure

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
methane	100	Yes.	Yes.	No.	No.	No.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

International lists

National inventory

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : This material is listed or exempted.

Malaysia : This material is listed or exempted.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan : This material is listed or exempted.

Canada

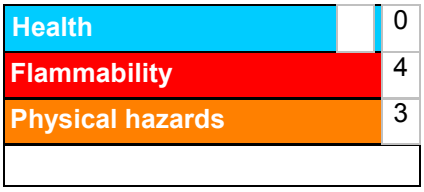
WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
Flam. Gas 1, H220 Press. Gas Comp. Gas, H280	Expert judgment According to package

History

Date of printing : 5/9/2016

Date of issue/Date of revision : 5/9/2016

Date of previous issue : No previous validation

Version : 0.01

Section 16. Other information

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Propane Odorized

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Revision date: 03/17/2015 Supersedes: 07/21/2009

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

1.1. Product identifier

Product form : Mixture

Product name : Propane Odorized

CAS No : 74-98-6

Other means of identification : Liquefied Propane;
Dimethylmethane;
Liquified Petroleum Gas or LPG

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

Use of the substance/mixture : Commercial petroleum industry product.

1.3. Details of the supplier of the safety data sheet

Enterprise Products
1100 Louisiana St.
Rm 23.174
Houston, TX 77002
T 888-806-3794
www.enterpriseproducts.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-824-9300

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Simple Asphy H380
Flam. Gas 1 H220
Liquefied gas H280

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS02 GHS04

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) : H220 - Extremely flammable gas
H280 - Contains gas under pressure; may explode if heated
H380 - May displace oxygen and cause rapid suffocation

Precautionary statements (GHS-US) : P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381 - In case of leaking gas fire, eliminate all ignition sources if safe to do so
P403 - Store in a well-ventilated place
P410+P403 - Protect from sunlight. Store in a well-ventilated place

2.3. Other hazards

Other hazards not contributing to the classification : Radon-222 may be present in a neglible amount (see Section 16 for more information concerning radioactivity).

2.4. Unknown acute toxicity (GHS-US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product identifier	%	Classification (GHS-US)
Propane	(CAS No) 74-98-6	>= 90	Simple Asphy, H380 Flam. Gas 1, H220 Compressed gas, H280
Ethane	(CAS No) 74-84-0	< 6	Flam. Gas 1, H220 Compressed gas, H280
Isobutane	(CAS No) 75-28-5	< 2.5	Simple Asphy, H380 Flam. Gas 1, H220
Propylene	(CAS No) 115-07-1	< 5	Flam. Gas 1, H220 Compressed gas, H280
Ethyl Mercaptan	(CAS No) 75-08-1	< 0.1	Flam. Liq. 2, H225 Acute Tox. 4 (Oral), H302 Acute Tox. 4 (Inhalation), H332 Aquatic Acute 1, H400 Aquatic Chronic 1, H410

Full text of H-phrases: see section 16

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

First-aid measures after inhalation : Call 911 or emergency medical service. If not breathing, give artificial respiration. If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

First-aid measures after skin contact : In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing. Obtain medical assistance.

First-aid measures after eye contact : Seek medical attention immediately. Contact with the liquid may cause frostbite and serious damage to eyes. Irrigate copiously with clean, fresh water for at least 15 minutes, holding the eyelids apart.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Vomiting: prevent asphyxia/aspiration pneumonia. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Asphyxiation. Freeze burns.

Symptoms/injuries after inhalation : Cough. Shortness of breath. Vapors may cause dizziness or suffocation. Some may be irritating if inhaled at high concentrations.

Symptoms/injuries after skin contact : May cause frostbite.

Symptoms/injuries after eye contact : May cause frostbite.

Symptoms/injuries after ingestion : This product is a compressed gas; hence oral exposure and resulting acute toxity are unlikely.

Chronic symptoms : Inhalation may produce mild intoxication, drowsiness, or loss of coordination. High concentrations produce intoxication followed by loss of consciousness, asphyxiation, and death. Caution is recommended for personnel with pre-existing central nervous system disorders. Personnel with pre-existing chronic respiratory diseases should refrain from breathing this material.

4.3. Indication of any immediate medical attention and special treatment needed

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias (irregular beating) in persons exposed to this material.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Small Fire: Dry Chemical or CO_2. Large Fire: Water spray or fog.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard : EXTREMELY FLAMMABLE. Will be easily ignited by heat, sparks or flames. Vapors from liquefied gas are initially heavier than air and spread along ground. Vapors may travel to source of ignition and flash back. Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.

Explosion hazard : May form flammable/explosive vapor-air mixture. Containers may explode when heated. Ruptured cylinders may rocket.

5.3. Advice for firefighters

Firefighting instructions : Move containers from fire area if you can do it without risk. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Protection during firefighting : Wear positive pressure self-contained breathing apparatus (SCBA).Structural firefighters' protective clothing will only provide limited protection. Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED. Remove ignition sources. Evacuate area.

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.

Emergency procedures : Ventilate area. As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas.

6.2. Environmental precautions

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

6.3. Methods and material for containment and cleaning up

For containment : ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Stop leak if you can do it without risk. Do not walk through spilled material. If possible, turn leaking containers so that gas escapes rather than liquid. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled.

Methods for cleaning up : All equipment used when handling the product must be grounded. Prevent entry into waterways, sewers, basements or confined areas. Isolate area until gas has dispersed.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Handle empty containers with care because residual vapors are flammable. Flammable gas. Hazardous waste due to potential risk of explosion.

Precautions for safe handling : Use only with adequate ventilation. Wear appropriate personal protective equipment and use exposure controls. Avoid all contact with skin and eyes. Avoid breathing product dust or vapors. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Do not reuse container. Remove contaminated clothing immediately. Wash with soap and water after working with this product.

Hygiene measures : Contaminated work clothing should not be allowed out of the workplace. Do not eat, drink or smoke when using this product. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Proper grounding procedures to avoid static electricity should be followed.

Storage conditions : Keep only in the original container in a cool, well ventilated place away from: all heat sources, direct sunlight, where freezing is possible, incompatible materials, and away from oxygen cylinders or other oxidizers by a minimum distance of 20 feet, or by a barrier of non-combustible material at least 5 feet high having a fire rating of at least 1/2 hour. Store in the original container or an approved alternative made from compatible material. Do not store in unlabelled containers. Treat empty containers in a similar fashion as residual product may exist. Keep container closed when not in use. Keep in fireproof place.

Incompatible products : Strong bases. Strong acids.

Incompatible materials : Sources of ignition. Direct sunlight. Heat sources.

Storage temperature : <= 50 °C (Based on Propane content)

Storage area : Store in a well-ventilated place.

7.3. Specific end use(s)

Commercial petroleum industry product.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Propane (74-98-6)		
ACGIH	ACGIH TWA (ppm)	0.50 ppm
ACGIH	Remark (ACGIH)	URT irr; CNS impair
OSHA	OSHA PEL (TWA) (mg/m³)	1800 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	1000 ppm
OSHA	OSHA PEL (Ceiling) (mg/m³)	25 mg/m³
OSHA	OSHA PEL (Ceiling) (ppm)	10 ppm

Propane (74-98-6)		
ACGIH	ACGIH TWA (mg/m³)	4508 mg/m³
ACGIH	ACGIH TWA (ppm)	2500 ppm
ACGIH	Remark (ACGIH)	Asphyxiant; CNS effects; Explosive
OSHA	OSHA PEL (TWA) (mg/m³)	1800 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	1000 ppm

Ethane (74-84-0)		
ACGIH	ACGIH TWA (ppm)	Formerly 1000 ppm Based on Aliphatic hydrocarbon gases, Alkanes [C1-C4] ; Refer to Appendix F : Minimal Oxygen Content of the 2014 TLV Book
ACGIH	Remark (ACGIH)	Simple Asphyxiant if Oxygen level is 18% by volume; Explosive
OSHA	Not applicable	

Propylene (115-07-1)		
ACGIH	ACGIH TWA (mg/m³)	860 mg/m³
ACGIH	ACGIH TWA (ppm)	500 ppm
ACGIH	Remark (ACGIH)	Asphyxia; URT irr
OSHA	Not applicable	

Isobutane (75-28-5)		
ACGIH	ACGIH STEL (ppm)	1000 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	none

Ethyl Mercaptan (75-08-1)		
ACGIH	ACGIH TWA (ppm)	0.50 ppm
ACGIH	Remark (ACGIH)	URT irr; CNS impair
OSHA	OSHA PEL (Ceiling) (mg/m³)	25 mg/m³
OSHA	OSHA PEL (Ceiling) (ppm)	10 ppm

8.2. Exposure controls

Appropriate engineering controls : Provide adequate general and local exhaust ventilation. Ensure exposure is below occupational exposure limits (where available).

Personal protective equipment : Avoid all unnecessary exposure.

Materials for protective clothing : Nitrile.

Hand protection : Wear chemically resistant protective gloves.

Eye protection : Employees should be provided with and required to use splash-proof safety goggles and splash shields where there is any possibility of product coming in contact with the eyes. Ensure that an eye wash station is operable and nearby.

Skin and body protection	: Wear fire resistant clothing (FRC).
Respiratory protection	: Depending on airborne concentration, a full-face supplied air respirator is recommended because air purifying respirators cannot provide adequate protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Gas
Color	: Colorless gas or liquified gas
Odor	: Distinct skunk-like odor
Odor threshold	: Not Established Not Established
pH	: Not Applicable
Relative evaporation rate (butyl acetate=1)	: Not Established
Relative evaporation rate (ether=1)	: Not Established
Melting point	: Not Established
Freezing point	: -305 °C (-517°F)
Boiling point	: -44 °C (-47°F)
Flash point	: -160 °C (-256°F)
Auto-ignition temperature	: 449 °C (840°F)
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapor pressure	: 208 psig max @ 100ºF
Relative vapor density at 20 °C	: 1.5 at 101 kPa
Relative density	: No data available
Specific gravity / density	: 0.51 at 40 °F
Solubility	: Insoluble.
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: Vapors may form explosive mixtures with air.
Oxidizing properties	: No data available
Explosive limits	: 2 - 9.5 vol %

9.2. Other information

Gas group	: Liquefied gas

SECTION 10: Stability and reactivity

10.1. Reactivity

Not reactive under normal use and conditions.

10.2. Chemical stability

This product is anticipated to be stable under normal ambient storage and handling conditions of temperature and pressure.

10.3. Possibility of hazardous reactions

Hazardoes polymerization will not occur.

10.4. Conditions to avoid

Air contact. Heat, sparks, open flame, and other ignition sources.

10.5. Incompatible materials

Oxidizing agent. chlorine. fluorine. bromine and metal catalysts.

10.6. Hazardous decomposition products

Products of thermal decomposition include sulfur oxides, carbon oxides and nitrogen oxides.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Propane (\f)74-98-6	
LD50 oral rat	NE
LD50 dermal rabbit	NE
LC50 inhalation rat (mg/l)	658 mg/l/4h
ATE US (vapors)	658.000 mg/l/4h
ATE US (dust, mist)	658.000 mg/l/4h
Additional information	This product is non-toxic and is a simple asphyxiant; however, it does have slight anaesthetic properties and higher concentrations may cause dizziness.

Ethane (74-84-0)	
Additional information	From a toxicologic standpoint, methane and ethane are of low anaesthetic potency and are practically inert; however, at very high concentrations, they act as a simple asphyxiant and can cause suffocation by displacement of oxygen from breathing atmosphere, below the critical level of 16% oxygen that is required to sustain life.

Propylene (115-07-1)	
ATE US (vapors)	86000.000 mg/l/4h

Isobutane (75-28-5)	
LC50 inhalation rat (ppm)	570000 ppm
ATE US (vapors)	658.000 mg/l/4h

Ethyl Mercaptan (75-08-1)	
LD50 oral rat	682 mg/kg American Industrial Hygiene Association Journal. Vol. 19, Pg. 171, 1958.
LC50 inhalation rat (ppm)	4420 ppm/4h American Industrial Hygiene Association Journal. Vol. 19, Pg. 171, 1958.
ATE US (oral)	682.000 mg/kg body weight
ATE US (gases)	4420.000 ppmV/4h
ATE US (vapors)	11.200 mg/l/4h
ATE US (dust, mist)	1.500 mg/l/4h

Skin corrosion/irritation : Not classified
pH: Not Applicable

Serious eye damage/irritation : Not classified
pH: Not Applicable

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified
(This product is not listed as a carcinogen by NTP, OSHA, or IARC.)

Propylene (115-07-1)	
IARC group	3 - Not classifiable

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Propane (74-98-6)	
Additional information	Exposure may have adverse health effects.

Specific target organ toxicity (repeated exposure) : Not classified

Propane (74-98-6)	
Additional information	Repeated exposure may cause frostbite injuries, respiratory, and central nervous system effects, depending on routes of exposure.

Aspiration hazard	:	Not classified
Symptoms/injuries after inhalation	:	Cough. Shortness of breath. Vapors may cause dizziness or suffocation. Some may be irritating if inhaled at high concentrations.
Symptoms/injuries after skin contact	:	May cause frostbite.
Symptoms/injuries after eye contact	:	May cause frostbite.
Symptoms/injuries after ingestion	:	This product is a compressed gas; hence oral exposure and resulting acute toxicity are unlikely.
Chronic symptoms	:	Inhalation may produce mild intoxication, drowsiness, or loss of coordination. High concentrations produce intoxication followed by loss of consciousness, asphyxiation, and death. Caution is recommended for personnel with pre-existing central nervous system disorders. Personnel with pre-existing chronic respiratory diseases should refrain from breathing this material.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	:	This product has no known eco-toxicological effects.
Ecology - water	:	This product is not expected to be harmful to aquatic life.

12.2. Persistence and degradability

Propane (74-98-6)	
Persistence and degradability	Readily biodegradable.

12.3. Bioaccumulative potential

Propane (74-98-6)	
Bioconcentration factor (BCF REACH)	log BCF is about 1.56-1.78; therefore the product is not expected to accumulate.
Bioaccumulative potential	No ecological damage caused by this product.

Propane (74-98-6)	
Log Pow	2.3

12.4. Mobility in soil

Ethane (74-84-0)	
Mobility in soil	If released to soil, ethane is expected to have very high mobility based upon an estimated Koc of 37.

12.5. Other adverse effects

Effect on the global warming	:	No known ecological damage caused by this product.
Other information	:	Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations	:	It is recommended that this product, in any form, be incinerated in a suitable combustion chamber for disposal. Empty containers should be disposed of in a similar fashion due to presence of product residue. Follow applicable Federal, state and local regulations.
Additional information	:	Handle empty containers with care because residual vapors are flammable. Hazardous waste due to potential risk of explosion.
Ecology - waste materials	:	Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

Transport document description	:	UN1075 Petroleum gases, liquefied or Liquefied petroleum gas, 2.1
UN-No.(DOT)	:	UN1075
Proper Shipping Name (DOT)	:	Petroleum gases, liquefied or Liquefied petroleum gas
Department of Transportation (DOT) Hazard Classes	:	2.1 - Class 2.1 - Flammable gas 49 CFR 173.115

Hazard labels (DOT)	:	2.1 - Flammable gas

DOT Special Provisions (49 CFR 172.102)	:	19 - For domestic transportation only, the identification number UN1978 may be used in place of the identification number specified in column (4) of the 172.101 table. The identification number used must be consistent on package markings, shipping papers and emergency response information. T50 - When portable tank instruction T50 is referenced in Column (7) of the 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 173.313 of this subchapter.
DOT Packaging Exceptions (49 CFR 173.xxx)	:	306
DOT Packaging Non Bulk (49 CFR 173.xxx)	:	304
DOT Packaging Bulk (49 CFR 173.xxx)	:	314;315
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	:	Forbidden
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	:	150 kg
DOT Vessel Stowage Location	:	E - The material may be stowed ''on deck'' or ''under deck'' on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length, but is prohibited from carriage on passenger vessels in which the limiting number of passengers is exceeded.
DOT Vessel Stowage Other	:	40 - Stow ''clear of living quarters''
Marine pollutant	:	Not Listed

Additional information

Emergency Response Guide (ERG) Number : 115

ADR

No additional information available

Transport by sea

No additional information available

Air transport

Class (IATA) : 2.1 - Gases : Flammable

SECTION 15: Regulatory information

15.1. US Federal regulations

Propane (74-98-6)	
EPA TSCA Regulatory Flag	This product is listed on the TSCA inventory or otherwise complies with TSCA pre-manufacture notification requirements
SARA Section 311/312 Hazard Classes	Fire hazard Immediate (acute) health hazard Sudden release of pressure hazard
Not listed on the United States SARA Section 313	

Ethane (74-84-0)
Listed on the United States TSCA (Toxic Substances Control Act) inventory Not listed on the United States SARA Section 313

Propylene (115-07-1)
Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on United States SARA Section 313

Isobutane (75-28-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory Not listed on the United States SARA Section 313

Ethyl Mercaptan (75-08-1)
Listed on the United States TSCA (Toxic Substances Control Act) inventory Not listed on the United States SARA Section 313

15.2. International regulations

CANADA

No additional information available

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC [DSD] or 1999/45/EC [DPD]

F+; R12

Full text of R-phrases: see section 16

15.2.2. National regulations

15.3. US State regulations

Propane(74-98-6)	
State or local regulations	U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities U.S. - Idaho - Occupational Exposure Limits - TWAs U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1 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 - Right To Know List U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2 U.S. - Michigan - Occupational Exposure Limits - TWAs U.S. - Minnesota - Hazardous Substance List U.S. - Minnesota - Permissible Exposure Limits - TWAs U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances U.S. - New Jersey - Environmental Hazardous Substances List 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 - Occupational Exposure Limits - TWAs U.S. - Ohio - Accidental Release Prevention - Threshold Quantities U.S. - Oregon - Permissible Exposure Limits - TWAs U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Tennessee - Occupational Exposure Limits - TWAs U.S. - Texas - Effects Screening Levels - Long Term U.S. - Texas - Effects Screening Levels - Short Term U.S. - Vermont - Permissible Exposure Limits - TWAs U.S. - Washington - Permissible Exposure Limits - TWAs U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr) U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)

Ethane (74-84-0)
U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

Propylene (115-07-1)
U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

Isobutane (75-28-5)
U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

Ethyl Mercaptan (75-08-1)
U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations
U.S. - New Jersey - Right to Know Hazardous Substance List
U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)
U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances

SECTION 16: Other information

Revision date : 03/17/2015

Data sources : ChemADVISOR, Inc.[https://www.chemadvisor.com].

Other information : Potential for radon daughter buildup within processing systems, whatever the source of product streams. During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma radiation to drop to background levels. Protective equipment should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination, ingestion, or inhalation.

Full text of H-phrases:

Acute Tox. 4 (Inhalation)	Acute toxicity (inhalation) 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 1	Hazardous to the aquatic environment - Chronic Hazard Category 1
Compressed gas	Gases under pressure Compressed gas
Flam. Gas 1	Flammable gases Category 1
Flam. Liq. 2	Flammable liquids Category 2
Liquefied gas	Gases under pressure Liquefied gas
Simple Asphy	Simple Asphyxiant
H220	Extremely flammable gas
H225	Highly flammable liquid and vapor
H280	Contains gas under pressure; may explode if heated
H302	Harmful if swallowed
H332	Harmful if inhaled
H380	May displace oxygen and cause rapid suffocation
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

NFPA health hazard : 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.

NFPA fire hazard : 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.

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

HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible

Flammability : 4 Severe Hazard

Physical : 0 Minimal Hazard

Personal Protection : H

SDS US (GHS HazCom 2012)

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

Design Results and Summary

AEREON

Quote No.: 18-11015 **Customer:** Space Exploration Technologies **Location:** Kennedy Space Center, USA
Description: 43.2 MMSCFD - DU-12 x 30ft Flare System **Prepared by:** LAM
Date: 7/6/2018

AMBIENT CONDITIONS	USCS	SI
Ambient Temperature*:	96.8 °F	36 °C
Wind Speed (Radiation Only):	20.0 mph	32.2 km/hr
Solar Radiation:	250.0 Btu/ft^2-hr	788.6 W/m^2

*Used only in Brzustowski's Radiation Calculation Method.

INPUT PARAMETERS		
Molecular Weight:	16.04	16.04
Max. Volumetric Flow Rate*:	43.20 MMSCFD	1223310.87 m^3/day
Max. Mass Flow Rate:	76173.57 lbs/hr	34551.79 kg/hr
Inlet Gas Temperature:	60.0 °F	15.6 °C
Total Heat Release:	1.64E+09 Btu/Hr	4.80E+05 kW

*Volumetric flow rate is considered at standard conditions.

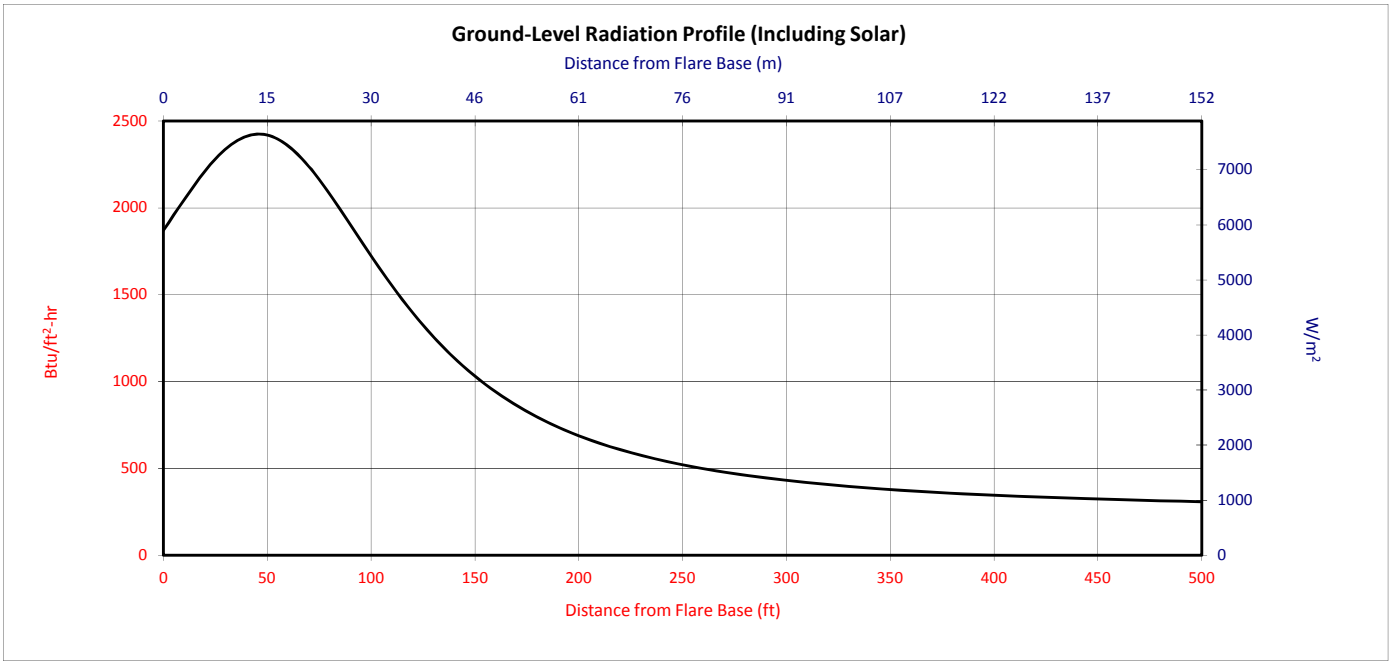
FLARE TIP CALCULATIONS		
Proposed Flare Tip:	**DU-12 Utility Flare**	
Flare Tip Diameter:	12.0 in	304.8 mm
Exit Velocity:	722.3 ft/sec	220.1 m/sec
Pressure Drop of Tip & Seal:	3.00 psi	20.71 kPa

FLARE RISER CALCULATIONS		
Minimum Flare Height:	30.0 Ft	9.1 m
Pressure Drop of Inlet and Riser:	0.48 psi	3.33 kPa
Total Pressure Drop of Flare Riser and Tip**:	3.49 psi	24.04 kPa

**Includes predicted inlet losses.

RADIATION RESULTS		
Maximum Radiation at Grade***:	2418.3 Btu/ft^2-hr	7628.7 W/m^2
Solar Radiation Considered:	250.0 Btu/ft^2-hr	788.6 W/m^2
Distance to Maximum Radiation:	50.0 ft	15.2 m

***Maximum Radiation includes solar radiation.



Pressure/Flow Rate Modeling

AEREON

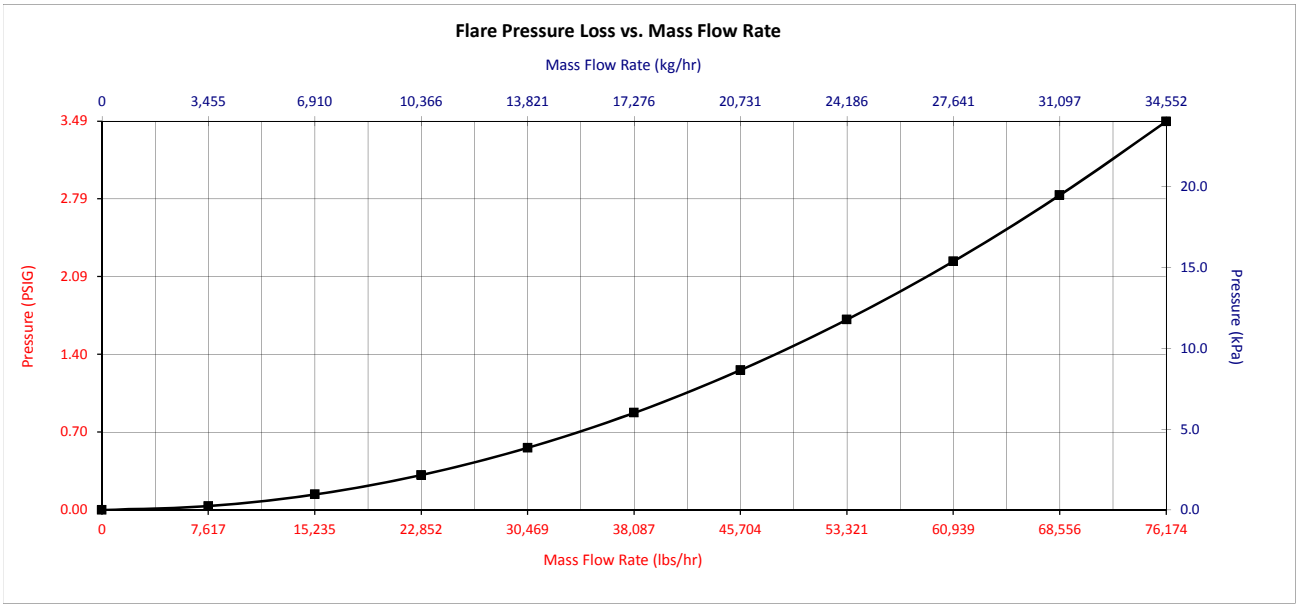
Quote No.:	18-11015	**Customer:**	Space Exploration Technologies	**Location:**	Kennedy Space Center, USA
Description:	43.2 MMSCFD - DU-12 x 30ft Flare System			**Prepared by:**	LAM
				Date:	7/6/2018

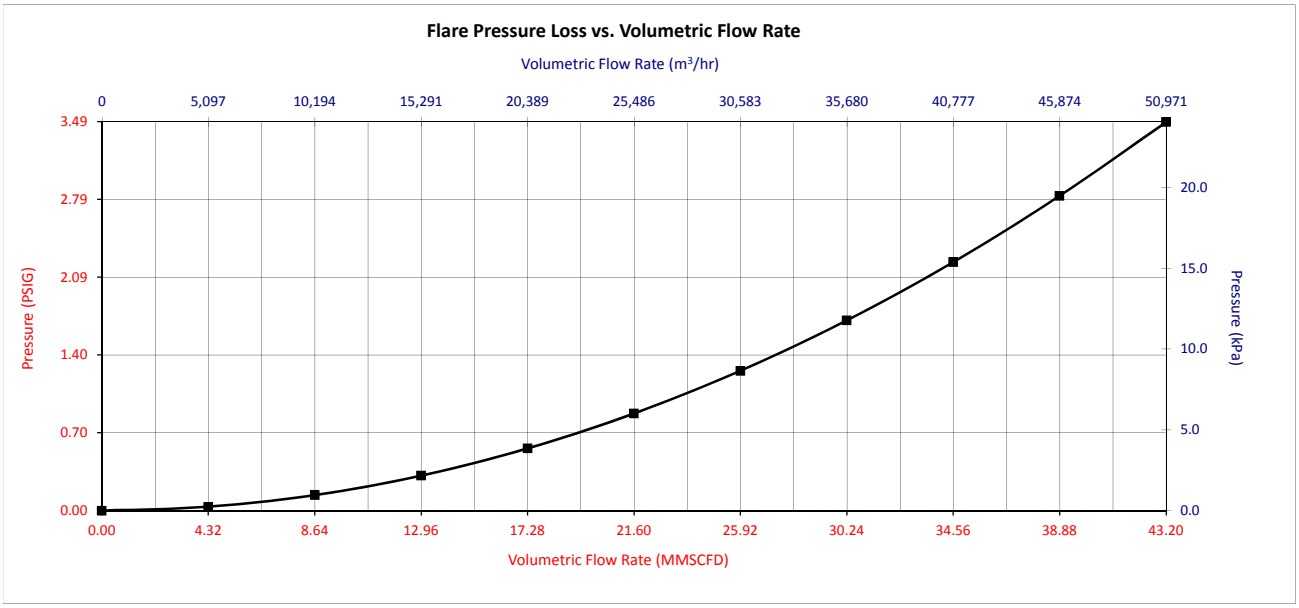
INPUT PARAMETERS	**USCS**	**SI**
Molecular Weight:	16.04	16.04
Max. Volumetric Flow Rate*:	43.20 MMSCFD	1223310.87 m^3/day
Max. Mass Flow Rate:	76173.57 lbs/hr	34551.79 kg/hr
Inlet Gas Temperature:	60.0 °F	15.6 °C

*Volumetric flow rate is considered at standard conditions.

PRESSURE CALCULATIONS	**DU-12 Utility Flare**	
Total Pressure Drop of Flare Riser and Tip**:	3.49 psi	24.04 kPa
Total Pressure Drop of Liquid Seal:	0.00 psi	0.00 kPa
Total Pressure Drop of Integral Knockout Drum:	0.00 psi	0.00 kPa
Total Pressure Drop of Flame Arrestor:	0.00 psi	0.00 kPa
Total Pressure Drop of Flare System:	3.49 psi	24.04 kPa

Flare system pressure drop excludes separators, liquid seals, and flame arrestors.





Noise Analysis

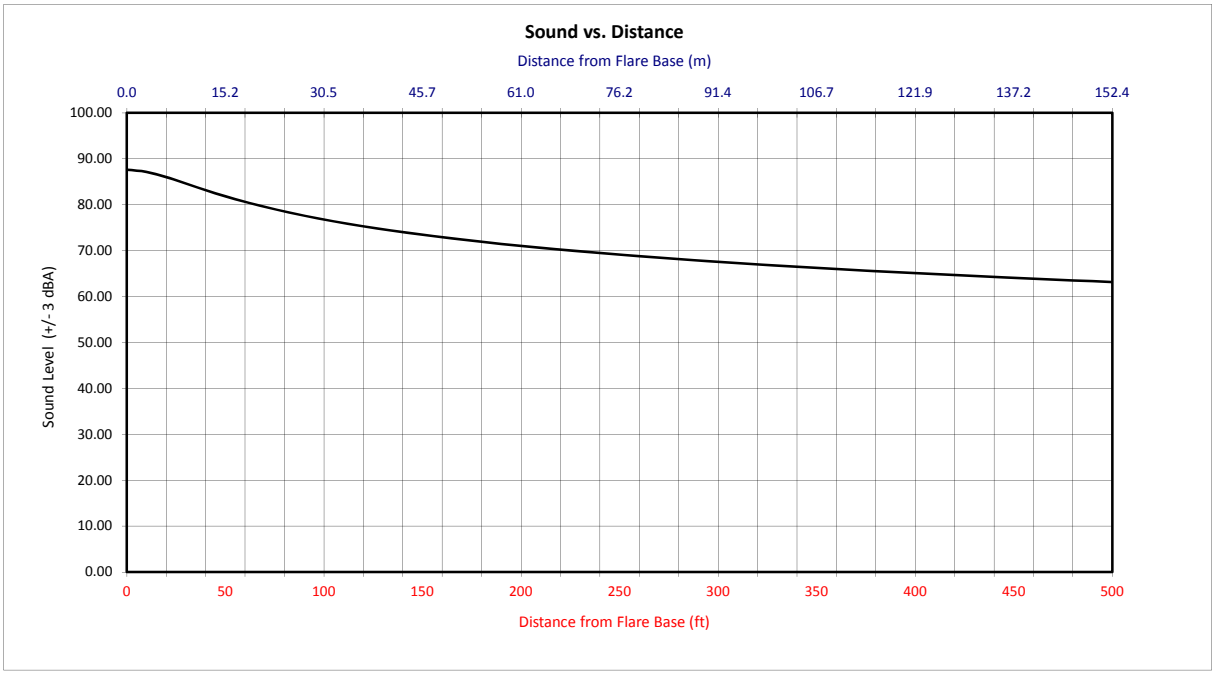
Quote No.: 18-11015 **Customer:** Space Exploration Technologies **Location:** Kennedy Space Center, USA
Description: 43.2 MMSCFD - DU-12 x 30ft Flare System **Prepared by:** LAM
Date: 7/6/2018

INPUT PARAMETERS	USCS		SI	
Molecular Weight:	16.04		16.04	
Max. Volumetric Flow Rate*:	43.20	MMSCFD	1223310.87	m^3/day
Max. Mass Flow Rate:	76173.57	lbs/hr	34551.79	kg/hr
Inlet Gas Temperature:	60.0	°F	15.6	°C

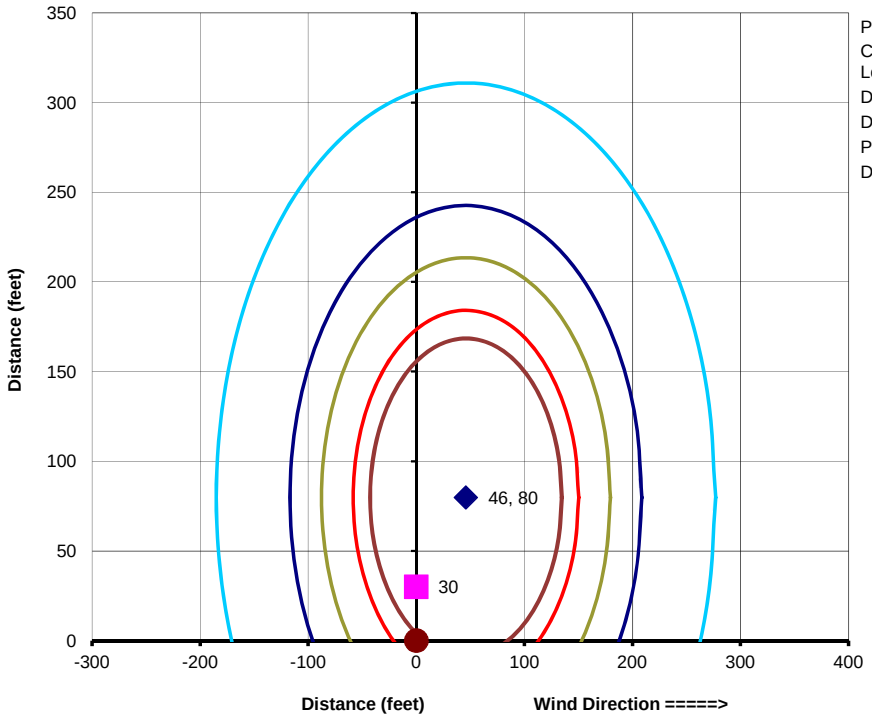
*Volumetric flow rate is considered at standard conditions.

FLARE TIP CALCULATIONS

Proposed Flare Tip:	DU-12 Utility Flare		
Flare Tip Diameter:	12.0	in	304.8 mm
Exit Velocity:	722.3	ft/sec	220.1 m/sec
Maximum Sound Level:	87.6	dB (A)	



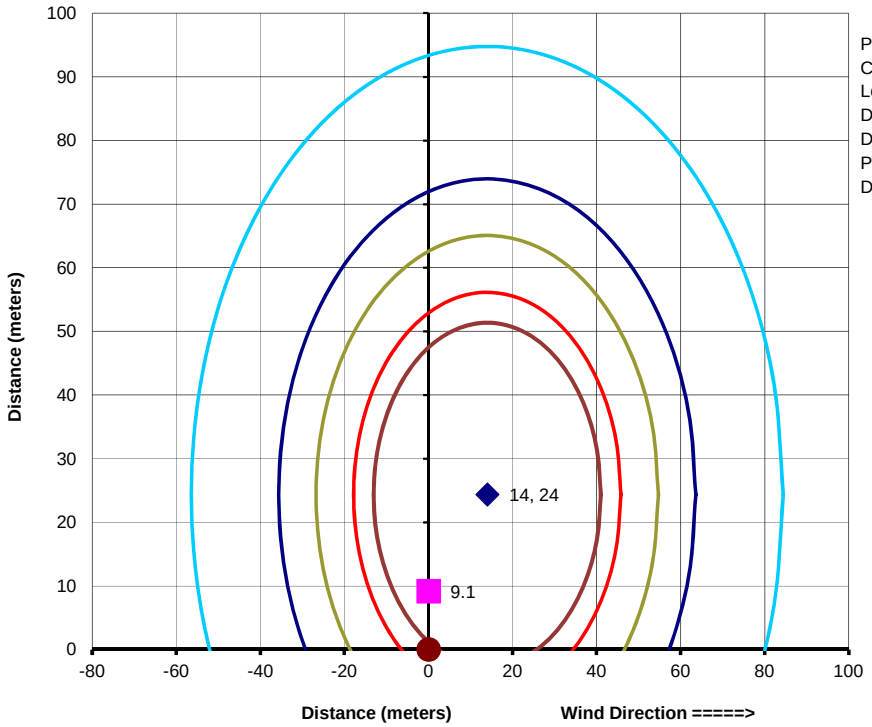
RADIATION ISOPLETH - Elevation View Relative to Flare Tip (Fixed Wind Direction)



Project # / Quote #:	18-11015
Customer Name:	Space Exploration Technologi
Location:	Kennedy Space Center, USA
Description:	43.2 MMSCFD - DU-12 x 30ft
Description:	Flare System
Prepared By:	LAM
Date:	7/6/2018

Wind Speed:	20 mph
Solar Radiation:	250 Btu/ft^2-hr

RADIATION ISOPLETH - Elevation View Relative to Flare Tip (Fixed Wind Direction)



Project # / Quote #:	18-11015
Customer Name:	Space Exploration Technologi
Location:	Kennedy Space Center, USA
Description:	43.2 MMSCFD - DU-12 x 30ft
Description:	Flare System
Prepared By:	LAM
Date:	7/6/2018

Wind Speed:	8.94 m/s
Solar Radiation:	0.789 kW/m^2