air pollution control district
SANTA BARBARA COUNTY

**DRAFT**

# Authority to Construct 15795



EQUIPMENT OWNER:

United Launch Alliance, L.L.C

EQUIPMENT OPERATOR:

United Launch Alliance, L.L.C

EQUIPMENT LOCATION:

Vandenberg Space Force Base, Vandenberg SFB

STATIONARY SOURCE/FACILITY:

United Launch Alliance — SSID: 11166
United Launch Alliance - SLC 3 — FID: 00206

AUTHORIZED MODIFICATION:

This permit authorizes installation of a liquefied natural gas (LNG) storage vessel, two elevated flares, a thermal oxidizer, and associated equipment for the Vulcan Centaur Program, launching up to [redacted] times per year.

EQUIPMENT DESCRIPTION:

The equipment subject to this permit is listed in the table at the end of this permit.

PROJECT/PROCESS DESCRIPTION:

The Vulcan Centaur V vehicle will be launched from Space Launch Complex 3 (SLC 3) on Vandenberg Space Force Base (VSFB) up to [redacted] times per year. Aborted launches (aborts) and wet dress rehearsals may also occur up to [redacted] times per year. A [redacted] LNG storage vessel and [redacted] piping will be installed to fuel the vehicle. LNG collected during the chill down of [redacted] piping and engines will be collected in a knockdown vessel, then converted to gas using vaporizers. This natural gas and fugitive LNG losses, known as boiloff, will

be combusted in elevated flares and a thermal oxidizer. One elevated flare, called the vehicle launch elevated flare (Device ID #398749), is dedicated to combusting LNG losses from the launch vehicle during launches, wet dress rehearsals, and aborts, as well as vehicle venting during depressurization. A second elevated flare, called the ground system elevated flare (Device ID #398750), is dedicated to combusting LNG losses from the storage vessel when pressure is reduced and from knockdown vessel boiloff. A thermal oxidizer (Device ID #398751) is dedicated to combusting LNG due to boiloff from the storage vessel, as well as during truck offloading and sampling events. The ground system elevated flare is also permitted to operate up to 240 hours per year combusting storage vessel boiloff, up to [redacted] truck offloading events per year, and up to [redacted] sampling events per year as a contingency when the thermal oxidizer is offline. [redacted] LNG offload stations will be constructed to provide tanker truck access to fill the storage vessel, which will occur no more than [redacted] times per day and [redacted] times per year.

CONDITIONS:

1. **Emission Limitations.** The mass emissions from the equipment permitted herein shall not exceed the values listed in Table 1. Compliance shall be based on the operational, monitoring, recordkeeping, reporting and source testing conditions of this permit. In addition, the following specific emission limits apply:

   a. *Elevated Flares (Device IDs #398749, 398750).*

      i. Reactive Organic Compound (ROC) Emission Limits and Control Requirements: The elevated flares shall reduce emissions of ROC by 98% (mass basis). Compliance with this condition shall be based on the operational, monitoring, recordkeeping and reporting requirements of this permit.

   b. *Thermal Oxidizer (Device ID #398751).*

      i. Oxides of Nitrogen ($NO_x$) Emission Limits: Emissions of $NO_x$ (as $NO_2$) from the thermal oxidizer shall not exceed a stack concentration of 15 ppmvd at 3% $O_2$ (as hexane) and a stack emission rate of 0.0183 lb/MMBtu. Compliance with this condition shall be based on the source testing condition of this permit.

      ii. Reactive Organic Compound (ROC) Emission Limits: Emissions of ROC from the thermal oxidizer shall not exceed a stack concentration of 10 ppmvd at 3% $O_2$ (as hexane) and a stack emission rate of 0.0042 lb/MMBtu. Compliance with this condition shall be based on the source testing condition of this permit.

      iii. Carbon Monoxide (CO) Emission Limits: Emissions of CO from the thermal oxidizer shall not exceed a stack concentration of 10 ppmvd at 3% $O_2$ (as hexane)

and a stack emission rate of 0.0074 lb/MMBtu. Compliance with this condition shall be based on the source testing condition of this permit.

iv. Particulate Matter (PM) Emission Limits: Emissions of PM from the thermal oxidizer shall not exceed a stack emission rate of 0.0077 lb/MMBtu. Compliance with this condition shall be based on the source testing condition of this permit.

2. **Operational Restrictions.** The equipment permitted herein is subject to the following operational restrictions:

a. *Fuel Type Limit:* Each elevated flare and the thermal oxidizer shall combust only natural gas with an ROC content equal to or less than 1% by weight.

b. *Operational Temperature:* Each elevated flare and the thermal oxidizer shall operate at a minimum temperature of 1700°F, or an alternative minimum temperature as established during the SCDP. The minimum temperature is not required to be achieved during startup and shutdown periods, which shall not exceed a time period established during the SCDP.

c. *Combustion Device Features:* Each elevated flare and the thermal oxidizer shall be equipped with a thermocouple, air assist blower, automatic damper, automatic shutdown device, and flame arrester.

d. *Combustion Device Downtime:* Each elevated flare and the thermal oxidizer shall be operating at all times when combustible gases are routed through that device.

e. *Heat Input Limits:* The daily and annual LNG heat input to the flares and the thermal oxidizer shall not exceed the limits in the table below. These limits are based on assumptions in the emissions calculations provided by the applicant. Compliance with the heat input limits shall be based on the equations in Section 2.6 of the Permit Evaluation.

| Device | Daily Heat Input (MMBtu/day) | Annual Heat Input (MMBtu/year) |
|---|---|---|
| Elevated Flares (Device IDs #398749, 398750) combined limits | 3,129.9 | 28,121.3 |
| Thermal Oxidizer (Device ID #398751) | 516.4 | 26,958.5 |

f. *Thermal Oxidizer Contingency:* Except during launch activities[1], the thermal oxidizer (Device ID #398751) shall be offline for no more than 240 hours per year, during which any combustible gases shall be routed to the ground system elevated flare (Device ID #398750).

g. *Truck Offloading:*

i. A maximum total of 17,280 pounds of LNG may be offloaded from delivery trucks on a daily basis.

ii. A maximum total of 228,960 pounds of LNG may be offloaded from delivery trucks on an annual basis.

iii. On an annual basis, no more than 21,600 pounds of LNG may be offloaded while the thermal oxidizer (Device ID #398751) is offline.

iv. Offloading shall not occur on the same day as a launch, abort, or wet dress rehearsal.

h. *LNG Sampling:*

i. Sampling of LNG shall occur no more than [redacted] times per year and [redacted] times per day.

ii. LNG sampling while the thermal oxidizer (Device ID #398751) is offline shall occur no more than [redacted] times per year.

iii. LNG sampling shall not occur on the same day as a launch, abort, or wet dress rehearsal.

i. *Launch Activity:* The vehicle launch activities listed below shall only occur when both elevated flares are operational. Vehicle launch activities are: fueling of the vehicle's tank, de-pressurization of the vehicle tank, launch countdown (during which vehicle tank boiloff is routed to the elevated flares), and system chill down.

3. **Monitoring.** The equipment permitted herein is subject to the following monitoring requirements:

[1] The thermal oxidizer does not operate during launch activities, as the elevated flares handle all LNG combustion during these operations.

a. *Fuel Deliveries:* For each fuel delivery, the permittee shall monitor the total volume of LNG delivered as measured by the supplier using liquid flow meters, as well as the date, start time and end time of each delivery. Additionally, the permittee shall monitor whether each fuel delivery occurs while the thermal oxidizer (Device ID #398751) is online or offline.

b. *Combustion Device Flame:* The presence of a flame in each elevated flare and the thermal oxidizer shall be continuously monitored by a thermocouple.

c. *Combustion Device Operational Temperature:* The combustion temperature data for each elevated flare and the thermal oxidizer shall be monitored at least every fifteen minutes with a District-approved thermocouple, which has an accuracy of plus or minus (±) 1 percent of the temperature being measured expressed in degrees Celsius or Fahrenheit and equipped with an electronic or other District-approved data recorder. This equipment shall be installed, calibrated, maintained, and operated according to the manufacturer's specifications.

d. *Calibration and Maintenance Logs:* Calibration and maintenance of the monitoring devices, including the results of each calibration, shall be monitored for each elevated flare and the thermal oxidizer.

e. *Hours of Operation:* The permittee shall monitor the daily and annual hours of operations for each of the elevated flares and the thermal oxidizer.

f. *Thermal Oxidizer Downtime:* The permittee shall monitor the dates and number of hours per year that the thermal oxidizer (Device ID #398751) is offline.

g. *Storage Vessel Fuel Level:* The fuel level in the storage vessel shall be continuously monitored [redacted]

h. *Launch Vehicle Fly-Away Volume:* During each launch, the permittee shall monitor the minimum amount of LNG contained in the launch vehicle that is not combusted in the elevated flares (i.e., the fly-away volume) [redacted] on the vehicle.

i. *Launches/Aborts/Wet Dress Rehearsals:* The permittee shall monitor the number of launches, aborts, and wet dress rehearsals each year, and the date and time during which each launch/abort/wet dress rehearsal occurs.

j. *LNG Sampling:* The permittee shall monitor the number of times an LNG sample is taken per year, the date and time during which each sample is taken, and the volume of each sample. Additionally, the permittee shall monitor whether each sampling event occurs while the thermal oxidizer (Device ID #398751) is online or offline.

k. *Leak Testing:* Each connection shall be leak tested prior to first use and after each modification, in accordance with site maintenance and launch operating procedures. Leak test procedures shall be maintained on-site at SLC 3 and made available to the District upon request.

l. *Source Testing*: The permittee shall perform source testing of the emissions and process parameters listed in Table 2. The permittee shall adhere to the requirements of Condition 7.

4. **Recordkeeping.** All records and logs required by this permit and any applicable District, state or federal rule or regulation shall be maintained for a minimum of five calendar years from the date of information collection. The following records shall be maintained by the permittee and shall be made available to the District upon request:

a. *Fuel Deliveries:* For each fuel delivery, the total volume of LNG delivered (in gallons), date and start/end time of delivery, and whether the delivery occurred while the thermal oxidizer (Device ID #398751) was online or offline. The total volume of LNG delivered shall be summed for each calendar year. Additionally, fuel purchase records shall be retained that state the LNG's ROC content, sulfur content, higher heating value, and density.

b. *Operational Temperature:* Records of the combustion temperature data from each elevated flare and the thermal oxidizer.

c. *Calibration and Maintenance Logs:* Records of calibration and maintenance of the monitoring devices, including the results of each calibration, for each elevated flare and the thermal oxidizer.

d. *Hours of Operation:* The daily and annual hours of operations for each of the elevated flares and the thermal oxidizer.

e. *Thermal Oxidizer Downtime:* The dates and number of hours per year that the thermal oxidizer (Device ID #398751) was offline.

f. *Heat Input:* The calculated daily heat input to each elevated flare and the thermal oxidizer (in MMBtu/day) based on the monitored data and the equations in Section 2.6 of the Permit Evaluation.

g. *Storage Vessel Fuel Level:* Continuous records of the fuel level in the storage vessel [redacted] LNG volume (in gallons).

h. *Launch Vehicle Fueling:* The date, start time and end time of each launch vehicle fueling event shall be recorded in order to assess compliance with Condition 3.g.

i. *Launch Vehicle Fly-Away Volume:* For each launch, the minimum volume of LNG (in gallons) contained in the launch vehicle, measured [redacted] on the vehicle, that was not combusted in the elevated flares (i.e., the fly-away volume).

j. *Launches/Wet Dress Rehearsals:* The number of launches/wet dress rehearsals each year, and the date and time during which each launch/wet dress rehearsal occurred.

k. *LNG Sampling:* The number of times an LNG sample was taken each year, the date and time during which each sample was taken, volume of LNG taken (in gallons), and whether the thermal oxidizer (Device ID #398751) was online or offline during each sampling event.

l. *Leak Testing:* Results of all leak testing performed in accordance with site maintenance and launch operating procedures as specified in Condition 2.k.

m. *Source Testing*: Results of any source tests conducted; see Table 2 and Condition 7 for the source test requirements.

5. **Reporting.** By March 1st of each year, a written report documenting compliance with the terms and conditions of this permit for the previous calendar year shall be provided by the permittee to the District (Attn: *Annual Report Coordinator*). The report shall contain information necessary to verify compliance with the emission limits and other requirements of this permit. The report shall be in a format approved by the District. Compliance with all limitations and restrictions shall be documented in the submittals. All logs and other basic source data not included in the report shall be made available to the District upon request. The report shall include all data required by the Recordkeeping condition of this permit.

6. **Best Available Control Technology (BACT).** The permittee shall apply emission control technology and equipment measures that represent Best Available Control Technology (BACT) to the operation of the equipment/facilities as described in this permit and the District's Permit Evaluation for this permit. Table 3 and the Emission Limitations, Operational Restrictions, Monitoring, Recordkeeping, and Reporting conditions of this permit define the specific control technology and performance standard emission limits for BACT. BACT shall be in place and shall be operational at all times for the life of the project. BACT-related monitoring, recordkeeping and reporting requirements are defined in those specific permit conditions.

7. **Source Testing.** The following source testing provisions shall apply:

   a. The permittee shall conduct stack emissions testing of air emissions and process parameters listed in Table 2 for the thermal oxidizer initially during SCDP and every 24 months thereafter. More frequent source testing may be required if the equipment does not comply with permitted limitations or if other compliance problems, as determined by the District, occur. Source testing of the air emissions and process parameters listed in Table 2 shall be performed no later than 45 days after the anniversary date of the initial source test.

   b. The permittee shall submit a written source test plan to the District for approval at least thirty (30) days prior to initiation of each source test. The source test plan shall be prepared consistent with the District's *Source Test Procedures Manual* (revised May 1990 and any subsequent revisions). The permittee shall obtain written District approval of the source test plan prior to commencement of source testing. The District shall be notified at least ten (10) calendar days prior to the start of source testing activity to arrange for a mutually agreeable source test date when District personnel may observe the test.

   c. Source test results shall be submitted to the District within forty-five (45) calendar days following the date of source test completion and shall be consistent with the requirements approved within the source test plan. Source test results shall document the permittee's compliance status with BACT requirements, mass emission rates and applicable permit conditions, rules and NSPS (if applicable). All District costs associated with the review and approval of all plans and reports and the witnessing of tests shall be paid by the permittee as provided for by District Rule 210.

   d. A source test for an item of equipment shall be performed on the scheduled day of testing (the test day mutually agreed to) unless circumstances beyond the control of the operator prevent completion of the test on the scheduled day. Such circumstances include mechanical malfunction of the equipment to be tested, malfunction of the source test equipment, delays in source test contractor arrival and/or set-up, or unsafe conditions on

site. Except in cases of an emergency, the operator shall seek and obtain District approval before deferring or discontinuing a scheduled test, or performing maintenance on the equipment item on the scheduled test day. If the test cannot be completed on the scheduled day, then the test shall be rescheduled for another time with prior authorization by the District. Once the sample probe has been inserted into the exhaust stream of the equipment unit to be tested (or extraction of the sample has begun), the test shall proceed in accordance with the approved source test plan. In no case shall a test run be aborted except in the case of an emergency or unless approval is first obtained from the District. Failing to perform the source test of an equipment item on the scheduled test day without a valid reason and without District's authorization shall constitute a violation of this permit. If a test is postponed due to an emergency, written documentation of the emergency event shall be submitted to the District by the close of the business day following the scheduled test day.

The timelines in (a), (b), and (c) above may be extended for good cause provided a written request is submitted to the District at least three (3) days in advance of the deadline, and approval for the extension is granted by the District.

8. **Emission Offsets.** The permittee shall offset all $NO_x$, ROC, PM, and $PM_{10}$ emissions pursuant to Tables 4(a) and 4(b). Emission reduction credits (ERCs) sufficient to offset the permitted annual $NO_x$, ROC, PM, and $PM_{10}$ emissions shall be in place for the life of the project.

9. **Source Compliance Demonstration Period.** Equipment permitted herein is allowed to operate temporarily during a 180-day SCDP. Initial operations of the permitted equipment (defined as the commencement of any activities applied for and authorized by this permit) define the start of the SCDP. During the SCDP, the permittee shall comply with all operational, monitoring, recordkeeping and reporting requirements as specified in this permit.

   During the SCDP, the permittee shall:

   a. Begin recordkeeping as specified in the Recordkeeping condition of this permit.

   b. Submit reports to the District containing the following information:

      i. For each fuel delivery, the total volume of LNG delivered (in gallons), date and start/end time of delivery, and whether the delivery occurred while the thermal oxidizer (Device ID #398751) was online or offline.

      ii. The daily hours of operations for the thermal oxidizer (Device ID #398751), including the dates and number of hours for each date that the thermal oxidizer was offline.

iii. Continuous records of the fuel level in the storage vessel [redacted] LNG volume (in gallons).

iv. The number of times an LNG sample was taken, the date and time during which each sample was taken, volume of LNG taken (in gallons), and whether the thermal oxidizer (Device ID #398751) was online or offline during each sampling event.

v. The calculated daily heat input to the thermal oxidizer (in MMBtu/day) based on the monitored data and the equations in Section 2.6 of the Permit Evaluation.

The first report is due 37 days after the start of SCDP and shall contain the information listed in 9.b.i through v for the first 30 days of the SCDP. The second report is due 67 days after the start of SCDP and shall contain information for days 31 through 60 of the SCDP. The third report is due 97 days after the start of SCDP and shall contain information for days 61 through 90 of the SCDP. The fourth report is due 127 days after the start of SCDP and shall contain information for days 91 through 120 of the SCDP. The fifth report is due 157 days after the start of SCDP and shall contain information for days 121 through 150 of the SCDP.

c. Within 14 of days of the start of the SCDP, the permittee shall provide the District written notification of the SCDP start date using the attached yellow SCDP notification card or by e-mail to enfr@sbcapcd.org.

d. Arrange for District inspection not more than 30 calendar days (or other mutually agreed to time period) after the SCDP begins. An inspection can be arranged via e-mail to enfr@sbcapcd.org or by calling the District Compliance Division at (805) 979-8050. A minimum of three calendar days advance notice shall be given to the District. The Compliance Division may waive this inspection requirement if an initial inspection is deemed unnecessary to verify that the modifications authorized by this permit are in compliance with District rules and permit conditions.

e. Submit and obtain District approval of a source test plan prior to the start of testing. This source test plan shall be prepared consistent with the District's *Source Test Procedures Manual* (revised May 1990 and any subsequent revisions).

f. Conduct stack emission source testing consistent with Table 2 and the Source Testing condition of this permit. Source test results shall be submitted to the District within 45

days after completion of the source test and shall be consistent with the requirements of the approved source test plan.

g. Submit a Permit to Operate (PTO) application and the appropriate filing fee not more than 150 calendar days after the SCDP begins pursuant to District Rule 201.E.2. Upon the District's determination that the permit application is "complete", the permittee may continue temporary operations under the SCDP until such time the PTO is issued final or one year from the date of PTO application completeness, whichever occurs earlier. Failure to submit the PTO application within the specified time period shall constitute a violation of this permit.

SCDP extensions may be granted by the District for good cause. Such extensions may be subject to conditions. When good cause cannot be demonstrated, no administrative extension is available and the permittee shall cease operations. Alternatively, the permittee may submit an application to revise the ATC permit and upon the District finding the application complete the SCDP can be extended. A written request to extend the SCDP shall be made by the permittee at least seven days prior to the SCDP expiration date.

10. **Consistency with Analysis.** Operation under this permit shall be conducted consistent with all data, specifications and assumptions included with the application and supplements thereof (as documented in the District's project file) and the District's analyses under which this permit is issued as documented in the Permit Analyses prepared for and issued with the permit.

11. **Equipment Maintenance.** The equipment listed in this permit shall be properly maintained and kept in good condition at all times. The equipment manufacturer's maintenance manual, maintenance procedures and/or maintenance checklists (if any) shall be kept on site.

12. **Compliance.** Nothing contained within this permit shall be construed as allowing the violation of any local, state or federal rules, regulations, air quality standards or increments.

13. **Severability.** In the event that any condition herein is determined to be invalid, all other conditions shall remain in force.

14. **Conflict Between Permits.** The requirements or limits that are more protective of air quality shall apply if any conflict arises between the requirements and limits of this permit and any other permitting actions associated with the equipment permitted herein.

15. **Access to Records and Facilities.** As to any condition that requires for its effective enforcement the inspection of records or facilities by the District or its agents, the permittee shall make such records available or provide access to such facilities upon notice from the

District. Access shall mean access consistent with California Health and Safety Code Section 41510 and Clean Air Act Section 114A.

16. **Equipment Identification.** Identifying tag(s) or name plate(s) shall be displayed on the equipment to show manufacturer, model number, and serial number. The tag(s) or plate(s) shall be affixed to the equipment in a permanent and conspicuous position.

17. **Emission Factor Revisions.** The District may update the emission factors for any calculation based on USEPA AP-42 or District emission factors at the next permit modification or permit reevaluation to account for USEPA and/or District revisions to the underlying emission factors.

18. **Reimbursement of Costs.** All reasonable expenses, as defined in District Rule 210, incurred by the District, District contractors, and legal counsel for the activities listed below that follow the issuance of this permit, including but not limited to permit condition implementation, compliance verification and emergency response, directly and necessarily related to enforcement of the permit shall be reimbursed by the permittee as required by Rule 210. Reimbursable activities include work involving: permitting, compliance, CEMS, modeling/AQIA, ambient air monitoring and air toxics.

19. **Nuisance.** Except as otherwise provided in Section 41705 of the California H&SC, no person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property.

20. **Grounds for Revocation.** Failure to abide by and faithfully comply with this permit or any Rule, Order, or Regulation may constitute grounds for revocation pursuant to California Health & Safety Code Section 42307 *et seq*.

21. **Transfer of Owner/Operator.** This permit is only valid for the owner and operator listed on this permit unless a *Transfer of Owner/Operator* application has been applied for and received by the District. Any transfer of ownership or change in operator shall be done in a manner as specified in District Rule 203. District Form –01T and the appropriate filing fee shall be submitted to the District within 30 days of the transfer.

AIR POLLUTION CONTROL OFFICER

DATE

Attachments:

- Table 1 – Permitted Emission Limits
- Table 2 – Thermal Oxidizer Source Test Requirements
- Table 3 – Best Available Control Technology Requirements
- Table 4(a) – Offset Liability Table for United Launch Alliance
- Table 4(b) – Emission Reduction Credits Table for United Launch Alliance
- Permit Equipment List(s)
- Permit Evaluation for Authority to Construct 15795

Notes:

- This permit is valid for one year from the date stamped above if unused.

## TABLE 1. PERMITTED EMISSION LIMITS

| Equipment | $NO_x$ | ROC | CO | $SO_x$ | PM | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|
| *Launch Vehicle Elevated Flare (Device ID 398749)* | | | | | | | |
| lb/day | 107.18 | 13.38 | 488.63 | 2.62 | 12.06 | 12.06 | 12.06 |
| TPY | 0.43 | 0.05 | 1.97 | 0.01 | 0.05 | 0.05 | 0.05 |
| *Ground System Elevated Flare (Device ID 398750)* | | | | | | | |
| lb/day | 105.65 | 13.19 | 481.65 | 2.58 | 11.89 | 11.89 | 11.89 |
| TPY | 0.52 | 0.07 | 2.39 | 0.01 | 0.06 | 0.06 | 0.06 |
| *Thermal Oxidizer (Device ID 398751)* | | | | | | | |
| lb/day | 9.45 | 2.17 | 3.82 | 0.86 | 3.95 | 3.95 | 3.95 |
| TPY | 0.25 | 0.06 | 0.10 | 0.02 | 0.10 | 0.10 | 0.10 |
| *Fugitive Natural Gas Emissions* | | | | | | | |
| lb/day | | 0.00 | | | | | |
| TPY | | 0.00 | | | | | |
| **Totals** | | | | | | | |
| **lb/day** | **212.84** | **26.57** | **970.28** | **5.20** | **23.94** | **23.94** | **23.94** |
| **TPY** | **1.20** | **0.18** | **4.46** | **0.05** | **0.21** | **0.21** | **0.21** |

*Table Notes*:
(a) Due to rounding, values that appear as '0.00' are greater than 0 but less than 0.005.

## TABLE 2. THERMAL OXIDIZER SOURCE TEST REQUIREMENTS

| Emission & Limit Test Points | Pollutants | Parameters | Test Methods [(a),(b)] | Emission Limits | |
|---|---|---|---|---|---|
| | | | | (ppmvd @ 3% $O_2$) | (lb/MMBtu) |
| Thermal Oxidizer Stack (Device ID #398751) | $NO_x$ | ppmvd, lb/hr, lb/MMBtu | EPA Method 7E, CARB Method 100 | 15 | 0.0183 |
| | ROC | ppmvd, lb/hr, lb/MMBtu | EPA Method 25A | 10 | 0.0042 |
| | CO | ppmvd, lb/hr, lb/MMBtu | EPA Method 10, CARB Method 100 | 10 | 0.0074 |
| | $PM/PM_{10}$ | ppmvd, lb/hr, lb/MMBtu | EPA Method 201A | | 0.0077 |
| | Sampling Point Det. | | EPA Method 1 | | |
| | Stack Gas Flow Rate | cfm | EPA Method 2 | | |
| | $O_2$ | Dry, Mol. Wt | EPA Method 3, 3A, 3C | | |
| | Moisture Content | percent | EPA Method 4 | | |
| | Temperature [(c)] | °C or °F | Thermocouple | | |
| Fuel Gas | Fuel Gas Flow Rate | scfm | Fuel Gas Meter [(d),(e)] | | |
| | Higher Heating Value | Btu/scf | ASTM D 1826-88 | | |

*Table Notes*:

(a) Alternative methods may be acceptable on a case-by-case basis.
(b) A minimum of three 40-minute runs shall be obtained during each test.
(c) Temperature to be measured every 15 minutes at a minimum and averaged over the course of the source test.
(d) Fuel meter shall be calibrated within 60 days of the source test date. Results shall be corrected for temperature and pressure at STP (60°F and 14.7 psia).
(e) Alternative methods of measuring fuel gas flow rate may be acceptable, if submitted in source test plan and approved by the District.

## TABLE 3. BEST AVAILABLE CONTROL TECHNOLOGY REQUIREMENTS

| Emission Unit/ Process | Control Technology | Pollutant | Performance Standard |
|---|---|---|---|
| Launch Vehicle Elevated Flare | Low-$NO_x$ burner | $NO_x$ | 0.0680 lb/MMBtu |
| | ≥1700 °F operating temperature | ROC | 98% destruction efficiency; 0.0085 lb/MMBtu |
| | Low-$NO_x$ burner | CO | 0.3100 lb/MMBtu |
| | Air assist | $PM/PM_{10}$ | 0.0077 lb/MMBtu |
| Ground System Elevated Flare | Low-$NO_x$ burner | $NO_x$ | 0.0680 lb/MMBtu |
| | ≥1700 °F operating temperature | ROC | 98% destruction efficiency; 0.0085 lb/MMBtu |
| | Low-$NO_x$ burner | CO | 0.3100 lb/MMBtu |
| | Air assist | $PM/PM_{10}$ | 0.0077 lb/MMBtu |
| Thermal Oxidizer | Low-$NO_x$ burner | $NO_x$ | 0.0183 lb/MMBtu; 15 ppmvd @ 3% $O_2$ |
| | ≥1700 °F operating temperature | ROC | 0.0042 lb/MMBtu; 10 ppmvd @ 3% $O_2$ |
| | Low-$NO_x$ burner | CO | 0.0074 lb/MMBtu; 10 ppmvd @ 3% $O_2$ |
| | Air assist | $PM/PM_{10}$ | 0.0077 lb/MMBtu |
| Fugitives | Leak-tight connections | ROC | Verified by leak testing [redacted] |

**Table 4(a) - Offset Liability Table for United Launch Alliance**
**Updated: July 16, 2024**

| Item | Permit | Issue Date | ERC Returned? | Project | Offset Liability ---- tons/year ---- $NO_X$ | ROC | $SO_X$ | PM | $PM_{10}$ | ERC Source | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ATC 10788 | pre-8/2016 | n/a | Abrasive Blasting Unit at SLC-6 | | | | 0.018 | 0.018 | #62 | (a)(b) |
| 2 | ATC 10956 | pre-8/2016 | n/a | EELV Solvent Use | | 3.124 | | | | #66 | (a)(b) |
| 3 | ATC/PTO 10846-02 | pre-8/2016 | n/a | EELV Marine Vessels | 6.411 | 0.427 | | 0.466 | 0.446 | #59, #62, #64 | (a)(b) |
| 4 | ATC/PTO 10846-03 | pre-8/2016 | n/a | EELV Marine Vessel Increased Engine Use | 4.365 | 0.267 | | 0.291 | 0.279 | #165, #166, #204, #245 | (a)(b) |
| 5 | ATC/PTO 13112 | pre-8/2016 | n/a | Backup Generators at SLC-6 | 0.548 | 0.037 | | 0.018 | 0.018 | #66, #165 | (a)(b) |
| 6 | ATC 15783 | 01/17/23 | No | Prime Generator at Various Locations | 0.017 | 0.008 | 0.000 | 0.000 | 0.000 | #598 | (f) |
| 7 | ATC 15795 | TBD | No | LNG storage vessel and 3 flares | 1.203 | 0.176 | 0.000 | 0.211 | 0.211 | #513, #514 | |
| | | | | TOTALS (tpy) = | 12.544 | 4.039 | 0.000 | 1.004 | 0.972 | | |

Notes
(a) Pre-August 26, 2016 offset liabilities are summarized in Items (1) - (5). See facility Archive Offset Tables for details.
(b) Pre-September 3, 2019 ERC requirements from Tables A-D of ATC/PTO Mod 14736-01.
(c) See Table 7.2 for ERCs required to mitigate the offset liability. ERC Source denotes the ERC Certificate # used by the ATC permit.
(d) Permits with zero emission increases not shown in this table.
(e) ERCs used after August 26, 2016 may be returned to the Source Register. This line item reflects such a return. It is entered as a negative entry to balance this ledger. Original entry is not revised.
(f) Because of rounding, values shown as 0.000 are less than the offset deminimis levels of 0.0005, but greater than zero.

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**Table 4(b) - Emission Reduction Credits Table for United Launch Alliance**
**Updated: July 16, 2024**

| Item | Permit | Surrender Date | ERC Returned? | Emission Reduction Credits ---- tons/year ---- $NO_X$ | ROC | $SO_X$ | PM | $PM_{10}$ | Offset Ratio | ERC Source | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ATC 10788 | pre-8/2016 | n/a | | | | 0.644 | 0.624 | 1.2 | #62 | (a)(b) |
| 2 | ATC 10956 | pre-8/2016 | n/a | | 3.749 | | | | 1.2 | #66 | (a)(b) |
| 3 | ATC/PTO 10846-02 | pre-8/2016 | n/a | 7.696 | 0.512 | | | | 1.2 | #59, #62, #64 | (a)(b) |
| 4 | ATC/PTO 10846-03 | pre-8/2016 | n/a | 5.848 | 0.315 | | 0.352 | 0.336 | 1.2/1.5 | #165, #166, #204, #245 | (a)(b) |
| 5 | ATC/PTO 13112 | pre-8/2016 | n/a | 0.792 | 0.062 | | 0.028 | 0.028 | 1.2 | #66, #165 | (a)(b) |
| 6 | ATC 15783 | 01/17/23 | No | 0.022 | 0.010 | 0.000 | 0.000 | 0.000 | 1.3 | #598 | |
| 7 | ATC 15795 | TBD | No | 1.564 | 0.229 | 0.000 | 0.274 | 0.274 | 1.3 | #513, #514 | |
| | | | | TOTALS (tpy) = 15.922 | 4.877 | 0.000 | 1.298 | 1.262 | | | |

Notes
(a) Items (1) - (5) reflect all NSR ERCs used for the ULA facilities prior to August 26, 2016. See Archive Offset Tables for details.
(b) Pre-September 3, 2019 ERC requirements from Tables A-D of ATC/PTO Mod 14736-01.

\\sbcapcd.org\shares\Groups\ENGR\WP\VAFB\ULA Offsets-ERCs Table\Post 2016 NSR Rule Change ULA Offset - ERC Table - 7-16-2024.xlsx

# PERMIT EQUIPMENT LIST - TABLE A

ATC 15795 / FID: 00206 United Launch Alliance - SLC 3 / SSID: 11166

## A PERMITTED EQUIPMENT

### 1 Launch Vehicle Elevated Flare

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398749** | ***Device Name*** | **Launch Vehicle Elevated Flare** |
| *Rated Heat Input* | 5083.000 MMBtu/Hour | *Physical Size* | |
| *Manufacturer* | John Zink | *Operator ID* | |
| *Model* | PLA-78 | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Stack tip inside diameter 4.08 ft. 90' tall. PUC quality natural gas used for pilot. Used to combust LNG from vehicle boiloff during launches/aborts/wet dress rehearsals and vehicle venting when pressure is reduced.<br>Rated heat input is much higher than the flare will typically operate; larger capacity is necessary in the case of a catastrophic failure. Maximum permitted daily heat input is 1,576.23 MMBtu/day. | | |

**2 Ground System Elevated Flare**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398750** | ***Device Name*** | **Ground System Elevated Flare** |
| *Rated Heat Input* | 5083.000 MMBtu/Hour | *Physical Size* | |
| *Manufacturer* | John Zink | *Operator ID* | |
| *Model* | PLA-78 | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Stack tip inside diameter 4.08 ft. 90' tall. PUC quality natural gas used for pilot. Used to combust LNG from storage vessel when pressure is reduced and from knockdown vessel boiloff. Also permitted to be used as a contingency in case the thermal oxidizer is offline: up to 240 hours per year for storage vessel boiloff, [redacted] LNG sampling events per year, and 21,600 pounds of LNG delivered by truck.<br>Rated heat input is much higher than the flare will typically operate; larger capacity is necessary in the case of a catastrophic failure. Maximum permitted daily heat input is 1,553.71 MMBtu/day. | | |

**3 Thermal Oxidizer**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398751** | ***Device Name*** | **Thermal Oxidizer** |
| *Rated Heat Input* | 50.838 MMBtu/Hour | *Physical Size* | |
| *Manufacturer* | John Zink | *Operator ID* | |
| *Model* | ZT-100-0875-1/07/14-LE | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Stack tip inside diameter 7.67 ft. 75' tall. PUC quality natural gas used for pilot. Used to combust LNG due to boiloff from the storage vessel as well as during truck offloading and sampling events.<br>Maximum permitted daily heat input is 516.39 MMBtu/day. | | |

**4 LNG Storage Vessel**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398752** | ***Device Name*** | **LNG Storage Vessel** |
| *Rated Heat Input* | | *Physical Size* | [redacted] Gallons |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Cryogenic [redacted] vessel, [redacted]. Liquid capacity [redacted] gallons. Maximum Allowable Working Pressure (MAWP) of [redacted] | | |

**5 Knockdown Vessel**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398753** | ***Device Name*** | **Knockdown Vessel** |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | Graver | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Natural gas collected during the chill down of piping and engines will accumulate in knockdown vessel. [redacted] | | |

**6 Storage Vessel Vaporizers**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398754** | ***Device Name*** | **Storage Vessel Vaporizers** |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Location Note* | SLC-3 | | |

| | |
|---|---|
| *Device Description* | Provides [redacted] of LNG storage vessel to push fuel through piping and inline components. |

**7 LNG Offload Stations**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398756** | ***Device Name*** | **LNG Offload Stations** |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | [redacted] offload stations providing back-in delivery tanker access for filling the storage vessel. [redacted]. | | |

**8 [redacted] Cross-Country Line**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398757** | ***Device Name*** | [redacted] **Cross-Country Line** |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Transfers LNG between the storage vessel and launch vehicle fuel tank. | | |

**9 Vent Line [redacted]**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398758** | ***Device Name*** | **Vent Line** [redacted] |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |

| | |
|---|---|
| *Location Note* | SLC-3 |
| *Device Description* | Runs from the [redacted] launch vehicle fuel tank to the launch vehicle elevated flare. |

**10 Vent Line [redacted]**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398759** | ***Device Name*** | **Vent Line (bottom of launch vehicle)** |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Location Note* | SLC-3 | | |
| *Device Description* | Runs from the [redacted] launch vehicle to the knockdown vessel. | | |

**B EXEMPT EQUIPMENT**

**1 [redacted] Cooling System**

| | | | |
|---|---|---|---|
| ***Device ID #*** | **398755** | ***Device Name*** | **[redacted] Cooling System** |
| *Rated Heat Input* | | *Physical Size* | |
| *Manufacturer* | | *Operator ID* | |
| *Model* | | *Serial Number* | |
| *Part 70 Insig?* | No | *District Rule Exemption:* | 201.A No Potential To Emit Air Contaminants |
| *Location Note* | SLC-3 | | |
| *Device Description* | Cools natural gas [redacted] Minimizes boiloff. | | |

air pollution control district
SANTA BARBARA COUNTY

**DRAFT**

# PERMIT EVALUATION FOR AUTHORITY TO CONSTRUCT 15795



## 1.0 BACKGROUND

1.1 General: United Launch Alliance (ULA) operated the Atlas V Program at Space Launch Complex (SLC) 3 and the Delta IV Program at SLC 6 on Vandenberg Space Force Base (VSFB) between 2006 and 2022. The Atlas V Program was the fifth major version in the Atlas launch vehicle family of Evolved Expendable Launch Vehicles (EELVs). Each Atlas V launch vehicle consists of two main stages: the first stage is powered by a single RD-180 engine burning kerosene and liquid oxygen, and the Centaur upper stage is powered by one or two American RL10 engine(s) burning liquid hydrogen and liquid oxygen. The Delta IV program consisted of five launch systems in the Delta rocket family. Both the first and second stages of Delta IV rockets burned liquid hydrogen and liquid oxygen. The Atlas and Delta Programs began operating at Vandenberg in the 1990s. Atlas was originally designed and operated by Lockheed Martin, and Delta was originally designed and operated by Boeing. ULA was formed in 2006 as a joint venture between these two companies and has operated at Vandenberg since then.

District Permit to Operate 14736 - R2 authorizes the transport of Atlas V and Delta IV EELV launch systems and ground support equipment from Decatur, Alabama to the harbor at VSFB via the Panama Canal on the *R/S Rocketship* (formerly *M/V Delta Mariner*) cargo ship. An assist tugboat may operate to support the docking of the *R/S Rocketship*. The District also permits ULA's solvent usage, abrasive blasting, diesel engines and hot water boilers as shown in the table in Section 1.2 below.

ULA has recently vacated SLC 6 and will operate only at SLC 3 on VSFB going forward. The Atlas V and Delta IV Programs have been phased out and will be replaced by the Vulcan Centaur Program. ULA is developing the Vulcan Centaur vehicle to provide a more versatile and cost-competitive space launch vehicle while maximizing the use of existing space launch infrastructure and reducing reliance on foreign-made materials, specifically the current Atlas V Launch Vehicle Russian-supplied RD-180 engines. The Vulcan Centaur vehicle will contain a [redacted] than the Atlas V, and its first stage will use new [redacted] engines burning liquid oxygen and liquefied natural gas. Just as for the Atlas V and Delta IV Programs, vehicle components for the Vulcan Centaur Program will be manufactured at ULA's facility in Decatur, Alabama and shipped to VSFB aboard the *R/S RocketShip*. ULA has not requested an increase to their historical permitted launch cadence of [redacted] rocket launches and [redacted] boat trips per year. ULA anticipates the first launch of the Vulcan rocket from VSFB to occur in 2025.

This permit authorizes installation of a liquefied natural gas (LNG) storage vessel, two elevated flares, a thermal oxidizer, and associated equipment for the Vulcan Centaur Program, launching up to [redacted] times per year. The permit application for Authority to Construct No. 15795 was received on September 28, 2021 and deemed complete on March 18, 2024.

1.2 Permit History:

| PERMIT | FINAL ISSUED | PERMIT DESCRIPTION |
|---|---|---|
| Reeval 13312 R4 | 03/25/2022 | Permit Reevaluation. ABS system operated in a tent near Building 8305. |
| Reeval 13724 R3 | 06/15/2023 | Reevaluation. Two stacked 2.000 MMBtu/hour equipped with low NOx burners and flue gas recirculation. SLC-3E, Bldg 778. |
| PTO 15783 | 03/06/2024 | Tier 4 2020 Caterpillar Model C4.4 ACERT rated at 173.5 bhp to be used at both facilities. Atlas EELV and Delta EELV. |
| Reeval 08930 R10 | 06/14/2024 | Surface Coating Operation in Bldg 8304. |
| Reeval 15079 R2 | 06/14/2024 | Combining existing permits for miscellaneous use of ROC containing materials. |
| Reeval 15080 R2 | 06/14/2024 | Five diesel engines previously under PERP registrations. The engines are used to provide prime power to the payload environmental conditioning systems while transporting satellites. |
| PTO 16146 | 06/27/2024 | Relocate 2016 Cummins QSL9-G7 (464 bhp) from Building 380 SLC 6 to Building 763 SLC-3. |

1.3 Compliance History: No violations have been issued in the last 3 years.

## 2.0 ENGINEERING ANALYSIS

2.1 Equipment/Processes: Emissions were calculated from the combustion of LNG in the elevated flares and thermal oxidizer due to losses from launches, aborts and wet dress rehearsals, vehicle venting, depressurization, storage vessel boiloff, truck offloading and LNG sampling events. Additionally, small fugitive emissions were quantified from the truck offloading and LNG sampling events.

The LNG storage vessel will be maintained at cryogenic temperature (approximately -260 F) and approximately [redacted] psig. LNG boiloff occurs because of natural warming, as natural gas vapors collect in the top of the vessel. LNG storage vessel pressure will be managed by chilling via the [redacted] cooling loop in the storage vessel, and sending any boiloff natural gas to the thermal oxidizer (Device ID #398751). When the thermal oxidizer is offline, up to 240 hours per year, storage vessel boiloff will be routed to the ground system elevated flare (Device ID #398750).

During fuel deliveries, trucks are connected to the LNG offload station using temporary flexhoses. The delivery truck tanks are pressurized using the truck's on-board equipment, and isolation valves are opened to transfer LNG to the storage vessel. A maximum of 228,960 pounds of LNG may be delivered per year and 17,280 pounds delivered per day. Natural gas losses from truck offloading are routed to the thermal oxidizer; when this device is offline, the natural gas will be routed to the ground system elevated flare; no more than 21,600 pounds of LNG per year may be delivered while the thermal oxidizer is offline. Fugitive emissions associated with disconnecting the flexhoses from the delivery trucks are also quantified.

The LNG will be sampled [redacted] per launch campaign for purity, for a maximum of [redacted] times per year. Losses from the sampling process are controlled by the thermal oxidizer; when this device is offline, the natural gas will be routed to the ground system elevated flare, during up to a maximum of [redacted] sampling events per year. Fugitive emissions associated with disconnecting the sampling lines from the storage vessel are also quantified.

In preparation for the transfer of LNG to the launch vehicle, the thermal oxidizer will be secured and all gas from storage vessel boiloff, LNG system chill down, and launch vehicle fueling will be directed to the elevated flares. Both elevated flares will remain lit until all launch operations are complete. One vent line will run from the [redacted] launch vehicle fuel tank to the launch vehicle elevated flare (Device ID #398749) to collect boiloff from the launch vehicle. The launch vehicle elevated flare will cease LNG combustion shortly after liftoff, as soon as the vehicle vent ground system is purged with inert gas. Another vent line will run from the [redacted] launch vehicle to the knockdown vessel, where natural gas and LNG will accumulate during engine chill down and storage vessel [redacted] Any LNG collected in the knockdown vessel will be vaporized prior to combustion in the ground system elevated flare. The ground system elevated flare will continue to burn LNG after liftoff until the knockdown vessel is empty and the rest of the ground system is purged with inert gas.

2.2 Emission Controls: [redacted] piping and the [redacted] cooling system minimize LNG boiloff in the storage vessel. As the system is designed to have no leaks, no fugitive piping emissions are quantified. ULA tests the connections on the storage vessel and process piping using a [redacted] Gaseous nitrogen purging of delivery truck flexhoses prior to disconnection minimizes fugitive offloading emissions. The thermal oxidizer (Device ID #398751) controls LNG losses from storage vessel boiloff, truck offloading, and sampling. The ground system elevated flare (Device ID #398750) controls LNG losses primarily from the knockdown vessel and storage vessel on launch days, as well as from storage vessel boiloff, truck offloading, and sampling as a contingency when the thermal oxidizer is offline. The launch vehicle elevated flare (Device ID #398749) controls LNG losses from launch

vehicle fueling, depressurization, and launch vehicle boiloff. These flares are considered Best Available Control Technology for this project, as discussed in Section 2.7.

2.3 Emission Factors: Flare and thermal oxidizer emission factors are based on mass balance for $SO_x$. The $PM/PM_{10}/PM_{2.5}$ emission factor comes from AP-42, Table 1.5-1 for LPG. The $NO_x$ and CO emission factors for the elevated flares come from AP-42, Tables 13.5-1 and 13.5-2, respectively. The ROC emission factor for the elevated flares is based on a conservatively high assumption that the ROC content of the fuel is 1%, and the manufacturer's guarantee of at least 98% destruction efficiency. The $NO_x$, ROC and CO emission factors for the thermal oxidizer are based on the manufacturer's guarantee.

2.4 Reasonable Worst Case Emission Scenario: Emissions from the flares and thermal oxidizer were calculated using conservative assumptions of operations provided by the applicant. The rated capacities of the devices were not used for the worst-case emission scenario because the elevated flares are sized to handle an LNG release during a catastrophic emergency, significantly more LNG than is typically expected to be flared. Such an emergency scenario is not permitted, and it would be considered a violation of permit limits if a volume of LNG representing the maximum rated heat input to the flares was combusted.

The worst-case daily emissions scenario consists of the two elevated flares operating during a launch day. Furthermore, LNG sampling shall not occur on the same day as launch activities. For these reasons, the PTE for daily emissions is based on the sum of the two elevated flares' maximum daily emissions.

2.5 Emission Calculations: Detailed emission calculation spreadsheets may be found in Attachment B. These emissions define the Potential to Emit for the permitted equipment. Fugitive LNG emissions were quantified based on hose dimensions for offloading and sampling events.

2.6 Special Calculations: The Potential to Emit for the flares and thermal oxidizer were calculated based on maximum expected heat input rather than the rated capacity of each device, as explained in Section 2.4 above. To assess compliance with the limits in this permit, the actual daily heat input to each combustion device shall be calculated as specified in the equations below. The annual heat input to each combustion device shall be calculated by summing the daily heat inputs for the year. Because the emission factors for the elevated flares are identical, and the [redacted] method of determining LNG volume combusted would be virtually impossible to parse out between each elevated flare, the heat input limits are totaled for both elevated flares.

Elevated Flares (Device IDs #398749 and 398750):

$$H_d = (V_{p,i} - V_{p,f} - V_F + V_C) \times \rho_{LNG} \times HHV_{LNG}$$

Where:

| | | |
|---|---|---|
| $H_d$ | = | Daily heat input (MMBtu) |
| $V_{p,i}$ | = | Initial (beginning of launch) volume of LNG in storage vessel calculated from [redacted] reading (gal) |
| $V_{p,f}$ | = | Final (end of launch) volume of LNG in storage vessel calculated from [redacted] reading (gal) |
| $V_F$ | = | Minimum fly-away volume of LNG contained in launch vehicle (gal) |
| $V_C$ | = | Volume of LNG combusted in elevated flare as contingency when thermal oxidizer is offline (gal); see equation below |
| $\rho_{LNG}$ | = | Density of LNG (3.57 lb/gal)[1] |
| $HHV_{LNG}$ | = | HHV of LNG (0.023536 MMBtu/lb)[1] |

The equation below is only used for days during which the thermal oxidizer is offline (i.e., if the thermal oxidizer is online for the entire day, $V_C = 0$). Note that this calculation conservatively does not account for any fugitive losses of LNG during offloading and sampling, as these fugitive emissions are extremely low.

$$V_C = V_{p,i} - V_{p,f} + V_D - V_S$$

Where:

| | | |
|---|---|---|
| $V_C$ | = | Volume of LNG combusted in elevated flare as contingency when thermal oxidizer is offline (gal) |
| $V_{p,i}$ | = | Initial volume of LNG in storage vessel calculated from [redacted] reading taken at 12:00am beginning of day (gal) |
| $V_{p,f}$ | = | Final volume of LNG in storage vessel calculated from [redacted] reading taken at 12:00am end of day (gal) |
| $V_D$ | = | Volume of LNG delivered by truck (gal) |
| $V_S$ | = | Volume of LNG sampled (gal) |

Thermal Oxidizer (Device ID #398751):

$$H_d = (V_{p,i} - V_{p,f} + V_D - V_S) \times \rho_{LNG} \times HHV_{LNG}$$

Where:

| | | |
|---|---|---|
| $H_d$ | = | Daily heat input (MMBtu) |
| $V_{p,i}$ | = | Initial (beginning of day) volume of LNG in storage vessel calculated from [redacted] reading (gal) |
| $V_{p,f}$ | = | Final (end of day) volume of LNG in storage vessel calculated from [redacted] reading (gal) |

[1] Values are based on vendor specifications.

$V_D$ = Volume of LNG delivered by truck (gal)
$V_S$ = Volume of LNG sampled (gal)
$\rho_{LNG}$ = Density of LNG (3.57 lb/gal)[1]
$HHV_{LNG}$ = HHV of LNG (0.023536 MMBtu/lb)[1]

2.7 BACT Analyses: Best Available Control Technology (BACT) is required based on the $NO_x$, ROC, CO, PM, and $PM_{10}$ emissions. BACT for the elevated flares and thermal oxidizer are defined by the manufacturer's guarantee. See Attachment C for more information.

2.8 Enforceable Operational Limits: The permit has enforceable operating conditions that ensure the equipment is operated properly.

2.9 Monitoring Requirements: Monitoring of the equipment's operational limits are required to ensure that these are enforceable.

2.10 Recordkeeping and Reporting Requirements: The permit requires that the data which is monitored be recorded and reported to the District.

## 3.0 REEVALUATION REVIEW (not applicable)

## 4.0 REGULATORY REVIEW

4.1 Partial List of Applicable Rules:

| | |
|---|---|
| Rule 201. | Permits Required |
| Rule 202. | Exemptions to Rule 201 |
| Rule 205. | Standards for Granting Permits |
| Rule 301. | Circumvention |
| Rule 302. | Visible Emissions |
| Rule 303. | Nuisance |
| Rule 801. | New Source Review- Definitions and General Requirements |
| Rule 802. | New Source Review |
| Rule 809. | Federal Minor Source New Source Review |
| Rule 810. | Federal Prevention of Significant Deterioration |

4.2 Rules Requiring Review:

4.2.1 *Rule 802 – New Source Review*: This rule applies to any applicant for a new or modified stationary source which emits or may emit any affected pollutant. The purpose of this rule is to provide for the review of new and modified stationary sources of air pollution and provide mechanisms by which Authorities to Construct for such sources may be granted

without interfering with the attainment or maintenance of any ambient air quality standard, preventing reasonable further progress towards the attainment or maintenance of any ambient air quality standard and without interfering with the protection of areas designated attainment or unclassifiable.

BACT – The BACT thresholds are exceeded for $NO_x$, ROC, CO, PM, and $PM_{10}$. See Section 2.7 for a discussion of the BACT requirements.

Air Quality Impact Analysis – The Air Quality Impact Analysis (AQIA) thresholds are exceeded for $NO_x$ and CO. See Section 5.0 for a discussion of the AQIA modeling.

Offsets – The offset thresholds are exceeded for $NO_x$, ROC, PM, and $PM_{10}$. See Section 6.0 for a discussion of the offset requirements.

Pre and Post-Construction Monitoring – The United Launch Alliance stationary source potential-to-emit exceeds the thresholds in Table 5 of District Rule 802.G. The potential-to-emit from the project exceeds only the CO threshold of 240 lb/day. Rule 802.G.1 allows an exemption for non-major stationary sources if there is sufficient data to determine the effects that the emissions from the stationary source modification may have on air quality. The District has determined that this project is exempt from pre-construction monitoring because data from the District's nearby Lompoc monitoring station is sufficient to determine the effects of the emissions from United Launch Alliance's operations. Furthermore, data from the Lompoc monitoring station can be used to satisfy the postconstruction monitoring requirements of Rule 802.G. For these reasons, United Launch Alliance is not required to- install ambient air monitoring equipment for pre or post-construction monitoring under ATC 15795.

## 5.0 AQIA

An Air Quality Impact Analysis (AQIA) was required because the potential-to-emit from the project exceeds the thresholds for $NO_x$ and CO in Table 4 of District Rule 802. The AQIA results are summarized below. All pollutant concentrations are below the National AAQS for each averaging period. All pollutant concentrations are below the California AAQS for each averaging period except for 24-hour $PM_{10}$ and the annual $PM_{10}$. The $PM_{10}$ background concentration alone exceeds the California AAQS for the 24-hour averaging period and the annual averaging period. The total modeled 24-hour $PM_{10}$ concentration for the ULA stationary source is 0.8 $\mu g/m^3$, well below the California AAQS of 50 $\mu g/m^3$. The total modeled annual $PM_{10}$ concentration for the ULA stationary source is 0.1 $\mu g/m^3$, well below the California AAQS of 20 $\mu g/m^3$. The total modeled concentration of all pollutants is below the minimum and maximum increment thresholds.

National Ambient Air Quality Standard Analysis Results

| Pollutant | Averaging[1,2] Period | Short-term Scenario with Highest Concentration | Modeled Conc. ($\mu g/m^3$) | Ambient Background Conc. ($\mu g/m^3$) | Total Conc. ($\mu g/m^3$) | Percent of NAAQS | National AAQS ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| $SO_2$ | 1-hour | Scrub/ Launch Day | 0.9 | 7.0 | 7.9 | 4.0% | 196.5 |
| | 3-hour | Scrub/ Launch Day | 0.3 | 2.6 | 2.9 | 0.2% | 1,300 |
| | 24-hour | Scrub/ Launch Day | 0.1 | 2.6 | 2.7 | 0.7% | 365 |
| | Annual | NA – Annual | 2.7E-04 | 0.8 | 0.8 | 1.0% | 80 |
| CO | 1-hour | Fueling Day | 1879.7 | 1264.0 | 3143.7 | 7.9% | 40,000 |
| | 8-hour | Fueling Day | 384.5 | 1149.0 | 1533.5 | 15.3% | 10,000 |
| $NO_2$[3] | 1-hour | Fueling Day | 49.7 | 8.8 | 58.5 | 31.1% | 188 |
| | Annual | NA – Annual | 0.3 | 0.6 | 0.9 | 0.9% | 100 |
| $PM_{10}$ | 24-hour | Fueling Day | 0.8 | 143.0 | 143.8 | 95.9% | 150 |
| $PM_{2.5}$ | 24-hour | Fueling Day | 0.4 | 23.3 | 23.7 | 67.7% | 35 |
| | Annual | NA – Annual | 2.7E-02 | 6.6 | 6.6 | 55.2% | 12[4] |

Notes:

1. All short-term results are the highest modeled value.
2. Annual results are the highest annual average.
3. $NO_2$ impacts modeled with ARM2 Tier 2 $NO_x/NO_2$ conversion.
4. EPA modified the annual $PM_{2.5}$ standard to 9.0 ug/$m^3$ on February 7, 2024, after this modeling effort was complete. For that reason, the standard in place at the time of modeling is shown.

California Ambient Air Quality Standard Analysis Results

| Pollutant | Averaging Period[1,2] | Short-term Scenario with Highest Concentration | Modeled Conc. ($\mu g/m^3$) | Ambient Background Conc. ($\mu g/m^3$) | Total Conc. ($\mu g/m^3$) | Percent of CAAQS | California AAQS ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| $SO_2$ | 1-hour | Scrub/ Launch Day | 0.9 | 10.5 | 11.4 | 1.7% | 655 |
| | 24-hour | Scrub/ Launch Day | 0.1 | 2.6 | 2.7 | 2.5% | 105 |
| CO | 1-hour | Fueling Day | 1879.7 | 1264.0 | 3143.7 | 13.7% | 23,000 |
| | 8-hour | Fueling Day | 384.5 | 1149.0 | 1,533.5 | 15.3% | 10,000 |
| $NO_2$[3] | 1-hour | Fueling Day | 49.7 | 22.6 | 72.3 | 21.3% | 339 |
| | Annual | NA – Annual | 0.3 | 0.6 | 0.9 | 1.5% | 57 |
| $PM_{10}$ | 24-hour | Fueling Day | 0.8 | 143.0[4] | 143.8 | 287.6% | 50 |
| | Annual | NA – Annual | 0.1 | 27.6[4] | 27.7 | 138.6% | 20 |
| $PM_{2.5}$ | Annual | NA – Annual | 2.7E-02 | 6.6 | 6.6 | 55.2% | 12 |

Notes:

1. All short-term results are the highest modeled value.
2. Annual results are the highest annual average.
3. $NO_2$ impacts modeled with ARM2 Tier 2 $NO_x/NO_2$ conversion.
4. Ambient background is greater than the CAAQS. Because the project contribution will not exceed 10% of the CAAQS, the contribution is considered less than significant.

Increment Analysis Results

| Pollutant | Averaging[1,2] Period | Short-term Scenario with Highest Concentration | Modeled Conc. ($\mu g/m^3$) | Increment ($\mu g/m^3$) | Percent of Increment |
|---|---|---|---|---|---|
| $SO_2$ | 3-hour | Scrub/Launch Day | 0.3[3] | 512 | 0.1% |
| | 24-hour | Scrub/Launch Day | 0.1 | 91 | 0.1% |
| | Annual | NA – Annual | 2.7E-04 | 20 | <0.01% |
| CO | 1-hour | Fueling Day | 1879.7 | 10,000 | 18.8% |
| | 8-hour | Fueling Day | 384.5 | 2,500 | 15.4% |
| $NO_2$[4] | 1-hour | Fueling Day | 49.7 | 100 – 188 | 49.7% |
| | Annual | NA – Annual | 0.3 | 25 | 1.0% |
| TSP | 24-hour | Minimal Op | 3.9 | 37 | 10.5% |
| | Annual | NA – Annual | 0.6 | 19 | 2.9% |
| $PM_{10}$ | 24-hour | Fueling Day | 0.8 | 12 – 30 | 6.6% |
| | Annual | NA – Annual | 0.1 | 17 | 0.7% |
| $PM_{2.5}$ | 24-hour | Fueling Day | 0.4 | 9 | 4.5% |
| | Annual | NA – Annual | 2.7E-02 | 4 | 0.7% |
| ROC | 3-hour | Fueling Day | 10.5 | 40 – 160 | 26.3% |

Notes:

1. All short-term results are the highest modeled value.
2. Annual results are the highest annual average.
3. ULA's Final AQIA Report incorrectly displays the 1-hour $SO_2$ result in place of the 3-hour $SO_2$ result for the increment analysis. This table displays the correct 3-hour $SO_2$ result.
4. $NO_2$ impacts modeled with ARM2 Tier 2 $NO_x/NO_2$ conversion.

Based on these results, the operations at United Launch Alliance's facility on Vandenberg Space Force Base will not contribute to an exceedance of any ambient air quality standard. More details may be found in Attachment D.

## 6.0 OFFSETS/ERCs

6.1 Offsets: The United Launch Alliance stationary source exceeds the emission offset thresholds of Regulation VIII for $NO_x$, ROC, PM, and $PM_{10}$.

6.2 ERCs: ULA provided emission credits to offset the emissions associated with this permit. ULA authorizes the use of 1.564 TPY of $NO_x$, 0.274 TPY of PM, and 0.274 TPY of $PM_{10}$ from ERC Certificate 513, as well as 0.229 TPY of ROC from ERC Certificate 514 to offset the emissions associated with this permit. These ERCs offset the project's $NO_x$ PTE of 1.203 TPY, ROC PTE of 0.176 TPY, PM PTE of 0.211 TPY and $PM_{10}$ PTE of 0.211 TPY, all at a 1.3 offset ratio. ERC

Certificates 513 and 514 are only partially used to offset this project. See Tables 4(a) and 4(b) for details.

## 7.0 AIR TOXICS

An air toxics Health Risk Assessment (HRA) was required as part of the permitting process for ATC 15795. The HRA included both onshore sources and offshore sources (e.g., marine vessels). The onshore sources were modeled using AERMOD (Version 21112), executed with AERMOD MPI from Lakes Software, Version 10.2.1. The offshore sources were modeled using Offshore and Coastal Dispersion (OCD) model version 5; January 5, 2000. Cancer risk and chronic and acute non-cancer Hazard Index (HI) risk values were calculated and compared to the significance thresholds adopted by the District's Board of Directors. The calculated risk values and applicable thresholds are as follows:

| | ULA Max Risks | Significance Threshold |
|---|---|---|
| Cancer risk: | 4.5/million | ≥10/million |
| Chronic non-cancer risk: | <0.1 | >1 |
| 8-hour non-cancer risk: | <0.1 | >1 |
| Acute non-cancer risk: | 0.6 | >1 |

Based on these results, the operations at United Launch Alliance's facility on Vandenberg Space Force Base do not present a significant risk to the surrounding community. More details may be found in Attachment D.

## 8.0 CEQA / LEAD AGENCY

The District has determined that the project is not subject to the California Environmental Quality Act (CEQA). Due to Vanderberg Space Force Base's special status as a federal enclave, the District is preempted from applying CEQA. No further action is required.

## 9.0 SCHOOL NOTIFICATION

A school notice pursuant to the requirements of Health and Safety Code §42301.6 was not required.

## 10.0 PUBLIC and AGENCY NOTFICATION PROCESS/COMMENTS ON DRAFT PERMIT

10.1 This project is subject to a 30-day public notice per District Rule 802.I. The District has published a notice in the Lompoc Record, and notified the applicant, California Air Resources Board, Ventura County Air Pollution Control District, San Luis Obispo County Air Pollution Control District, and San Joaquin Valley Air Pollution Control District of the preliminary decision to grant this Authority to Construct. In accordance with District Rule 802.I, a public hearing may be called if any

aggrieved party so requests in writing within the 30-day comment period. The public notice period begins on October 23rd, 2024 and ends on November 22nd, 2024.

10.2 Draft comments, if any, may be found in the final permit attachment.

## 11.0 FEE DETERMINATION

Fees for this permit are assessed under the cost reimbursement provisions of Rule 210. The Project Code is *205779* (*United Launch Alliance - Vulcan*).

## 12.0 RECOMMENDATION

It is recommended that this permit be granted with the conditions as specified in the permit.

| Charlotte Mountain | 9/1/2024 | | |
|---|---|---|---|
| AQ Engineer/Technician | Date | Supervisor | Date |

## 13.0 ATTACHMENT(S)

A. IDS Tables
B. Emission Calculations
C. BACT Documentation
D. AQIA and HRA Documentation

**DRAFT**

Authority to Construct 15795

# ATTACHMENT A
# IDS Tables

## PERMIT POTENTIAL TO EMIT

| | $NO_x$ | ROC | CO | $SO_x$ | PM | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|
| lb/day | 212.84 | 26.57 | 970.28 | 5.20 | 23.94 | 23.94 | 23.94 |
| lb/hr | | | | | | | |
| TPQ | | | | | | | |
| TPY | 1.20 | 0.18 | 4.46 | 0.05 | 0.21 | 0.21 | 0.21 |

## FACILITY POTENTIAL TO EMIT

| | $NO_x$ | ROC | CO | $SO_x$ | PM | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|
| lb/day | 403.66 | 127.34 | 1,295.69 | 7.21 | 33.93 | 33.93 | 33.93 |
| lb/hr | | | | | | | |
| TPQ | | | | | | | |
| TPY | 2.75 | 9.32 | 10.99 | 0.29 | 0.39 | 0.39 | 0.39 |

## STATIONARY SOURCE POTENTIAL TO EMIT

| | $NO_x$ | ROC | CO | $SO_x$ | PM | $PM_{10}$ | $PM_{2.5}$ |
|---|---|---|---|---|---|---|---|
| lb/day | 4,553.99 | 454.12 | 2,856.60 | 9.36 | 267.44 | 265.03 | 265.03 |
| lb/hr | | | | | | | |
| TPQ | | | | | | | |
| TPY | 14.04 | 10.09 | 13.39 | 0.32 | 1.06 | 1.04 | 1.04 |

Notes:
(1) Emissions in these tables are from IDS.
(2) Because of rounding, values in these tables shown as 0.00 are less than 0.005, but greater than zero.

**DRAFT**

Authority to Construct 15795

# ATTACHMENT B
## Emission Calculations

### FLARE EMISSION CALCULATIONS (Ver. 2.0)

Attachment: B-1
Permit Number: ATC 15795
Facility: United Launch Alliance - Vulcan EELV

**Fuel Information**

| *Data* | *Value* | *Units* | *Reference* |
|---|---|---|---|
| Flare Throughput..... | not used | MMscf/day | Permit Application |
| Gas Heat Content..... | 1,017.7 | Btu/scf | Permit Application |
| Sulfur Content..... | 10 | ppmv as total sulfur | Permit Application |

**Heat Input Data**

| *Value* | *Units* | *Reference* |
|---|---|---|
| 303.615 | MMBtu/hour | Permit Application |
| 1,576.23 | MMBtu/day | Permit Application |
| 12,699.80 | MMBtu/year | Permit Application |

**Emission Factors**

| *Pollutant* | *lb/MMBtu* | *Reference* |
|---|---|---|
| $NO_x$ | 0.0680 | AP-42, Table 13.5-1 |
| ROC | 0.0085 | 1% ROC content and 98% destruction efficiency |
| CO | 0.3100 | AP-42, Table 13.5-2 |
| $SO_x$ | 0.0017 | Mass Balance Calculation |
| PM | 0.0077 | AP-42, Table 1.5-1 |
| $PM_{10}$ | 0.0077 | AP-42, Table 1.5-1 |
| $PM_{2.5}$ | 0.0077 | AP-42, Table 1.5-1 |

**Launch Vehicle Elevated Flare (Device ID 398749) Potential to Emit**

| Pollutant | lb/day | TPY |
|---|---|---|
| $NO_x$ | 107.18 | 0.43 |
| ROC | 13.38 | 0.05 |
| CO | 488.63 | 1.97 |
| $SO_x$ | 2.62 | 0.01 |
| PM | 12.06 | 0.05 |
| $PM_{10}$ | 12.06 | 0.05 |
| $PM_{2.5}$ | 12.06 | 0.05 |

Processed By: CIM Date: 5/13/2024

**DRAFT**

Authority to Construct 15795

# ATTACHMENT B
## Emission Calculations

### FLARE EMISSION CALCULATIONS (Ver. 2.0)

Attachment: B-2
Permit Number: ATC 15795
Facility: United Launch Alliance - Vulcan EELV

**Fuel Information**

| Data | Value | Units | Reference |
|---|---|---|---|
| Flare Throughput | not used | MMscf/day | Permit Application |
| Gas Heat Content | 1,017.7 | Btu/scf | Permit Application |
| Sulfur Content | 10 | ppmv as total sulfur | Permit Application |

**Heat Input Data**

| Value | Units | Reference |
|---|---|---|
| 273.442 | MMBtu/hour | Permit Application |
| 1,553.71 | MMBtu/day | Permit Application |
| 15,421.52 | MMBtu/year | Permit Application |

**Emission Factors**

| Pollutant | lb/MMBtu | Reference |
|---|---|---|
| $NO_x$ | 0.0680 | AP-42, Table 13.5-1 |
| ROC | 0.0085 | 1% ROC content and 98% destruction efficiency |
| CO | 0.3100 | AP-42, Table 13.5-2 |
| $SO_x$ | 0.0017 | Mass Balance Calculation |
| PM | 0.0077 | AP-42, Table 1.5-1 |
| $PM_{10}$ | 0.0077 | AP-42, Table 1.5-1 |
| $PM_{2.5}$ | 0.0077 | AP-42, Table 1.5-1 |

**Ground System Elevated Flare (Device ID 398750) Potential to Emit**

| Pollutant | lb/day | TPY |
|---|---|---|
| $NO_x$ | 105.65 | 0.52 |
| ROC | 13.19 | 0.07 |
| CO | 481.65 | 2.39 |
| $SO_x$ | 2.58 | 0.01 |
| PM | 11.89 | 0.06 |
| $PM_{10}$ | 11.89 | 0.06 |
| $PM_{2.5}$ | 11.89 | 0.06 |

Processed By: CIM Date: 5/13/2024

**DRAFT**

Authority to Construct 15795

# ATTACHMENT B
## Emission Calculations

### FLARE EMISSION CALCULATIONS (Ver. 2.0)

Attachment: B-3
Permit Number: ATC 15795
Facility: United Launch Alliance - Vulcan EELV

**Fuel Information**

| *Data* | *Value* | *Units* | *Reference* |
|---|---|---|---|
| Flare Throughput..... | not used | MMscf/day | Permit Application |
| Gas Heat Content..... | 1,017.7 | Btu/scf | Permit Application |
| Sulfur Content..... | 10 | ppmv as total sulfur | Permit Application |

**Heat Input Data**

| *Value* | *Units* | *Reference* |
|---|---|---|
| 50.838 | MMBtu/hour | Permit Application |
| 516.39 | MMBtu/day | Permit Application |
| 26,958.49 | MMBtu/year | Permit Application |

**Emission Factors**

| *Pollutant* | *lb/MMBtu* | *Reference* |
|---|---|---|
| $NO_x$ | 0.0183 | BACT/manufacturer's guarantee |
| ROC | 0.0042 | BACT/manufacturer's guarantee |
| CO | 0.0074 | BACT/manufacturer's guarantee |
| $SO_x$ | 0.0017 | Mass Balance Calculation |
| PM | 0.0077 | AP-42, Table 1.5-1 |
| $PM_{10}$ | 0.0077 | AP-42, Table 1.5-1 |
| $PM_{2.5}$ | 0.0077 | AP-42, Table 1.5-1 |

**Thermal Oxidizer (Device ID 398751) Potential to Emit**

| Pollutant | lb/day | TPY |
|---|---|---|
| $NO_x$ | 9.45 | 0.25 |
| ROC | 2.17 | 0.06 |
| CO | 3.82 | 0.10 |
| $SO_x$ | 0.86 | 0.02 |
| PM | 3.95 | 0.10 |
| $PM_{10}$ | 3.95 | 0.10 |
| $PM_{2.5}$ | 3.95 | 0.10 |

Processed By: CIM Date: 5/13/2024

**DRAFT**

Authority to Construct 15795

# ATTACHMENT B
## Emission Calculations

**FUGITIVE NATURAL GAS EMISSIONS**

Attachment: B-4
Permit Number: ATC 15795
Facility: United Launch Alliance - Vulcan EELV

| Event Type | Daily Maximum (events/day) | Annual Maximum (events/year) | Gas Vented per Event[1] (scf) | Gas Vented per Event[2] (lb) | ROC Content[3] (%) | ROC Emissions[4] | |
|---|---|---|---|---|---|---|---|
| | | | | | | lb/day | TPY |
| LNG Offloading | [redacted] | [redacted] | 0.8727 | 3.77E-02 | 1.0 | 0.00 | 0.00 |
| LNG Sampling | | | 0.0082 | 3.54E-04 | 1.0 | 0.00 | 0.00 |

1. Offloading vented volume is based on [redacted] offloading hose. Sampling vented volume is based on two sampling lines, each [redacted]
2. Calculated using ideal gas law and conservative assumption of [redacted]
3. Conservative estimate based on vendor analysis.
4. Due to rounding, values that appear as '0.00' are greater than 0 but less than 0.005.

**DRAFT**

Authority to Construct 15795

# ATTACHMENT C
# BACT Documentation

1. Pollutant(s): $NO_x$, ROC, CO, and $PM/PM_{10}$

2. Emission Units:

   Two (2) John Zink PLA-78 Elevated Flares rated at 5083.0 MMBtu/hr

   John Zink ZT-100-0875-1/07/14-LE Thermal Oxidizer rated at 50.838 MMBtu/hr

3. BACT Determination Summary:

   John Zink PLA-78 Elevated Flares:

   *Technology*: Low-$NO_x$ burner, good combustion practices, air assist
   *Performance Standards*: $NO_x$ Emission Standard of 0.0680 lb/MMBtu
   ROC Emission Standard of 0.0085 lb/MMBtu
   CO Emission Standard of 0.3100 lb/MMBtu
   $PM/PM_{10}$ Emission Standard of 0.0077 lb/MMBtu

   John Zink ZT-100-0875-1/07/14-LE Thermal Oxidizer:

   *Technology*: Low-$NO_x$ burner, good combustion practices, air assist
   *Performance Standards*: $NO_x$ Emission Standard of 0.0183 lb/MMBtu
   ROC Emission Standard of 0.0042 lb/MMBtu
   CO Emission Standard of 0.0074 lb/MMBtu
   $PM/PM_{10}$ Emission Standard of 0.0077 lb/MMBtu

4. Level of Stringency: [x] Achieved in Practice
   [ ] Technologically Feasible
   [ ] RACT, BARCT, NSPS, NESHAPS, MACT

5. BACT Selection Process Discussion: BACT has not been previously established for flares/thermal oxidizers that combust LNG in support of vehicle launches in Santa Barbara County. South Coast Air Quality Management District (SCAQMD), Bay Area Air Quality Management District (BAAQMD), and San Joquin Valley Air Pollution Control District (SJVAPCD) BACT databases were reviewed. The manufacturer's guaranteed emission rates for $NO_x$, ROC, and CO were established as BACT. The $PM/PM_{10}$ emission factor obtained from AP-42 was established as BACT.

6. BACT Effectiveness: BACT is expected to be effective over all operating loads.

7. BACT During Non-Standard Operations: Non-standard operations were not identified by the applicant.

8. Operating Constraints: None.

**DRAFT**

Authority to Construct 15795

# ATTACHMENT C
## BACT Documentation

9. Continuously Monitored BACT: CEMS are not required for this project.

10. Source Testing Requirement: Source testing of the air emissions and process parameters listed in Table 2 of the permit is required for the thermal oxidizer, as explained in Condition 7.

11. Compliance Averaging Times: N/A

12. Multi-Phase Projects: This is not a multi-year project.

13. Referenced Documents: BACT Guidelines are found online at:

| | |
|---|---|
| District BACT Guidelines: | https://www.ourair.org/bact/ |
| SCAQMD BACT Guidelines: | http://www.aqmd.gov/home/permits/bact/guidelines |
| BAAQMD BACT Workbook: | https://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook |
| SJVAPCD BACT Clearinghouse: | https://ww2.valleyair.org/permitting/best-available-control-technology/district-bact-clearinghouse/ |
| CARB BACT Clearinghouse: | https://ww2.arb.ca.gov/our-work/programs/technology-clearinghouse |

14. PSD BACT: Not Applicable.

**DRAFT**

Authority to Construct 15795

# ATTACHMENT D
# AQIA and HRA Documentation

## Background

A health risk assessment (HRA) and an Air Quality Impact Analysis (AQIA) were submitted by United Launch Alliance (ULA) for three liquefied natural gas flares, a storage tank, and associated equipment used for Vulcan Centaur launches at Vandenberg Space Force Base (VSFB) for California Environmental Quality Act (CEQA) requirements and for the application of Authority to Construct (ATC) No. 15795. Several iterations of modeling were submitted, as described below in the *Historical Submittals and District Correspondence for ATC No. 15795* section of this memo. Prior to issuance of ATC No. 15795, it was determined that modeling under CEQA was not required. However, the HRA and AQIA are required under New Source Review (NSR) for ATC No. 15795.

## Summary

This memo summarizes the HRA and AQIA results, as well as the modeling documentation. In addition, this memo documents the deficiencies in the HRA and AQIA modeling submitted for ATC No. 15795, and reasoning for not requiring revisions to the modeling at this time. Based on the discussion within this memo, it can be seen with certainty that the project as proposed will not result in exceedances of any Ambient Air Quality Standard (AAQS), increment threshold or health risk threshold. If the modeling is revised in the future, the issues described in the *Modeling Inconsistencies and Deficiencies* section of this memo should be corrected for completeness.

## Historical Submittals and District Correspondence for ATC No. 15795

ULA's submittals regarding the HRA and AQIA are listed below, along with the District's review correspondence on each submittal.

- **ULA Submittal (September 28, 2021).** This was the initial submittal for the ATC No. 15795 application, which included a preliminary AQIA modeling protocol dated September 24, 2021. https://sbcapcd.sharepoint.com/sites/Confidential Files - Documents\Confidential\FID 11785 ULA-Vulcan EELV\ATC 15795\Submittal 1

- **District Correspondence (October 28, 2021).** The District provided comments on the AQIA protocol in this ATC No. 15795 incompleteness letter, also commenting that an HRA was required. \\sbcapcd.org\shares\Groups\ENGR\WP\VAFB\ULA - Vulcan EELV\ATCs\ATC 15795\Submittal 1\ATC 15795 - ATC Incompleteness - 10-20-2021.pdf

- **ULA Submittal (March 14, 2022).** ULA submitted their *Dispersion Modeling Protocol* dated March 7, 2022, which addressed only the AQIA. https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/ULA Modeling Protocol-ATC 15795_ 14Mar2022 Confidential Submittal

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Authority to Construct 15795

# ATTACHMENT D
## AQIA and HRA Documentation

- **District Correspondence (April 8, 2022).** The District provided comments on the March 7, 2022 *Dispersion Modeling Protocol*, noting that a revised submittal was not required. The comment letter included detailed comments on the emission calculations.
https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/ULA Modeling Protocol-ATC 15795_ 14Mar2022 Confidential Submittal/APCD Review/Comments on ULA Vulcan AQIA Protocol for ATC 15975.pdf

- **ULA Submittal (August 1, 2022).** ULA submitted the first version of the AQIA, along with Modeling Protocol Tables for the HRA. The *Dispersion Modeling Report* for the AQIA was dated July 18, 2022.
https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/AQIA-HRA-Modeling-1Aug2022-ConfidentialSubmittal/ULA Modeling Submittal Aug2022

- **District Correspondence (August 18, 2022).** The District emailed informational comments on the AQIA (Email from Robin Cobbs to Mary Kaplan Re: *ULA Vulcan AQIA Questions/Comments*).
https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/AQIA-HRA-Modeling-1Aug2022-ConfidentialSubmittal/Emailed RE_ ULA Vulcan AQIA Questions_ AQIA and HRA Modeling Protocol Table Comments.pdf

- **ULA Submittal (October 4, 2022).** ULA submitted a revised AQIA and revised Modeling Protocol Tables for the HRA. The final AQIA emission calculations for permitted equipment were included in this submittal in the spreadsheet, *ULA Operational Emissions for Modeling_14Sept2022.xlsx*. The revised *Dispersion Modeling Report* for the AQIA was dated September 22, 2022. **This file location contains the emission calculations used in the final AQIA for permitted equipment.**
https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/AQIA-HRA-Modeling-4Oct2022ConfidentialSubmittal

- **District Correspondence (November 3, 2022).** The District conditionally approved the revised AQIA and revised Modeling Protocol Tables for the HRA.
https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/AQIA-HRA-Modeling-4Oct2022ConfidentialSubmittal/Conditional Approval of ULA Vulcan AQIA and HRA Protocol for ATC 15795.pdf

**DRAFT**

Authority to Construct 15795

# ATTACHMENT D
## AQIA and HRA Documentation

- **ULA Submittal (November 23, 2022).** ULA submitted their second revised AQIA and first version of the HRA. The *HRA Modeling Report* was dated November 21, 2022. The second revised *Dispersion Modeling Report* for the AQIA was dated November 14, 2022. This was the final AQIA for all pollutants except for 1-hour $NO_2$. A revised AQIA submittal for 1-hour $NO_2$ was submitted on August 9, 2023. **This file location contains the final AQIA files and the final AQIA Report (*Dispersion Modeling Report*) for all pollutants/averaging times except for the 1-hour $NO_2$.**
  https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/HRA-Final AQIA-23Nov2022-ConfidSubmittal

- **District Correspondence (March 9, 2023).** The District provided comments on the HRA and the second revised AQIA. The District's letter provided detailed comments on required revisions for the HRA and noted that all AQIA items from the District's November 3, 2022 letter were addressed.
  https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/HRA-Final AQIA-23Nov2022-ConfidSubmittal/Comments on ULA Vulcan HRA and Final Revised AQIA for ATC 15795.pdf

- **ULA Submittal (May 5, 2023).** ULA submitted responses to the District's comments on the HRA, along with revised emission calculations based on the District's comments.
  https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/ULA Response to HRA Comments - May 2023

- **District Correspondence (May 30, 2023).** The District provided comments on ULA's May 5, 2023 submittal. The comment letter noted that a full review was not performed, as the permitted potential to emit calculations were not yet finalized and additional revisions to HRA were expected. https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/District Comments on Emission Calculations for HRA and ULA's 5May2023 Response to Comments.pdf

- **ULA Submittal (August 9, 2023).** ULA submitted the revised HRA and the 1-hour $NO_2$-only AQIA. The revised *HRA Modeling Report* was dated August 4, 2023. The *Dispersion Modeling Report Addendum* for the 1-hour $NO_2$-only AQIA was dated July 24, 2023. The final AQIA emission calculations for mobile equipment were included in this submittal in the spreadsheet, *1 Hour Operational Equipment_07212023.xlsx*. Additionally, the final HRA emission calculations for permitted sources and mobile equipment are found in the spreadsheets, *1 Hour Operational Equipment_07212023.xlsx* and *ULA Sources TACs_072423.xlsx*. **This file location contains the final HRA files, final HRA report (*HRA Modeling Report*), final HRA emission calculations, final AQIA emission calculations for mobile equipment, final 1-hour $NO_2$ AQIA files and the final 1-hour $NO_2$-only AQIA Report (*Dispersion Modeling Report Addendum*).**

# ATTACHMENT D
# AQIA and HRA Documentation

https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/HRA and NOx AQIA Submittal - 09Aug2023

- **District Correspondence (November 14, 2023).** The District provided comments on the HRA and the 1-hour $NO_2$-only AQIA. No further revisions were required for the HRA and the AQIA. https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/District Comments on ULA August 2023 HRA and AQIA .pdf

**Model Information for AQIA and HRA**

The air dispersion modeling for both the AQIA and the overland HRA were conducted using AERMOD (Version 21112), executed with AERMOD MPI from Lakes Software, Version 10.2.1. The regulatory default control options were enabled, and the rural dispersion coefficient was selected. A flagpole height of 0 m was used in the AQIA. For the HRA, the flagpole height for pathway receptors should have been set to 0 m, and all other receptors set to 1.5 m, which was not done. See the *Modeling Inconsistencies and Deficiencies* section of this memo for additional discussion. The flagpole heights are found in the receptor files, ending in *.*ROU*, and the AERMOD output files, ending in *.*OUT*.

The AQIA included only onshore sources and therefore was modeled using only AERMOD. The HRA included both onshore sources and offshore sources (e.g., marine vessels). The onshore sources were modeled using AERMOD. The offshore sources were modeled using Offshore and Coastal Dispersion (OCD) model version 5; January 5, 2000, as described in Section 3.1 of ULA's August 2023 *Revised HRA Modeling Report* (Final HRA Report). The same receptors used in the overland HRA were also used in the offshore HRA. AERMOD created plotfiles for both the 1-hour and annual averaging periods for onshore sources. The OCD code was modified to generate plotfiles with the same averaging periods for the offshore sources. The plotfiles were then imported into HARP2 Build 22118 for the risk analysis.

Meteorological data used in the onshore air dispersion modeling were acquired at the Lompoc Watt Road monitoring station from 1993-1996. A detailed discussion of the meteorological data selected is found in Section 3.2 of the Final HRA Report. Section 3.2 includes a table with overland meteorological parameters and overwater meteorological parameters, along with wind roses and references for obtaining the meteorological parameters.

For the AQIA, averaging periods and reporting forms for the modeled concentrations were selected in accordance with Tables 4.1-1 and 4.2-1 of the District's *Modeling Guidelines for Air Quality Impact Assessments*. The District provided the background concentrations to ULA. The background concentrations for all pollutants except $PM_{2.5}$ were obtained from the South Vandenberg Power Plant (SVPP) station for the years 2016 through 2018. $PM_{2.5}$ was not monitored at the SVPP station and was instead obtained from the Lompoc H Street monitoring station in the years 2018 through 2020. The background concentrations are listed in Table 3-1 of ULA's November 2022 *Dispersion Modeling Report* (Final AQIA Report).

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# ATTACHMENT D
# AQIA and HRA Documentation

Building downwash was included in the overland air dispersion analysis with nineteen buildings/structures.

Variable emissions were used for the air dispersion modeling and detailed on the Variable Emissions and Notes tab of *Modeling-Protocol-Tables-for-HRA-Report - Unprotected Source Parameters tab_073023.xlsx* in ULA's August 9, 2023 submittal.

The final modeling parameters for the emission release points and UTM coordinates were submitted by ULA in the *Modeling-Protocol-Tables-for-HRA-Report - Unprotected Source Parameters tab_073023.xlsx* in ULA's August 9, 2023 submittal. Section 3.5 of the Final AQIA Report and Section 3.5 of the Final HRA Report provides a detailed discussion of the source parameters. The District reviewed the source parameters and provided comments on the prior submittals of the Modeling Protocol tables. The source parameters used in the AQIA and overland HRA are found in the AERMOD output files ending in **.OUT*, and source parameters for the overwater HRA are found in the OCD output files ending in **.OUT*.

The District allowed VSFB's entire property boundary to be used for the dispersion modeling, as identified in the July 2020 AB 2588 ATEIP submittal. However, some areas of VSFB are accessible by the public including the Point Sal trail, areas east of Route 1 (Cabrillo Highway) and San Antonio Road W, and areas west of the 13th Street gate along West Ocean Avenue out to Surf Beach and Ocean Park. U.S. Environmental Protection Agency (EPA) defines ambient air as "that portion of the atmosphere, external to buildings, to which the general public has access." The District follows EPA's guidance on ambient air and considers any areas accessible by the public as ambient air. In addition, acute receptors must be placed in areas accessible by the public. For these reasons, ULA modified the property boundary to exclude areas accessible by the public as shown in Figure 3-5 of the Final AQIA Report.

**AQIA Emissions**

The emission rates used in the final AQIA modeling were detailed in two spreadsheets, *ULA Operational Emissions for Modeling_14Sept2022.xlsx* of ULA's October 4, 2022 submittal and *1 Hour Operational Equipment_07212023.xlsx* of ULA's August 9, 2023 submittal. The spreadsheet, *ULA Operational Emissions for Modeling_14Sept2022.xlsx*, included emission calculations for permitted equipment and a summary of emission rates in g/s for permitted sources and permit-exempt sources included for the CEQA analysis (e.g., mobile equipment). Detailed emission calculations for mobile equipment are included in the spreadsheet, *1 Hour Operational Equipment_07212023.xlsx*. However, as noted in the *Background* section of this memo, it was later determined that modeling under CEQA was not required. See the *Modeling Inconsistencies and Deficiencies* section of this memo for a discussion of modeling errors that have minimal impact on the AQIA results.

**National Ambient Air Quality Standard Analysis Results**

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# AQIA and HRA Documentation

The results of the National Ambient Air Quality Standard analysis are presented in Table 1. All pollutant concentrations are below the National AAQS for each averaging period.

**Table 1. National Ambient Air Quality Standard Analysis Results**

| Pollutant | Averaging[1,2] Period | Short-term Scenario with Highest Concentration | Modeled Conc. ($\mu g/m^3$) | Ambient Background Conc. ($\mu g/m^3$) | Total Conc. ($\mu g/m^3$) | Percent of NAAQS | National AAQS ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| $SO_2$ | 1-hour | Scrub/ Launch Day | 0.9 | 7.0 | 7.9 | 4.0% | 196.5 |
| | 3-hour | Scrub/ Launch Day | 0.3 | 2.6 | 2.9 | 0.2% | 1,300 |
| | 24-hour | Scrub/ Launch Day | 0.1 | 2.6 | 2.7 | 0.7% | 365 |
| | Annual | NA – Annual | 2.7E-04 | 0.8 | 0.8 | 1.0% | 80 |
| CO | 1-hour | Fueling Day | 1879.7 | 1264.0 | 3143.7 | 7.9% | 40,000 |
| | 8-hour | Fueling Day | 384.5 | 1149.0 | 1533.5 | 15.3% | 10,000 |
| $NO_2$[3] | 1-hour | Fueling Day | 49.7 | 8.8 | 58.5 | 31.1% | 188 |
| | Annual | NA – Annual | 0.3 | 0.6 | 0.9 | 0.9% | 100 |
| $PM_{10}$ | 24-hour | Fueling Day | 0.8 | 143.0 | 143.8 | 95.9% | 150 |
| $PM_{2.5}$ | 24-hour | Fueling Day | 0.4 | 23.3 | 23.7 | 67.7% | 35 |
| | Annual | NA – Annual | 2.7E-02 | 6.6 | 6.6 | 55.2% | 12[4] |

Notes:

1. All short-term results are the highest modeled value.
2. Annual results are the highest annual average.
3. $NO_2$ impacts modeled with ARM2 Tier 2 $NO_x/NO_2$ conversion.
4. EPA modified the annual $PM_{2.5}$ standard to 9.0 ug/m$^3$ on February 7, 2024, after this modeling effort was complete. For that reason, the standard in place at the time of modeling is shown.

# ATTACHMENT D
# AQIA and HRA Documentation

**California Ambient Air Quality Standard Analysis Results**

The results of the California Ambient Air Quality Standard analysis are presented in Table 2 below. All pollutant concentrations are below the California AAQS for each averaging period except for 24-hour $PM_{10}$ and the annual $PM_{10}$. The $PM_{10}$ background concentration alone exceeds the California AAQS for the 24-hour averaging period and the annual averaging period. The total modeled 24-hour $PM_{10}$ concentration for the ULA stationary source is 0.8 µg/m$^3$, well below the California AAQS of 50 µg/m$^3$. The total modeled annual $PM_{10}$ concentration for the ULA stationary source is 0.1 µg/m$^3$, well below the California AAQS of 20 µg/m$^3$.

**Table 2. California Ambient Air Quality Standard Analysis Results**

| Pollutant | Averaging Period[1,2] | Short-term Scenario with Highest Concentration | Modeled Conc. ($\mu g/m^3$) | Ambient Background Conc. ($\mu g/m^3$) | Total Conc. ($\mu g/m^3$) | Percent of CAAQS | California AAQS ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| $SO_2$ | 1-hour | Scrub/ Launch Day | 0.9 | 10.5 | 11.4 | 1.7% | 655 |
| | 24-hour | Scrub/ Launch Day | 0.1 | 2.6 | 2.7 | 2.5% | 105 |
| CO | 1-hour | Fueling Day | 1879.7 | 1264.0 | 3143.7 | 13.7% | 23,000 |
| | 8-hour | Fueling Day | 384.5 | 1149.0 | 1,533.5 | 15.3% | 10,000 |
| $NO_2$[3] | 1-hour | Fueling Day | 49.7 | 22.6 | 72.3 | 21.3% | 339 |
| | Annual | NA – Annual | 0.3 | 0.6 | 0.9 | 1.5% | 57 |
| $PM_{10}$ | 24-hour | Fueling Day | 0.8 | 143.0[4] | 143.8 | 287.6% | 50 |
| | Annual | NA – Annual | 0.1 | 27.6[4] | 27.7 | 138.6% | 20 |
| $PM_{2.5}$ | Annual | NA – Annual | 2.7E-02 | 6.6 | 6.6 | 55.2% | 12 |

Notes:

1. All short-term results are the highest modeled value.
2. Annual results are the highest annual average.
3. $NO_2$ impacts modeled with ARM2 Tier 2 $NO_x/NO_2$ conversion.
4. Ambient background is greater than the CAAQS. Because the project contribution will not exceed 10% of the CAAQS, the contribution is considered less than significant.

# ATTACHMENT D
# AQIA and HRA Documentation

## Increment Analysis Results

The results of the increment analysis are shown in Table 3 below. The total modeled concentration of all pollutants is below the minimum and maximum increment thresholds.

**Table 3. Increment Analysis Results**

| Pollutant | Averaging[1,2] Period | Short-term Scenario with Highest Concentration | Modeled Conc. ($\mu g/m^3$) | Increment ($\mu g/m^3$) | Percent of Increment |
|---|---|---|---|---|---|
| $SO_2$ | 3-hour | Scrub/Launch Day | 0.3[3] | 512 | 0.1% |
| | 24-hour | Scrub/Launch Day | 0.1 | 91 | 0.1% |
| | Annual | NA – Annual | 2.7E-04 | 20 | <0.01% |
| CO | 1-hour | Fueling Day | 1879.7 | 10,000 | 18.8% |
| | 8-hour | Fueling Day | 384.5 | 2,500 | 15.4% |
| $NO_2$[4] | 1-hour | Fueling Day | 49.7 | 100 – 188 | 49.7% |
| | Annual | NA – Annual | 0.3 | 25 | 1.0% |
| TSP | 24-hour | Minimal Op | 3.9 | 37 | 10.5% |
| | Annual | NA – Annual | 0.6 | 19 | 2.9% |
| $PM_{10}$ | 24-hour | Fueling Day | 0.8 | 12 – 30 | 6.6% |
| | Annual | NA – Annual | 0.1 | 17 | 0.7% |
| $PM_{2.5}$ | 24-hour | Fueling Day | 0.4 | 9 | 4.5% |
| | Annual | NA – Annual | 2.7E-02 | 4 | 0.7% |
| ROC | 3-hour | Fueling Day | 10.5 | 40 – 160 | 26.3% |

Notes:

1. All short-term results are the highest modeled value.
2. Annual results are the highest annual average.
3. ULA's Final AQIA Report incorrectly displays the 1-hour $SO_2$ result in place of the 3-hour $SO_2$ result for the increment analysis. This table displays the correct 3-hour $SO_2$ result.
4. $NO_2$ impacts modeled with ARM2 Tier 2 $NO_x/NO_2$ conversion.

## HRA Emissions

ULA's final toxic air contaminant (TAC) emission calculations for the HRA are found in the spreadsheets, *ULA Sources TACs_072423.xlsx* and *1 Hour Operational Equipment_07212023.xlsx*, of the August 2023 HRA submittal. See the *Modeling Inconsistencies and Deficiencies* section of this memo for a discussion of modeling errors that have minimal impact on the HRA results.

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# ATTACHMENT D
# AQIA and HRA Documentation

**Risk Analysis**

The risk analysis portion of the HRA was conducted using HARP 2, Build 22118. The *health.mdb* file used by HARP2 was version 23118, dated April 28, 2023. The cancer risks for the point of maximum impact (PMI), residential and sensitive receptors were determined using the "individual resident" receptor type, 30-year exposure duration and the intake rate from the "RMP using the Derived Method." The inhalation, soil, dermal, mother's milk, homegrown produce and fish[1] pathways were enabled for all residential[2] and sensitive receptors. The dairy pathway was enabled for only the federal penitentiary receptors[3]. The uncontrolled deposition rate of 0.05 m/s was selected. A "warm" climate was used for the dermal pathway. The default fractions for households that farm were used for the homegrown produce. The fraction of time at home (FAH) option was selected for only ages 16 years and older.

The cancer risks for the worker receptors were determined using the "worker" receptor type, 25-year exposure duration and the intake rate from the "OEHHA Derived Method." The worker exposure frequency of 250 days/year was selected. The chronic non-cancer hazard indices for the worker receptors were determined using the "worker" receptor type and the intake rate from the "OEHHA Derived Method." The required worker pathways (i.e., inhalation, soil and dermal) were enabled. The 8-hour moderate breathing rate was used. The uncontrolled deposition rate of 0.05 m/s was selected. A "warm" climate was used for the dermal pathway. A worker adjustment factor of 4.2 was applied to the worker cancer risk calculation for an operating schedule of 8 hours per day, 5 days per week. Worker adjustment factors do not apply for the chronic non-cancer risk calculation.

The 8-hour chronic hazard indices were calculated for worker receptors, residential receptors and sensitive receptors because the facility does not operate continuously. A worker adjustment factor of 4.2

[1] The fish pathway receptor with the highest risk for both modeled scenarios is Receptor No. 1, Pine Canyon Lakes (Lower), located at 728679 m E, 3844177 m N. The waterbody has a surface area of 44,970 square meters and a volume of 64,245,387 liters, and an assumed 0.5 volume changes per year. The fraction of human diet of fish from this waterbody is assumed to be 50%, consistent with VSFB's 2008 AB 2588 HRA.

[2] The chicken and egg pathways were not included for the Scenario 1 G1 and the Scenario 2 G1 runs, although ULA's Final HRA Report indicates they were included. See the *Modeling Inconsistencies and Deficiencies* section of this memo.

[3] Cattle graze on pastures located on VSFB, but only the federal penitentiary residents consume dairy products from these cattle. The beef pathway is not enabled as no beef products are consumed from these cattle. The pasture receptor with the highest risk in each scenario was used for the dairy exposure pathway; i.e., Receptor No. 49 (718584.17 E, 3826484 N) for Scenario 1 and Receptor No. 27 (720923.05 E, 3837559.6 N) for Scenario 2.

was applied to the worker 8-hour chronic non-cancer risk for an operating schedule of 8 hours per day, 5 days per week. Only the inhalation pathway affects the 8-hour chronic non-cancer risk calculation.

**Health Risk Assessment Results**

Cancer risk and chronic and acute non-cancer Hazard Index (HI) risk values were calculated and compared to the significance thresholds adopted by the District's Board of Directors. The calculated risk values and applicable thresholds are as follows:

| | ULA Max Risks | Significance Threshold |
|---|---|---|
| Cancer risk: | 4.49/million | ≥10/million |
| Chronic non-cancer risk: | <0.1 | >1 |
| 8-hour non-cancer risk: | <0.1 | >1 |
| Acute non-cancer risk: | 0.57 | >1 |

Based on these results, ULA's proposed project under ATC No. 15795 does not present a significant risk to the surrounding community.

The HRA results for the maximally exposed individual resident (MEIR) and maximally exposed individual worker (MEIW) are shown in Tables 4 through 7 of this memo. In addition, the point of maximum impact (PMI) is shown in Table 7 for acute non-cancer risk.

**Table 4. Cancer Risk Results at the MEIR and MEIW**

| Type of Receptor | Scenario[4] No. | Receptor Number | Cancer Risk (in a million) | UTME (m) | UTMN (m) |
|---|---|---|---|---|---|
| MEIR | 2 | G1-1070 | 1.36 | 723437.64 | 3838883.83 |
| MEIW | 2 | G1-1232 | 4.49 | 720961.48 | 3835987.82 |

**Table 5. Chronic Non-Cancer Risk Results at the MEIR and MEIW**

| Type of Receptor | Receptor Number | Chronic Non-Cancer HI | Health Endpoint | UTME (m) | UTMN (m) |
|---|---|---|---|---|---|

[4] The two scenarios are based on the mobile equipment locations. Mobile equipment currently operates at the Horizontal Integration Facility (HIF), SLC-3, and B945, B7525, and B8305. The equipment at SLC-3, B945, B7525 and B8305 will remain at their current locations. The equipment located at the HIF may move operations from the HIF to SLC-3. Therefore, the modeling was conducted assuming either location. Scenario 1 assumes the equipment remains at the HIF; while Scenario 2 assumes the equipment moves to SLC-3. This is described further in Section 3.5 of the Final HRA Report.

| | | | | | |
|---|---|---|---|---|---|
| MEIR[1] | G1-1070 | 4.33E-02 | Respiratory | 723437.64 | 3838883.83 |
| MEIW[1] | G1-1346 | 2.21E-02 | Respiratory | 716662.70 | 3831373.00 |

Note:
1. The results at the MEIR and MEIW were identical for Scenarios 1 and 2.

**Table 6. Chronic 8-Hour Non-Cancer Risk Results at the MEIR and MEIW**

| Type of Receptor | Receptor Number | Chronic 8-Hour Non-Cancer HI | Health Endpoint | UTME (m) | UTMN (m) |
|---|---|---|---|---|---|
| MEIR[1] | G1-1070 | 3.00E-03 | Central Nervous System | 723437.64 | 3838883.83 |
| MEIW[1] | G1-1346 | 5.48E-03 | Central Nervous System | 716662.70 | 3831373.00 |

Note:
1. The results at the MEIR and MEIW were identical for Scenarios 1 and 2.

**Table 7. Acute Non-Cancer Risk Results at the PMI, MEIR and MEIW**

| Type of Receptor | Scenario[4] No. | Receptor Number | Acute Non-Cancer HI | Health Endpoint | UTME (m) | UTMN (m) |
|---|---|---|---|---|---|---|
| PMI (onsite) | 2 | G1-1293 | 5.74E-01 | Eyes | 724120.76 | 3839874.83 |
| MEIR | 2 | G1-1074 | 1.33E-01 | Eyes | 725437.32 | 3845600.77 |
| MEIW | 2 | G1-1293 | 5.74E-01 | Eyes | 720918.77 | 3836195.57 |

**Modeling Inconsistencies and Deficiencies**[5]

The District identified several inconsistencies and minor errors in the final submittal of the HRA and AQIA. However, it can be seen with certainty that correcting these errors will not result in a significant health risk or an exceedance of an air quality standard. For that reason, revising the HRA and AQIA was not required. The inconsistencies/errors are listed below.

1. The annual heat inputs for each flare in the HRA emission calculations are not identical to the permit emission calculations. However, because the same TAC emission factor profile was used for all flares, the District compared the total annual heat input from all three flares. The total permitted heat

[5] Additional issues with the emission calculations were identified in the District's November 14, 2023 comment letter on the HRA and the revised 1-hour $NO_2$ AQIA. However, those items were related to emissions required for CEQA, which is no longer part of this analysis.

input is 55,079.81 MMBtu/yr, equaling 54.122 MMcf/yr; the total modeled fuel usage was 54.076 MMcf/yr. Therefore, revising the HRA was not required.

2. The maximum hourly fuel usage in the HRA emission calculations was not corrected for the Rocketship's emergency generator; the 0.5 fuel factor should not be included in maximum hourly emission calculations. The correct equation is listed below:

   371 bhp *(7420 Btu/chp-hr)/(140,000 Btu/gal)*(10^6 Btu/MMBtu) = 19.663 gal/hr

   Correcting this error is not expected to substantially increase the risk as the offshore sources are not acute risk drivers. For this reason, revising the HRA was not required.

3. The annual heat input of 14,373.1 MMBtu/yr in the AQIA emission calculations, *ULA Operational Emissions for Modeling_14Sept2022.xlsx*, cell C22 of the *GSE Flare* tab, is lower than the permitted annual heat input of 15,421.52 MMBtu/yr. The annual emissions in the AQIA modeling are based on this value and are therefore slightly underestimated. However, re-modeling was not required because the annual modeling results are well below the AAQS and it can be seen with certainty that this change will not result in an exceedance of an AAQS.

4. For the "Fueling Day" short-term scenario in the AQIA and for the HRA acute modeling, the flare emissions for both the AQIA and HRA were calculated based on a maximum hourly heat input of 50.838 MMBtu/hr. However, the worst-case hour will be:

   86.41 MMBtu/yr =
   (101.4 lb LNG/hr from tank boiloff + 3,570 lb LNG/hr from LNG sampling) * 0.023536 MMBtu/lb.

   Re-modeling was not required based on the risk driver, or the results and thresholds, as described below:

   a. $SO_2$ - While the "Scrub/Launch Day" scenario with the GSE Flare and Vehicle Flare have the highest $SO_2$ concentrations, the concentrations are all well below the thresholds for all three scenarios.
   b. CO - There is negligible change in the concentration between the "Minimal Operations" scenario and the "Scrub/Launch Day" scenario, indicating that the flares are not the drivers; the CO concentrations are impacted primarily from vehicles.
   c. $NO_2$ - The 1-hour $NO_2$ concentration is driven by the mobile equipment and vehicles, not the flares. The "Minimal Operations" scenario and the "Fueling Day" scenario have nearly identical results while the results of the "Scrub/Launch Day" scenario are the lowest due to the removal of

MOBEQ1. Furthermore, in the August 9, 2023 AQIA modeling, the 1-hour $NO_2$ concentrations in all scenarios decreased to below the increment threshold as a result of the emissions decrease from mobile equipment and vehicles.

d. $PM_{10}$ - The 24-hour $PM_{10}$ concentrations were the lowest in the "Scrub/Launch Day" scenario, indicating that the mobile equipment and vehicles are the driver. Doubling the heat input of the flares clearly will not increase the $PM_{10}$ concentration beyond ten percent of the CAAQS threshold of 50 $\mu g/m^3$, as the highest $PM_{10}$ concentration is 0.8 $\mu g/m^3$.

e. $PM_{2.5}$ - The 24-hour $PM_{2.5}$ concentration was the same across all scenarios, indicating that MOBEQ2 was the driver, as this was the only source that has identical emission rates in all scenarios.

f. The acute non-cancer risk was driven by the mobile equipment. This is demonstrated in the two scenarios included in the August 2023 HRA. The difference in scenarios is the locations of the mobile equipment; no changes in the flare emissions occur between scenarios. For Scenario 1, the PMI is 0.349 and for Scenario 2, the PMI is 0.574.

5. For the "Scrub/Launch Day" short-term scenario in the AQIA and for the HRA acute modeling, emissions from the GSE elevated flare were calculated based on a maximum hourly heat input of 271.465 MMBtu/hr. However, the worst-case hour will be:

   442.91 MMBtu/yr =
   (101.4 lb LNG/hr from tank boiloff + 4,316.8 lb LNG/hr from K/O drum boiloff + 14,400 lb LNG/hr from storage tank vent) * 0.023536 MMBtu/lb.

   If the worst-case hourly emissions from the GSE elevated flare were corrected, the modeling results would not change in any significant way, as described in item no. 4 above.

6. For the "Fueling Day" short-term scenario in the AQIA, no emissions were modeled for the GSE elevated flare. The enclosed flare may be offline up to 10 days per year and during up to [redacted] truck offloading events per year, during which LNG will be routed to the GSE elevated flare, which has higher CO, ROC and NOx emission factors than the enclosed flare. The modeled CO, ROC and $NO_2$ emissions were based on the enclosed flare emission factors rather than the GSE elevated flare emission factors. Although their modeling parameters are not identical, no re-modeling is required because these two flares are in close proximity to each other and are not risk drivers or drivers for the CO, ROC, $NO_2$ AQIA results.

7. The District allowed ULA the option to revise the ROC emission rate for the GASOFFLD source to match the permit emission calculations, which is lower than what was modeled, and the option to revise the ROC emission factor in the Vehicle Flare and GSE Flare tabs to match the permit calculations, which use lower ROC emission factors. Re-modeling is unnecessary because the modeled emissions are conservative. Furthermore, the modeling results show that the ROC increment

was the same for every scenario because it is driven by the mobile equipment (MOBEQ1 and MOBEQ2 sources).

8. For most runs in the HRA, all receptors, including pathway receptors, used the default flagpole height set at 1.5 m. However, there were three runs with no default flagpole height specified, as identified in the District's November 14, 2023 comment letter, in which case AERMOD assigns a flagpole height of zero. If HRA modeling is conducted in the future, all pathway receptor **.ROU* files should be revised to specify the flagpole height of zero and the flagpole height of all other receptors should be set at 1.5 meters (i.e., the default flagpole height should not be set). The flagpole heights have minimal impact on the receptor concentration. Because none of the risk results are close to the significance thresholds, revising the flagpole heights was not required.

9. As noted in the District's November 14, 2023 comment letter, the plotfile for the Federal Penitentiary (Source ID G_14837) was listed twice in the HARP file, *ULA_PENIT_Plotfiles.csv*. The same error was found in the HARP files *S1PENIT_080623_IMPORTPLOT.CSV* and *S2PENIT_080623_IMPORTPLOT.CSV*. If the HRA is rerun, the plotfile lists should be corrected accordingly. As this error did not result in an underestimated risk, revision was not required.

10. The chicken and egg pathways were not included for Scenario 1 G1 and Scenario 2 G1 runs, although ULA's Final HRA Report indicates they were included. While these pathways should have been included in the residential risk calculations, the impact of these pathways is negligible on the HRA results. For example, in the first submittal of the HRA (e.g., November 2022 submittal), the sum of the residential cancer risk from the chicken and egg pathways contributed less than 0.001% to the total residential cancer risk at all receptors. For that reason, revision of the risk analysis was not required.

**Conclusion**

Based on the AQIA modeling results, operation of ULA's three liquefied natural gas flares, a storage tank, and associated equipment used for Vulcan Centaur launches will not exceed an ambient air quality standard for CO, $SO_2$, $NO_2$, and $PM_{2.5}$. The 24-hour $PM_{10}$ California AAQS and annual $PM_{10}$ is exceeded based on the background concentration alone. The modeled 24-hour $PM_{10}$ concentration for the entire stationary source is less than ten percent of the California AAQS and the modeled annual $PM_{10}$ is less than ten percent of the California AAQS. Furthermore, the modeling shows that this project's impact is below the allowable increment for all pollutants in a Class II area.

Per District guidelines, if a facility's toxic emissions result in a cancer risk equal to or greater than 10 in a million, it is considered a significant risk facility. For non-cancer risk, if a facility's toxic emissions result in a Hazard Index greater than 1.0, it is considered a significant risk facility. The HRA modeling results show that the equipment permitted under ATC No. 15795 will not present a significant risk to the surrounding community.

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# ATTACHMENT D
# AQIA and HRA Documentation

**References**


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# ATTACHMENT D
AQIA and HRA Documentation

https://sbcapcd.sharepoint.com/sites/Confidential_Files/Shared Documents/Confidential/FID 11785 ULA-Vulcan EELV/ATC 15795/Memo Re AQIA and HRA Modeling.docx