State of Utah

SPENCER J. COX
Governor

DEIDRE HENDERSON
Lieutenant Governor

Department of
Environmental Quality

Kimberly D. Shelley
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

RN143260009

December 1, 2022

David Robinson
Sawtooth Caverns, LLC
6965 South Union Park Center #270
Midvale, UT 84047
david.robinson@sawtoothcaverns.com

Dear David Robinson,

Re: Engineer Review:
Modification to Approval Order to DAQE-AN143260008-22, to Update Equipment and Emissions
Project Number: N143260009

The DAQ requests a company representative review and sign the attached Engineer Review (ER). This ER identifies all applicable elements of the New Source Review permitting program. Sawtooth Caverns, LLC should complete this review within **10 business days** of receipt.

Sawtooth Caverns, LLC should contact **Tad Anderson** at (385) 306-6515 if there are questions or concerns with the review of the draft permit conditions. Upon resolution of your concerns, please email tdanderson@utah.gov the signed cover letter to Tad Anderson. Upon receipt of the signed cover letter, the DAQ will prepare an ITA for a 30-day public comment period. At the completion of the comment period, the DAQ will address any comments and will prepare an AO for signature by the DAQ Director.

If Sawtooth Caverns, LLC does not respond to this letter within **10 business days,** the project will move forward without source concurrence. If Sawtooth Caverns, LLC has concerns that cannot be resolved and the project becomes stagnant, the DAQ Director may issue an Order prohibiting construction.

Approval Signature _____
*(Signature & Date)*

# UTAH DIVISION OF AIR QUALITY
# ENGINEER REVIEW

## SOURCE INFORMATION

| | |
|---|---|
| Project Number | N143260009 |
| Owner Name | Sawtooth Caverns, LLC |
| Mailing Address | 6965 South Union Park Center #270<br>Midvale, UT, 84047 |
| Source Name | Sawtooth Caverns, LLC - Sawtooth NGL Storage Facility |
| Source Location | 9650 North 540 East<br>Delta, UT 84624 |
| UTM Projection | 365,044 m Easting, 4,372,053 m Northing |
| UTM Datum | NAD83 |
| UTM Zone | UTM Zone 12 |
| SIC Code | 4226 (Special Warehousing & Storage, NEC) |
| Source Contact | David Robinson |
| Phone Number | (832) 489-8837 |
| Email | david.robinson@sawtoothcaverns.com |
| Project Engineer | Tad Anderson, Engineer |
| Phone Number | (385) 306-6515 |
| Email | tdanderson@utah.gov |
| Notice of Intent (NOI) Submitted | June 16, 2022 |
| Date of Accepted Application | November 9, 2022 |

# SOURCE DESCRIPTION

General Description
Sawtooth Caverns, LLC (Sawtooth) operates the Sawtooth Natural Gas Liquids (NGL) Storage Facility near Delta, Utah. The Sawtooth NGL Storage Facility receives NGLs and refined products from trucks and railcars and stores NGLs and refined products in multiple underground salt caverns. Equipment includes pipelines, four refined products storage vessels (tanks), four small additive and waste tanks, and allows refined products to be stored in the salt caverns in addition to NGL. The products will be moved only by pipeline, truck, and railcar.

NSR Classification:
Minor Modification at Minor Source

Source Classification
Located in Attainment Area, Millard County
Airs Source Size: B

Applicable Federal Standards
NSPS (Part 60), A: General Provisions
NSPS (Part 60), Kb: Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984
NSPS (Part 60), XX: Standards of Performance for Bulk Gasoline Terminals
NSPS (Part 60), IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
MACT (Part 63), A: General Provisions
MACT (Part 63), ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines
MACT (Part 63), BBBBBB: National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Distribution Bulk Terminals, Bulk Plants, and Pipeline Facilities

Project Proposal
Modification to Approval Order to DAQE-AN143260008-22, to Update Equipment and Emissions

Project Description
Sawtooth has requested to add a 350 hp fire water pump engine, a 15,000 bbl ethanol tank, 17 pressurized storage tanks and four ethanol railcar unloading points to the existing facility. The 17 pressurized storage tanks are not emitting units, but the fugitives VOC emissions associated with the piping are considered part of the unit count on fugitive emissions. The emissions from the new equipment have been added to the emissions summary.

## EMISSION IMPACT ANALYSIS

Modeling is not required as the emission increases are below the thresholds below those established in R307-410-4 and R307-410-5. The emission increase from this modification are 0.01 tons per year of $PM_{10}$, 0.03 tons per year of $PM_{2.5}$, 0.77 tons per year of $NO_x$, 0.39 tons per year of CO, 0.04 tons per year of $SO_x$, 0.78 tons per year of VOC, and 0.13 tons per year of combined HAP's emissions. [Last updated November 14, 2022]

## SUMMARY OF EMISSIONS

The emissions listed below are an estimate of the total potential emissions from the source. Some rounding of emissions is possible.

| Criteria Pollutant | Change (TPY) | Total (TPY) |
|---|---|---|
| $CO_2$ Equivalent | 197.77 | 2835.00 |
| Carbon Monoxide | 0.39 | 4.46 |
| Nitrogen Oxides | 0.77 | 2.18 |
| Particulate Matter - $PM_{10}$ | 0.01 | 2.72 |
| Particulate Matter - $PM_{2.5}$ | 0.03 | 0.38 |
| Sulfur Dioxide | 0.04 | 0.05 |
| Volatile Organic Compounds | 0.78 | 31.08 |

| Hazardous Air Pollutant | Change (lbs/yr) | Total (lbs/yr) |
|---|---|---|
| 2,2,4-Trimethylpentane (CAS #540841) | 460 | 460 |
| Benzene (Including Benzene From Gasoline) (CAS #71432) | 20 | 80 |
| Ethyl Benzene (CAS #100414) | 160 | 160 |
| Generic HAPs (CAS #GHAPS) | -1680 | 2180 |
| Hexane (CAS #110543) | 60 | 120 |
| Toluene (CAS #108883) | 480 | 800 |
| Xylenes (Isomers And Mixture) (CAS #1330207) | 760 | 800 |
| | **Change (TPY)** | **Total (TPY)** |
| Total HAPs | 0.13 | 2.30 |

***Note: Change in emissions indicates the difference between previous AO and proposed modification.***

# Review of BACT for New/Modified Emission Units

1. **BACT review regarding Fire Pump, Ethanol Storage Tank and Unloading**

Sawtooth has proposed installing a new fire water pump engine with a maximum power rating of 350 hp, a 15,000 bbl ethanol storage tank with four railcar unloading points at the Sawtooth natural gas liquids storage facility. Sawtooth analyzed the following control technology in the BACT analysis for the fire water pump: Selective Catalyst Reduction (SCR), Diesel Particulate Filters (DPF), Diesel Oxidation Catalyst (DOC), tier certified engines, limited use of ultra-low sulfur fuel, hours of operation, and good combustion practices. The Ethanol storage tank and railcar unloading points were reviewed for fugitive VOC emissions.

**$NO_x$**

$NO_x$ is the primary pollutant emitted from new fire water pump engine. The following control technologies were evaluated for $NO_x$: SCR, and use of EPA certified engines.

*SCR*

The SCR process works by chemically reducing the $NO_x$ molecule in an emission stream into molecular nitrogen and water vapor. A reagent such as ammonia or urea is injected into the ductwork downstream of the combustion unit, which mixes with the waste gas, and the mixture enters a catalyst. The mixture diffuses through the catalyst and reacts selectively with the $NO_x$ to reduce emissions. SCR systems are estimated to reduce $NO_x$ emissions by up to 90%.

Sawtooth analyzed the use of SCR to control the NOx emissions on new fire water pump engine and SCR is technically feasible for the new fire water pump engine. The additional cost to install and maintain SCR on the fire water pump engine makes the use of SCR on fire water pump engine economically infeasible.

An ammonia slip is an additional consideration with the use of an SCR system. Ammonia slip occurs from unreacted ammonia, which occurs when excess reagent is needed to adequately control $NO_x$ emissions. Ammonia slip increases over time as the catalyst degrades. This is a negative environmental impact which adds exclusion of SCR to the BACT determination.

*Use EPA Certified Engines*

Engines are required to meet certain emission limits, or tier ratings, based on the size and model year. Sawtooth proposed to use a fire water pump engine that meets EPA certification requirements for stationary applications.

**Other Criteria Pollutants**

PM, CO, VOCs, and $SO_2$ are also emitted from fire water pump engine. The following control technologies were identified.

Diesel Oxidation Catalyst

A diesel oxidation catalyst (DOC) utilizes a catalyst such as platinum or palladium to oxidize hydrocarbons and VOCs in the engine's exhaust to $CO_2$ and water. Use of a DOC can result in approximately 90 percent reduction in HC/VOC emissions. In addition to controlling HC/VOC a DOC also has the potential to control PM by 30 percent and CO by 50 percent if low sulfur diesel fuel is used. The technology is technically feasible; however, due to the minimal emissions from fire water pump engine it is not economically feasible.

Diesel Particulate Filters (DPF's)

This technology is placed in the exhaust pathway to prevent the release of particulate and may be

coated with a catalyst to further capture hydrocarbon emissions. The technology is technically feasible; however, due to the minimal emissions from fire water pump engine it is not economically feasible.

Ultra-Low Sulfur Diesel

Ultra-low sulfur diesel (ULSD) contains less than 0.0015 % sulfur by weight. The reduced sulfur content reduces the potential for $SO_x$ emissions. The low sulfur content results in a lower potential for aggregation of sulfur containing compounds and reduces $PM_{2.5}$ emissions. The use of ULSD is technically and economically feasible.

Good Combustion Practices

Good combustion practices refer to the operation of engines at high combustion efficiency, which reduces the products of incomplete combustion. The fire water pump engine is designed to achieve maximum combustion efficiency. The manufacturer will provide operation and maintenance manuals that detail the required methods to achieve the highest levels of combustion efficiency making good combustion practices technically feasible.

**BACT Determination**

DAQ has determined that BACT for the fire water pump engine will be met or exceeded as follows:

1) Use of EPA certified engine.
2) Use low-sulfur diesel fuel.
3) Conduct proper maintenance according to the manufacturer specifications.
4) Limit visible emissions to 20%.

The ethanol storage tank and railcar unloading points were reviewed for fugitive VOC emissions.

The ethanol storage tank is subject to NSPS Subpart Kb standards. The available control technology options to control VOC emissions include, a fixed roof tank with vapor combustion (95% control), an internal floating roof (IFR) tank, a domed external floating roof (DEFR) tank, and proper operations and maintenance.

The VOC emissions associated with the ethanol storage tank is 0.14 tons per year. BACT for the ethanol storage tanks is the installation of an internal floating roof in the tank and proper operations and maintenance.

The railcar loading activity will be subject to NESHAP Subpart BBBBBB and NSPS XX standards. The available control technology options include vapor combustion of loading operations (98.5% capture and control efficiency) and periodic Leak Detection and Repair (LDAR).

The VOC emissions associated with the unloading points are 0.09 tons per year. BACT for the unloading points is the use of LDAR program.

The added pressurized storage tanks are not considered an emitting unit by design but has valves, pumps, flanges, valves, and other components that could have fugitive VOC emissions which will are covered by sitewide LDAR.
[Last updated November 14, 2022]

# SECTION I: GENERAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

| | |
|---|---|
| I.1 | All definitions, terms, abbreviations, and references used in this AO conform to those used in the UAC R307 and 40 CFR. Unless noted otherwise, references cited in these AO conditions refer to those rules. [R307-101] |
| I.2 | The limits set forth in this AO shall not be exceeded without prior approval. [R307-401] |
| I.3 | Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved. [R307-401-1] |
| I.4 | All records referenced in this AO or in other applicable rules, which are required to be kept by the owner/operator, shall be made available to the Director or Director's representative upon request, and the records shall include the two-year period prior to the date of the request. Unless otherwise specified in this AO or in other applicable state and federal rules, records shall be kept for a minimum of two (2) years. [R307-401-8] |
| I.5 | At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this AO, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded. [R307-401-4] |
| I.6 | The owner/operator shall comply with UAC R307-107. General Requirements: Breakdowns. [R307-107] |
| I.7 | The owner/operator shall comply with UAC R307-150 Series. Emission Inventories. [R307-150] |
| I.8 | The owner/operator shall submit documentation of the status of construction of tanks T-006 and T-007 to the Director within 18 months from the date of previous AO dated May 24, 2022. The owner/operator shall submit documentation of the status of construction or modification to the Director within 18 months from the date of this AO. This AO may become invalid if construction is not commenced within 18 months from the date of this AO or if construction is discontinued for 18 months or more. To ensure proper credit when notifying the Director, send the documentation to the Director, attn.: NSR Section. [R307-401-18] |

# SECTION II: PERMITTED EQUIPMENT

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

## II.A THE APPROVED EQUIPMENT

| | |
|---|---|
| II.A.1 | **Sawtooth NGL Storage Facility** |
| II.A.2 | **Emergency Generator Engine**<br>Rating: 144 hp<br>Fuel: Diesel<br>Manufacturer Date: 2016<br>Installation Date: 2016<br>NSPS Applicability: 40 CFR 60 Subpart IIII<br>MACT Applicability: 40 CFR 63 Subpart ZZZZ |
| II.A.3 | **Emergency Generator Engine**<br>Rating: 144 hp<br>Fuel: Diesel<br>Manufacturer Date: 2016<br>Installation Date: 2016<br>NSPS Applicability: 40 CFR 60 Subpart IIII<br>MACT Applicability: 40 CFR 63 Subpart ZZZZ |
| II.A.4<br>NEW | **Fire Pump Engine (NEW)**<br>Rating: 350 hp<br>Fuel: Diesel<br>NSPS Applicability: 40 CFR 60 Subpart IIII<br>MACT Applicability: 40 CFR 63 Subpart ZZZZ |
| II.A.5 | **Evaporation Ponds** |
| II.A.6 | **Degassifier**<br>Vessel used to degas brine. Released gases controlled by integrated enclosed combustor. |
| II.A.7 | **Rail/Truck Loading and Unloading Equipment** |
| II.A.8 | **Piping Fugitives**<br>Gasoline and diesel pipeline fugitive emission points, including:<br>electric product pumps, pipeline connectors (flanges, valves, connectors) and ancillary equipment (pig launching and receiving equipment) |
| II.A.9 | **One Refined Fuel Loading Rack**<br>Capacity: 10,000 bbls per day<br>Control: Vapor Combustion Unit<br>MACT Applicability: Subpart BBBBBB<br>NSPS Applicability: Subpart XX |

| | |
|---|---|
| II.A.10 | **Vapor Combustion Unit**<br>Rating: 40 MMBtu/hr<br>Supplemental Fuel: Propane<br>Controls: Refined Fuel/Ethanol Loading Racks<br>NSPS Applicability: Subpart XX |
| II.A.11 | **Four Refined Product Storage Tanks**<br>RP T-004, RP T-005, RP T-006, RP T-007<br>Capacity: 1,000 bbls each<br>Control: Internal floating roof<br>NSPS Applicability: Subpart Kb |
| II.A.12 | **One Butane Vaporizer**<br>Rating: 2.53 MMbtu/hr<br>Fuel: Propane |
| II.A.13<br>NEW | **Ethanol Storage Tank (NEW)**<br>RP T-008<br>Capacity: 15,000 bbl<br>Control: Internal floating roof<br>NSPS Applicability: Subpart Kb |
| II.A.14<br>NEW | **Four Ethanol Railcar Unloading Points (NEW)**<br>Control: Vapor Combustion Unit |
| II.A.15 | **Miscellaneous Storage Tanks**<br>1 fixed roof tank for storage of tank bottoms<br>3 fixed roof tanks for storage of diesel additives<br>17 pressurized storage tanks (NEW)<br>1 wastewater tank (NEW) |

# SECTION II: SPECIAL PROVISIONS

The intent is to issue an air quality AO authorizing the project with the following recommended conditions and that failure to comply with any of the conditions may constitute a violation of the AO. **(New or Modified conditions are indicated as "New" in the Outline Label):**

## II.B REQUIREMENTS AND LIMITATIONS

| | |
|---|---|
| II.B.1 | **Site-wide Requirements** |
| II.B.1.a<br>NEW | Unless otherwise specified in this AO, the owner/operator shall not allow visible emissions to exceed the following opacity limits:<br><br>A. Diesel-fired emergency generators and fire pump engine - 20%<br>B. Haul roads - 20%<br>C. Degassifier combustor and the vapor combustion unit shall operate with no visible emissions<br>D. All other points - 10%. [R307-401-8] |

| | |
|---|---|
| II.B.1.a.1<br>NEW | Unless otherwise specified in this AO, opacity observations of emissions from stationary sources shall be conducted in accordance with 40 CFR 60, Appendix A, Method 9. [R307-401-8] |
| II.B.1.a.2<br>NEW | Visible fugitive dust emission determinations shall use procedures similar to Method 9. The normal requirement for observations to be made at 15-second intervals over a six-minute period, however, shall not apply. Visible emissions shall be measured at the densest point of the plume but at a point not less than 1/2 vehicle length behind the vehicle and not less than 1/2 the height of the vehicle. [R307-401-8] |
| II.B.1.a.3<br>NEW | Visual determination of emissions from the combustor and vapor combustion unit shall be conducted according to 40 CFR 60, Appendix A, Method 22. [R307-401-8] |
| II.B.2 | **Brine Ponds Requirements** |
| II.B.2.a | The owner/operator shall not extract more than 16,000,000 bbls of brine from the caverns per rolling 12-month period. [R307-401-8] |
| II.B.2.a.1<br>NEW | To determine compliance with a rolling 12-month total, the owner/operator shall:<br>A. Calculate a new 12-month total using data from the previous 12 months.<br>B. Determine the volume of extracted brine using monthly NGL throughput data.<br>C. Keep records of extracted brine for all periods when the plant is in operation.<br>D. Record volume of extracted brine on a monthly basis. [R307-401-8] |
| II.B.3 | **Combustor and Vapor Combustion Unit Requirements** |
| II.B.3.a | The degassifier combustor, and the vapor combustion unit, shall be equipped with an operational auto-igniter. [R307-401-8] |
| II.B.3.b | The degassifier combustor shall be limited to 500 hours of downtime per rolling 12-month period for inspection, maintenance, and repair. No fluids shall be present in the degassifier during periods of flare downtime. [R307-401-8] |
| II.B.3.b.1 | The owner/operator shall:<br>A. Determine hours of downtime by monitoring and maintaining an operation log<br>B. Record downtime in a monthly operator log<br>C. Use records to calculate a new rolling 12-month total each month using data from the previous 12 months. [R307-401-8] |
| II.B.4<br>NEW | **Engine Requirements** |

| | |
|---|---|
| II.B.4.a<br>NEW | The owner/operator shall not exceed:<br><br>A. 500 hours of operation per rolling 12-month total for the fire pump engine<br>B. 100 hours of non-emergency situation operation per calendar year of the emergency generator engines<br><br>There is no time limit on the use of the emergency generator engines during emergencies. [R307-401-8] |
| II.B.4.a.1<br>NEW | To determine compliance with calendar year engine requirement the owner/operator shall calculate total yearly use by the 20th day of January using data from the previous 12 months. To determine compliance with the rolling 12-month total the owner/operator shall calculate a new rolling 12-month total by the 20th day of each month using data from the previous 12 months. Records documenting the operation of the engines shall be kept in a log and shall include the following:<br><br>A. The date the engines were used;<br><br>B. The duration of operation each day in hours; and<br><br>C. The reason for the emergency generator engine usage. [R307-401-8] |
| II.B.4.b<br>NEW | Records of hours of operation shall be determined by installing a non-resettable hour meter for the engines. [R307-401-8] |
| II.B.4.c<br>NEW | The owner/operator shall only use diesel fuel (fuel oil #1, #2 or diesel fuel oil additives) in the emergency generator engines and the fire pump engine. All diesel burned shall meet the requirements of 40 CFR 80.510(c). [40 CFR 60 Subpart IIII] |
| II.B.4.c.1 | To demonstrate compliance with the fuel oil requirements, the owner/operator shall keep and maintain fuel purchase invoices. The fuel purchase invoices shall indicate that the diesel fuel meets the ultra-low sulfur diesel requirements, or the owner/operator shall obtain certification of sulfur content from the fuel supplier. [40 CFR 60 Subpart IIII] |
| II.B.5 | **Monitoring Requirements of Fugitive Emissions (Leak Detection and Repair)** |
| II.B.5.a | The owner/operator shall develop a fugitive emissions monitoring plan. At a minimum, the plan shall include:<br><br>A. Monitoring frequency. For equipment in gasoline service the monitoring frequency shall be no less than monthly as per 40 CFR 63 Subpart BBBBBB<br><br>B. Monitoring technique and equipment<br><br>C. Monitoring for "difficult-to-monitor" and "unsafe-to-monitor" components<br><br>D. Procedures and time frames for identifying and repairing leaks<br><br>E. Record keeping practices<br><br>F. Calibration and maintenance procedures<br><br>[40 CFR 63 Subpart BBBBBB, R307-401-8] |

| | |
|---|---|
| II.B.5.a.1 | Monitoring shall be conducted according to the following schedule:<br><br>A. No later than 60 days from the date of the final installation.<br><br>B. Annually after the initial monitoring survey.<br><br>C. Monthly for equipment in gasoline service.<br><br>D. As required by the owner/operator's monitoring plan for "unsafe-to-monitor" components.<br><br>[40 CFR 63 Subpart BBBBBB, R307-401-8] |
| II.B.5.b | If fugitive emissions are detected at any time, the owner/operator shall repair the fugitive emissions component as soon as possible but no later than 30 calendar days after detection (15 days for equipment in gasoline service).<br><br>If the repair or replacement is technically infeasible without a process unit shutdown, the repair or replacement must be completed after an unscheduled, planned, or emergency unit shutdown or within 24 months, whichever is earlier.<br><br>[40 CFR 63 Subpart BBBBBB, R307-401-8] |
| II.B.5.b.1 | The owner/operator shall resurvey the repaired or replaced fugitive emissions component no later than 30 calendar days after the fugitive emissions component was repaired. [R307-401-8] |
| II.B.5.c | The owner/operator shall maintain records of the fugitive emissions monitoring plan, monitoring surveys, repairs, and resurveys. [R307-401-8] |
| II.B.6 | **Haul Road and Fugitive Dust Requirements** |
| II.B.6.a | All unpaved roads and other unpaved operational areas that are used by mobile equipment shall be water sprayed and/or chemically treated to control fugitive dust when the ambient temperature is above freezing. Treatments shall be of sufficient frequency and quantity to meet the opacity limits listed in this AO, or as determined necessary by the Director. [R307-401-8] |
| II.B.6.a.1 | Records of water/chemical treatment shall be kept for all periods when the facility is in operation. The records shall include the following items:<br><br>A. Date of treatment;<br><br>B. Number of treatments made; and<br><br>C. Records of temperature if the temperature is below freezing. [R307-401-8] |
| II.B.6.b | Water/chemical treatment and opacity requirements for haul roads only apply to roads exclusive to and located within the Sawtooth NGL Storage Facility leased property. Roads located on SITLA or Magnum easements are not subject to the requirements of this AO. [R307-401-8] |

| | |
|---|---|
| II.B.7 | **Loading Requirements** |
| II.B.7.a<br>NEW | The owner/operator shall not exceed:<br><br>A.15,120,000 gallons of ethanol per rolling 12-month period.<br>B.153,000,000 gallons of refined fuel loading per rolling 12-month period.<br><br>Refined fuel means gasoline, jet fuel, or diesel fuel. [R307-401-8] |
| II.B.7.a.1<br>NEW | The owner/operator shall:<br><br>A. Determine fuel/ethanol loading volume by examination of company and/or customer billing records.<br><br>B. Record fuel loading on a daily basis.<br><br>C. Use the fuel/ethanol loading record to calculate a new rolling 12-month total by the 20th day of each month using data from the previous 12 months. [R307-401-8] |
| II.B.7.b<br>NEW | The owner/operator shall route all vapors from the refined fuel/ethanol loading racks through the vapor combustion unit prior to venting to the atmosphere. [R307-401-8] |
| II.B.7.c | The owner/operator shall route all gasoline vapors displaced from tank trucks and railcars during product loading through the vapor combustion unit before venting to the atmosphere. [40 CFR 60 Subpart XX, R307-401-8] |

# PERMIT HISTORY

When issued, the approval order shall supersede (if a modification) or will be based on the following documents:

| | |
|---|---|
| Supersedes | AO DAQE-AN143260008-22 dated May 24, 2022 |
| Is Derived From | NOI dated June 2, 2022 |
| Incorporates | Additional Information dated August 19, 2022 |

# REVIEWER COMMENTS

1. **Comment regarding Equipment List Update:**
The source never installed or used the 50,000 bbl tanks requested in the AO DAQE-AN143260004-19. The storage tank emissions were recalculated with an updated throughput to reflect the installation of 2 additional 1000 bbl tanks versus the 50,000 bbl tanks. [Last updated July 12, 2022]

2. **Comment regarding Emission Estimates:**
Sawtooth has requested to install a new fire water pump engine, an ethanol storage tank with four railcar unloading points. The following are the emissions estimates for requested sources.

   The new fire pump engine emissions estimates use 500 hours of operations limitation and emission factors from NSPS IIII and AP-42.

   The ethanol storage tank with four railcar unloading points emissions estimates use a throughput of 169,327,200 gallons annually and emission equations and emissions factors from AP-42 Section 5.2, AP-42 Chapter 7 table 7.1-2, NSPS Subpart XX, program TANKS 4.0.9d and 40 CFR 98 Subpart C for GHG's.

   The emissions from the pressurized tanks valves, pumps, flanges, valves, and other components have already been included into the unit count for VOC fugitive emissions. [Last updated November 14, 2022]

3. **Comment regarding HAP emissions:**
The previous AO identified some individual HAPs were not listed. This NOI clarified some HAPs that were included in this modification. The additional HAP emissions listed from the NOI came from the truck loading, HAP emissions on product speciation. [Last updated December 1, 2022]

4. **Comment regarding Applicable Regulations:**
The Sawtooth facility is subject to NSPS (Part 60), A: General Provisions, NSPS (Part 60), Kb: Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984, NSPS (Part 60), XX: Standards of Performance for Bulk Gasoline Terminals, NSPS (Part 60), IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, MACT (Part 63), A: General Provisions MACT (Part 63), ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines, and MACT (Part 63), BBBBBB: National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Distribution Bulk Terminals, Bulk Plants, and Pipeline Facilities. The new fire water pump engine is subject to 40 CFR 60 Subpart IIII and 40 CFR 63 subpart ZZZZ. The new ethanol storage tank is subject to 40 CFR 60 Subpart Kb. [Last updated November 14, 2022]

5. **Comment regarding Limited Use Fire Water Pump:**
Sawtooth has requested to classify the fire water pump engine as a limited use piece of equipment instead of an emergency piece of equipment. The fire water pump engine is limited to 500 hours per year of operation including maintenance and testing. [Last updated November 14, 2022]

6. **Comment regarding Pressurized Storage Tanks:**
During the latest compliance inspection from UDAQ, the compliance inspector noted 17 pressurized storage tanks that were not listed in the AO. Pressurized storage tanks are not emitting units but the pumps, flanges, valves, and other components for the pressurized storage tanks are considered emitting units under the fugitive VOC emissions under the LDAR program. The pressurized storage tanks are listed in the equipment list but do not have any AO requirements. [Last updated November 14, 2022]

7. **Comment regarding Wastewater Storage Tank:**
The equipment list has been updated with wastewater storage tanks. UDAQ considered miscellaneous storage tanks low (less than 0.01 VOC) emitting units or non-emitting units listed for informational purposes. These tanks do not have any AO requirements since the emissions are so low or nonexistent. [Last updated November 14, 2022]

8. **Comment regarding AO Rule Requirement Removal:**
State and federal rule requirement referencing fugitive dust and Subpart XX were removed from the AO. The State and Federal rule requirement are not required to listed in the AO for the source to be subject to them. They have been removed to minimize AO requirements. [Last updated November 18, 2022]

9. **Comment regarding AO Requirement Update:**
The visible emissions requirement has been combined and updated in this AO modification. The AO requirement that has equipment numerical references has been updated to remove specific numerical references. [Last updated November 14, 2022]

10. **Comment regarding BACT Analysis:**
The BACT analysis for this modification was conducted on the 500 hours of operations for the fire water pump engine. [Last updated November 14, 2022]

# ACRONYMS

The following lists commonly used acronyms and associated translations as they apply to this document:

| | |
|---|---|
| 40 CFR | Title 40 of the Code of Federal Regulations |
| AO | Approval Order |
| BACT | Best Available Control Technology |
| CAA | Clean Air Act |
| CAAA | Clean Air Act Amendments |
| CDS | Classification Data System (used by EPA to classify sources by size/type) |
| CEM | Continuous emissions monitor |
| CEMS | Continuous emissions monitoring system |
| CFR | Code of Federal Regulations |
| CMS | Continuous monitoring system |
| CO | Carbon monoxide |
| $CO_2$ | Carbon Dioxide |
| $CO_2e$ | Carbon Dioxide Equivalent - 40 CFR Part 98, Subpart A, Table A-1 |
| COM | Continuous opacity monitor |
| DAQ/UDAQ | Division of Air Quality |
| DAQE | This is a document tracking code for internal UDAQ use |
| EPA | Environmental Protection Agency |
| FDCP | Fugitive dust control plan |
| GHG | Greenhouse Gas(es) - 40 CFR 52.21 (b)(49)(i) |
| GWP | Global Warming Potential - 40 CFR Part 86.1818-12(a) |
| HAP or HAPs | Hazardous air pollutant(s) |
| ITA | Intent to Approve |
| LB/HR | Pounds per hour |
| LB/YR | Pounds per year |
| MACT | Maximum Achievable Control Technology |
| MMBTU | Million British Thermal Units |
| NAA | Nonattainment Area |
| NAAQS | National Ambient Air Quality Standards |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NOI | Notice of Intent |
| $NO_x$ | Oxides of nitrogen |
| NSPS | New Source Performance Standard |
| NSR | New Source Review |
| $PM_{10}$ | Particulate matter less than 10 microns in size |
| $PM_{2.5}$ | Particulate matter less than 2.5 microns in size |
| PSD | Prevention of Significant Deterioration |
| PTE | Potential to Emit |
| R307 | Rules Series 307 |
| R307-401 | Rules Series 307 - Section 401 |
| $SO_2$ | Sulfur dioxide |
| Title IV | Title IV of the Clean Air Act |
| Title V | Title V of the Clean Air Act |
| TPY | Tons per year |
| UAC | Utah Administrative Code |
| VOC | Volatile organic compounds |

**Source:** Sawtooth
**Site:** Natural gas Storage
**Project #:** N14326-0009

| | AN143260008-22 TPY | permit change TPY | new AO TPY |
|---|---|---|---|
| PM10 Total | 2.71 | 0.01 | 2.72 |
| PM10 point | 2.71 | 0.00 | 2.72 |
| PM10 fugtive | 2.48 | 0.00 | 2.48 |
| PM2.5 Total | 0.35 | 0.03 | 0.38 |
| NOx | 1.41 | 0.77 | 2.18 |
| CO | 4.07 | 0.39 | 4.46 |
| SOx | 0.01 | 0.04 | 0.05 |
| VOC Total | 30.30 | 0.78 | 31.08 |
| VOC point | 30.30 | 0.78 | 31.08 |
| VOC Fugtive | 1.65 | 0.00 | 1.65 |
| HAPs | 2.17 | 0.13 | 2.30 |
| GHGs | 2637.23 | 197.77 | 2835.00 |

HAP Summary Sheet

| Existing TPY | Change TPY | New TPY |
|---|---|---|
| 2.17 | 0.13 | 2.3 |

**Source:** Sawtooth
**Site:** Natural gas Storage
**Project #:** N14326-0009

| | Existing TPY | Change TPY | New TPY |
|---|---|---|---|
| HAPs Totals | 2.17000 | 0.13000 | 2.30000 |

| HAP | Existing TPY | Change TPY | New TPY | Existing lb/yr | Change lb/yr |
|---|---|---|---|---|---|
| Acenaphthene | | | | | |
| Acetaldehyde | | | | | |
| Acetonitrile | | | | | |
| Acrolein | | | | | |
| Acrylonitrile | | | | | |
| Anthracene | | | | | |
| Arsenic | | | | | |
| Benzene | 0.03000 | 0.01000 | 0.04000 | | |
| Benzo-anthracene | | | | | |
| Benzo-[a]pyrene | | | | | |
| Benzo-[b]fluoranthene | | | | | |
| Benzo-[e]pyrene | | | | | |
| Benzo-perylene | | | | | |
| Benzo-[k]fluoranthene | | | | | |
| 1,3-Butadiene | | | | | |
| Carbon disulfide | | | | | |
| Ethyl Benzene | 0.00000 | 0.08000 | 0.08000 | | |
| Formaldehyde | | | | | |
| Methanol | | | | | |
| Hexane | 0.03000 | 0.03000 | 0.06000 | | |
| Hydrochloric Acid | | | | | |
| Mercury Compounds | | | | | |
| Styrene | | | | | |
| 2,2,4-Trimethylpentane | 0.00000 | 0.23000 | 0.23000 | | |
| Toluene | 0.16000 | 0.24000 | 0.40000 | | |
| Xylene | 0.02000 | 0.38000 | 0.40000 | | |
| Generic | 1.93000 | -0.84000 | 1.09000 | | |
| Metal HAPs | | | | | |
| **Total** | **2.17000** | **0.13000** | 2.30000 | | |

| HAP's Modeling HAP | Existing Source lb/hr | Increase Source lb/hr | New Source lb/hr | Vert. Restricted (lb/hr) <20m | 20-50 | 50-100 |
|---|---|---|---|---|---|---|
| 2,2,4-Trimethylpentane | | | | | | |
| Acetaldehyde | | | 0.00000 | 1.71155 | 2.29709 | 4.14376 |
| Acrolein | | | 0.00000 | 0.00871 | 0.01169 | 0.02109 |
| Benzene | | | 0.00000 | 0.02720 | 0.03510 | 0.06550 |
| Cobalt | | | 0.00000 | 0.00100 | 0.00130 | 0.00250 |

| | | | | |
|---|---|---|---|---|
| Ethylbenzene | 0.00000 | 22.14000 | 28.66000 | 53.41000 |
| Formaldehyde | 0.00000 | 0.01400 | 0.01880 | 0.03390 |
| Hex. Chromium | 0.00000 | 0.00020 | 0.00020 | 0.00040 |
| n-Hexane | 0.00000 | 8.98810 | 11.63166 | 21.67718 |
| Methanol | 0.00000 | 14.20074 | 18.37742 | 34.24883 |
| Naphthalene | 0.00000 | 2.67000 | 3.46000 | 6.45000 |
| Nickel | 0.00000 | 0.00170 | 0.00220 | 0.00410 |
| Toluene | 0.00000 | 3.84000 | 4.97000 | 9.27000 |
| Xylene | 0.00000 | 22.14000 | 28.66000 | 53.41000 |

| New lb/yr | Change lb/hr | hr/yr= |
|---|---|---|

| | Vert. Unrestricted (lb/hr) | | | Modeling |
|---|---|---|---|---|
| >100 | <50 | 50-100 | >100 | Required |
| 8.10736 | 6.93630 | 10.08916 | 13.96268 | |
| 0.04127 | 0.03531 | 0.05136 | 0.07108 | |
| 0.14380 | 0.10540 | 0.12940 | 0.19650 | |
| 0.00540 | 0.00400 | 0.00450 | 0.00740 | |

| | | | |
|---|---|---|---|
| 116.80000 | 85.97000 | 97.26000 | 159.78000 |
| 0.06630 | 0.05670 | 0.08250 | 0.11420 |
| 0.00090 | 0.00070 | 0.00080 | 0.00120 |
| 47.40781 | 34.89497 | 39.47714 | 64.85530 |
| 74.90192 | 55.13227 | 62.37186 | 102.46806 |
| 14.10000 | 10.38000 | 11.74000 | 19.29000 |
| 0.00900 | 0.00660 | 0.00810 | 0.01230 |
| 20.27000 | 14.92000 | 16.88000 | 27.73000 |
| 116.80000 | 85.97000 | 97.26000 | 159.78000 |


**Tad Anderson <tdanderson@utah.gov>**

# Re: Sawtooth Caverns Ethanol Modification

**LaVern Choquette** <vchoquette@bearcreekconsultants.com> Tue, Nov 8, 2022 at 1:57 PM
To: Tad Anderson <tdanderson@utah.gov>

Please classify it as limited use with 500 hours
[Quoted text hidden]


**Jacob Ries <jries@utah.gov>**

# Sawtooth Caverns Modification

**LaVern Choquette** <vchoquette@bearcreekconsultants.com> Fri, Aug 19, 2022 at 11:46 AM
To: Jacob Ries <jries@utah.gov>, pgbushman@utah.gov
Cc: David.robinson@sawtoothcaverns.com, Jonathan Lovell <jonathan.lovell@sawtoothcaverns.com>

Hi Jake:

Please find the BACT analysis for the fire water pump attached. Sawtooth recently had a visit for UDEQ's Paul Bushman. Paul mentioned that the pressurized propane / butane tanks could be mentioned in the permit general facility description . These vessels operate at 150 psi and do not vent to the atmosphere. The pressure relief valves, pumps, flanges, valves, and other components associated with the vessels are included in the Equipment Fugitives. For completeness, the pressure vessels include:

- Four 60,000-gallon propane vessels;
- Four 60,000-gallon butane vessels;
- Four 90,000-gallon butane vessels;
- Four 18,000-gallon butane vessels; and
- One 18,000-gallon propane vessel

Additionally, there is a 1,000-barrel wastewater tank that collects stormwater from the loading area. The tank could also collect spilled petroleum products. Wastewater tanks are generally exempt for air permitting. How does Utah handle these tanks?

Vern Choquette
Principal Consultant
Bear Creek Consultants
405-615-3757

…Think about things that are excellent and worthy of praise. –Phil 4:8

[Quoted text hidden]

**Diesel Fire Pump BACT.pdf**
192K

BEAR CREEK
CONSULTANTS
1320 E. 9th Street, Suite 2
Edmond, OK 73034

June 13, 2022

Utah Department of Environmental Quality
Division of Air Quality
P.O. Box 144820
Salt Lake City, UT 84114-2820

Ref: Sawtooth Caverns, LLC
Delta Storage Caverns
Approval Order No. DAQE-AN143260006-21

Dear Sir or Madam:

Bear Creek Consultants (BCC) on the behalf of Sawtooth Caverns (Sawtooth) is pleased to submit the attached Notice of Intent Modification application for Sawtooth Caverns, LLC near Delta, Utah. This modification will make the following changes to the equipment at the facility:

- Add one 15,000-bbl IFR ethanol tank (RP T-008) and associated product loading emissions;
- Add four ethanol railcar unloading points (fugitive equipment); and
- Add one 350-hp fire water pump.

If you have any questions or comments, please contact Mr. David Robinson at (832) 489-8837 or me at (405) 531-0600.

Sincerely,

**BEAR CREEK CONSULTANTS**

Vern Choquette
Principal Consultant

Attachments: Notice of Intent Modification application

# NOTICE OF INTENT MODIFICATION

**Sawtooth Caverns, LLC**
**9650 N 540 E Street**
**Delta, Utah 84624**

**June 13, 2022**

Prepared for:

**Sawtooth Caverns, LLC**
**6965 South Union Park Center #270**
**Midvale, UT 84047**

Prepared by:

BEAR CREEK
CONSULTANTS
1320 E. 9th Street, Suite 2
Edmond, OK 73034

## TABLE OF CONTENTS



## LIST OF APPENDICES

## 1.0 EXECUTIVE SUMMARY

Sawtooth Caverns, LLC (Sawtooth) owns and operates a Liquid Petroleum Gas (LPG) storage facility near Delta, Utah. The facility currently consists of multiple salt caverns (maximum total throughput of 16,000,000 barrels), brine storage ponds, railcar loading and unloading equipment, a brine degassifier, and an emergency generator.

Sawtooth would like to add the following equipment to DAQE-AN143260006-21:

- One 15,000-bbl IFR ethanol tank (RP T-008) and associated product loading emissions;
- Four ethanol railcar unloading points (fugitive equipment); and
- One 350-hp fire water pump.

Table 1-1 presents the emissions associated with this modification, including quantifiable maintenance emissions. Changes to facility emissions points are highlighted in yellow.

**Table 1-1. Facility Emissions**

| | PM | PM10 | PM2.5 | NOx | CO | SO2 | VOC | HAPs | $CO_2e$ |
|---|---|---|---|---|---|---|---|---|---|
| **Totals** | 3.15 | 2.72 | 0.38 | 2.18 | 4.46 | 0.05 | 31.08 | 2.30 | 2,835 |
| **Brine Ponds** | --- | --- | --- | --- | --- | --- | 9.61 | 0.00 | |
| **Product Storage Tanks** | --- | --- | --- | --- | --- | --- | 6.72 | 0.43 | |
| **NGL Truck/Rail Loading/Unloading** | --- | --- | --- | --- | --- | --- | 0.75 | 0.00 | |
| **Equipment Fugitives** | --- | --- | --- | --- | --- | --- | 1.88 | 0.01 | |
| **Road Dust** | 2.48 | 2.48 | 0.25 | --- | --- | --- | --- | --- | --- |
| **Degassifier** | 0.00 | 0.00 | 0.00 | 0.09 | 0.36 | 0.000 | 0.01 | 0.00 | 101 |
| **Butane Vaporizer** | 0.08 | 0.08 | 0.08 | 0.75 | 0.91 | 0.003 | 0.06 | 0.00 | 1,498 |
| **Emergency Generator** | 0.004 | 0.004 | 0.004 | 0.22 | 0.03 | 0.01 | 0.003 | 0.000 | 15 |
| **Fire Pump** | 0.010 | 0.010 | 0.029 | 0.55 | 0.07 | 0.03 | 0.008 | 0.001 | 92 |
| **Refined Products Loading** | 0.00 | 0.00 | 0.00 | 0.57 | 3.09 | 0.001 | 5.71 | 1.35 | 1,129 |
| **Maintenance (incl roof landings)** | 0.57 | 0.13 | 0.01 | --- | --- | --- | 6.33 | 0.51 | 0 |

## 2.0 FEDERAL REGULATIONS

**Prevention of Significant Deterioration (PSD), 40 CFR Part [Not Applicable]**
The facility will be a PSD minor source with total VOC emissions less than 100 TPY. Therefore, a PSD review is not included.

**NSPS, 40 CFR Part 60 [Applicable]**
**Subpart A** requires the submittal of several notifications for NSPS-affected sources. For example, a notification of the actual date of initial startup of any affected facility will be submitted within 15 days after such date. If required, initial performance tests are to be conducted within 60 days of achieving the maximum production rate, but not later than 180 days after initial startup of the facility. The facility must notify at least 30 days prior to any initial performance test and must submit the results of the initial performance tests to UDAQ. The facility will meet the applicable notification requirements under this Subpart.

**Subpart Kb** affects VOC storage tanks constructed after July 23, 1984, with a capacity greater than or equal to 75 m3 (19,813 gal). The new 15,000-bbl IFR ethanol tank is subject to this regulation and will comply with the monitoring and recordkeeping requirements of this subpart.

**Subpart XX** Standards of Performance for Bulk Gasoline Terminals affects loading racks. Sawtooth will comply with the applicable requirements of this subpart.

**Subpart IIII** Standards of Performance for Stationary Compression Ignition Internal Combustion Engines affects both the emergency generator and the new fire pump. Sawtooth will comply with the applicable requirements of this subpart.

**NESHAP, 40 CFR Part 61 [Not Applicable]**
There are no emissions of the regulated pollutants: arsenic, asbestos, beryllium, coke oven emissions, radionuclides, or vinyl chloride. The facility will emit benzene in extremely small quantities; however, the facility is not one of the listed affected sources and is, therefore, exempt from this Part.

**NESHAP, 40 CFR Part 63 [Applicable]**
Potential HAP emissions from the facility are below the 10/25 TPY major source thresholds as shown in the emissions section. Based on emission calculations this facility is not a Major Source of HAPs but is considered an Area Source.

**Subpart ZZZZ**, Reciprocating Internal Combustion Engines (RICE). This rule affects new or reconstructed engines at area sources. Both the emergency generator and fire water pump are affected sources.

**Subpart BBBBBB**, This subpart establishes national emission limitations and management practices for hazardous air pollutants (HAP) emitted from area source gasoline distribution bulk terminals, bulk plants, and pipeline facilities. This facility and the modification will comply with the applicable provisions of this subpart.

**Subpart R** This facility and the modification will not be subject to these control requirements since it is an Area Source instead of a Major Source of HAPs.

**CAM, 40 CFR Part 64 [Not Applicable]**
Compliance Assurance Monitoring (CAM) applies to any pollutant-specific emission unit at a major source that is required to obtain a Title V permit, if it meets all of the following criteria:

- It is subject to an emission limit or standard for an applicable regulated air pollutant.
- It uses a control device to achieve compliance with the applicable emission limit or standard.
- It has potential emissions, prior to the control device, of the applicable regulated air pollutant of greater than 100 TPY.

This facility is a not a major source, so CAM does not apply.

**Chemical Accident Prevention Provisions, 40 CFR Part 68 [Applicable]**
The Sawtooth facility stores more than 10,000 pounds of propane is and subject to Risk Management Plan (RMP) requirements. The facility complies with the applicable provisions of this regulation.

**Stratospheric Ozone Protection, 40 CFR Part 82 [Not Applicable]**
The facility does not produce, consume, recycle, import, or export any of the controlled substances or controlled products as defined in this part, nor will service on motor (fleet) vehicles, which involves ozone-depleting substances, be performed. Therefore, as currently operated, the facility is not subject to these requirements.

## 3.0 UTAH AIR POLLUTION CONTROL RULES

**R307-101 to 107 (General Requirements and Procedures) [Applicable]**
Facility will comply with applicable general requirements and procedures.

**R307-110 (State Implantation Plan) [Applicable]**
Subchapter 110 enumerates the incorporation by reference, permitting requirements, source surveillance, ambient air quality standards, prevention of significant deterioration, and other programs agreed upon by the UDEQ to comply with U.S. EPA air quality requirements.

**R307-201 to 205 (Emissions Standards) [Applicable]**
Subchapters 201-205 establish emission standards for all areas of the state.

**R307-210 (NSPS) [Applicable]**
Subchapter 210 Incorporates New Source Performance Standards except for Subparts Cb, Cc, Cd, Ce, BBBB, DDDD, and HHHH in 40 CFR Part 60 by reference.

**R307-214 (NESHAPs) [Applicable]**
Subchapter 214 Incorporate the National Emission Standards for Hazardous Air Pollutants in 40 CFR Parts 61 and 63 by reference.

**R307-401 (Permits for New and Modified Sources) [Applicable]**
Subchapter 401 sets forth the basic substantive requirements of permits for minor facilities. The criteria pollutant emissions are less than 100 TPY, and emissions of HAPs will not exceed 10 TPY for any one HAP or 25 TPY for any aggregate of HAP, so the facility is defined as a minor source.

**R307-503 (Oil and Gas Industry: Flares) [Not Applicable]**
Subchapter 503 sets forth establishes conditions to ensure that flares used in the oil and gas industry are operated effectively. The site is not an oil and gas exploration and production operation, a well site, a natural gas compressor station, or a natural gas processing plant; so, this rule does not apply.

**R307-506 (Oil and Gas Industry: Storage Vessels) [Not Applicable]**
Subchapter 506 sets forth establishes conditions to control emissions of volatile organic compounds (VOCs) from storage vessels associated with a well site. This site is not a well site, so this subchapter does not apply.

## 4.0 BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Per UACR R307-401-8, the proposed new equipment (i.e., gasoline tanks, truck loading spots, and fugitives) must consider best available control technology (BACT). Per Utah's BACT Guidelines, the following five criteria were used to analyze BACT for every facility, operation, or process that proposes any activity that would emit an air contaminant into the air:

1. Energy Impacts
2. Environmental Impacts
3. Economic Impacts
4. Other Considerations
5. Cost Calculation

### 4.1 BACT for the Ethanol Tank

The ethanol storage tank is subject to NSPS Subpart Kb standards. Sawtooth is proposing the installation of an internal floating roof in the tank. The proposed BACT is therefore required to be at least as stringent as, or more stringent than, the NSPS standard. The available control technology options include:

1. A fixed roof tank with vapor combustion (95% control)
2. An internal floating roof (IFR) tank
3. A domed external floating roof (DEFR) tank

**Energy Impacts**

The fixed roof tank with vapor combustion has a greater energy impact than either the IFR or DEFR tank because the combustor would require supplemental fuel to maintain combustion temperature. The vapor combustor is also an active system (i.e., add-on control) versus a passive system (i.e., floating roofs are intrinsic to the design and operation of the IFR and DEFR tanks).

**Environmental Impacts**

The vapor combustion system is less efficient (i.e., 96% control versus 99%+ control) and has a greater environmental impact because it adds products of combustion (i.e., $NO_x$, CO) to the environment.

**Economic Impacts**

Economic impacts were not evaluated because the proposed IFR tank is more expensive than a fixed roof tank with a vapor combustor.

**Other Considerations**

There are no special circumstances impacting this BACT analysis.

## 4.2 BACT for Gasoline Loading

The gasoline loading activity will be subject to NESHAP Subpart BBBBBB and NSPS XX standards. Sawtooth is proposing no additional control measures. The available control technology options include:

1. Vapor combustion of loading operations (98.5% capture and control efficiency)
2. Periodic Leak Detection and Repair (LDAR)

**Energy Impacts**

The vapor combustor for gasoline loading is the standard method of control.

**Environmental Impacts**

The vapor combustion system is demonstrated to have the preferred environmental impact since it has been specified by EPA as the Maximum Achievable Control Technology (MACT) standard. Periodic LDAR is also included in this standard.

**Economic Impacts**

The evaluation of the economic impacts is not appropriate since there are no other feasible BACT options.

**Other Considerations**

There are no special circumstances impacting this BACT analysis.

**Cost Calculation**

A cost calculation is not appropriate since there are no other feasible BACT options.

**Conclusion**

The vapor combustor controlling gasoline loading with periodic LDAR is the best option considering energy and environmental impacts.

## 4.3 BACT for Fugitive Equipment Leaks

The fugitive equipment (i.e., valves, flanges, pumps, connectors, etc.) are subject both to the control provisions of NESHAP Subpart BBBBBB - *National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Distribution Bulk Terminals, Bulk Plants, and Pipeline Facilities* and annual Method 21 leak detection monitoring contained in the air permit. Sawtooth is proposing the LDAR outlined in MACT BBBBBB and the air permit as BACT. No further analysis is required.

## 5.0 Project Description

Sawtooth Caverns, LLC (Sawtooth) owns and operates a Liquid Petroleum Gas (LPG) storage facility near Delta, Utah. The facility currently consists of multiple salt caverns (maximum total throughput of 16,000,000 barrels), brine storage ponds, railcar loading and unloading equipment, a brine degassifier, and an emergency generator. Sawtooth obtained a modification (DAQE-AN143260006-21) to install equipment to unload store, and load refined petroleum products (i.e., gasoline and diesel in February of 2021.

Sawtooth also submitted an NOI modification in February of 2022 to adjust refined products equipment at the site. This NOI modification will make the following changes to the equipment at the facility:

- Add one 15,000-bbl IFR ethanol tank (RP T-008) and associated product loading emissions;
- Add four ethanol railcar unloading points (fugitive equipment); and
- Add one 350-hp fire water pump.

Sawtooth is hoping to have this project installed by October of 2022.

# Appendix A: Emissions Calculations

# Facility Emissions Summary

| | PM | PM10 | PM2.5 | NOx | CO | SO2 | VOC | HAPs | $CO_2e$ |
|---|---|---|---|---|---|---|---|---|---|
| **Totals** | ***3.15*** | ***2.72*** | ***0.38*** | ***2.18*** | ***4.46*** | ***0.05*** | ***31.08*** | ***2.30*** | ***2,835.32*** |
| **Brine Ponds** | --- | --- | --- | --- | --- | --- | 9.61 | 0.00 | |
| **Product Storage Tanks** | --- | --- | --- | --- | --- | --- | 6.72 | 0.43 | |
| **NGL Truck/Rail Loading/Unloading** | --- | --- | --- | --- | --- | --- | 0.75 | 0.00 | |
| **Equipment Fugitives** | --- | --- | --- | --- | --- | --- | 1.88 | 0.01 | |
| **Road Dust** | 2.48 | 2.48 | 0.25 | --- | --- | --- | --- | --- | --- |
| **Degassifier** | 0.00 | 0.00 | 0.00 | 0.09 | 0.36 | 0.000 | 0.01 | 0.00 | 100.96 |
| **Butane Vaporizer** | 0.08 | 0.08 | 0.08 | 0.75 | 0.91 | 0.003 | 0.06 | 0.00 | 1,498.34 |
| **Emergency Generator** | 0.004 | 0.004 | 0.004 | 0.22 | 0.03 | 0.01 | 0.003 | 0.000 | 15.46 |
| **Fire Pump** | 0.010 | 0.010 | 0.029 | 0.55 | 0.07 | 0.03 | 0.008 | 0.001 | 91.57 |
| **Refined Products Loading** | 0.00 | 0.00 | 0.00 | 0.57 | 3.09 | 0.001 | 5.71 | 1.35 | 1,128.61 |
| **Maintenance (incl roof landings)** | 0.57 | 0.13 | 0.01 | --- | --- | --- | 6.33 | 0.51 | 0.39 |

## Annual Tank Emissions

| EPN | Product | Capacity gal | Turnovers | Throughput gal | VOC Emissions[1] (lb/yr) | VOC Emissions[1] (TPY) | Hexane (TPY) | Benzene (TPY) | Toluene (TPY) | 1,2,4, TMB (TPY) | Xylene (TPY) | Ethylbenzne (TPY) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Slop T-003 | Gasoline/Water | 18,189 | 12 | 218,268 | 40.66 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RP T-004 | Gasoline/Diesel | 21,000 | 1825 | 38,325,000 | 2683.97 | 1.34 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.01 |
| RP T-005 | Gasoline/Diesel | 21,000 | 1825 | 38,325,000 | 2683.97 | 1.34 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.01 |
| RP T-006 | Gasoline/Diesel | 21,000 | 1825 | 38,325,000 | 2683.97 | 1.34 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.01 |
| RP T-007 | Gasoline/Diesel | 21,000 | 1825 | 38,325,000 | 2683.97 | 1.34 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.01 |
| RP T-008 | Ethanol | 630,000 | 24 | 15,120,000 | 283.92 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Additive 001 | Additive | 12,600 | 24 | 302,400 | 804.31 | 0.40 | 0.013 | 0.003 | 0.003 | 0.006 | 0.001 | 0.000 |
| Additive 002 | Additive | 12,600 | 24 | 302,400 | 804.31 | 0.40 | 0.013 | 0.003 | 0.003 | 0.006 | 0.001 | 0.000 |
| Additive 003 | Additive | 12,600 | 24 | 302,400 | 804.31 | 0.40 | 0.013 | 0.003 | 0.003 | 0.006 | 0.001 | 0.000 |
| **Total:** | | | | | | **6.72** | **0.07** | **0.03** | **0.16** | **0.07** | **0.14** | **0.03** |

Notes: 169,327,200

[1] Based upon AP-42 Chapter 7 (06/20) Equations.

## *Equipment Leak Fugitives Potential Emissions Calculations*

Assumptions: (1) Operation is assumed to be 8760 hours per year
(2) Item type counts are estimates based on P&IDs provided. Conservatively assumed 4 connectors/flanges per valve.
(3) If gas/vapor vs. liquid is unknown (or potentially both), worst case is assumed
(4) Conservatively assumed 3 connectors and flanges per valve.

***Emission Factors***

| Emissions Source Equipment Type | Emission Factor (lb/hr/source) | References |
|---|---|---|
| Light Liquid Valve | 9.48E-05 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Gas/Vapor Valve | 2.87E-05 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Gas Relief Valve (Other) | 2.65E-04 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Pump | 1.43E-04 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Compressor | 2.65E-04 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Light Liquid Other | 2.87E-04 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Gas/Vapor Other | 2.65E-04 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Light Liquid Connector | 1.76E-05 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Gas/Vapor Connector | 9.26E-05 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Light Liquid Flange | 1.76E-05 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |
| Gas/Vapor Flange | 9.26E-05 | EPA-453/R-95-017 Protocol for Equipment Leak Emission Estimates (Table 2-3, Marketing Terminals Average Emission Factors) |

***Control Efficiencies Used***

| Control Type | Control Efficiency | References |
|---|---|---|
| None | 0.00 | No Leak Detection and Repair Program, therefore no control used. |

***Product Speciation***

| Propane Product Overall | | Propane Product C6+ | | Butane Product Overall | | Butane Product C6+ | | RGB Product Overall | | RGB Product C6+ | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Component | Weight Percent | HAP Component | Weight Percent of Total | Component | Weight Percent | HAP Component | Weight Percent of Total | Component | Weight Percent | HAP Component | Weight Percent of Total |
| Methane | | n-Hexane | 0.0000 | Methane | | n-Hexane | 0.1000 | Methane | | n-Hexane | 0.1000 |
| Carbon Dioxide | | Benzene | 0.0000 | Carbon Dioxide | | Benzene | 0.0000 | Carbon Dioxide | | Benzene | 0.0000 |
| Ethane | | Toluene | 0.0000 | Ethane | | Toluene | 0.0000 | Ethane | | Toluene | 0.0000 |
| Propane | 90.5 | Ethylbenzene | 0.0000 | Propane | 2.5 | Ethylbenzene | 0.0000 | Propane | 2.0 | Ethylbenzene | 0.0000 |
| Iso-Butane | | o-Xylene | 0.0000 | Iso-Butane | 6.0 | o-Xylene | 0.0000 | Iso-Butane | 15.0 | o-Xylene | 0.0000 |
| Normal-Butane | 2.5 | m,p-Xylene | 0.0000 | Normal-Butane | 94.0 | m,p-Xylene | 0.0000 | Normal-Butane | 75.0 | m,p-Xylene | 0.0000 |
| Isopentane | | | | Isopentane | | | | Isopentane | | | |
| n-Pentane | | | | n-Pentane | 3.0 | | | n-Pentane | 15.0 | | |
| Propylene | 5.0 | | | Propylene | | | | Propylene | 1.0 | | |
| | | | | | | | | C4 Olefin | 5.0 | | |
| Hexanes+ | | | | Hexanes+ | 0.1 | | | Hexanes+ | 0.1 | | |

| ***Potential Emissions Calculations*** | | | | | | Annual Emissions (tpy) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Component Type | Number of Components | Weight Percent VOC | Emission Factor (lb/hr/source) | Control Efficiency | VOC (lb/hr) | VOC | Total HAP | n-Hexane | BTEX |
| **Cavern Wells #5, #6, #7, & #8 (Inc. Pumps)** | | | | | | | | | |
| Light Liquid Valve | 120 | 100 | 9.48E-05 | 0.00 | 1.14E-02 | 0.050 | 4.98E-03 | 4.98E-03 | |
| Gas/Vapor Valve | 12 | 100 | 2.87E-05 | 0.00 | 3.44E-04 | 0.002 | 1.51E-04 | 1.51E-04 | |
| Relief Valves | 20 | 100 | 2.65E-04 | 0.00 | 5.29E-03 | 0.023 | 2.32E-03 | 2.32E-03 | |
| Pumps | 8 | 100 | 1.43E-04 | 0.00 | 1.15E-03 | 0.005 | 5.02E-04 | 5.02E-04 | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Light Liquid Conns | 360 | 100 | 1.76E-05 | 0.00 | 6.35E-03 | 0.028 | 2.78E-03 | 2.78E-03 | |
| Gas/Vapor Conns | 36 | 100 | 9.26E-05 | 0.00 | 3.33E-03 | 0.015 | 1.46E-03 | 1.46E-03 | |
| Light Liquid Flange | 360 | 100 | 1.76E-05 | 0.00 | 6.35E-03 | 0.028 | 2.78E-03 | 2.78E-03 | |
| Gas/Vapor Flange | 36 | 100 | 9.26E-05 | 0.00 | 3.33E-03 | 0.015 | 1.46E-03 | 1.46E-03 | |
| **Salt Dryers, Coalescer, and Afterfilter** | | | | | | | | | |
| Light Liquid Valve | 54 | 100 | 9.48E-05 | 0.00 | 5.12E-03 | 0.022 | 2.24E-03 | 2.24E-03 | |
| Gas/Vapor Valve | 3 | 100 | 2.87E-05 | 0.00 | 8.60E-05 | 0.000 | 3.77E-05 | 3.77E-05 | |
| Relief Valves | 7 | 100 | 2.65E-04 | 0.00 | 1.85E-03 | 0.008 | 8.11E-04 | 8.11E-04 | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Light Liquid Conns | 162 | 100 | 1.76E-05 | 0.00 | 2.86E-03 | 0.013 | 1.25E-03 | 1.25E-03 | |
| Gas/Vapor Conns | 9 | 100 | 9.26E-05 | 0.00 | 8.33E-04 | 0.004 | 3.65E-04 | 3.65E-04 | |
| Light Liquid Flange | 162 | 100 | 1.76E-05 | 0.00 | 2.86E-03 | 0.013 | 1.25E-03 | 1.25E-03 | |
| Gas/Vapor Flange | 9 | 100 | 9.26E-05 | 0.00 | 8.33E-04 | 0.004 | 3.65E-04 | 3.65E-04 | |
| **Mercaptan Truck & Rail Loading** | | | | | | | | | |
| Light Liquid Valve | 14 | 100 | 9.48E-05 | 0.00 | 1.33E-03 | 0.006 | 0.00E+00 | | |
| Gas/Vapor Valve | 25 | 100 | 2.87E-05 | 0.00 | 7.17E-04 | 0.003 | 0.00E+00 | | |
| Relief Valves | 2 | 100 | 2.65E-04 | 0.00 | 5.29E-04 | 0.002 | 0.00E+00 | | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | | |
| Compressors | 8 | 100 | 2.65E-04 | 0.00 | 2.12E-03 | 0.009 | 0.00E+00 | | |
| Light Liquid Conns | 42 | 100 | 1.76E-05 | 0.00 | 7.41E-04 | 0.003 | 0.00E+00 | | |
| Gas/Vapor Conns | 75 | 100 | 9.26E-05 | 0.00 | 6.94E-03 | 0.030 | 0.00E+00 | | |
| Light Liquid Flange | 42 | 100 | 1.76E-05 | 0.00 | 7.41E-04 | 0.003 | 0.00E+00 | | |
| Gas/Vapor Flange | 75 | 100 | 9.26E-05 | 0.00 | 6.94E-03 | 0.030 | 0.00E+00 | | |
| **Truck Loading, Unloading** | | | | | | | | | |
| Light Liquid Valve | 72 | 100 | 9.48E-05 | 0.00 | 6.83E-03 | 0.030 | 2.99E-03 | 2.99E-03 | |

## *Equipment Leak Fugitives Potential Emissions Calculations*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Gas/Vapor Valve | 4 | 100 | 2.87E-05 | 0.00 | 1.15E-04 | 0.001 | 5.02E-05 | 5.02E-05 | |
| Relief Valves | 14 | 100 | 2.65E-04 | 0.00 | 3.70E-03 | 0.016 | 1.62E-03 | 1.62E-03 | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Light Liquid Conns | 216 | 100 | 1.76E-05 | 0.00 | 3.81E-03 | 0.017 | 1.67E-03 | 1.67E-03 | |
| Gas/Vapor Conns | 12 | 100 | 9.26E-05 | 0.00 | 1.11E-03 | 0.005 | 4.87E-04 | 4.87E-04 | |
| Light Liquid Flange | 216 | 100 | 1.76E-05 | 0.00 | 3.81E-03 | 0.017 | 1.67E-03 | 1.67E-03 | |
| Gas/Vapor Flange | 12 | 100 | 9.26E-05 | 0.00 | 1.11E-03 | 0.005 | 4.87E-04 | 4.87E-04 | |
| **Loading Pumps** | | | | | | | | | |
| Light Liquid Valve | 79 | 100 | 9.48E-05 | 0.00 | 7.49E-03 | 0.033 | 3.28E-03 | 3.28E-03 | |
| Gas/Vapor Valve | | 100 | 2.87E-05 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Relief Valves | 22 | 100 | 2.65E-04 | 0.00 | 5.82E-03 | 0.025 | 2.55E-03 | 2.55E-03 | |
| Pumps | 7 | 100 | 1.43E-04 | 0.00 | 1.00E-03 | 0.004 | 4.39E-04 | 4.39E-04 | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Light Liquid Conns | 237 | 100 | 1.76E-05 | 0.00 | 4.18E-03 | 0.018 | 1.83E-03 | 1.83E-03 | |
| Gas/Vapor Conns | 0 | 100 | 9.26E-05 | 0.00 | 0.00E+00 | 0.000 | 0.00E+00 | 0.00E+00 | |
| Light Liquid Flange | 237 | 100 | 1.76E-05 | 0.00 | 4.18E-03 | 0.018 | 1.83E-03 | 1.83E-03 | |
| Gas/Vapor Flange | 0 | 100 | 9.26E-05 | 0.00 | 0.00E+00 | 0.000 | 0.00E+00 | 0.00E+00 | |
| **Piping Manifolds** | | | | | | | | | |
| Light Liquid Valve | 26 | 100 | 9.48E-05 | 0.00 | 2.46E-03 | 0.011 | 1.08E-03 | 1.08E-03 | |
| Gas/Vapor Valve | | 100 | 2.87E-05 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Relief Valves | 7 | 100 | 2.65E-04 | 0.00 | 1.85E-03 | 0.008 | 8.11E-04 | 8.11E-04 | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Light Liquid Conns | 78 | 100 | 1.76E-05 | 0.00 | 1.38E-03 | 0.006 | 6.03E-04 | 6.03E-04 | |
| Gas/Vapor Conns | 0 | 100 | 9.26E-05 | 0.00 | 0.00E+00 | 0.000 | 0.00E+00 | 0.00E+00 | |
| Light Liquid Flange | 78 | 100 | 1.76E-05 | 0.00 | 1.38E-03 | 0.006 | 6.03E-04 | 6.03E-04 | |
| Gas/Vapor Flange | 0 | 100 | 9.26E-05 | 0.00 | 0.00E+00 | 0.000 | 0.00E+00 | 0.00E+00 | |
| **Propane Storage Tanks** | | | | | | | | | |
| Light Liquid Valve | 114 | 100 | 9.48E-05 | 0.00 | 1.08E-02 | 0.047 | 0.00E+00 | | |
| Gas/Vapor Valve | 95 | 100 | 2.87E-05 | 0.00 | 2.72E-03 | 0.012 | 0.00E+00 | | |
| Relief Valves | 6 | 100 | 2.65E-04 | 0.00 | 1.59E-03 | 0.007 | 0.00E+00 | | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | | |
| Light Liquid Conns | 342 | 100 | 1.76E-05 | 0.00 | 6.03E-03 | 0.026 | 0.00E+00 | | |
| Gas/Vapor Conns | 285 | 100 | 9.26E-05 | 0.00 | 2.64E-02 | 0.116 | 0.00E+00 | | |
| Light Liquid Flange | 342 | 100 | 1.76E-05 | 0.00 | 6.03E-03 | 0.026 | 0.00E+00 | | |
| Gas/Vapor Flange | 285 | 100 | 9.26E-05 | 0.00 | 2.64E-02 | 0.116 | 0.00E+00 | | |
| **Refined Products Storage Tanks** | | | | | | | | | |
| Light Liquid Valve | 55 | 100 | 9.48E-05 | 0.00 | 5.21E-03 | 0.023 | 1.00E-01 | 3.65E-02 | 6.39E-02 |
| Relief Valves | 6 | 100 | 2.65E-04 | 0.00 | 1.59E-03 | 0.007 | 3.06E-02 | 1.11E-02 | 1.95E-02 |
| Pumps | 10 | 100 | 1.43E-04 | 0.00 | 1.43E-03 | 0.006 | 2.76E-02 | 1.00E-02 | 1.76E-02 |
| Light Liquid Conns | 165 | 100 | 1.76E-05 | 0.00 | 2.91E-03 | 0.013 | 5.61E-02 | 2.04E-02 | 3.57E-02 |
| Light Liquid Flange | 165 | 100 | 1.76E-05 | 0.00 | 2.91E-03 | 0.013 | 5.61E-02 | 2.04E-02 | 3.57E-02 |
| **Refined Products Loading Rack** | | | | | | | | | |
| Light Liquid Valve | 120 | 100 | 9.48E-05 | 0.00 | 1.14E-02 | 0.050 | 2.19E-01 | 7.97E-02 | 1.40E-01 |
| Relief Valves | 12 | 100 | 2.65E-04 | 0.00 | 3.17E-03 | 0.014 | 6.12E-02 | 2.22E-02 | 3.89E-02 |
| Pumps | 8 | 100 | 1.43E-04 | 0.00 | 1.15E-03 | 0.005 | 2.21E-02 | 8.03E-03 | 1.41E-02 |
| Light Liquid Conns | 360 | 100 | 1.76E-05 | 0.00 | 6.35E-03 | 0.028 | 1.22E-01 | 4.45E-02 | 7.79E-02 |
| Light Liquid Flange | 360 | 100 | 1.76E-05 | 0.00 | 6.35E-03 | 0.028 | 1.22E-01 | 4.45E-02 | 7.79E-02 |
| **Ethanol Railcar Unloading Area** | | | | | | | | | |
| Light Liquid Valve | 96 | 100 | 9.48E-05 | 0.00 | 9.10E-03 | 0.040 | | | |
| Relief Valves | 10 | 100 | 2.65E-04 | 0.00 | 2.65E-03 | 0.012 | | | |
| Pumps | 4 | 100 | 1.43E-04 | 0.00 | 5.73E-04 | 0.003 | | | |
| Light Liquid Conns | 288 | 100 | 1.76E-05 | 0.00 | 5.08E-03 | 0.022 | | | |
| Light Liquid Flange | 288 | 100 | 1.76E-05 | 0.00 | 5.08E-03 | 0.022 | | | |
| **Compressors** | | | | | | | | | |
| Light Liquid Valve | 68 | 100 | 9.48E-05 | 0.00 | 6.45E-03 | 0.028 | 2.82E-03 | 2.82E-03 | |
| Gas/Vapor Valve | 47 | 100 | 2.87E-05 | 0.00 | 1.35E-03 | 0.006 | 5.90E-04 | 5.90E-04 | |
| Relief Valves | 24 | 100 | 2.65E-04 | 0.00 | 6.35E-03 | 0.028 | 2.78E-03 | 2.78E-03 | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Compressors | 8 | 100 | 2.65E-04 | 0.00 | 2.12E-03 | 0.009 | 9.27E-04 | 9.27E-04 | |
| Light Liquid Conns | 204 | 100 | 1.76E-05 | 0.00 | 3.60E-03 | 0.016 | 1.58E-03 | 1.58E-03 | |
| Gas/Vapor Conns | 141 | 100 | 9.26E-05 | 0.00 | 1.31E-02 | 0.057 | 5.72E-03 | 5.72E-03 | |
| Light Liquid Flange | 204 | 100 | 1.76E-05 | 0.00 | 3.60E-03 | 0.016 | 1.58E-03 | 1.58E-03 | |
| Gas/Vapor Flange | 141 | 100 | 9.26E-05 | 0.00 | 1.31E-02 | 0.057 | 5.72E-03 | 5.72E-03 | |
| **Rail Loading** | | | | | | | | | |
| Light Liquid Valve | 274 | 100 | 9.48E-05 | 0.00 | 2.60E-02 | 0.114 | 1.14E-02 | 1.14E-02 | |
| Gas/Vapor Valve | 82 | 100 | 2.87E-05 | 0.00 | 2.35E-03 | 0.010 | 1.03E-03 | 1.03E-03 | |
| Relief Valves | 40 | 100 | 2.65E-04 | 0.00 | 1.06E-02 | 0.046 | 4.63E-03 | 4.63E-03 | |
| Pumps | | 100 | 1.43E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Compressors | | 100 | 2.65E-04 | 0.00 | 0.00E+00 | 0.000 | | 0.00E+00 | |
| Light Liquid Conns | 822 | 100 | 1.76E-05 | 0.00 | 1.45E-02 | 0.063 | 6.35E-03 | 6.35E-03 | |
| Gas/Vapor Conns | 246 | 100 | 9.26E-05 | 0.00 | 2.28E-02 | 0.100 | 9.98E-03 | 9.98E-03 | |
| Light Liquid Flange | 822 | 100 | 1.76E-05 | 0.00 | 1.45E-02 | 0.063 | 6.35E-03 | 6.35E-03 | |
| Gas/Vapor Flange | 246 | 100 | 9.26E-05 | 0.00 | 2.28E-02 | 0.100 | 9.98E-03 | 9.98E-03 | |
| | | | | **Total** | **0.43** | **1.88** | **0.01** | **0.01** | **0.52** |

# Emergency Generator
## Sawtooth NGL Caverns, LLC

| | | |
|---|---|---|
| Engine Make / Model | TBD | TBD |
| Generator Make / Model | TBD | TBD |
| Date of construction/instalation | 2015 | 2015 or newer |
| Subpart IIII EPA Emissions | Tier 3 | Tier 3 |
| Control Device | (none) | (none) |
| Nameplate Horse Power | 144 HP | 350 HP |
| Fuel Consumption | 7.3 gph | 34.0 gph |
| Annual Operating Hours[1] | 500 hours | 500 hours |
| $NO_x$ Factor[2] | 2.83 g/hp-hr | 2.83 g/hp-hr |
| CO Factor[2] | 0.38 g/hp-hr | 0.38 g/hp-hr |
| NMNEHC (VOC) Factor[2] | 0.04 g/hp-hr | 0.04 g/hp-hr |
| PM10 Factor[2] | 0.05 g/hp-hr | 0.05 g/hp-hr |
| $SO_2$ Factor[2] | 0.15 g/hp-hr | 0.15 g/hp-hr |
| $CO_{2e}$ Factor[3] | 1.15 lb/hp-hr | 1.15 lb/hp-hr |
| Formaldehyde Factor[3] | 0.00118 lb/Mmbtu | 0.00118 lb/Mmbtu |

| Pollutant | lb/hr | Expected tpy | lb/hr | Expected tpy |
|---|---|---|---|---|
| NOx | 0.90 | 0.224 | 2.18 | 0.546 |
| CO | 0.12 | 0.030 | 0.29 | 0.073 |
| VOC | 0.01 | 0.003 | 0.03 | 0.008 |
| PM10 | 0.02 | 0.004 | 0.04 | 0.010 |
| $SO_2$ | 0.05 | 0.012 | 0.12 | 0.029 |
| $CO_2$ | 214.98 | 15.46 | 523.25 | 91.57 |
| Formaldehyde | 0.0017 | 0.0001 | 0.0042 | 0.0007 |

Notes:

1. Annual Expected Emissions are based on up to 500 hours per year of operation
2. Emissions factors based on NSPS IIII and AP-42 Emission Factors.

## Refined Products Truck Loading
**Sawtooth NGL Caverns, LLC**

| Products | Throughput [2] | S [3] | P [4] | M [4] | T | Loading Loss [1] (LL) | Generated Vapors | Capture Efficiency [5] | Control Efficiency [6] | Vapors at Truck Loading (Uncontrolled) | | Vapors at Combustion Device (Controlled) | | Total Emitted VOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Captured (to flare) | Emitted | Destroyed | Emitted | (Uncaptured + Uncontrolled) |
| | (gal/yr) | | (psia) | (lb/lb-mole) | (R) | (lb/Mgal) | (tpy) | % | % | (tpy) | (tpy) | (tpy) | (tpy) | (tpy) |
| Gasoline/diesel/ ethanol | 169,327,200 | 0.6 | 4.7 | 66 | 514.72 | 4.51 | 381.45 | 98.7 | 99.8 | 376.49 | 4.96 | 375.74 | 0.75 | 5.71 |
| **Totals:** | **169,327,200** | | | | | | | | | **376.49** | **4.96** | **375.74** | **0.75** | **5.71** |

**Data Sources and Notes:**

Loading rack VOC emissions calculations are performed in accordance with Section 5.2 of U.S. EPA's Compilation of Air Pollutant Emission Factors, Fifth Edition (7/08 version).

[1] - Equation 1 from AP-42 Section 5.2 (06/08):

$$L_L = 12.46 \frac{SPM}{T}$$

Where:

LL = loading loss, lb/Mgal

S = saturation factor, dimensionless

P = true vapor pressure of liquid loaded, psia

M = molecular weight of vapors, lb/lb-mole

T = temperature of bulk liquid loaded, R

**HAP Emissions Based on Product Speciation**

| Compound | Weight % | tpy |
|---|---|---|
| 124-TMB | 2.50 | 0.14 |
| Benzene | 0.68 | 0.04 |
| Ethlybenzene | 1.40 | 0.08 |
| n-Hexane | 1.00 | 0.06 |
| Toluene | 7.00 | 0.40 |
| Xylenes | 7.00 | 0.40 |
| Iso-Octane | 4.00 | 0.23 |
| Total: | 23.58 | **1.35** |

[2] - Based on loading 10,000-bbls per day.

[3] - Table 5.2-1 of AP-42 (07/08) - S Factor for Submerged loading:dedicated vapor balance service.

[4] - AP-42 Chapter 7,Table 7.1-2.

[5] - AP-42 Chapter 5, Page 5.2-6.

[6] - NSPS Subpart XX Control Requirement of 35 mg/L loaded.

| Product | Heat Value [1] | Flared Amount [2] | Flared Amount [2] | Density [3] | Heat Released | Emission Factors [4] | | | | | Emissions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | CO | $NO_x$ | $CO_2$ | $SO_2$ | $PM_{10}$ | CO | $NO_x$ | $CO_2$ | $SO_2$ | $PM_{10}$ |
| | (Btu/gal) | (lb) | (liter) | (lb/gal) | (MMBtu) | (lb/MMBtu) | (lb/MMBtu) | (lb/MMBtu) | (lb/1000 gal) | (µg/l) | (tpy) | (tpy) | (lb/MMBtu) | (tpy) | (tpy) |
| Gasoline/diesel/e | 124,000 | 752,981 | 508,989 | 5.600 | 16,673 | 0.37 | 0.068 | 135 | 0.016 | 177 | 3.08 | 0.57 | 1125.44 | 0.001 | 0.0001 |
| Propane | 91,330 | 2,500 | 1,947 | 4.860 | 47 | 0.37 | 0.068 | 135 | 0.016 | 177 | 0.009 | 0.002 | 3.17 | 0.00000 | 0.00000 |
| | | | | | | | | | | **Totals:** | **3.09** | **0.57** | **1128.61** | **0.001** | **0.0001** |

**Data Sources and Notes:**

[1] - www.engineeringtoolbox.com

[2] - Flared Amount based on the captured vapors.

[3] - AP-42 Chapter 7,Table 7.1-2.

[4] - NOx and CO: AP-42, Table 13.5-1, p.13-5-4 (02/2018).

[4] - $SO_2$: AP-42 Table 1.5-1, assumed average sulfur content is 0.18 grains/100 $ft^3$, which converts to .016 lb of SO2/1000 gal.

[4] - $CO_2$: 40 CFR 98 Subpart C, Table C-1 (Default CO2 e.f. in kg/MMbtu) x 2.2 lb/kg

[4] - $PM_{10}$: AP-42 Table 13.5-1 (02/2018) (for average smoking flares).

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

**Identification**

| | |
|---|---|
| User Identification: | Sawtooth Ethanol Tank RP T-008 |
| City: | Delta |
| State: | Utah |
| Company: | Sawtooth Caverns, LLC |
| Type of Tank: | Internal Floating Roof Tank |
| Description: | 15,000 bbl IFR Ethanol Tank |

**Tank Dimensions**

| | |
|---|---|
| Diameter (ft): | 48.00 |
| Volume (gallons): | 630,000.00 |
| Turnovers: | 24.00 |
| Self Supp. Roof? (y/n): | N |
| No. of Columns: | 1.00 |
| Eff. Col. Diam. (ft): | 0.70 |

**Paint Characteristics**

| | |
|---|---|
| Internal Shell Condition: | Light Rust |
| Shell Color/Shade: | White/White |
| Shell Condition | Good |
| Roof Color/Shade: | White/White |
| Roof Condition: | Good |

**Rim-Seal System**

| | |
|---|---|
| Primary Seal: | Mechanical Shoe |
| Secondary Seal | None |

**Deck Characteristics**

| | |
|---|---|
| Deck Fitting Category: | Detail |
| Deck Type: | Welded |

| Deck Fitting/Status | Quantity |
|---|---|
| Access Hatch (24-in. Diam.)/Bolted Cover, Gasketed | 1 |
| Automatic Gauge Float Well/Bolted Cover, Gasketed | 1 |
| Roof Leg or Hanger Well/Adjustable | 14 |
| Sample Pipe or Well (24-in. Diam.)/Slit Fabric Seal 10% Open | 1 |
| Vacuum Breaker (10-in. Diam.)/Weighted Mech. Actuation, Gask. | 1 |

Meterological Data used in Emissions Calculations: Salt Lake City New, Utah (Avg Atmospheric Pressure = 12.62 psia)

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

**Sawtooth Ethanol Tank RP T-008 - Internal Floating Roof Tank**
**Delta, Utah**

| Mixture/Component | Month | Daily Liquid Surf. Temperature (deg F) Avg. | Min. | Max. | Liquid Bulk Temp (deg F) | Vapor Pressure (psia) Avg. | Min. | Max. | Vapor Mol. Weight. | Liquid Mass Fract. | Vapor Mass Fract. | Mol. Weight | Basis for Vapor Pressure Calculations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ethyl alcohol | All | 55.05 | 49.66 | 60.44 | 53.12 | 0.5539 | N/A | N/A | 46.0700 | | | 46.07 | Option 2: A=8.321, B=1718.21, C=237.52 |

**TANKS 4.0.9d**
**Emissions Report - Summary Format**
**Individual Tank Emission Totals**

**Emissions Report for: Annual**

**Sawtooth Ethanol Tank RP T-008 - Internal Floating Roof Tank**
**Delta, Utah**

| | Losses(lbs) | | | | |
|---|---|---|---|---|---|
| Components | Rim Seal Loss | Withdrawl Loss | Deck Fitting Loss | Deck Seam Loss | Total Emissions |
| Ethyl alcohol | 143.92 | 71.15 | 68.86 | 0.00 | 283.92 |

# Appendix B:  Utah DAQ Forms

# Form 2
# Company Information/Notice of Intent (NOI)

Date 6/13/2022

## Utah Division of Air Quality
**New Source Review Section**

AIR QUALITY

**Application for:** ☐ Initial Approval Order ☑ Approval Order Modification

## General Owner and Source Information

1. Company name and mailing address:
Sawtooth Caverns, LLC

Midvale, UT 84047
Phone No.: (801) 255-0418
Fax No.: ( )

2. Company** contact for environmental matters:
David Robinson
Phone no.: (832) 489-8837
Email:
** *Company contact only; consultant or independent contractor contact information can be provided in a cover letter*

3. Source name and physical address (if different from above):
Sawtooth Caverns, LLC
9650 N. 540 E
Delta, UT 84624
Phone no.: (435) 864-1916
Fax no.: (435) 864-1901

4. Source Property Universal Transverse Mercator coordinates (UTM), including System and Datum:
UTM: 12
X: 365,044
Y: 4,372,053

5. The Source is located in: Millard County

6. Standard Industrial Classification Code (SIC)
4226

7. If request for modification, AO# to be modified: DAQE # AN143260006-21 DATED: 02 / 12 / 21

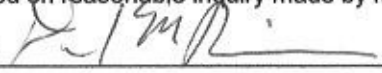
8. Brief (50 words or less) description of process.
Sawtooth Caverns, LLC stores up to 16 million barrels of natural gas liquids or refined products in 5 salt caverns. The modification includes a new 15,000-bbl ethanol tank, the addition of four ethanol unloading points, and the addition of a 350-hp fire water pump.

Electronic NOI
9. A complete and accurate electronic NOI submitted to DAQ Permitting Mangers Jon Black (*jlblack@utah.gov*) or Alan Humpherys (ahumpherys@utah.gov) can expedite review process. Please mark application type.

Hard Copy Submittal ☐ Electronic Copy Submittal ☑ Both ☐

## Authorization/Singnature

I hereby certify that the information and data submitted in and with this application is completely true, accurate and complete, based on reasonable inquiry made by me and to the best of my knowledge and belief.

Signature:  Title: Chief Operating Officer

| David Robinson<br>Name (Type or print) | Telephone Number:<br>(832) 489-8837<br>Email: david.robinson<br>@sawtoothcaverns.com | Date: 6/13/2022 |
|---|---|---|

# Form 4
# Project Information

Company Sawtooth Caverns, LLC

Site Delta, Utah

## Utah Division of Air Quality
### New Source Review Section

AIR QUALITY

## Process Data - For Modification/Amendment ONLY

1. Permit Number DAQE-AN143260006-21

***If submitting a new permit, then use Form 3***

## Requested Changes

2. Name of process to be modified/added:

Ethanol Tank and Fire Pump

End product of this process:

Ethanol Transfer

3. Permit Change Type:

| | New | Increase* |
|---|---|---|
| Equipment | ☑ | ☐ |
| Process | ☑ | ☐ |

Condition Change _____

Other _____

Other _____

Other _____

4. Does new emission unit affect existing permitted process limits?

Yes ☐ No ☑

5. Condition(s) Changing:

6. Description of Permit/Process Change**

7. New or modified materials and quantities used in process. **

| Material | Quantity Annually (bbls) |
|---|---|
| Ethanol | 360,000.00 |
| | |
| | |

8. New or modified process emitting units **

| Emitting Unit(s) | Capacity(s) | Manufacture Date(s) |
|---|---|---|
| RP T-008 | 15,000.00 (bbls) | 11/01/22 |
| Fugitives (Ethanol Rail unloading) | 30.00 (bbls) | 11/01/22 |
| Fire Pump | 215.00 | 06/18/22 |
| | | |
| | | |
| | | |
| | | |

**If the permit being modified does not include $CO_2e$ or $PM_{2.5}$, the emissions need to be calculated and submitted to DAQ, which may result in an emissions increase and a public comment period.*

***If additional space is required, please generate a document to accommodate and attach to form.*

# Form 4
# Emissions Information
# Criteria/GHGs/ HAP's
# Utah Division of Air Quality
## New Source Review Section

Company Sawtooth Caverns, LLC

Site Delta, Utah

| Potential to Emit* Criteria Pollutants & GHGs | | | |
|---|---|---|---|
| **Criteria Pollutants** | **Permitted Emissions (tons/yr)** | **Emissions Increases (tons/yr)** | **Proposed Emissions (tons/yr)** |
| $PM_{10}$ Total | 2.71 | 0.01 | 2.72 |
| $PM_{10}$ Fugitive | 2.48 | 0.00 | 2.48 |
| $PM_{2.5}$ | 0.35 | 0.03 | 0.38 |
| $NO_x$ | 1.41 | 0.56 | 1.97 |
| $SO_2$ | 0.01 | 0.04 | 0.05 |
| CO | 4.07 | 0.39 | 4.46 |
| VOC | 30.30 | 0.78 | 31.08 |
| VOC Fugitive | 1.65 | 0.14 | 1.88 |
| $NH_3$ | | | |
| **Greenhouse Gases** | **$CO_2e$** | **$CO_2e$** | **$CO_2e$** |
| $CO_2$ | | | |
| $CH_4$ | | | |
| $N_2O$ | | | |
| HFCs | | | |
| PFCs | | | |
| $SF_6$ | | | |
| **Total CO2e** | 2,637.23 | 198.09 | 2,835.32 |

**Potential to emit to include pollution control equipment as defined by R307-401-2.*

| Hazardous Air Pollutants** (***Defined in Section 112(b) of the Clean Air Act )* | | | | |
|---|---|---|---|---|
| **Hazardous Air Pollutant***** | **Permitted Emissions (tons/yr)** | **Emission Increase (tons/yr)** | **Proposed Emission (tons/yr)** | **Emission Increase (lbs/hr)** |
| HAP | 1.88 | 0.42 | 2.30 | 0.06 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| **Total HAP** | | | | |

**** Use additional sheets for pollutants if needed*

# Diesel Fire Pump BACT Analysis

Sawtooth Caverns, LLC (Sawtooth) is proposing to install a 350-hp diesel powered fire pump for emergency use. The proposed engine meets federal requirements under 40 CFR Part 60 Subpart IIII and 40 CFR Part 63 Subpart ZZZZ. A review of the EPA's RACT/BACT/LAER Clearinghouse (RBLC) indicates that previously approved BACT determinations include compliance with applicable federal regulations. Additionally, Subpart ZZZZ restricts operation to the use of ULSD.

**Engines) Option 1** - **Title:** Meet Federal Regulatory Requirements

**Description of Option 1:** Description of Option 1: The new emergency fire pump must meet the federal requirements under 40 CFR Part 60 Subpart IIII and 40 CFR Part 63 Subpart ZZZZ. EPA's RBLC indicates that the use of Tier-compliant engines is BACT for emergency engines. The proposed fire pump is NSPS IIII compliant.

**Option 2** - Post Combustion Control – (i.e., particulate filter + oxidation catalyst + SCR Catalyst) This control option uses an add on control device designed for diesel engines where a non-selective catalyst will reduce VOC and CO while a selective catalyst will reduce NOx. These systems are widely available.

## Technical Feasibility

This step of the BACT analysis eliminates from consideration technically infeasible options, a control technology is not considered technically feasible unless it is both available and applicable according to the New Source Review Workshop manual. To be considered available, a technology must have reached the licensing and commercial demonstration phase of its development. Applicability is based on source-specific factors and physical, chemical, and engineering principles that preclude safe and successful operation of a control option at a specific location.

### Option 1: Meet Federal Regulatory Standards -Technically Feasible

Sawtooth will combust only ultra-low sulfur diesel (ULSD) in their emergency engines and utilizes good combustion practices. Additionally, as required by Subpart ZZZZ, Sawtooth will comply with specified maintenance schedules (crankcase oil, belts and hoses, etc.), and minimize time at idle. A review of the EPA's RACT/BACT/LAER Clearinghouse (RBLC) indicates that previously approved BACT determinations include compliance with applicable federal regulations.

**Option 2 - Title: Diesel Catalyst - Technically Feasible**
The use of PM/SCR/NSCR is technically feasible for reducing NOx, VOC, PM and CO emissions from diesel engines. No examples of the use of this control system were identified in the RBLC, but the technology is widely available and used on diesel engines nationwide.

## Economic Feasibility

The economic impact incurred by the use of a pollution control alternative is measured as cost effectiveness. Cost effectiveness is the value obtained by dividing the annual tons of pollutant controlled into the annual cost. This results in a "dollar per ton" effectiveness value used in the economic feasibility analysis. The cost effectiveness calculations for installing oxidation catalysts on the emergency engines were based upon EPA's Air Pollution Cost Control Manual. Based on information obtained from EPA cost data, the following tables present the economic feasibility analysis for oxidation catalyst installation and operation for the emergency fire pump engine.

As identified in the table, the cost effectiveness for catalyst installation is $6,987 per ton of NOx abated at 500 hours per year of operation. However, Sawtooth expects to run the engine for maintenance checks only (i.e., 12 hours per year). Therefore, the cost per ton is more likely to be $290,658 per ton. The economic analysis for the other pollutants is also shown in the attached table. Sawtooth considers the installation of a catalyst for the emergency diesel fire pump engine as economically unreasonable for all pollutants.

# Best Available Control Technology Control Cost Analysis Worksheet

(Based on Office of Air Quality Planning and Standards, EPA, OAQPS Control Cost Manual, Fourth Edition, EPA 450/3-90-006, January 1990, Section 2.3.2)

| Pollutant | Control Method | Typical BACT (%) | Targeted Emission without Control (TPY) | Targeted Emission with Control (TPY) |
|---|---|---|---|---|
| $PM_{10}$ | Particulate Filter | 90% | 0.01 | 0.001 |
| $NO_x$ | SCR Catalyst | 80% | 0.55 | 0.055 |
| CO | Oxyidation Catalyst | 75% | 0.07 | 0.007 |
| VOC | Oxyidation Catalyst | 50% | 0.03 | 0.003 |

| Pollutant | Interest Rate (i) | Control System Life (n) | Capital Recovery Factor (CRF) | Capital Investment (P) | Annual Maint/Fuel Cost | Capital Recovery Cost (CRC) | Realized Economic Benefit |
|---|---|---|---|---|---|---|---|
| PM10 | 0.065 | 10 | 0.139 | $6,999 | $450 | $974 | $0 |
| NOx | 0.065 | 10 | 0.139 | $8,651 | $2,230 | $1,203 | $0 |
| CO | 0.065 | 10 | 0.139 | $8,651 | $2,230 | $1,203 | $0 |
| VOC | 0.065 | 10 | 0.139 | $8,651 | $2,230 | $1,203 | $0 |

"n" is the control system economic life, typically thought to be 10-20 years.
"i" is the considered the annual pretax marginal rate of return on private investment (i.e., what it may cost you to borrow the money).
"P" is the capital investment required to install the controls (i.e., equipment purchase cost, installation/retrofit cost, engineering, etc.).
Annual Maintenance Cost is the yearly costs to maintain the control effectiveness (i.e., cleaning, testing, etc).

**CRC = CRF * P**

CRC = Capital Recovery Cost (Annualized cost of control over the life of the control)
CRF = Capital recovery Factor
P = Capital Investment

**CRF = i(1+i)n/(1+i)n-1**

i = Annual Interest Rate
n = Economic life of the control

**Total Annual Cost (TAC) = Annual Maintenance Cost + Capital Recovery Cost - Realized Economic Benefit**

**Cost to Control = TAC / (Targeted Emission Volume Without Control - Targeted Emission Volumn with Control)**

| Pollutant | TAC ($) | Cost to Control ($/Ton) @ 500 hrs | Cost to Control ($/Ton) @ 12 hrs |
|---|---|---|---|
| PM10 | $1,424 | **$158,177** | **$6,580,167** |
| NOx | $3,433 | **$6,987** | **$290,658** |
| CO | $3,433 | **$52,259** | **$2,173,961** |
| VOC | $3,433 | **$127,163** | **$5,289,971** |