Appendix A
PSCAA Notice of Construction Forms

AGENCY USE ONLY	NOC#:	REG#:	Date Fee Pd:	Eng. Assigned:
	12353	10088	5/22/23	

PUGET SOUND
Clean Air Agency

1904 3rd Ave #105, Seattle, WA 98101
206-343-8800
pscleanair.gov

NOTICE OF CONSTRUCTION APPLICATION FOR ORDER OF APPROVAL

The following information must be submitted as part of this application packet before an Agency engineer is assigned to review your project.

SECTION 1. FACILITY INFORMATION

Business Name
King County Department of Natural Resources and Parks, Wastewater Treatment Division, West Point Treatment Plant

Equipment Installation Address	City	State	Zip
1400 Discovery Park Blvd.	Seattle	WA	98199

Is the business registered with the Agency at this equipment installation address?

☒ Yes. Current Registration or AOP No. 10088 ☐ No, not registered ☐ Unknown

Business Owner Name
King County Department of Natural Resources and Parks

Business Mailing Address	City	State	Zip
1400 Discovery Park Blvd.	Seattle	WA	98199

Type of Business
Wastewater Treatment Plant

Is the installation address located within the city limits?

☒ Yes ☐ No

NAICS Code	NAICS Description
221320	Sewage Treatment Facilities

Contact Name (for this application)	Phone	Email
Jesse Collins	206-477-6449	Jesse.Collins@kingcounty.gov

Description for Agency Website

Provide a 1-2 sentence simple description of this project. See examples www.pscleanair.gov/176
King County is proposing to replacing three existing boilers (1,125 hp total), with 4 new units (1,000 hp total) that are intended to increase energy efficiency, operational flexibility, and reliability of the heat loop system.

SECTION 2: REQUIRED APPLICATION PACKET ATTACHMENTS

1) **Process flow diagram**
☒ YES, attached. ☐ NO, not attached. This application is incomplete

2) **Emission estimate**. Emission rate increases for all pollutants.
☒ YES, attached. ☐ NO, not attached. This application is incomplete.

3) **Environmental Checklist** (or a determination made by another Agency under the State Environmental Policy Act) www.pscleanair.gov/DocumentCenter/View/170
☒ YES, attached. ☐ NO, not attached. This application is incomplete.

SECTION 2: REQUIRED APPLICATION PACKET ATTACHMENTS (CONT)

4) Attach **equipment form**(s) applicable to your operation. Forms are available online at www.pscleanair.gov/179

☒ YES, attached. ☐ NO, not attached. This application is incomplete.

5) **Detailed Project Description**

The project description must include a detailed description of the project, a list of process and control equipment to be installed or modified, a description of how the proposed project will impact your existing operations (if applicable), and measures that will be taken to minimize air emissions.

Detailed description of the proposed project included in packet?

☒ YES, attached. ☐ NO, not attached. This application is incomplete.

6) **$1,550 filing fee** (nonrefundable)

☒ ~~PAY BY CHECK – Attached and made payable to **Puget Sound Clean Air Agency**~~

☒ PAY BY CREDIT – Accounting technician will contact person identified below for payment information
Would like to pay by King County credit card

Contact Name:	Contact Number:
Alton Gaskill WQPPM for King County	206 447-5389

SECTION 3: PROCESS AND CONTROL EQUIPMENT (attach additional pages if necessary)

Process Equipment		Does this equipment have air pollution control equipment?	**Air Pollution Control Equipment**	
# of Units	Equipment Type & Design Capacity		# of Units	Equipment Type
2	100 hp (4.46 MMBtu/hr) boilers	☒ Yes ☐ No	2	low-NOx Burners
2	400 hp (17.82 MMBtu/hr) Boilers	☒ Yes ☐ No	2	low-NOx Burners
		☐ Yes ☐ No		
		☐ Yes ☐ No		

SECTION 4: CERTIFICATION STATEMENT

I, the undersigned, certify that the information contained in this application and the accompanying forms, plans, specifications, and supplemental data described herein is, to the best of my knowledge, accurate and complete.

Alton Gaskill
Signature

_5/18/2023___
Date

__Alton Gaskill WQPPM IV for King County DNRP/WTD_
Printed Name

Water Quality PM/Permitting
Title

SECTION 5: APPLICATION SUBMITTAL

☒ **EMAIL application and attachments to:**

NOC@pscleanair.gov

-OR-

☐ **MAIL application, payment, and attachments to:**

Puget Sound Clean Air Agency
ATTN: NOC Application Submittal
1904 3rd Ave, Suite 105 - Seattle, WA 98101

PUGET SOUND
Clean Air Agency

1904 3rd Ave #105, Seattle, WA 98101
206-343-8800
pscleanair.gov

NOC APPLICATION SUPPLEMENTAL FORM

Boilers and Process Heaters

This application is for activities or equipment that is (check all that apply):

- ☒ New (including existing, unpermitted equipment)
- ☐ Physical or operational modification of existing equipment
- ☐ Relocation of existing equipment

Estimated date to begin construction: March 2025 Estimated date to startup: September 2026

Operating Data

Normal 24 hours/day 7 days/week 52 weeks/yr

Maximum 24 hours/day 7 days/week 52 weeks/yr

Boiler/Heater

Manufacturer: Will provide at 100 percent design. Model: Will provide at 100 percent design.

Max. Heat Input Rating: ~4,460,000 (100 Hp) BTU per hour

Boiler Type: ☐ Water-Tube ☒ Fire-Tube

Turndown Ratio: _____ Percent Excess Air: Assumed 3%

Burner

Manufacturer(s): Will provide at 100 percent design. Model(s): low-NOx

Number of burners: 1 burner Rating of each burner: 4,460,000 BTU per hour

Form 50-169 | 03/20

Heat Transfer		
Heat Transfer Medium: Water		
Temperature (°F) Input: 170 F Output: 190 F	Pressure (psia) Input: _____ Output: _____	Flow Rate (specify units): Average: _____ Maximum: _____

Fuel Type (check all that apply)

☐ Natural Gas ☒ Liquefied Petroleum Gas ☐ Refinery Gas ☒ Digester Gas ☐ Landfill Gas

☐ Other_____ ☐ Fuel Oil (specify grade) _____

Emission Controls (check all that apply)	**Exhaust Stack Parameters**
☒ Low NOx Burner ☒ Flue Gas Recirculation ☐ Oxygen Trim ☐ CO Catalyst ☐ Selective Catalytic Reduction (SCR) ☐ Selective Non-Catalytic Reduction (SNCR) ☐ Baghouse ☐ Electrostatic Precipitator ☐ Other, describe: _____	☐ Stack information is specified on NOC Application Supplemental Form for proposed control device ☒ Stack information is specified below: Stack diameter: 16 inches Stack height above ground: ~32 feet Exhaust Flow Rate: 1,200 to 2,400 acfm 2-100hp shared stack. Exhaust Temperature: ~350 °F Building Dimensions of project location: Building Height (highest point of roof) ~30 ft Building Width ~750 ft Building Length ~250 ft

Fuel Information

If gas or oil fuel is used, attach the fuel specification sheet requested below. If wood fuel is used, provide the following:

Heat Value: _____ Btu/lb wood - Specify if on: ☐ Wet or ☐ Dry basis

% bark: _____

% sander dust: _____

% reinjected cinders: _____

% moisture: _____

Required Attachments

1. Manufacturer specification sheets for boiler, burner(s), and each identified control device (including guaranteed emission rates). Will provide when vendor is selected.
2. Supplier-provided fuel specification sheet. Digester gas data provided in NOC application.
3. Any applicable Agency specific control device form.
   See: www.pscleanair.org/180/Source-Specific-Applications-for-Permits
4. A copy of each applicable New Source Performance Standard (NSPS) with the applicable portions of each rule marked. Included in NOC application
5. A copy of each applicable National Emissions Standard for Hazardous Air Pollutants (NESHAP) with the applicable portions of each rule marked. Included in NOC application

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Maximum 24 hours/day 7 days/week 52 weeks/yr

Boiler/Heater

Manufacturer: Will provide at 100 percent design. Model: Will provide at 100 percent design.

Max. Heat Input Rating: ~17,820,000 (400 Hp) BTU per hour

Boiler Type: ☐ Water-Tube ☒ Fire-Tube

Turndown Ratio: _____ Percent Excess Air: Assume 3%

Burner

Manufacturer(s): Will provide at 100 percent design. Model(s): low-NOx

Number of burners: 1 burner Rating of each burner: 17,820,000 BTU per hour

Form 50-169 | 03/20

Heat Transfer		
Heat Transfer Medium: Water		
Temperature (°F) Input: 170 F Output: 190 F	Pressure (psia) Input: _____ Output: _____	Flow Rate (specify units): Average: _____ Maximum: _____

Fuel Type (check all that apply)

☐ Natural Gas ☒ Liquefied Petroleum Gas ☐ Refinery Gas ☒ Digester Gas ☐ Landfill Gas

☐ Other_____ ☐ Fuel Oil (specify grade) _____

Emission Controls (check all that apply)	**Exhaust Stack Parameters**
☒ Low NOx Burner ☒ Flue Gas Recirculation ☐ Oxygen Trim ☐ CO Catalyst ☐ Selective Catalytic Reduction (SCR) ☐ Selective Non-Catalytic Reduction (SNCR) ☐ Baghouse ☐ Electrostatic Precipitator ☐ Other, describe: _____	☐ Stack information is specified on NOC Application Supplemental Form for proposed control device ☒ Stack information is specified below: Stack diameter: 24 inches Stack height above ground: ~25, ~40 feet Exhaust Flow Rate: ~5,000 acfm Exhaust Temperature: ~350 °F Building Dimensions of project location: Building Height (highest point of roof) 30 ft Building Width ~750 ft Building Length ~250 ft

Fuel Information

If gas or oil fuel is used, attach the fuel specification sheet requested below. If wood fuel is used, provide the following:

Heat Value: _____ Btu/lb wood - Specify if on: ☐ Wet or ☐ Dry basis

% bark: _____

% sander dust: _____

% reinjected cinders: _____

% moisture: _____

Required Attachments

1. Manufacturer specification sheets for boiler, burner(s), and each identified control device (including guaranteed emission rates). Will provide when vendor is selected.
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4. A copy of each applicable New Source Performance Standard (NSPS) with the applicable portions of each rule marked. Included in NOC application
5. A copy of each applicable National Emissions Standard for Hazardous Air Pollutants (NESHAP) with the applicable portions of each rule marked. Included in NOC application

Appendix B
Fuel Data and Sampling Data

SAFETY DATA SHEET

SDS ID NO.: 0101MAR019 **Revision date** 09/30/2020

1. IDENTIFICATION

Product Name Marathon Petroleum Propane - All Grades

Synonym Deodorized LPG; Unstenched Propane; Unstenched Propane Tfr; Liquified Petroleum Gas; Odorized Propane; Propane HD-5; 0100MAR019

Product code 0101MAR019

Chemical family Hydrocarbon Gas

Recommended use Fuel and Feedstock.

Restrictions on use All others.

Manufacturer, Importer, or Responsible Party Name and Address

MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS Information 1-419-421-3070 (M-F; 8-5 EST)

24 Hour Emergency Telephone CHEMTREC: 1-800-424-9300 (CCN# 13740)

2. HAZARD IDENTIFICATION

OSHA Regulatory Status
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Classification

Flammable gases	Category 1
Gases under pressure	Liquefied Gas
Simple asphyxiant	-
Specific target organ toxicity (single exposure)	Category 3

Hazards Not Otherwise Classified (HNOC)
Static accumulating flammable liquid
Liquid product may cause freeze burn

Label Elements

Danger

Extremely flammable gas
Contains gas under pressure; may explode if heated
May accumulate electrostatic charge and ignite or explode
May displace oxygen and cause rapid suffocation
May cause drowsiness or dizziness
Contact with liquid product may cause freeze burn.

Appearance Colorless Liquefied Gas **Physical State** Liquefied Gas **Odor** Odorless to rotten egg like.

Precautionary Statements - Prevention
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Avoid breathing fume/gas/vapors
Use only outdoors or in a well-ventilated area

Precautionary Statements - Response
Leaking gas fire: Do not extinguish, unless leak can be stopped safely
Eliminate all ignition sources if safe to do so
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Call a poison center or doctor if you feel unwell

Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Protect from sunlight
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container at an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Propane is an aliphatic petroleum hydrocarbon. Propane shipped from Catlettsburg may contain trace amounts of benzene.

Composition Information

Name	CAS Number	% Concentration
Propane	74-98-6	94-100
Propylene	115-07-1	0-3.5
Isobutane	75-28-5	0-2.5
n-Butane	106-97-8	0-2.5
Ethane	74-84-0	0-2
Methane	74-82-8	0-1.5
Sulfur containing compounds	7704-34-9	0-0.01

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First aid measures

General advice In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).

Inhalation Remove to fresh air. If not breathing, utilize bag valve mask or other form of barrier device to institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Get immediate medical attention.

Skin contact Immediately wash exposed skin with plenty of soap and water while removing contaminated

clothing and shoes. If frostbite is expected thaw frostbitten areas slowly with lukewarm water or by wrapping affected areas with blankets. Do not rub affected areas. Let circulation reestablish itself naturally. Get immediate medial attention.

Eye contact Flush with large amounts of tepid water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists. If frostbite is suspected (cloudy lens or greyish white tissue around the eye), get immediate medical attention.

Ingestion Ingestion not likely. If swallowed, immediately call a poison control center or physician.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse effects Contact with liquid product may cause freeze burn. Asphyxiant gas. High concentrations in the immediate area can displace oxygen causing the feeling of suffocation and can cause headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue from oxygen deprivation.

Indication of any immediate medical attention and special treatment needed

Notes to physician Treat symptomatically. Administer supplemental oxygen as needed. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media For small fires, Class B fire extinguishing media such as CO2 or dry chemical can be used. For large fires use water spray or fog. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.

Specific hazards arising from the chemical This product has been determined to be an extremely flammable gas per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Sealed containers may rupture when heated. A phenomena known as boiling liquid expanding vapor explosions (Bleve) can occur when a liquid in a pressurized container comes in close proximity to a fire and reaches a temperature well above its boiling point. A catastrophic failure of the vessel can occur, resulting in flying equipment fragments, a shock wave and a fireball causing serious damage and death. For additional fire related information see NFPA 30 or the Emergency Response Guidebook 115.

Hazardous combustion products Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data

Sensitivity to mechanical impact: No.

Sensitivity to static discharge: Yes.

Special protective equipment and precautions for firefighters Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Isolate hazard area. If safe to do so, stop the flow of gas and allow fire to burn out. Extinguishing the flame before shutting off the supply can cause the formation of explosive mixtures. In some cases it may be preferred to allow the flame to continue to burn. Use extreme caution when fighting liquefied petroleum gas fires. Keep surrounding area cool with water spray from a distance and prevent further ignition of combustible material. Avoid use of solid water streams. Contact with water and liquefied product can cause increased vaporization.

Additional firefighting tactics FIRES INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices;

icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles: if this is impossible, withdraw from area and let fire burn.

EVACUATION: Consider initial downwind evacuation for at least 1000 feet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 5280 feet (1 mile) in all directions; also, consider initial evacuation of 5280 feet (1 mile) in all directions.

NFPA	Health 1	Flammability 4	Instability 0	Special Hazard -

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Keep people away from and upwind of spill/leak. Isolate and evacuate area. Shut off source if safe to do so. Distant ignition and flashback are possible. Eliminate all ignition sources. Use grounded and bonded, explosion-proof equipment. Monitor area for flammable or explosive atmosphere. Before entry, especially into confined areas, check atmosphere with an appropriate monitor.

Protective equipment

Use personal protection measures as recommended in Section 8.

Emergency procedures

Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.

Environmental precautions

If leaking, take appropriate steps to disperse gas.

Methods and materials for containment

Prevent further leakage or spillage if safe to do so.

Methods and materials for cleaning up

Shut off gas supply, if safe to do so. Allow equipment to depressurize. Isolate area until gas has dispersed.

7. HANDLING AND STORAGE

Safe handling precautions

Avoid breathing gas or mists. Use only with adequate ventilation. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Gas and/or vapors may accumulate along the ground, settle in low lying areas or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback may occur along vapor trails. Use only non-sparking tools. Use appropriate grounding and bonding practices. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Comply with all applicable EPA, OSHA, NFPA and consistent state and local requirements.

Components of this product are basically non-conductors of electricity and can become electrostatically charged during mixing, filtering or pumping at high flow rates. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic vapors or mists from process equipment operating at elevated temperature and pressure, or sudden ingress of air into vacuum equipment, may result in ignitions without the presence of obvious ignition sources.

Storage conditions

Product is stored as a liquid but used in the gaseous state. Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Keep product and empty container away from heat and sources of ignition. Do not puncture or incinerate container.

Incompatible materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Name	ACGIH TLV	OSHA PELS	NIOSH IDLH
Propane 74-98-6	Simple asphyxiant	TWA: 1000 ppm TWA: 1800 mg/m³	2100 ppm
Propylene 115-07-1	500 ppm TWA	-	3400 ppm
Isobutane 75-28-5	1000 ppm STEL	-	-
n-Butane 106-97-8	1000 ppm STEL	-	1600 ppm
Ethane 74-84-0	Simple asphyxiant	-	-
Methane 74-82-8	Simple asphyxiant	-	-

Notes: No further information available.

Engineering measures Local or general exhaust required in an enclosed area or when there is inadequate ventilation. Use mechanical ventilation equipment that is explosion-proof. Monitor atmospheric oxygen levels.

Personal protective equipment

Eye protection Goggles or faceshield may be needed when handling pressurized gases.

Skin and body protection Wear insulated gloves when handling pressurized gases to prevent skin contact and frostbite or freeze burn. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.

Respiratory protection Use atmosphere supplying respirators in the event of oxygen deficiency, when material produces vapors that exceed permissible limits, or when excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134.

Note: Air purifying respirators are not to be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturers instructions), in oxygen deficient atmospheres, (less than 19.5% oxygen) or under conditions that are immediately dangerous to life and health (IDLH).

Hygiene measures Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing. Do not smoke while handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Colorless Liquefied Gas
Physical State	Liquefied Gas
Color	Colorless
Odor	Odorless to rotten egg like.
Odor Threshold	No data available.

Property	Values (method)
pH	Not applicable
Melting Point / Freezing Point	-187.8 °C / -306 °F
Initial Boiling Point / Boiling Range	-42 °C / -43.8 °F
Flash Point	-104 °C / -155 °F

Evaporation Rate	No data available.
Flammability (solid, gas)	Extremely flammable gas
Flammability Limit in Air (%):	
Upper Flammability Limit:	9.5
Lower Flammability Limit:	2.0
Explosion Limits	No data available.
Vapor Pressure	105 psi @ 15°C
Vapor Density	1.55 (Air = 1)
Specific Gravity / Relative Density	0.5
Water Solubility	3.2 x 10-5 mole fraction @ 15 °C
Partition Coefficient	No data available.
Autoignition Temperature	450 °C / 842 °F
Decomposition Temperature	No data available.
Kinematic Viscosity	No data available.
VOC Content (%)	No data available.
Density	31.6 lbs/gal 60°F
Bulk Density	Not applicable

10. STABILITY AND REACTIVITY

Reactivity	The product is non-reactive under normal conditions.
Chemical stability	The material is stable at 70°F (21°C), 760 mmHg pressure.
Possibility of hazardous reactions	None under normal processing.
Hazardous polymerization	Does not polymerize except under special conditions (extreme temperatures, pressure, oxidizers).
Conditions to avoid	Sources of heat or ignition.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation	May cause central nervous system depression with nausea, headache, dizziness, vomiting, and incoordination. In high concentration the gas may cause suffocation. Victim may not be aware of asphyxiation.
Eye contact	Gas or vapor is generally non-irritating to eyes. Direct contact with liquefied product can cause freeze burn or frostbite.
Skin contact	Gas or vapor is generally non-irritating to skin. Direct contact with liquefied product can cause freeze burn or frostbite.
Ingestion	Ingestion not likely.

Acute toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50
Propane 74-98-6	-	-	> 1,464 mg/L (Rat) 15 min
Propylene 115-07-1	-	-	658 mg/L (Rat) 4 h
Isobutane	-	-	570,000 ppm (Rat) 15 min

75-28-5			
n-Butane 106-97-8	-	-	658 mg/L (Rat) 4 h
Ethane 74-84-0	-	-	658 mg/L (Rat) 4 h
Methane 74-82-8	-	-	326 mg/m³ (Mouse) 2 h

Immediate and delayed effects as well as chronic effects from short and long-term exposure

PROPANE: Laboratory animal studies indicate exposure to extremely high levels of propane (1 to 10 vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

PROPYLENE: At extremely high levels propylene gas acts as a general anesthetic and central nervous system depressant. Studies in laboratory animals indicate evidence of mild, reversible hydrocarbon nephropathy in male rats exposed to levels of 1000-4,500 ppm propylene for 90-days.

BUTANES: Laboratory animal studies indicate exposure to extremely high levels of butanes (1-10 vol% or higher in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

METHANE and ETHANE: Exposure to high levels of these gases produce weak central nervous system (CNS) depressant effects without significant potential for systemic toxicity. At very high levels they act as asphyxiant gases by diluting and displacing oxygen. Symptoms of persons exposed to oxygen deficient atmospheres include headache, dizziness, incoordination, cyanosis and narcosis. Extremely high concentrations can produce unconsciousness followed by death.

CARBON MONOXIDE: Chemical asphyxiant with no warning properties (such as odor). At 400-500 ppm for 1 hour headache and dyspnea may occur. If activity is increased, symptoms of overexposure may include nausea, irritability, increased respiration, tinnitus, sweating, chest pain, confusion, impaired judgement, dizziness, weakness, drowsiness, ataxia, irregular heart beat, cyanosis and pallor. Levels in excess of 1000 ppm can result in collapse, loss of conciousness, respiratory failure and death. Extremely high concentrations (12,800 ppm) can cause immediate unconsciousness and death in 1-3 minutes. Repeated anoxia can lead to central nervous system damage and peripheral neuropathy, with loss of sensation in the fingers, amnesia, and mental deterioration and possible congestive heart failure. Damage may also occur to the fetus, lung, liver, kidney, spleen, cardiovascular system and other organs.

Adverse effects related to the physical, chemical and toxicological characteristics

Signs and symptoms Contact with liquid product may cause freeze burn. Asphyxiant gas. High concentrations in the immediate area can displace oxygen causing the feeling of suffocation and can cause headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue from oxygen deprivation.

Acute toxicity None known.

Skin corrosion/irritation None known.

Serious eye damage/eye irritation None known.

Sensitization None known.

Mutagenic effects None known.

Carcinogenicity None known.

Reproductive toxicity None known.

Specific Target Organ Toxicity (STOT) - single exposure May cause drowsiness or dizziness.

Specific Target Organ Toxicity (STOT) - repeated exposure None known.

Aspiration hazard Not applicable.

12. ECOLOGICAL INFORMATION

Ecotoxicity Not classified in terms of aquatic toxicity.

Persistence and degradability Expected to be inherently biodegradable.

Bioaccumulation Not expected to bioaccumulate in aquatic organisms.

Mobility in soil Expected to rapidly partition to air.

Other adverse effects The aquatic 96 hour TLM for propane is >100 ppm.

13. DISPOSAL CONSIDERATIONS

Description of waste residues No information available.

Safe handling of wastes Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required. Use appropriate grounding and bonding practices. Use only non-sparking tools. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking.

Disposal of wastes / methods of disposal The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Contaminated packaging disposal Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT

UN/Identification No:	UN 1978
UN Proper Shipping Name:	Propane
Transport Hazard Class(es):	2.1
Packing Group:	Not applicable

NOTE: UN1075 may be substituted for the UN number shown above for domestic transport, as long as the substitution is consistent on package markings, shipping papers, and emergency response information. See 49 CFR 172.102 Special Provision 19.

IATA

UN/Identification No:	UN 1978
UN Proper Shipping Name:	Propane
Transport Hazard Class(es):	2.1
Packing Group:	Not applicable
ERG code:	10L

IMDG

UN/Identification No:	UN 1978
UN Proper Shipping Name:	Propane
Transport Hazard Class(es):	2.1
Packing Group:	Not applicable
EmS No:	F-D, S-U
Marine Pollutant:	No

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

15. REGULATORY INFORMATION

Regulatory Information

US TSCA Chemical Inventory This product and/or its components are listed on the TSCA Chemical Inventory or are exempt.

Canada DSL/NDSL Inventory This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

EPA Superfund Amendment & Reauthorization Act (SARA)

SARA Section 302 This product does not contain any component(s) included on EPA's Extremely Hazardous Substance (EHS) List above the de minimis threshold.

SARA Section 304 This product does not contain any component(s) identified as an EHS or a CERCLA Hazardous substance above the de minimis threshold.

SARA Section 311/312 The following EPA hazard categories apply to this product:

Flammable
Gas under pressure
Hazard Not Otherwise Classified (HNOC)-Physical
Specific target organ toxicity
Simple asphyxiant
Hazard Not Otherwise Classified (HNOC)-Health

SARA Section 313 This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting
Propylene 115-07-1	1.0 % de minimis concentration

U.S. State Regulations

California Proposition 65 Chemicals known to the State of California to cause cancer, birth defects or other reproductive harm are created by the combustion of propane.

For more information, go to www.P65Warnings.ca.gov.

State Right-To-Know Regulations The following component(s) of this material are identified on the regulatory lists below:

Name	New Jersey Right-To-Know	Pennsylvania Right-To-Know	Massachusetts Right-To Know
Propane 74-98-6	Listed	Listed	Listed
Propylene 115-07-1	Listed	Listed	Listed
Isobutane 75-28-5	Listed	Listed	Listed
n-Butane 106-97-8	Listed	Listed	Listed
Ethane 74-84-0	Listed	Listed	Listed
Methane	Listed	Listed	Listed

74-82-8			

16. OTHER INFORMATION

Prepared by Toxicology & Product Safety

NFPA

Revision Notes

Revision date 09/30/2020

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Atmospheric Analysis & Consulting, Inc

CLIENT	: Jacobs Engineering
PROJECT NAME	: West Point RSP Replacement
PROJECT NO.	: 148032418
AAC PROJECT NO.	: 220365
REPORT DATE	: 02/28/2022

On February 18, 2022, Atmospheric Analysis & Consulting, Inc. received two (2) Six-Liter Silonite Canisters for BTU analysis by ASTM D-3588/5504 and TNMOC analysis by EPA 25C. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab No.	Return Pressure (mmHg)
Raw Gas (SP 003)	220365-28076	765.4
Treated Gas (SP 017)	220365-28077	798.4

This analysis is performed in accordance with AAC's Quality Manual. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples. The Technical Director or his/her designee, as verified by the following signature, has authorized release of the data.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 12 pages.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Atmospheric Analysis & Consulting, Inc.

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Jacobs Engineering
PROJECT NO. : 220365

SAMPLING DATE : 02/11/2022
ANALYSIS DATE : 02/21-22/2022

	Client ID:	Raw Gas (SP 003)			
	AAC ID:	220365-28076			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.33	1.33	< 0.001	0.001
	O_2	< 0.133	0.133	< 0.001	0.001
	N_2	< 0.133	0.133	< 0.001	0.001
	CO	< 0.133	0.133	< 0.001	0.001
	CO_2	42.5	0.133	67.0	0.002
	CH_4	57.4	0.00007	33.0	0.003
	He	NM	NM	NM	NM
	Ar	< 0.133	0.133	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00033	0.00033	< 0.0003	0.0003
	C_3 (as Propane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_4 (as Butane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_5 (as Pentane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_6 (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_{6+} (as Hexane)	0.0008	0.00007	0.0025	0.0002
TRS	Total Reduced Sulfur	0.0187	0.0000013	0.0228	0.000001
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	7882
Carbon (C)	43.0	*LHV Btu/lb*	7097
Hydrogen (H)	8.29	*HHV Btu/dscf*	580
Oxygen (O)	48.7	*LHV Btu/dscf*	523
Nitrogen (N)	0.0	*F-Factor*	9329
Helium (He)	0.00	*Relative Density*	0.965
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.00254
Sulfur (S)	0.0214	*MW lb/lb-mole*	27.9
Motor Octane Number	89.6	*Methane Number*	26.5
		Wobbe Number	591

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Atmospheric Analysis & Consulting, Inc.

LABORATORY ANALYSIS REPORT

CLIENT : **Jacobs Engineering**
PROJECT NO. : **220365**
MATRIX : **AIR**
UNITS : **ppmV**

SAMPLING DATE : **02/11/2022**
ANALYSIS DATE : **02/21/2022**

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	Raw Gas (SP 003)
AAC ID	220365-28076
Canister Dil. Fac.	1.3
Analyte	Result
Hydrogen Sulfide	**71.6**
COS / SO2	**0.168**
Methyl Mercaptan	< 0.066
Ethyl Mercaptan	< 0.066
Dimethyl Sulfide	< 0.066
Carbon Disulfide	< 0.066
Isopropyl Mercaptan	< 0.066
tert-Butyl Mercaptan	< 0.066
n-Propyl Mercaptan	**0.098**
Methylethylsulfide	< 0.066
sec-Butyl Mercaptan / Thiophene	< 0.066
iso-Butyl Mercaptan	< 0.066
Diethyl Sulfide	< 0.066
n-Butyl Mercaptan	< 0.066
Dimethyl Disulfide	< 0.066
2-Methylthiophene	< 0.066
3-Methylthiophene	< 0.066
Tetrahydrothiophene	< 0.066
Bromothiophene	< 0.066
Thiophenol	< 0.066
Diethyl Disulfide	< 0.066
Total Unidentified Sulfur	< 0.066
Total Reduced Sulfurs	**71.7**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Jacobs Engineering
PROJECT NO. : 220365

SAMPLING DATE : 02/11/2022
ANALYSIS DATE : 02/21-22/2022

	Client ID:	Treated Gas (SP 017)			
	AAC ID:	220365-28077			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.28	1.28	< 0.001	0.001
	O_2	< 0.128	0.128	< 0.001	0.001
	N_2	0.436	0.128	0.443	0.001
	CO	< 0.128	0.128	< 0.001	0.001
	CO_2	41.1	0.128	65.6	0.002
	CH_4	58.4	0.00006	34.0	0.003
	He	NM	NM	NM	NM
	Ar	< 0.128	0.128	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00032	0.00032	< 0.0003	0.0003
	C_3 (as Propane)	0.0001	0.00006	0.0001	0.0001
	C_4 (as Butane)	< 0.00006	0.00006	< 0.0001	0.0001
	C_5 (as Pentane)	< 0.00006	0.00006	< 0.0002	0.0002
	C_6 (as Hexane)	< 0.00006	0.00006	< 0.0002	0.0002
	C_{6+} (as Hexane)	< 0.00006	0.00006	< 0.0002	0.0002
TRS	Total Reduced Sulfur	0.00350	0.0000013	0.00433	0.000001
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	8113
Carbon (C)	43.3	*LHV Btu/lb*	7305
Hydrogen (H)	8.53	*HHV Btu/dscf*	590
Oxygen (O)	47.7	*LHV Btu/dscf*	531
Nitrogen (N)	0.443	*F-Factor*	9302
Helium (He)	0.00	*Relative Density*	0.953
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.000119
Sulfur (S)	0.00	*MW lb/lb-mole*	27.6
Motor Octane Number	91.0	*Methane Number*	28.7
		Wobbe Number	604

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Atmospheric Analysis & Consulting, Inc.

LABORATORY ANALYSIS REPORT

CLIENT : **Jacobs Engineering**
PROJECT NO. : **220365**
MATRIX : **AIR**
UNITS : **ppmV**

SAMPLING DATE : **02/11/2022**
ANALYSIS DATE : **02/21/2022**

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	**Treated Gas (SP 017)**
AAC ID	**220365-28077**
Canister Dil. Fac.	**1.3**
Analyte	**Result**
Hydrogen Sulfide	**36.9**
COS / SO2	< 0.064
Methyl Mercaptan	< 0.064
Ethyl Mercaptan	< 0.064
Dimethyl Sulfide	< 0.064
Carbon Disulfide	< 0.064
Isopropyl Mercaptan	< 0.064
tert-Butyl Mercaptan	< 0.064
n-Propyl Mercaptan	< 0.064
Methylethylsulfide	< 0.064
sec-Butyl Mercaptan / Thiophene	< 0.064
iso-Butyl Mercaptan	< 0.064
Diethyl Sulfide	< 0.064
n-Butyl Mercaptan	< 0.064
Dimethyl Disulfide	< 0.064
2-Methylthiophene	< 0.064
3-Methylthiophene	< 0.064
Tetrahydrothiophene	< 0.064
Bromothiophene	< 0.064
Thiophenol	< 0.064
Diethyl Disulfide	< 0.064
Total Unidentified Sulfur	< 0.064
Total Reduced Sulfurs	**36.9**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Laboratory Analysis Report

Client : Jacobs Engineering
Project No. : 220365
Matrix : AIR
Units : ppmC

Sampling Date : 02/11/2022
Receiving Date : 02/18/2022
Analysis Date : 02/21/2022
Report Date : 02/28/2022

EPA 25C

Reporting Limit: 3.0 ppmC		*Canister Dilution Factor*	*Analysis Dilution Factor*	TNMOC*	SRL (RL x DF's)
Client Sample ID	AAC ID				
Raw Gas (SP 003)	220365-28076	1.3	1.0	<SRL	4.0
Treated Gas (SP 017)	220365-28077	1.3	1.0	<SRL	3.8

Sample Reporting Limit (SRL) is equal to Reporting Limit x Analysis Dil. Fac x Canister Dil. Fac.

**Total Non-Methane Organic Carbon*

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Quality Control/Quality Assurance Report

Analysis Date : 02/21/2022
Analyst : DL/ZD
Units : ppmv

Instrument ID: GCTCA#2-FID
Calibration Date: 1/7/2021

I - Opening Calibration Verification Standard - Method 25C

Analyte	xRF	DRF	%RPD*
Propane	315066	336316	6.5

II - TNMOC Response Factor - Method 25C

Analyte	xRF	CV RF	CV dp RF	CV tp RF	Average RF	% RPD***
Propane	315066	336316	333335	334974	334875	6.1

III - Method Blank - Method 25C

AAC ID	Analyte	Sample Result
MB	TNMOC	0.00

IV - Laboratory Control Spike & Duplicate - Method 25C

AAC ID	Analyte	Spike Added	LCS	LCSD	LCS % Rec **	LCSD % Rec **	% RPD***
LCS/LCSD	Propane	51.0	53.61	53.88	105.2	105.7	0.5

V - Closing Calibration Verification Standard - Method 25C

Analyte	xCF	dCF	%RPD*
Propane	315066	321679	2.1

xCF - Average Calibration Factor from Initial Calibration Curve
dCF - Daily Calibration Factor
* Must be <15%
** Must be 90-110 %
*** Must be <20%

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Atmospheric Analysis & Consulting, Inc.

Quality Control/Quality Assurance Report

Date Analyzed : 02/21/2022
Analyst : DL/MR
Units : %

Instrument ID : TCD #1
Calb Date : 02/01/22
Reporting Limit : 0.1%

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
CCV	Spike Conc	9.9	10.4	20.2	10.0	10.0	10.0
	Result	10.1	10.6	20.2	10.0	10.0	11.0
	% Rec *	101.5	102.3	100.1	100.5	100.3	109.7

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	9.9	10.4	20.2	10.0	10.0	10.0
	LCS Result	10.1	10.7	20.3	10.1	10.1	11.0
	LCSD Result	10.1	10.6	20.1	10.0	10.0	10.9
	LCS % Rec *	102.0	102.9	100.7	100.7	100.9	109.9
	LCSD % Rec *	101.4	102.1	99.8	100.3	100.2	109.2
	% RPD ***	0.6	0.7	0.9	0.4	0.6	0.6

IV -Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
220364-28074	Sample	0.0	4.8	40.3	0.0	0.5	3.5
	Sample Dup	0.0	4.5	39.8	0.0	0.5	3.6
	Mean	0.0	4.6	40.1	0.0	0.5	3.6
	% RPD ***	0.0	5.1	1.2	0.0	1.9	0.6

V - Matrix Spike & Duplicate- BTU/ASTM D-1945

AAC ID	Analyte	H_2	N_2	CH_4	CO	CO_2
220364-28074	Sample Conc	0.0	20.0	0.0	0.2	1.8
	Spike Conc	9.9	10.1	10.0	10.0	10.0
	MS Result	10.4	30.3	10.2	10.4	13.1
	MSD Result	9.8	31.3	9.5	9.7	12.5
	MS % Rec **	104.8	101.3	102.1	101.6	113.3
	MSD % Rec **	99.2	111.7	95.0	94.6	107.7
	% RPD ***	5.4	9.8	7.2	7.1	5.0

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
CCV	Spike Conc	9.9	10.4	20.2	10.0	10.0	10.0
	Result	10.2	10.6	20.0	10.0	10.0	10.9
	% Rec *	103.2	101.7	99.2	99.8	99.7	108.9

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

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Atmospheric Analysis & Consulting, Inc.

Quality Control/Quality Assurance Report

Date Analyzed : 02/22/2022
Analyst : DL/MR
Units : ppmv

Instrument ID : FID #3
Calb Date : 02/01/22
Reporting Limit : 0.5 ppmv

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	Result	99.0	100.1	98.2	98.4	98.5	98.9
	% Rec *	100.2	100.9	99.5	100.3	100.3	99.1

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	LCS Result	98.2	99.4	98.6	97.9	98.0	98.2
	LCSD Result	103.5	104.3	102.3	102.1	102.3	102.8
	LCS % Rec *	99.3	100.3	99.9	99.8	99.9	98.5
	LCSD % Rec *	104.7	105.2	103.6	104.1	104.2	103.0
	% RPD ***	5.2	4.7	3.6	4.3	4.3	4.5

IV - Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
212340-26395	Sample	8.7	0.0	0.0	0.0	0.0	0.0
	Sample Dup	8.7	0.0	0.0	0.0	0.0	0.0
	Mean	8.7	0.0	0.0	0.0	0.0	0.0
	% RPD ***	0.4	0.0	0.0	0.0	0.0	0.0

V - Matrix Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
212340-26395	Sample Conc	4.4	0.0	0.0	0.0	0.0	0.0
	Spike Conc	49.4	49.6	49.4	49.0	49.1	49.9
	MS Result	58.1	53.9	52.8	52.5	52.7	53.0
	MSD Result	61.8	58.3	57.1	57.1	57.6	58.4
	MS % Rec **	108.7	108.7	107.0	107.0	107.5	106.3
	MSD % Rec **	116.3	117.6	115.7	116.5	117.3	117.1
	% RPD ***	6.7	7.9	7.8	8.5	8.8	9.7

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	Result	94.8	95.3	93.6	93.7	94.3	95.9
	% Rec *	95.9	96.1	94.8	95.5	96.1	96.2

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Quality Control/Quality Assurance Report
ASTM D-5504

Date Analyzed: 2/21/2022
Analyst: DL
Units: ppbV

Instrument ID: SCD#10
Calb. Date: 12/8/2021

Opening Calibration Verification Standard

519.8 ppbV H2S (SS1289)

H_2S	Resp. (area)	Result	% Rec *	% RPD ****
Initial	2922	512	98.6	0.3
Duplicate	2902	509	97.9	1.0
Triplicate	2972	521	100.3	1.4

527.0 ppbV H2S (SS1289)

MeSH	Resp. (area)	Result	% Rec *	% RPD ****
Initial	3418	517	98.1	1.4
Duplicate	3345	506	96.0	0.8
Triplicate	3351	507	96.2	0.6

522.0 ppbV H2S (SS1289)

DMS	Resp. (area)	Result	% Rec *	% RPD ****
Initial	3938	522	100.1	1.6
Duplicate	3830	508	97.3	1.2
Triplicate	3857	512	98.0	0.5

Method Blank

Analyte	Result
H_2S	<PQL
MeSH	<PQL
DMS	<PQL

Duplicate Analysis Sample ID 220362-28071

Analyte	Sample Result	Duplicate Result	Mean	% RPD ***
H_2S	<PQL	<PQL	0.0	0.0
MeSH	<PQL	<PQL	0.0	0.0
DMS	<PQL	<PQL	0.0	0.0

Matrix Spike & Duplicate Sample ID 220362-28071 x10

Analyte	Sample Conc.	Spike Added	MS Result	MSD Result	MS % Rec **	MSD % Rec **	% RPD ***
H_2S	<PQL	259.9	255.7	261.5	98.4	100.6	2.2
MeSH	<PQL	263.5	262.2	254.9	99.5	96.7	2.8
DMS	<PQL	261.0	273.5	275.8	104.8	105.7	0.9

Closing Calibration Verification Standard

Analyte	Std. Conc.	Result	% Rec **
H_2S	519.8	526.0	101.2
MeSH	527.0	538.2	102.1
DMS	522.0	534.2	102.3

** Must be 95-105%, ** Must be 90-110%, *** Must be < 10%, **** Must be < 5% RPD from Mean result.*

H2S: PQL = 10.5 ppbV, MDL = 1.12 ppbV
MeSH: PQL = 10.5 ppbV, MDL = 1.12 ppbV
DMS: PQL = 11.0 ppbV, MDL = 1.12 ppbV

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22036F

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Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name
Jacobs Engineering

Project Manager Name
Karla Kasick

Project Name
West Point RSP Replacement

Project Number
148032418

Send Report To (Name/Email/Address)
Stacia Dugan
(stacia.dugan@jacobs.com)

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h x Normal

Sampler Name
Print: Karla Kasick
Signature: Karla Kasick

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	Analysis Requested: VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588	LAB USE ONLY: Lab ID
Raw Gas (SP 003)	001165	2/11/22	12:49		X	X	X	X	
28076									

LAB USE ONLY
Sample Received via:
☐FedEx
☐UPS
☐Courier
☐Other

Temperature °C
Thermometer ID
Initials

Returned Eqmt
Total cans:
Unused cans:
Flow Controllers:

Client Notes/Special Instructions:

EDD?
☑Yes
☐No

LAB USE ONLY
Notes:

Relinquished By	Date	Received By	Date
Print: Karla Kasick	2/14/22	Print: Hunter Dacon	2/18/22
Signature: K. Kasick	Time 1:30	Signature: H	Time 1053
Relinquished By	Date	Received By	Date
Print:	Time	Print:	Time
Signature:		Signature:	

Ex - 2x cans

Issued 02/04/2021

220365

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Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name
Jacobs Engineering
Project Manager Name
Karla Kasick

Project Name
West Point RSP Replacement
Project Number
148032418

Analysis Requested

Send Report To (Name/Email/Address)
Stacia Dugan
(stacia.dugan@jacobs.com)

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h x Normal

Sampler Name
Print: Karla Kasick
Signature: Karla Kasick

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		LAB USE ONLY Lab ID
Treated Gas (SP 017)	000750	2/11/22	12:57		X	X	X	X		
28077										

LAB USE ONLY
Sample Received via:
☐FedEx
☑UPS
☐Courier
☐Other _____
Temperature _____ °C
Thermometer ID _____
Initials _____
Returned Eqmt
Total cans: _____
Unused cans: _____
Flow Controllers: _____

Client Notes/Special Instructions:

EDD?
☑Yes
☐No

LAB USE ONLY
Notes:

Relinquished By Karla Kasick **Print:** **Signature:** K.Kasick	**Date** 2/14/22 **Time** 1:30	**Received By** **Print:** HUNTER DALTON **Signature:** H	**Date** 2/18/22 **Time** 1053
Relinquished By **Print:** **Signature:**	**Date** **Time**	**Received By** **Print:** **Signature:**	**Date** **Time**

Atmospheric Analysis & Consulting, Inc.

CLIENT	: Jacobs Engineering
PROJECT NAME	: West Point RSP Replacement
PROJECT NO.	: 148032418
AAC PROJECT NO.	: 220365
REPORT DATE	: 2/23/2022

On February 18, 2022, Atmospheric Analysis & Consulting, Inc. received two (2) Six-Liter Silonite Canisters for Volatile Organic Compounds and Siloxanes analysis by EPA Method TO-15. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab ID	Return Pressure (mmHga)
Raw Gas (SP 003)	220365-28076	765.4
Treated Gas (SP 017)	220365-28077	798.4

This analysis is accredited under the laboratory's ISO/IEC 17025:2017 accreditation issued by the ANSI National Accreditation Board. Refer to certificate and scope of accreditation AT-1908. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples.

The Technical Director or his designee, as verified by the following signature, has authorized release of the data contained in this hardcopy report.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 12 pages.

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Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 220365
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 02/18/2022
DATE REPORTED : 02/23/2022
ANALYST : MB/RC

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Raw Gas (SP 003)			Sample Reporting Limit (SRL) (MRLxDF's)	Treated Gas (SP 017)			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	220365-28076				220365-28077				
Date Sampled	02/11/2022				02/11/2022				
Date Analyzed	02/22/2022				02/22/2022				
Can Dilution Factor	1.33				1.28				
Compound	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Chlorodifluoromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Propene	382		10	13.3	1090		10	12.8	1.00
Dichlorodifluoromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Chloromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Dichlorotetrafluoroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Vinyl Chloride	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Methanol	<SRL	U	10	66.4	<SRL	U	10	64.0	5.00
1,3-Butadiene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Bromomethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Chloroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Dichlorofluoromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Ethanol	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
Vinyl Bromide	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Acetone	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
Trichlorofluoromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
2-Propanol (IPA)	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
Acrylonitrile	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
1,1-Dichloroethene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Methylene Chloride (DCM)	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
Allyl Chloride	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
Carbon Disulfide	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
Trichlorotrifluoroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
trans-1,2-Dichloroethene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,1-Dichloroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Methyl Tert Butyl Ether (MTBE)	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
Vinyl Acetate	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
2-Butanone (MEK)	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
cis-1,2-Dichloroethene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Hexane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Chloroform	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Ethyl Acetate	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Tetrahydrofuran	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,2-Dichloroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,1,1-Trichloroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Benzene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50

Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 220365
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 02/18/2022
DATE REPORTED : 02/23/2022
ANALYST : MB/RC

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Raw Gas (SP 003)			Sample Reporting Limit (SRL) (MRLxDF's)	Treated Gas (SP 017)			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	220365-28076				220365-28077				
Date Sampled	02/11/2022				02/11/2022				
Date Analyzed	02/22/2022				02/22/2022				
Can Dilution Factor	1.33				1.28				
Compound	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Carbon Tetrachloride	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Cyclohexane	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
1,2-Dichloropropane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Bromodichloromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,4-Dioxane	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
Trichloroethene (TCE)	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
2,2,4-Trimethylpentane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Heptane	10.5		10	6.64	<SRL	U	10	6.40	0.50
cis-1,3-Dichloropropene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
4-Methyl-2-pentanone (MiBK)	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
trans-1,3-Dichloropropene	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
1,1,2-Trichloroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Toluene	977		10	13.3	<SRL	U	10	12.8	1.00
2-Hexanone (MBK)	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
Dibromochloromethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,2-Dibromoethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Tetrachloroethene (PCE)	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Chlorobenzene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Ethylbenzene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
m & p-Xylene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
Bromoform	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
Styrene	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
1,1,2,2-Tetrachloroethane	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
o-Xylene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
4-Ethyltoluene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
1,3,5-Trimethylbenzene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
1,2,4-Trimethylbenzene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	10	26.6	<SRL	U	10	25.6	2.00
1,3-Dichlorobenzene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,4-Dichlorobenzene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,2-Dichlorobenzene	<SRL	U	10	6.64	<SRL	U	10	6.40	0.50
1,2,4-Trichlorobenzene	<SRL	U	10	66.4	<SRL	U	10	64.0	5.00
Hexachlorobutadiene	<SRL	U	10	13.3	<SRL	U	10	12.8	1.00
BFB-Surrogate Std. % Recovery		96%				86%			70-130%

U - Compound was not detected at or above the SRL.

Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 220365
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 02/18/2022
DATE REPORTED : 02/23/2022
ANALYST : MB/RC

SILOXANES BY EPA TO-15

Client ID	Raw Gas (SP 003)		
AAC ID	220365-28076		
Date Sampled	02/11/2022		
Date Analyzed	02/22/2022		
Canister Dilution Factor	1.33		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	<SRL	10	13.3
Tetramethylsilane*	<SRL	10	13.3
Hexamethyldisiloxane (L2)	<SRL	10	13.3
Hexamethylcyclotrisiloxane (D3)	<SRL	10	13.3
Octamethyltrisiloxane (L3)	<SRL	10	13.3
Octamethylcyclotetrasiloxane (D4)	44.0	10	13.3
Decamethyltetrasiloxane (L4)	<SRL	10	13.3
Decamethylcyclopentasiloxane (D5)	216	10	13.3
Dodecamethylpentasiloxane (L5)*	<SRL	10	13.3
BFB-Surrogate Std. % Recovery	96%		70-130%

Client ID	Treated Gas (SP 017)		
AAC ID	220365-28077		
Date Sampled	02/11/2022		
Date Analyzed	02/22/2022		
Canister Dilution Factor	1.28		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	<SRL	10	12.8
Tetramethylsilane*	<SRL	10	12.8
Hexamethyldisiloxane (L2)	<SRL	10	12.8
Hexamethylcyclotrisiloxane (D3)	<SRL	10	12.8
Octamethyltrisiloxane (L3)	<SRL	10	12.8
Octamethylcyclotetrasiloxane (D4)	<SRL	10	12.8
Decamethyltetrasiloxane (L4)	<SRL	10	12.8
Decamethylcyclopentasiloxane (D5)	<SRL	10	12.8
Dodecamethylpentasiloxane (L5)*	<SRL	10	12.8
BFB-Surrogate Std. % Recovery	86%		70-130%

SRL - Sample Reporting Limit
ND - Not Detected
*Results and SRL are estimated

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 02/22/2022
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-012722-01
ANALYST : RC

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Continuing Calibration Verification of the 02/16/2022 Calibration

Analyte Compounds	*Source*[1]	*CCV*[2]	*% Recovery*[3]
4-BFB (surrogate standard)	10.00	9.71	97
Chlorodifluoromethane	10.50	8.60	82
Propene	10.60	8.49	80
Dichlorodifluoromethane	10.40	10.51	101
Dimethyl Ether	10.80	11.84	110
Chloromethane	10.40	10.40	100
Dichlorotetrafluoroethane	10.30	9.48	92
Vinyl Chloride	10.50	10.30	98
Acetaldehyde	22.50	27.76	123
Methanol	20.10	22.04	110
1,3-Butadiene	10.60	11.59	109
Bromomethane	10.40	10.40	100
Chloroethane	10.30	9.51	92
Dichlorofluoromethane	10.50	10.21	97
Ethanol	11.20	8.99	80
Vinyl Bromide	10.50	11.39	108
Acrolein	11.10	9.23	83
Acetone	10.60	8.42	79
Trichlorofluoromethane	10.50	9.91	94
2-Propanol (IPA)	11.00	8.77	80
Acrylonitrile	11.40	9.25	81
1,1-Dichloroethene	10.40	10.47	101
Methylene Chloride (DCM)	10.50	10.06	96
TertButanol (TBA)	11.30	10.20	90
Allyl Chloride	10.40	8.43	81
Carbon Disulfide	10.50	10.08	96
Trichlorotrifluoroethane	10.40	10.32	99
trans-1,2-Dichloroethene	10.60	10.31	97
1,1-Dichloroethane	10.50	10.57	101
Methyl Tert Butyl Ether (MTBE)	10.50	9.57	91
Vinyl Acetate	11.00	10.20	93
2-Butanone (MEK)	10.60	9.99	94
cis-1,2-Dichloroethene	10.50	11.66	111
Hexane	10.70	10.39	97
Chloroform	10.60	10.39	98
Ethyl Acetate	10.60	10.84	102
Tetrahydrofuran	10.20	10.04	98
1,2-Dichloroethane	10.50	10.56	101
1,1,1-Trichloroethane	10.40	10.54	101
Benzene	10.60	10.39	98
Carbon Tetrachloride	10.20	9.57	94
Cyclohexane	10.50	10.16	97

Analyte Compounds (Continued)	*Source*[1]	*CCV*[2]	*% Recovery*[3]
1,2-Dichloropropane	10.50	10.17	97
Bromodichloromethane	10.40	9.75	94
1,4-Dioxane	10.40	10.47	101
Trichloroethene (TCE)	10.40	11.19	108
2,2,4-Trimethylpentane	10.40	11.41	110
Methyl Methacrylate	11.00	9.92	90
Heptane	10.50	11.79	112
cis-1,3-Dichloropropene	10.40	9.89	95
4-Methyl-2-pentanone (MiBK)	10.40	9.75	94
trans-1,3-Dichloropropene	10.50	9.52	91
1,1,2-Trichloroethane	10.50	9.93	95
Toluene	10.60	10.89	103
2-Hexanone (MBK)	10.50	9.03	86
Dibromochloromethane	10.30	10.17	99
1,2-Dibromoethane	10.60	10.57	100
Tetrachloroethene (PCE)	10.40	10.96	105
Chlorobenzene	10.60	10.48	99
Ethylbenzene	10.50	11.45	109
m & p-Xylene	21.00	23.41	111
Bromoform	10.50	10.94	104
Styrene	10.50	10.68	102
1,1,2,2-Tetrachloroethane	10.50	10.86	103
o-Xylene	10.50	11.28	107
1,2,3-Trichloropropane	10.40	10.15	98
Isopropylbenzene (Cumene)	10.40	11.28	108
α-Pinene	11.40	11.05	97
2-Chlorotoluene	10.40	11.54	111
n-Propylbenzene	10.50	11.40	109
4-Ethyltoluene	10.30	11.07	107
1,3,5-Trimethylbenzene	10.30	10.88	106
β-Pinene	11.30	9.06	80
1,2,4-Trimethylbenzene	10.30	10.67	104
Benzyl Chloride (a-Chlorotoluene)	10.40	9.41	90
1,3-Dichlorobenzene	10.40	11.45	110
1,4-Dichlorobenzene	10.30	11.13	108
Sec-ButylBenzene	10.40	11.08	107
1,2-Dichlorobenzene	10.60	11.05	104
n-ButylBenzene	10.40	9.55	92
1,2-Dibromo-3-Chloropropane	10.40	9.59	92
1,2,4-Trichlorobenzene	11.00	8.47	77
Naphthalene	11.50	8.86	77
Hexachlorobutadiene	11.00	9.64	88

[1] Concentration of analyte compound in certified source standard.

[2] Measured result from daily Continuing Calibration Verification (CCV).

[3] The acceptable range for analyte recovery is 100±30%.

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QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 02/22/2022
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-012722-01
ANALYST : RC

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Laboratory Control Spike Analysis

System Monitoring Compounds	*Sample Concentration*	*Spike Added*	*LCS[1] Recovery*	*LCSD[1] Recovery*	*LCS[1] % Recovery[2]*	*LCSD[1] % Recovery[2]*	*RPD[3]*
4-BFB (surrogate standard)	0.0	10.00	9.71	9.36	97.1	93.6	3.7
1,1-Dichloroethene	0.0	10.40	10.47	10.52	101	101	0.5
Methylene Chloride (DCM)	0.0	10.50	10.06	10.35	96	99	2.8
Benzene	0.0	10.60	10.39	10.23	98	97	1.6
Trichloroethene (TCE)	0.0	10.40	11.19	10.95	108	105	2.2
Toluene	0.0	10.60	10.89	10.72	103	101	1.6
Tetrachloroethene (PCE)	0.0	10.40	10.96	10.81	105	104	1.4
Chlorobenzene	0.0	10.60	10.48	10.38	99	98	1.0
Ethylbenzene	0.0	10.50	11.45	11.60	109	110	1.3
m & p-Xylene	0.0	21.00	23.41	23.35	111	111	0.3
o-Xylene	0.0	10.50	11.28	11.15	107	106	1.2

[1] Laboratory Control Spike (LCS) / Laboratory Control Spike Duplicate (LCSD)

[2] The acceptable range for analyte recovery is 100±30%.

[3] Relative Percent Difference (RPD) between LCS recovery and LCSD recovery (acceptable range is <25%).

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QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 02/22/2022 | **INSTRUMENT ID : GC/MS-02**
MATRIX : High Purity He or N_2 | **ANALYST : RC**
UNITS : PPB (v/v)

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Method Blank Analysis

Analyte Compounds	*MB 022222*	*Reporting Limit (RL)*
4-BFB (surrogate standard)	87%	100±30%
Chlorodifluoromethane	<RL	0.5
Propene	<RL	1.0
Dichlorodifluoromethane	<RL	0.5
Dimethyl Ether	<RL	0.5
Chloromethane	<RL	0.5
Dichlorotetrafluoroethane	<RL	0.5
Vinyl Chloride	<RL	0.5
Acetaldehyde	<RL	5.0
Methanol	<RL	5.0
1,3-Butadiene	<RL	0.5
Bromomethane	<RL	0.5
Chloroethane	<RL	0.5
Dichlorofluoromethane	<RL	0.5
Ethanol	<RL	2.0
Vinyl Bromide	<RL	0.5
Acrolein	<RL	1.0
Acetone	<RL	2.0
Trichlorofluoromethane	<RL	0.5
2-Propanol (IPA)	<RL	2.0
Acrylonitrile	<RL	2.0
1,1-Dichloroethene	<RL	0.5
Methylene Chloride (DCM)	<RL	1.0
TertButanol (TBA)	<RL	0.5
Allyl Chloride	<RL	1.0
Carbon Disulfide	<RL	2.0
Trichlorotrifluoroethane	<RL	0.5
trans-1,2-Dichloroethene	<RL	0.5
1,1-Dichloroethane	<RL	0.5
Methyl Tert Butyl Ether (MTBE)	<RL	2.0
Vinyl Acetate	<RL	2.0
2-Butanone (MEK)	<RL	1.0
cis-1,2-Dichloroethene	<RL	0.5
Hexane	<RL	0.5
Chloroform	<RL	0.5
Ethyl Acetate	<RL	0.5
Tetrahydrofuran	<RL	0.5
1,2-Dichloroethane	<RL	0.5
1,1,1-Trichloroethane	<RL	0.5
Benzene	<RL	0.5
Carbon Tetrachloride	<RL	0.5
Cyclohexane	<RL	1.0

Analyte Compounds (Continued)	*MB 022222*	*Reporting Limit (RL)*
1,2-Dichloropropane	<RL	0.5
Bromodichloromethane	<RL	0.5
1,4-Dioxane	<RL	1.0
Trichloroethene (TCE)	<RL	0.5
2,2,4-Trimethylpentane	<RL	0.5
Methyl Methacrylate	<RL	2.0
Heptane	<RL	0.5
cis-1,3-Dichloropropene	<RL	1.0
4-Methyl-2-pentanone (MiBK)	<RL	2.0
trans-1,3-Dichloropropene	<RL	2.0
1,1,2-Trichloroethane	<RL	0.5
Toluene	<RL	1.0
2-Hexanone (MBK)	<RL	2.0
Dibromochloromethane	<RL	0.5
1,2-Dibromoethane	<RL	0.5
Tetrachloroethene (PCE)	<RL	0.5
Chlorobenzene	<RL	0.5
Ethylbenzene	<RL	1.0
m & p-Xylene	<RL	1.0
Bromoform	<RL	0.5
Styrene	<RL	2.0
1,1,2,2-Tetrachloroethane	<RL	0.5
o-Xylene	<RL	1.0
1,2,3-Trichloropropane	<RL	0.5
Isopropylbenzene (Cumene)	<RL	1.0
α-Pinene	<RL	2.0
2-Chlorotoluene	<RL	0.5
n-Propylbenzene	<RL	0.5
4-Ethyltoluene	<RL	1.0
1,3,5-Trimethylbenzene	<RL	1.0
β-Pinene	<RL	5.0
1,2,4-Trimethylbenzene	<RL	1.0
Benzyl Chloride (a-Chlorotoluene)	<RL	2.0
1,3-Dichlorobenzene	<RL	0.5
1,4-Dichlorobenzene	<RL	0.5
Sec-ButylBenzene	<RL	1.0
1,2-Dichlorobenzene	<RL	0.5
n-ButylBenzene	<RL	2.0
1,2-Dibromo-3-Chloropropane	<RL	1.0
1,2,4-Trichlorobenzene	<RL	5.0
Naphthalene	<RL	5.0
Hexachlorobutadiene	<RL	1.0

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 02/22/2022
MATRIX : Air
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
ANALYST : RC
DILUTION FACTOR[1] : x39.01

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Duplicate Analysis of AAC Sample ID: 220364-28074

Analyte Compounds	*Sample*	*Duplicate*	*RPD[2]*
4-BFB (surrogate standard)	9.46	8.97	5.3
Chlorodifluoromethane	<SRL	<SRL	*NA*
Propene	<SRL	<SRL	*NA*
Dichlorodifluoromethane	<SRL	<SRL	*NA*
Dimethyl Ether	<SRL	<SRL	*NA*
Chloromethane	<SRL	<SRL	*NA*
Dichlorotetrafluoroethane	<SRL	<SRL	*NA*
Vinyl Chloride	<SRL	<SRL	*NA*
Acetaldehyde	<SRL	<SRL	*NA*
Methanol	<SRL	<SRL	*NA*
1,3-Butadiene	<SRL	<SRL	*NA*
Bromomethane	<SRL	<SRL	*NA*
Chloroethane	<SRL	<SRL	*NA*
Dichlorofluoromethane	<SRL	<SRL	*NA*
Ethanol	<SRL	<SRL	*NA*
Vinyl Bromide	<SRL	<SRL	*NA*
Acrolein	<SRL	<SRL	*NA*
Acetone	96.0	94.4	1.6
Trichlorofluoromethane	<SRL	<SRL	*NA*
2-Propanol (IPA)	<SRL	<SRL	*NA*
Acrylonitrile	<SRL	<SRL	*NA*
1,1-Dichloroethene	<SRL	<SRL	*NA*
Methylene Chloride (DCM)	<SRL	<SRL	*NA*
TertButanol (TBA)	<SRL	<SRL	*NA*
Allyl Chloride	<SRL	<SRL	*NA*
Carbon Disulfide E	9130	9380	2.7
Trichlorotrifluoroethane	<SRL	<SRL	*NA*
trans-1,2-Dichloroethene	<SRL	<SRL	*NA*
1,1-Dichloroethane	<SRL	<SRL	*NA*
Methyl Tert Butyl Ether (MTBE)	<SRL	<SRL	*NA*
Vinyl Acetate	<SRL	<SRL	*NA*
2-Butanone (MEK)	<SRL	<SRL	*NA*
cis-1,2-Dichloroethene	<SRL	<SRL	*NA*
Hexane	<SRL	<SRL	*NA*
Chloroform	<SRL	<SRL	*NA*
Ethyl Acetate	<SRL	<SRL	*NA*
Tetrahydrofuran	<SRL	<SRL	*NA*
1,2-Dichloroethane	<SRL	<SRL	*NA*
1,1,1-Trichloroethane	<SRL	<SRL	*NA*
Benzene	2570	2710	5.4
Carbon Tetrachloride	<SRL	<SRL	*NA*
Cyclohexane	<SRL	<SRL	*NA*

Analyte Compounds (Continued)	*Sample*	*Duplicate*	*RPD[2]*
1,2-Dichloropropane	<SRL	<SRL	*NA*
Bromodichloromethane	<SRL	<SRL	*NA*
1,4-Dioxane	<SRL	<SRL	*NA*
Trichloroethene (TCE)	<SRL	<SRL	*NA*
2,2,4-Trimethylpentane	<SRL	<SRL	*NA*
Methyl Methacrylate	<SRL	<SRL	*NA*
Heptane	<SRL	<SRL	*NA*
cis-1,3-Dichloropropene	<SRL	<SRL	*NA*
4-Methyl-2-pentanone (MiBK)	<SRL	<SRL	*NA*
trans-1,3-Dichloropropene	<SRL	<SRL	*NA*
1,1,2-Trichloroethane	<SRL	<SRL	*NA*
Toluene	<SRL	<SRL	*NA*
2-Hexanone (MBK)	<SRL	<SRL	*NA*
Dibromochloromethane	<SRL	<SRL	*NA*
1,2-Dibromoethane	<SRL	<SRL	*NA*
Tetrachloroethene (PCE)	<SRL	<SRL	*NA*
Chlorobenzene	<SRL	<SRL	*NA*
Ethylbenzene	<SRL	<SRL	*NA*
m & p-Xylene	<SRL	<SRL	*NA*
Bromoform	<SRL	<SRL	*NA*
Styrene	<SRL	<SRL	*NA*
1,1,2,2-Tetrachloroethane	<SRL	<SRL	*NA*
o-Xylene	<SRL	<SRL	*NA*
1,2,3-Trichloropropane	<SRL	<SRL	*NA*
Isopropylbenzene (Cumene)	<SRL	<SRL	*NA*
α-Pinene	<SRL	<SRL	*NA*
2-Chlorotoluene	<SRL	<SRL	*NA*
n-Propylbenzene	<SRL	<SRL	*NA*
4-Ethyltoluene	<SRL	<SRL	*NA*
1,3,5-Trimethylbenzene	<SRL	<SRL	*NA*
β-Pinene	<SRL	<SRL	*NA*
1,2,4-Trimethylbenzene	<SRL	<SRL	*NA*
Benzyl Chloride (a-Chlorotoluene)	<SRL	<SRL	*NA*
1,3-Dichlorobenzene	<SRL	<SRL	*NA*
1,4-Dichlorobenzene	<SRL	<SRL	*NA*
Sec-ButylBenzene	<SRL	<SRL	*NA*
1,2-Dichlorobenzene	<SRL	<SRL	*NA*
n-ButylBenzene	<SRL	<SRL	*NA*
1,2-Dibromo-3-Chloropropane	<SRL	<SRL	*NA*
1,2,4-Trichlorobenzene	<SRL	<SRL	*NA*
Naphthalene	<SRL	<SRL	*NA*
Hexachlorobutadiene	<SRL	<SRL	*NA*

[1] Dilution factor is the product of the Canister Dilution Factor and the Analysis Dilution Factor.

[2] Relative Percent Difference (RPD) between Sample analysis and Duplicate analysis (acceptable range is <25%).

SRL - Sample Reporting Limit (minimum)

E - Estimated value above the maximum reporting limit, shown for duplication purposes only.

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220365

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name
Jacobs Engineering

Project Manager Name
Karla Kasick

Project Name
West Point RSP Replacement

Project Number
148032418

Send Report To (Name/Email/Address)
Stacia Dugan
(stacia.dugan@jacobs.com)

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h x Normal

Sampler Name
Print: Karla Kasick
Signature: Karla Kasick

Analysis Requested

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		Lab ID
Raw Gas (SP 003)	001165	2/11/22	12:49		X	X	X	X		
28076										

LAB USE ONLY

Sample Received via:
☐FedEx
☐UPS
☐Courier
☐Other_____

Temperature
_____°C
Thermometer ID _____
Initials _____

Returned Eqmt
Total cans: _____
Unused cans: _____
Flow Controllers: _____

Client Notes/Special Instructions:

EDD?
☑Yes
☐No

LAB USE ONLY
Notes:

Relinquished By Print: Karla Kasick Signature: K. Kasick	**Date** 2/14/22 **Time** 1:30	**Received By** Print: Hunter Dalton Signature: H	**Date** 2/18/22 **Time** 1053
Relinquished By Print: Signature:	**Date** **Time**	**Received By** Print: Signature:	**Date** **Time**

AAC COC Rev 3

Ft - 2x cans

Issued 02/04/2021

Page_____of_____

Atmospheric Analysis & Consulting, Inc.

CLIENT	: Jacobs Engineering
PROJECT NAME	: West Point RSP Replacement
PROJECT NO.	: 148032418
AAC PROJECT NO.	: 220838
REPORT DATE	: 05/03/202

On April 18th, 2022, Atmospheric Analysis & Consulting, Inc. received two (2) Six-Liter Silonite Canisters for BTU analysis by ASTM D-3588/5504 and TNMOC analysis by EPA 25C. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab No.	Return Pressure (mmHg)
Raw Gas (SP 003)	220838-30323	783.0
Treated Gas (SP 017)	220838-30324	785.4

This analysis is performed in accordance with AAC's Quality Manual. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples. The Technical Director or his/her designee, as verified by the following signature, has authorized release of the data.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 10 pages.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Atmospheric Analysis & Consulting, Inc

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Jacobs Engineers
PROJECT NO. : 220838

SAMPLING DATE : 04/12/2022
ANALYSIS DATE : 04/22-25/2022

	Client ID:	Raw Gas (SP 003)			
	AAC ID:	220838-30323			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.32	1.32	< 0.001	0.001
	O_2	< 0.132	0.132	< 0.001	0.001
	N_2	0.397	0.132	0.412	0.001
	CO	< 0.132	0.132	< 0.001	0.001
	CO_2	39.1	0.132	63.7	0.002
	CH_4	60.5	0.00007	35.9	0.004
	He	NM	NM	NM	NM
	Ar	< 0.132	0.132	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00033	0.00033	< 0.0003	0.0003
	C_3 (as Propane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_4 (as Butane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_5 (as Pentane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_6 (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_{6+} (as Hexane)	0.00114	0.00007	0.0036	0.0002
TRS	Total Reduced Sulfur	0.0339	0.0000013	0.0428	0.000002
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	8578
Carbon (C)	44.2	*LHV Btu/lb*	7723
Hydrogen (H)	9.0	*HHV Btu/dscf*	611
Oxygen (O)	46.3	*LHV Btu/dscf*	550
Nitrogen (N)	0.4	*F-Factor*	9247
Helium (He)	0.00	*Relative Density*	0.9334
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.0000
Sulfur (S)	0.04	*MW lb/lb-mole*	27.032
Motor Octane Number	93.02	*Methane Number*	31.96
		Wobbe Number	632.421

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Atmospheric Analysis & Consulting, Inc

LABORATORY ANALYSIS REPORT

CLIENT : **Jacobs Engineers**
PROJECT NO. : **220838**
MATRIX : **AIR**
UNITS : **ppmV**

SAMPLING DATE : **04/12/2022**
ANALYSIS DATE : **04/19/2022**

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	**Raw Gas (SP 003)**
AAC ID	**220838-30323**
Canister Dil. Fac.	**1.3**
Analyte	**Result**
Hydrogen Sulfide	**338**
COS / SO2	< 0.066
Methyl Mercaptan	**0.175**
Ethyl Mercaptan	< 0.066
Dimethyl Sulfide	< 0.066
Carbon Disulfide	< 0.066
Isopropyl Mercaptan	**0.134**
tert-Butyl Mercaptan	< 0.066
n-Propyl Mercaptan	**0.661**
Methylethylsulfide	< 0.066
sec-Butyl Mercaptan / Thiophene	< 0.066
iso-Butyl Mercaptan	< 0.066
Diethyl Sulfide	< 0.066
n-Butyl Mercaptan	< 0.066
Dimethyl Disulfide	< 0.066
2-Methylthiophene	< 0.066
3-Methylthiophene	< 0.066
Tetrahydrothiophene	< 0.066
Bromothiophene	< 0.066
Thiophenol	< 0.066
Diethyl Disulfide	< 0.066
Total Unidentified Sulfur	**0.097**
Total Reduced Sulfurs	**339**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Atmospheric Analysis & Consulting, Inc

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Jacobs Engineers
PROJECT NO. : 220838

SAMPLING DATE : 04/12/2022
ANALYSIS DATE : 04/22-25/2022

	Client ID:	Treated Gas (SP 017)			
	AAC ID:	220838-30324			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.32	1.32	< 0.001	0.001
	O_2	< 0.132	0.132	< 0.001	0.001
	N_2	0.536	0.132	0.557	0.001
	CO	< 0.132	0.132	< 0.001	0.001
	CO_2	38.8	0.132	63.4	0.002
	CH_4	60.6	0.00007	36.1	0.004
	He	NM	NM	NM	NM
	Ar	< 0.132	0.132	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00033	0.00033	< 0.0003	0.0003
	C_3 (as Propane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_4 (as Butane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_5 (as Pentane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_6 (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_{6+} (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
TRS	Total Reduced Sulfur	0.00530	0.0000013	0.00669	0.000002
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	8617
Carbon (C)	44.3	*LHV Btu/lb*	7759
Hydrogen (H)	9.1	*HHV Btu/dscf*	612
Oxygen (O)	46.1	*LHV Btu/dscf*	551
Nitrogen (N)	0.6	*F-Factor*	9243
Helium (He)	0.00	*Relative Density*	0.9312
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.0000
Sulfur (S)	0.01	*MW lb/lb-mole*	26.968
Motor Octane Number	93.20	*Methane Number*	32.26
		Wobbe Number	634.585

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LABORATORY ANALYSIS REPORT

CLIENT : Jacobs Engineers
PROJECT NO. : 220838
MATRIX : AIR
UNITS : ppmV

SAMPLING DATE : 04/12/2022
ANALYSIS DATE : 04/19/2022

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	Treated Gas (SP 017)
AAC ID	220838-30324
Canister Dil. Fac.	1.3
Analyte	Result
Hydrogen Sulfide	**52.9**
COS / SO2	< 0.066
Methyl Mercaptan	< 0.066
Ethyl Mercaptan	< 0.066
Dimethyl Sulfide	< 0.066
Carbon Disulfide	< 0.066
Isopropyl Mercaptan	< 0.066
tert-Butyl Mercaptan	< 0.066
n-Propyl Mercaptan	< 0.066
Methylethylsulfide	< 0.066
sec-Butyl Mercaptan / Thiophene	< 0.066
iso-Butyl Mercaptan	< 0.066
Diethyl Sulfide	< 0.066
n-Butyl Mercaptan	< 0.066
Dimethyl Disulfide	< 0.066
2-Methylthiophene	< 0.066
3-Methylthiophene	< 0.066
Tetrahydrothiophene	< 0.066
Bromothiophene	< 0.066
Thiophenol	< 0.066
Diethyl Disulfide	< 0.066
Total Unidentified Sulfur	< 0.066
Total Reduced Sulfurs	**52.9**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Laboratory Analysis Report

Client : Jacobs Engneering
Project No. : 220838
Matrix : AIR
Units : ppmC

Sampling Date : 04/12/2022
Receiving Date : 04/18/2022
Analysis Date : 04/22/2022
Report Date : 05/03/2022

EPA 25C

Reporting Limit: 3.0 ppmC		*Canister Dilution Factor*	*Analysis Dilution Factor*	TNMOC*	SRL (RL x DF's)
Client Sample ID	AAC ID				
Raw Gas (SP 003)	220838-30323	1.3	1.0	171	4.0
Treated Gas (SP 017)	220838-30324	1.3	1.0	<SRL	4.0

Sample Reporting Limit (SRL) is equal to Reporting Limit x Analysis Dil. Fac x Canister Dil. Fac.

**Total Non-Methane Organic Carbon*

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Atmospheric Analysis & Consulting, Inc.

Quality Control/Quality Assurance Report

Date Analyzed : 04/22/2022
Analyst : ZD
Units : %

Instrument ID : GC-TCA #2
Calb Date : 01/17/2022
Reporting Limit : 0.1%

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
CCV	Spike Conc	9.4	10.8	21.4	10.3	10.2	10.2
	Result	10.0	10.9	22.1	9.9	9.9	9.7
	% Rec *	106.7	101.6	103.4	96.1	96.3	95.5

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	9.4	10.8	21.4	10.3	10.2	10.2
	LCS Result	10.8	10.1	21.0	10.5	10.5	10.2
	LCSD Result	10.1	10.6	21.7	9.9	9.9	9.8
	LCS % Rec *	115.0	94.0	98.4	102.2	102.2	100.5
	LCSD % Rec *	108.0	98.3	101.8	96.4	96.7	96.1
	% RPD ***	6.3	4.5	3.4	5.9	5.6	4.5

IV -Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
220860-30385	Sample	0.0	3.0	76.5	1.0	0.0	15.0
	Sample Dup	0.0	2.9	76.6	1.0	0.0	15.1
	Mean	0.0	2.9	76.5	1.0	0.0	15.1
	% RPD ***	0.0	3.5	0.2	0.1	0.0	0.7

V - Matrix Spike & Duplicate- BTU/ASTM D-1945

AAC ID	Analyte	H_2	N_2	CH_4	CO	CO_2
220860-30385	Sample Conc	0.0	38.3	0.5	0.0	7.5
	Spike Conc	9.4	10.1	10.3	10.2	10.2
	MS Result	10.6	48.5	10.0	10.6	17.4
	MSD Result	10.2	48.7	10.1	10.6	17.4
	MS % Rec **	112.6	101.2	92.8	103.8	97.1
	MSD % Rec **	108.6	103.6	93.6	104.1	96.4
	% RPD ***	3.6	2.3	0.8	0.2	0.8

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H_2	O_2	N_2	CH_4	CO	CO_2
CCV	Spike Conc	9.4	10.8	21.4	10.3	10.2	10.2
	Result	10.3	10.3	20.7	10.6	9.7	10.1
	% Rec *	109.6	95.9	97.0	103.3	94.3	99.4

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Atmospheric Analysis & Consulting, Inc

Quality Control/Quality Assurance Report

Date Analyzed : 04/25/2022
Analyst : ZD/MR
Units : ppmv

Instrument ID : FID #3
Calb Date : 02/01/22
Reporting Limit : 0.5 ppmv

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	Result	101.5	105.0	104.4	106.2	106.1	110.5
	% Rec *	102.7	105.9	105.7	108.3	108.1	110.8

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	LCS Result	97.6	100.0	99.6	101.3	104.1	109.6
	LCSD Result	100.3	102.3	100.0	103.4	105.6	109.8
	LCS % Rec *	98.7	100.9	100.9	103.2	106.1	109.9
	LCSD % Rec *	101.4	103.3	101.4	105.4	107.6	110.1
	% RPD ***	2.7	2.3	0.5	2.1	1.4	0.1

IV - Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
220521-28934	Sample	0.0	0.0	0.0	0.0	0.0	0.0
	Sample Dup	0.0	0.0	0.0	0.0	0.0	0.0
	Mean	0.0	0.0	0.0	0.0	0.0	0.0
	% RPD ***	0.0	0.0	0.0	0.0	0.0	0.0

V - Matrix Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
220521-28934	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	49.4	49.6	49.4	49.0	49.1	49.9
	MS Result	47.4	48.0	46.9	47.4	48.7	50.9
	MSD Result	45.6	46.2	46.1	46.5	47.7	48.7
	MS % Rec **	96.0	96.8	94.9	96.6	99.3	102.0
	MSD % Rec **	92.3	93.2	93.3	94.8	97.3	97.6
	% RPD ***	3.8	3.8	1.7	1.9	2.1	4.4

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	Result	89.6	89.4	88.4	89.1	91.0	93.8
	% Rec *	90.6	90.2	89.6	90.8	92.7	94.1

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

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Quality Control/Quality Assurance Report
ASTM D-5504

Date Analyzed: 4/19/2022
Analyst: ZD
Units: ppmV

Instrument ID: SCD-BTU
Calb. Date: 10/21/2021

Opening Calibration Verification Standard

0.520 ppbV H2S (SS1289)

H_2S	Resp. (area)	Result	% Rec *	% RPD ****
Initial	524	0.528	101.6	1.8
Duplicate	496	0.500	96.2	3.6
Triplicate	524	0.528	101.6	1.8

0.527 ppbV H2S (SS1289)

MeSH	Resp. (area)	Result	% Rec *	% RPD ****
Initial	549	0.509	96.5	3.5
Duplicate	579	0.536	101.7	1.6
Triplicate	580	0.537	101.9	1.9

0.522 ppbV H2S (SS1289)

DMS	Resp. (area)	Result	% Rec *	% RPD ****
Initial	665	0.540	103.5	2.6
Duplicate	642	0.521	99.9	1.0
Triplicate	639	0.518	99.3	1.6

Method Blank

Analyte	Result
H_2S	<PQL
MeSH	<PQL
DMS	<PQL

Duplicate Analysis **Sample ID** 220629-29435

Analyte	Sample Result	Duplicate Result	Mean	% RPD ***
H_2S	<PQL	<PQL	0.000	0.0
MeSH	<PQL	<PQL	0.000	0.0
DMS	<PQL	<PQL	0.000	0.0

Matrix Spike & Duplicate **Sample ID** 220629-29435 x2

Analyte	Sample Conc.	Spike Added	MS Result	MSD Result	MS % Rec **	MSD % Rec **	% RPD ***
H_2S	<PQL	0.260	0.266	0.243	102.4	93.5	9.0
MeSH	<PQL	0.264	0.247	0.249	93.7	94.5	0.8
DMS	<PQL	0.261	0.253	0.249	96.9	95.4	1.6

Closing Calibration Verification Standard

Analyte	Std. Conc.	Result	% Rec **
H_2S	0.520	0.561	107.9
MeSH	0.527	0.536	101.7
DMS	0.522	0.522	100.0

** Must be 95-105%, ** Must be 90-110%, *** Must be < 10%, **** Must be < 5% RPD from Mean result.*

PQL = 50.0 ppbV
MDL = 1.1 ppbV

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~~220837~~ 220838
or

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name	**Project Name**	**Analysis Requested**					**Send Report To** (Name/Email/Address)
Jacobs Engineering **Project Manager Name** Karla Kasick	West Point RSP Replacement **Project Number** 148032418	VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		Stacia Dugan (stacia.dugan@jacobs.com)
Turnaround Time ☐ Rush 24 h ☐ Same Day ☐ Rush 48 h ☐ 5 Days ☐ Rush 72 h ☑ Normal	**Sampler Name** **Print:** Kevin Birchok **Signature:**						**Send Invoice To** (Name/Email/Address) Karla Kasick (karla.kasick@jacobs.com) **PO Number**

Client Sample Name	**Sample ID**	**Sampling Date**	**Sampling Time**	**Container Type/Qty**						**LAB USE ONLY** **Lab ID**	**Sample Received via:** ☐FedEx ☐UPS ☐Courier ☐Other
Raw Gas (SP 003) 30323	501166	4/12/22	10:24		X	X	X	X			**Temperature** °C **Thermometer ID** **Initials**
											Returned Eqmt **Total cans:** **Unused cans:** **Flow Controllers:**

Client Notes/Special Instructions:

EDD? ☑Yes ☐No

LAB USE ONLY
Notes:

Relinquished By **Print:** Kevin Birchok **Signature:**	**Date** 4/13/22 **Time** 4:21	**Received By** **Print:** **Signature:**	**Date** **Time**
Relinquished By **Print:** **Signature:**	**Date** **Time**	**Received By** **Print:** **Signature:**	**Date** 4/18/22 **Time** 1300

FX

2x cans

220838 220838 CM

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name
Jacobs Engineering

Project Manager Name
Karla Kasick

Project Name
West Point RSP Replacement

Project Number
148032418

Send Report To (Name/Email/Address)
Stacia Dugan
(stacia.dugan@jacobs.com)

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h ☑ Normal

Sampler Name
Print: Kevin Birchok
Signature: Kevin Birchok

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	Analysis Requested: VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		LAB USE ONLY: Lab ID
Treated Gas (SP 017) 30324	000818	4/12/22	10:12		X	X	X	X		

LAB USE ONLY

Sample Received via:
☐ FedEx
☐ UPS
☐ Courier
☐ Other

Temperature _____ °C

Thermometer ID _____

Initials _____

Returned Eqmt
Total cans: _____
Unused cans: _____
Flow Controllers: _____

Client Notes/Special Instructions:

EDD?
☑ Yes
☐ No

LAB USE ONLY
Notes:

Relinquished By **Print:** Kevin Birchok **Signature:** Kevin Birchok	**Date** 4/13/22 **Time** 4:21	**Received By** **Print:** **Signature:**	**Date** **Time**
Relinquished By **Print:** **Signature:**	**Date** **Time**	**Received By** **Print:** **Signature:**	**Date** 4/18/22 **Time** 1300

Atmospheric Analysis & Consulting, Inc.

CLIENT	: Jacobs Engineering
PROJECT NAME	: West Point RSP Replacement
PROJECT NO.	: 148032418
AAC PROJECT NO.	: 220838
REPORT DATE	: 04/27/2022

On April 18, 2022, Atmospheric Analysis & Consulting, Inc. received two (2) 6-Liter Silonote Canisters for Volatile Organic Compounds and Siloxanes analysis by EPA Method TO-15. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab ID	Return Pressure (mmHga)
Raw Gas (SP 003)	220838-30323	783.0
Treated Gas (SP 017)	220838-30324	785.4

This analysis is accredited under the laboratory's ISO/IEC 17025:2017 accreditation issued by the ANSI National Accreditation Board. Refer to certificate and scope of accreditation AT-1908. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples.

The Technical Director or his designee, as verified by the following signature, has authorized release of the data contained in this hardcopy report.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 10 pages.

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Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 220838
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 04/18/2022
DATE REPORTED : 04/27/2022
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Raw Gas (SP 003)			Sample Reporting Limit (SRL) (MRLxDF's)	Treated Gas (SP 017)			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	220838-30323				220838-30324				
Date Sampled	04/12/2022				04/12/2022				
Date Analyzed	04/26/2022				04/26/2022				
Can Dilution Factor	1.32				1.32				
Compound	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Chlorodifluoromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Propene	777		10	13.2	727		10	13.2	1.00
Dichlorodifluoromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Chloromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Dichlorotetrafluoroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Vinyl Chloride	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Methanol	<SRL	U	10	66.2	<SRL	U	10	65.9	5.00
1,3-Butadiene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Bromomethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Chloroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Dichlorofluoromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Ethanol	<SRL	U	10	26.5	<SRL	U	10	26.4	2.00
Vinyl Bromide	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Acetone	<SRL	U	10	26.5	<SRL	U	10	26.4	2.00
Trichlorofluoromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
2-Propanol (IPA)	<SRL	U	10	26.5	<SRL	U	10	26.4	2.00
Acrylonitrile	<SRL	U	10	26.5	<SRL	U	10	26.4	2.00
1,1-Dichloroethene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Methylene Chloride (DCM)	<SRL	U	10	13.2	<SRL	U	10	13.2	1.00
Allyl Chloride	<SRL	U	10	13.2	<SRL	U	10	13.2	1.00
Carbon Disulfide	<SRL	U	10	26.5	<SRL	U	10	26.4	2.00
Trichlorotrifluoroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
trans-1,2-Dichloroethene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,1-Dichloroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Methyl Tert Butyl Ether (MTBE)	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Vinyl Acetate	<SRL	U	10	13.2	<SRL	U	10	13.2	1.00
2-Butanone (MEK)	<SRL	U	10	13.2	<SRL	U	10	13.2	1.00
cis-1,2-Dichloroethene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Hexane	13.9		10	6.62	<SRL	U	10	6.59	0.50
Chloroform	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Ethyl Acetate	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Tetrahydrofuran	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,2-Dichloroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,1,1-Trichloroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Benzene	7.15		10	6.62	<SRL	U	10	6.59	0.50

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Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 220838
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 04/18/2022
DATE REPORTED : 04/27/2022
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Raw Gas (SP 003)			Sample Reporting Limit (SRL) (MRLxDF's)	Treated Gas (SP 017)			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	220838-30323				220838-30324				
Date Sampled	04/12/2022				04/12/2022				
Date Analyzed	04/26/2022				04/26/2022				
Can Dilution Factor	1.32				1.32				
Compound	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Carbon Tetrachloride	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Cyclohexane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,2-Dichloropropane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Bromodichloromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,4-Dioxane	<SRL	U	10	13.2	<SRL	U	10	13.2	1.00
Trichloroethene (TCE)	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
2,2,4-Trimethylpentane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Heptane	20.0		10	6.62	<SRL	U	10	6.59	0.50
cis-1,3-Dichloropropene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
4-Methyl-2-pentanone (MiBK)	6.88		10	6.62	<SRL	U	10	6.59	0.50
trans-1,3-Dichloropropene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,1,2-Trichloroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Toluene	1040		10	6.62	<SRL	U	10	6.59	0.50
2-Hexanone (MBK)	<SRL	U	10	13.2	<SRL	U	10	13.2	1.00
Dibromochloromethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,2-Dibromoethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Tetrachloroethene (PCE)	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Chlorobenzene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Ethylbenzene	9.66		10	6.62	<SRL	U	10	6.59	0.50
m & p-Xylene	15.1		10	13.2	<SRL	U	10	13.2	1.00
Bromoform	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
Styrene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,1,2,2-Tetrachloroethane	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
o-Xylene	7.68		10	6.62	<SRL	U	10	6.59	0.50
4-Ethyltoluene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,3,5-Trimethylbenzene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,2,4-Trimethylbenzene	15.4		10	6.62	<SRL	U	10	6.59	0.50
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,3-Dichlorobenzene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,4-Dichlorobenzene	7.68		10	6.62	<SRL	U	10	6.59	0.50
1,2-Dichlorobenzene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
1,2,4-Trichlorobenzene	<SRL	U	10	26.5	<SRL	U	10	26.4	2.00
Hexachlorobutadiene	<SRL	U	10	6.62	<SRL	U	10	6.59	0.50
BFB-Surrogate Std. % Recovery		98%				91%			70-130%

U - Compound was not detected at or above the SRL.

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Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 220838
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 04/18/2022
DATE REPORTED : 04/27/2022
ANALYST : MB/DL

SILOXANES BY EPA TO-15

Client ID	Raw Gas (SP 003)		
AAC ID	220838-30323		
Date Sampled	04/12/2022		
Date Analyzed	04/26/2022		
Canister Dilution Factor	1.32		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	<SRL	10	13.2
Tetramethylsilane*	<SRL	10	13.2
Hexamethyldisiloxane (L2)	<SRL	10	13.2
Hexamethylcyclotrisiloxane (D3)	13.9	10	13.2
Octamethyltrisiloxane (L3)	<SRL	10	13.2
Octamethylcyclotetrasiloxane (D4)	107	10	13.2
Decamethyltetrasiloxane (L4)	<SRL	10	13.2
Decamethylcyclopentasiloxane (D5)	28.1	10	13.2
Dodecamethylpentasiloxane (L5)*	<SRL	10	13.2
BFB-Surrogate Std. % Recovery	98%		70-130%

Client ID	Treated Gas (SP 017)		
AAC ID	220838-30324		
Date Sampled	04/12/2022		
Date Analyzed	04/26/2022		
Canister Dilution Factor	1.32		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	<SRL	10	13.2
Tetramethylsilane*	<SRL	10	13.2
Hexamethyldisiloxane (L2)	<SRL	10	13.2
Hexamethylcyclotrisiloxane (D3)	<SRL	10	13.2
Octamethyltrisiloxane (L3)	<SRL	10	13.2
Octamethylcyclotetrasiloxane (D4)	<SRL	10	13.2
Decamethyltetrasiloxane (L4)	<SRL	10	13.2
Decamethylcyclopentasiloxane (D5)	<SRL	10	13.2
Dodecamethylpentasiloxane (L5)*	<SRL	10	13.2
BFB-Surrogate Std. % Recovery	91%		70-130%

SRL - Sample Reporting Limit
ND - Not Detected
*Results and SRL are estimated

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QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 04/26/2022
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-040622-01
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Continuing Calibration Verification of the 04/22/2022 Calibration

Analyte Compounds	*Source*[1]	*CCV*[2]	*% Recovery*[3]
4-BFB (surrogate standard)	10.00	9.96	100
Chlorodifluoromethane	10.40	10.01	96
Propene	10.60	9.98	94
Dichlorodifluoromethane	10.40	10.45	100
Dimethyl Ether	10.20	9.17	90
Chloromethane	10.40	10.30	99
Dichlorotetrafluoroethane	10.30	9.86	96
Vinyl Chloride	10.50	9.92	94
Acetaldehyde	21.10	20.21	96
Methanol	18.80	18.47	98
1,3-Butadiene	10.60	10.08	95
Bromomethane	10.40	9.79	94
Chloroethane	10.30	9.53	93
Dichlorofluoromethane	10.20	9.66	95
Ethanol	11.20	10.69	95
Vinyl Bromide	10.10	9.95	99
Acrolein	11.10	10.55	95
Acetone	10.60	10.48	99
Trichlorofluoromethane	10.50	10.45	100
2-Propanol (IPA)	11.00	10.12	92
Acrylonitrile	11.20	11.00	98
1,1-Dichloroethene	10.40	9.78	94
Methylene Chloride (DCM)	10.50	10.33	98
TertButanol (TBA)	11.10	12.07	109
Allyl Chloride	10.20	9.51	93
Carbon Disulfide	10.50	10.45	100
Trichlorotrifluoroethane	10.40	9.62	93
trans-1,2-Dichloroethene	10.60	10.22	96
1,1-Dichloroethane	10.50	10.06	96
Methyl Tert Butyl Ether (MTBE)	10.50	9.37	89
Vinyl Acetate	11.00	11.42	104
2-Butanone (MEK)	10.60	9.83	93
cis-1,2-Dichloroethene	10.50	9.99	95
Hexane	10.70	9.82	92
Chloroform	10.60	10.11	95
Ethyl Acetate	10.60	10.48	99
Tetrahydrofuran	10.20	9.13	90
1,2-Dichloroethane	10.50	10.32	98
1,1,1-Trichloroethane	10.40	9.98	96
Benzene	10.60	9.50	90
Carbon Tetrachloride	10.20	9.71	95
Cyclohexane	10.50	9.04	86

Analyte Compounds (Continued)	*Source*[1]	*CCV*[2]	*% Recovery*[3]
1,2-Dichloropropane	10.50	9.42	90
Bromodichloromethane	10.40	9.59	92
1,4-Dioxane	10.40	10.23	98
Trichloroethene (TCE)	10.40	9.15	88
2,2,4-Trimethylpentane	10.00	9.07	91
Methyl Methacrylate	11.00	10.00	91
Heptane	10.50	8.41	80
cis-1,3-Dichloropropene	10.40	9.22	89
4-Methyl-2-pentanone (MiBK)	10.40	10.07	97
trans-1,3-Dichloropropene	10.50	9.72	93
1,1,2-Trichloroethane	10.50	9.35	89
Toluene	10.60	9.60	91
2-Hexanone (MBK)	10.50	10.43	99
Dibromochloromethane	10.30	9.28	90
1,2-Dibromoethane	10.60	9.38	88
Tetrachloroethene (PCE)	10.40	9.16	88
Chlorobenzene	10.60	9.61	91
Ethylbenzene	10.50	9.94	95
m & p-Xylene	21.00	18.86	90
Bromoform	10.50	10.13	96
Styrene	10.50	9.90	94
1,1,2,2-Tetrachloroethane	10.50	10.07	96
o-Xylene	10.50	10.11	96
1,2,3-Trichloropropane	11.00	10.12	92
Isopropylbenzene (Cumene)	10.30	9.96	97
α-Pinene	10.70	8.57	80
2-Chlorotoluene	10.30	9.15	89
n-Propylbenzene	10.10	9.81	97
4-Ethyltoluene	10.30	10.34	100
1,3,5-Trimethylbenzene	10.30	9.92	96
β-Pinene LR	11.00	7.10	65
1,2,4-Trimethylbenzene	10.30	10.05	98
Benzyl Chloride (a-Chlorotoluene)	10.40	9.64	93
1,3-Dichlorobenzene	10.40	9.42	91
1,4-Dichlorobenzene	10.30	9.59	93
Sec-ButylBenzene	10.10	9.77	97
1,2-Dichlorobenzene	10.60	9.72	92
n-ButylBenzene	10.20	10.17	100
1,2-Dibromo-3-Chloropropane	10.10	9.13	90
1,2,4-Trichlorobenzene	11.00	8.62	78
Naphthalene	11.50	9.26	81
Hexachlorobutadiene	11.00	9.59	87

[1] Concentration of analyte compound in certified source standard.

[2] Measured result from daily Continuing Calibration Verification (CCV).

[3] The acceptable range for analyte recovery is 100±30%.

LR - Recovery for this compound was low. Results should be considered estimated.

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 04/26/2022
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-040622-01
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Laboratory Control Spike Analysis

System Monitoring Compounds	*Sample Concentration*	*Spike Added*	*LCS[1] Recovery*	*LCSD[1] Recovery*	*LCS[1] % Recovery[2]*	*LCSD[1] % Recovery[2]*	*RPD[3]*
4-BFB (surrogate standard)	0.0	9.80	9.96	9.67	101.6326531	98.67346939	3.0
1,1-Dichloroethene	0.0	10.40	9.78	9.92	94	95	1.4
Methylene Chloride (DCM)	0.0	10.50	10.33	10.49	98	100	1.5
Benzene	0.0	10.60	9.50	9.61	90	91	1.2
Trichloroethene (TCE)	0.0	10.40	9.15	9.53	88	92	4.1
Toluene	0.0	10.60	9.60	9.57	91	90	0.3
Tetrachloroethene (PCE)	0.0	10.40	9.16	9.33	88	90	1.8
Chlorobenzene	0.0	10.60	9.61	9.46	91	89	1.6
Ethylbenzene	0.0	10.50	9.94	9.81	95	93	1.3
m & p-Xylene	0.0	21.00	18.86	19.01	90	91	0.8
o-Xylene	0.0	10.50	10.11	10.22	96	97	1.1

[1] Laboratory Control Spike (LCS) / Laboratory Control Spike Duplicate (LCSD)

[2] The acceptable range for analyte recovery is 100±30%.

[3] Relative Percent Difference (RPD) between LCS recovery and LCSD recovery (acceptable range is <25%).

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QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 04/26/2022
MATRIX : High Purity He or N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Method Blank Analysis

Analyte Compounds	*MB 042622*	*Reporting Limit (RL)*
4-BFB (surrogate standard)	93%	100±30%
Chlorodifluoromethane	<RL	0.5
Propene	<RL	1.0
Dichlorodifluoromethane	<RL	0.5
Dimethyl Ether	<RL	0.5
Chloromethane	<RL	0.5
Dichlorotetrafluoroethane	<RL	0.5
Vinyl Chloride	<RL	0.5
Acetaldehyde	<RL	5.0
Methanol	<RL	5.0
1,3-Butadiene	<RL	0.5
Bromomethane	<RL	0.5
Chloroethane	<RL	0.5
Dichlorofluoromethane	<RL	0.5
Ethanol	<RL	2.0
Vinyl Bromide	<RL	0.5
Acrolein	<RL	1.0
Acetone	<RL	2.0
Trichlorofluoromethane	<RL	0.5
2-Propanol (IPA)	<RL	2.0
Acrylonitrile	<RL	2.0
1,1-Dichloroethene	<RL	0.5
Methylene Chloride (DCM)	<RL	1.0
TertButanol (TBA)	<RL	0.5
Allyl Chloride	<RL	1.0
Carbon Disulfide	<RL	2.0
Trichlorotrifluoroethane	<RL	0.5
trans-1,2-Dichloroethene	<RL	0.5
1,1-Dichloroethane	<RL	0.5
Methyl Tert Butyl Ether (MTBE)	<RL	0.5
Vinyl Acetate	<RL	1.0
2-Butanone (MEK)	<RL	1.0
cis-1,2-Dichloroethene	<RL	0.5
Hexane	<RL	0.5
Chloroform	<RL	0.5
Ethyl Acetate	<RL	0.5
Tetrahydrofuran	<RL	0.5
1,2-Dichloroethane	<RL	0.5
1,1,1-Trichloroethane	<RL	0.5
Benzene	<RL	0.5
Carbon Tetrachloride	<RL	0.5
Cyclohexane	<RL	0.5

Analyte Compounds (Continued)	*MB 042622*	*Reporting Limit (RL)*
1,2-Dichloropropane	<RL	0.5
Bromodichloromethane	<RL	0.5
1,4-Dioxane	<RL	1.0
Trichloroethene (TCE)	<RL	0.5
2,2,4-Trimethylpentane	<RL	0.5
Methyl Methacrylate	<RL	0.5
Heptane	<RL	0.5
cis-1,3-Dichloropropene	<RL	0.5
4-Methyl-2-pentanone (MiBK)	<RL	0.5
trans-1,3-Dichloropropene	<RL	0.5
1,1,2-Trichloroethane	<RL	0.5
Toluene	<RL	0.5
2-Hexanone (MBK)	<RL	1.0
Dibromochloromethane	<RL	0.5
1,2-Dibromoethane	<RL	0.5
Tetrachloroethene (PCE)	<RL	0.5
Chlorobenzene	<RL	0.5
Ethylbenzene	<RL	0.5
m & p-Xylene	<RL	1.0
Bromoform	<RL	0.5
Styrene	<RL	0.5
1,1,2,2-Tetrachloroethane	<RL	0.5
o-Xylene	<RL	0.5
1,2,3-Trichloropropane	<RL	0.5
Isopropylbenzene (Cumene)	<RL	0.5
α-Pinene	<RL	0.5
2-Chlorotoluene	<RL	0.5
n-Propylbenzene	<RL	0.5
4-Ethyltoluene	<RL	0.5
1,3,5-Trimethylbenzene	<RL	0.5
β-Pinene	<RL	0.5
1,2,4-Trimethylbenzene	<RL	0.5
Benzyl Chloride (a-Chlorotoluene)	<RL	0.5
1,3-Dichlorobenzene	<RL	0.5
1,4-Dichlorobenzene	<RL	0.5
Sec-ButylBenzene	<RL	0.5
1,2-Dichlorobenzene	<RL	0.5
n-ButylBenzene	<RL	0.5
1,2-Dibromo-3-Chloropropane	<RL	0.5
1,2,4-Trichlorobenzene	<RL	2.0
Naphthalene	<RL	2.0
Hexachlorobutadiene	<RL	0.5

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 04/26/2022
MATRIX : Air
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
ANALYST : MB/DL
DILUTION FACTOR[1] : x6879.89

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Duplicate Analysis of AAC Sample ID: 220873-30436

Analyte Compounds	*Sample*	*Duplicate*	*RPD[2]*
4-BFB (surrogate standard)	9.21	9.16	0.5
Chlorodifluoromethane	<SRL	<SRL	*NA*
Propene	<SRL	<SRL	*NA*
Dichlorodifluoromethane	<SRL	<SRL	*NA*
Dimethyl Ether	<SRL	<SRL	*NA*
Chloromethane	<SRL	<SRL	*NA*
Dichlorotetrafluoroethane	<SRL	<SRL	*NA*
Vinyl Chloride	<SRL	<SRL	*NA*
Acetaldehyde	<SRL	<SRL	*NA*
Methanol	<SRL	<SRL	*NA*
1,3-Butadiene	<SRL	<SRL	*NA*
Bromomethane	<SRL	<SRL	*NA*
Chloroethane	<SRL	<SRL	*NA*
Dichlorofluoromethane	<SRL	<SRL	*NA*
Ethanol	29700	27400	8.2
Vinyl Bromide	<SRL	<SRL	*NA*
Acrolein	<SRL	<SRL	*NA*
Acetone	<SRL	<SRL	*NA*
Trichlorofluoromethane	<SRL	<SRL	*NA*
2-Propanol (IPA)	<SRL	<SRL	*NA*
Acrylonitrile	<SRL	<SRL	*NA*
1,1-Dichloroethene	<SRL	<SRL	*NA*
Methylene Chloride (DCM)	<SRL	<SRL	*NA*
TertButanol (TBA)	<SRL	<SRL	*NA*
Allyl Chloride	<SRL	<SRL	*NA*
Carbon Disulfide	<SRL	<SRL	*NA*
Trichlorotrifluoroethane	<SRL	<SRL	*NA*
trans-1,2-Dichloroethene	<SRL	<SRL	*NA*
1,1-Dichloroethane	<SRL	<SRL	*NA*
Methyl Tert Butyl Ether (MTBE)	<SRL	<SRL	*NA*
Vinyl Acetate	<SRL	<SRL	*NA*
2-Butanone (MEK)	<SRL	<SRL	*NA*
cis-1,2-Dichloroethene	<SRL	<SRL	*NA*
Hexane	<SRL	<SRL	*NA*
Chloroform	<SRL	<SRL	*NA*
Ethyl Acetate	<SRL	<SRL	*NA*
Tetrahydrofuran	<SRL	<SRL	*NA*
1,2-Dichloroethane	<SRL	<SRL	*NA*
1,1,1-Trichloroethane	<SRL	<SRL	*NA*
Benzene	<SRL	<SRL	*NA*
Carbon Tetrachloride	<SRL	<SRL	*NA*
Cyclohexane	<SRL	<SRL	*NA*

Analyte Compounds (Continued)	*Sample*	*Duplicate*	*RPD[2]*
1,2-Dichloropropane	<SRL	<SRL	*NA*
Bromodichloromethane	<SRL	<SRL	*NA*
1,4-Dioxane	<SRL	<SRL	*NA*
Trichloroethene (TCE)	<SRL	<SRL	*NA*
2,2,4-Trimethylpentane	<SRL	<SRL	*NA*
Methyl Methacrylate	<SRL	<SRL	*NA*
Heptane	<SRL	<SRL	*NA*
cis-1,3-Dichloropropene	<SRL	<SRL	*NA*
4-Methyl-2-pentanone (MiBK)	<SRL	<SRL	*NA*
trans-1,3-Dichloropropene	<SRL	<SRL	*NA*
1,1,2-Trichloroethane	<SRL	<SRL	*NA*
Toluene	<SRL	<SRL	*NA*
2-Hexanone (MBK)	<SRL	<SRL	*NA*
Dibromochloromethane	<SRL	<SRL	*NA*
1,2-Dibromoethane	<SRL	<SRL	*NA*
Tetrachloroethene (PCE)	<SRL	<SRL	*NA*
Chlorobenzene	<SRL	<SRL	*NA*
Ethylbenzene	<SRL	<SRL	*NA*
m & p-Xylene	<SRL	<SRL	*NA*
Bromoform	<SRL	<SRL	*NA*
Styrene	<SRL	<SRL	*NA*
1,1,2,2-Tetrachloroethane	<SRL	<SRL	*NA*
o-Xylene	<SRL	<SRL	*NA*
1,2,3-Trichloropropane	<SRL	<SRL	*NA*
Isopropylbenzene (Cumene)	<SRL	<SRL	*NA*
α-Pinene	<SRL	<SRL	*NA*
2-Chlorotoluene	<SRL	<SRL	*NA*
n-Propylbenzene	<SRL	<SRL	*NA*
4-Ethyltoluene	<SRL	<SRL	*NA*
1,3,5-Trimethylbenzene	<SRL	<SRL	*NA*
β-Pinene	<SRL	<SRL	*NA*
1,2,4-Trimethylbenzene	<SRL	<SRL	*NA*
Benzyl Chloride (a-Chlorotoluene)	<SRL	<SRL	*NA*
1,3-Dichlorobenzene	<SRL	<SRL	*NA*
1,4-Dichlorobenzene	<SRL	<SRL	*NA*
Sec-ButylBenzene	<SRL	<SRL	*NA*
1,2-Dichlorobenzene	<SRL	<SRL	*NA*
n-ButylBenzene	<SRL	<SRL	*NA*
1,2-Dibromo-3-Chloropropane	<SRL	<SRL	*NA*
1,2,4-Trichlorobenzene	<SRL	<SRL	*NA*
Naphthalene	<SRL	<SRL	*NA*
Hexachlorobutadiene	<SRL	<SRL	*NA*

[1] Dilution factor is the product of the Canister Dilution Factor and the Analysis Dilution Factor.

[2] Relative Percent Difference (RPD) between Sample analysis and Duplicate analysis (acceptable range is <25%).

SRL - Sample Reporting Limit (minimum)

~~220837~~ 220838

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Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name	**Project Name**	**Analysis Requested**					**Send Report To** (Name/Email/Address)
Jacobs Engineering **Project Manager Name** Karla Kasick	West Point RSP Replacement **Project Number** 148032418	VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		Stacia Dugan (stacia.dugan@jacobs.com)
Turnaround Time ☐ Rush 24 h ☐ Same Day ☐ Rush 48 h ☐ 5 Days ☐ Rush 72 h ☑ Normal	**Sampler Name** **Print:** Kevin Birchok **Signature:**						**Send Invoice To** (Name/Email/Address) Karla Kasick (karla.kasick@jacobs.com) **PO Number**

Client Sample Name	**Sample ID**	**Sampling Date**	**Sampling Time**	**Container Type/Qty**						**LAB USE ONLY** **Lab ID**	**Sample Received via:** ☐FedEx ☐UPS ☐Courier ☐Other_____
Raw Gas (SP 003) 30323	501166	4/12/22	10:24		X	X	X	X			**Temperature** _____°C Thermometer ID _____ Initials _____
											Returned Eqmt Total cans: _____ Unused cans: _____ Flow Controllers: _____

Client Notes/Special Instructions:

EDD? ☑Yes ☐No

LAB USE ONLY Notes:

Relinquished By Print: Kevin Birchok Signature:	**Date** 4/13/22 **Time** 4:21	**Received By** Print: Signature:	**Date** **Time**
Relinquished By Print: Signature:	**Date** **Time**	**Received By** Print: Signature:	**Date** 4/18/22 **Time** 1300

FX

2x Cans

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AAC Project No.:

Client/Company Name Jacobs Engineering **Project Manager Name** Karla Kasick	**Project Name** West Point RSP Replacement **Project Number** 148032418			**Analysis Requested**					**Send Report To** (Name/Email/Address) Stacia Dugan (stacia.dugan@jacobs.com)	
Turnaround Time ☐ Rush 24 h ☐ Same Day ☐ Rush 48 h ☐ 5 Days ☐ Rush 72 h ☑ Normal	**Sampler Name** **Print:** Kevin Birchok **Signature:**			VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		**Send Invoice To** (Name/Email/Address) Karla Kasick (karla.kasick@jacobs.com) **PO Number**	
Client Sample Name	**Sample ID**	**Sampling Date**	**Sampling Time**	**Container Type/Qty**					**LAB USE ONLY** **Lab ID**	**Sample Received via:** ☐FedEx ☐UPS ☐Courier ☐Other_____
Treated Gas (SP 017) 30324	000818	4/12/22	10:12		X	X	X	X		**Temperature** _____ °C Thermometer ID _____ Initials _____
										Returned Eqmt Total cans: _____ Unused cans: _____ Flow Controllers: _____

Client Notes/Special Instructions:

EDD? ☑Yes ☐No

LAB USE ONLY
Notes:

Relinquished By **Print:** Kevin Birchok **Signature:**	**Date** 4/13/22 **Time** 4:21	**Received By** **Print:** **Signature:**
Relinquished By **Print:** **Signature:**	**Date** **Time**	**Received By** **Print:** **Signature:**

Date
Time

Date 4/18/22
Time 1300

Atmospheric Analysis & Consulting, Inc

CLIENT	: Jacobs Engineering
PROJECT NAME	: West Point RSP Replacement
PROJECT NO.	: 148032418
AAC PROJECT NO.	: 221065
REPORT DATE	: 05/31/2022

On May 17th, 2022, Atmospheric Analysis & Consulting, Inc. received two (2) Six-Liter Silonite Canisters for BTU analysis by ASTM D-3588/5504 and TNMOC analysis by EPA 25C. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab No.	Return Pressure (mmHg)
Treated Gas (SP 017)	221065-31337	782.6
Treated Gas (SP 003)	221065-31338	779.8

This analysis is performed in accordance with AAC's Quality Manual. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples. The Technical Director or his/her designee, as verified by the following signature, has authorized release of the data.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 12 pages.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Atmospheric Analysis & Consulting, Inc

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Jacobs Engineering
PROJECT NO. : 221065

SAMPLING DATE : 05/10/2022
ANALYSIS DATE : 05/19-20/2022

	Client ID:	Treated Gas (SP 017)			
	AAC ID:	221065-31337			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.31	1.31	< 0.001	0.001
	O_2	0.220	0.131	0.260	0.001
	N_2	0.925	0.131	0.956	0.001
	CO	< 0.131	0.131	< 0.001	0.001
	CO_2	39.0	0.131	63.4	0.002
	CH_4	59.8	0.00007	35.4	0.004
	He	NM	NM	NM	NM
	Ar	< 0.131	0.131	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00033	0.00033	< 0.0003	0.0003
	C_3 (as Propane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_4 (as Butane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_5 (as Pentane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_6 (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_{6+} (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
TRS	Total Reduced Sulfur	0.00614	0.0000013	0.00772	0.000002
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	8463
Carbon (C)	43.8	*LHV Btu/lb*	7620
Hydrogen (H)	8.9	*HHV Btu/dscf*	604
Oxygen (O)	46.3	*LHV Btu/dscf*	544
Nitrogen (N)	1.0	*F-Factor*	9247
Helium (He)	0.00	*Relative Density*	0.9358
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.0000
Sulfur (S)	0.01	*MW lb/lb-mole*	27.101
Motor Octane Number	92.83	*Methane Number*	31.66
		Wobbe Number	624.773

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Atmospheric Analysis & Consulting, Inc

LABORATORY ANALYSIS REPORT

CLIENT : **Jacobs Engineering**
PROJECT NO. : **221065**
MATRIX : **AIR**
UNITS : **ppmV**

SAMPLING DATE : **05/10/2022**
ANALYSIS DATE : **05/17/2022**

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	**Treated Gas (SP 017)**
AAC ID	**221065-31337**
Canister Dil. Fac.	**1.3**
Analyte	**Result**
Hydrogen Sulfide	**61.0**
COS / SO2	< 0.065
Methyl Mercaptan	**0.140**
Ethyl Mercaptan	< 0.065
Dimethyl Sulfide	< 0.065
Carbon Disulfide	< 0.065
Isopropyl Mercaptan	< 0.065
tert-Butyl Mercaptan	< 0.065
n-Propyl Mercaptan	< 0.065
Methylethylsulfide	< 0.065
sec-Butyl Mercaptan / Thiophene	< 0.065
iso-Butyl Mercaptan	< 0.065
Diethyl Sulfide	< 0.065
n-Butyl Mercaptan	< 0.065
Dimethyl Disulfide	< 0.065
2-Methylthiophene	< 0.065
3-Methylthiophene	< 0.065
Tetrahydrothiophene	< 0.065
Bromothiophene	< 0.065
Thiophenol	< 0.065
Diethyl Disulfide	< 0.065
Total Unidentified Sulfur	< 0.065
Total Reduced Sulfurs	**61.1**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

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Atmospheric Analysis & Consulting, Inc

Laboratory Analysis Report
ASTM-D3588 (BTU and F-Factor)

CLIENT : Jacobs Engineering
PROJECT NO. : 221065

SAMPLING DATE : 05/10/2022
ANALYSIS DATE : 05/19-20/2022

	Client ID:	Treated Gas (SP 003)			
	AAC ID:	221065-31338			
	Component	Mole %	Mole % SRL	Weight %	Weight % SRL
FIXED GASES	H_2	< 1.31	1.31	< 0.001	0.001
	O_2	0.516	0.131	0.609	0.001
	N_2	2.02	0.131	2.08	0.001
	CO	< 0.131	0.131	< 0.001	0.001
	CO_2	38.4	0.131	62.4	0.002
	CH_4	59.0	0.00007	34.9	0.004
	He	NM	NM	NM	NM
	Ar	< 0.131	0.131	< 0.002	0.002
HYDROCARBONS	C_2 (as Ethane)	< 0.00033	0.00033	< 0.0003	0.0003
	C_3 (as Propane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_4 (as Butane)	< 0.00007	0.00007	< 0.0001	0.0001
	C_5 (as Pentane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_6 (as Hexane)	< 0.00007	0.00007	< 0.0002	0.0002
	C_{6+} (as Hexane)	0.00080	0.00007	0.0026	0.0002
TRS	Total Reduced Sulfur	0.0313	0.0000013	0.0393	0.000002
H2O	Moisture content	NM	NM	NM	NM

All results have been normalized to 100% on a dry basis.

Fuel Gas Specifications			
Atomic Breakdown - (scf/lb) / %		*HHV Btu/lb*	8339
Carbon (C)	43.1	*LHV Btu/lb*	7509
Hydrogen (H)	8.8	*HHV Btu/dscf*	596
Oxygen (O)	46.0	*LHV Btu/dscf*	537
Nitrogen (N)	2.1	*F-Factor*	9246
Helium (He)	0.00	*Relative Density*	0.9366
Argon (Ar)	0.00	*C2-C6+ Weight %*	0.0000
Sulfur (S)	0.04	*MW lb/lb-mole*	27.124
Motor Octane Number	92.85	*Methane Number*	31.69
		Wobbe Number	615.911

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Atmospheric Analysis & Consulting, Inc.

LABORATORY ANALYSIS REPORT

CLIENT : **Jacobs Engineering**
PROJECT NO. : **221065**
MATRIX : **AIR**
UNITS : **ppmV**

SAMPLING DATE : **05/10/2022**
ANALYSIS DATE : **05/17/2022**

Total Reduced Sulfur Compounds Analysis by ASTM D-5504

Client ID	**Treated Gas (SP 003)**
AAC ID	**221065-31338**
Canister Dil. Fac.	**1.3**
Analyte	**Result**
Hydrogen Sulfide	**308**
COS / SO2	< 0.065
Methyl Mercaptan	**0.109**
Ethyl Mercaptan	< 0.065
Dimethyl Sulfide	< 0.065
Carbon Disulfide	< 0.065
Isopropyl Mercaptan	< 0.065
tert-Butyl Mercaptan	< 0.065
n-Propyl Mercaptan	< 0.065
Methylethylsulfide	< 0.065
sec-Butyl Mercaptan / Thiophene	< 0.065
iso-Butyl Mercaptan	< 0.065
Diethyl Sulfide	< 0.065
n-Butyl Mercaptan	< 0.065
Dimethyl Disulfide	< 0.065
2-Methylthiophene	< 0.065
3-Methylthiophene	< 0.065
Tetrahydrothiophene	< 0.065
Bromothiophene	< 0.065
Thiophenol	< 0.065
Diethyl Disulfide	< 0.065
Total Unidentified Sulfur	< 0.065
Total Reduced Sulfurs	**308**

All unidentified compound's concentrations expressed in terms of H_2S (TRS does not include COS and SO_2)
Sample Reporting Limit (SRL) is equal to Reporting Limit x Canister Dil. Fac. x Analysis Dil. Fac.

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Laboratory Analysis Report

Client : **Jacobs Engineering**
Project No. : **221065**
Matrix : **AIR**
Units : **ppmC**

Sampling Date : **05/10/2022**
Receiving Date : **05/17/2022**
Analysis Date : **05/20/2022**
Report Date : **05/31/2022**

EPA 25C

Reporting Limit: 3.0 ppmC		*Canister Dilution Factor*	*Analysis Dilution Factor*	TNMOC*	SRL (RL x DF's)
Client Sample ID	AAC ID				
Treated Gas (SP 017)	221065-31337	1.3	1.0	<SRL	3.9
Treated Gas (SP 003)	221065-31338	1.3	1.0	53	3.9

Sample Reporting Limit (SRL) is equal to Reporting Limit x Analysis Dil. Fac x Canister Dil. Fac.

**Total Non-Methane Organic Carbon*

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Atmospheric Analysis & Consulting, Inc

Quality Control/Quality Assurance Report

Date Analyzed : 05/20/2022
Analyst : ZD
Units : %

Instrument ID : GC-TCA #2
Calb Date : 01/17/2022
Reporting Limit : 0.1%

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
CCV	Spike Conc	9.4	10.8	21.4	10.3	10.2	10.2
	Result	10.3	10.3	20.3	10.2	10.2	10.1
	% Rec *	109.8	95.3	95.3	99.7	99.6	99.5

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	9.4	10.8	21.4	10.3	10.2	10.2
	LCS Result	10.3	10.2	20.0	10.1	10 0	10.0
	LCSD Result	10.1	10.1	19.8	10.1	9.9	10.0
	LCS % Rec *	109.3	95.0	93.7	98.3	98.2	98.3
	LCSD % Rec *	107.1	93.9	92.9	98.0	97.2	97.9
	% RPD ***	2.0	1.1	0.8	0.3	1.0	0.4

IV -Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
220954-30872	Sample	0.0	0.2	0.7	45.6	0.0	29.7
	Sample Dup	0.0	0.2	0.7	45.4	0.0	29.6
	Mean	0.0	0.2	0.7	45.5	0.0	29.7
	% RPD ***	0.0	3.0	1.1	0.4	0.0	0.4

V - Matrix Spike & Duplicate- BTU/ASTM D-1945

AAC ID	Analyte	H2	N2	CH4	CO	CO2
220954-30872	Sample Conc	0.0	0.4	22.8	0.0	14.8
	Spike Conc	9.4	10.1	10.3	10.2	10.2
	MS Result	10.3	10.5	32.6	9.8	24.6
	MSD Result	10.2	10.9	32.3	9.9	24.5
	MS % Rec **	109.8	100.3	96.0	95.3	95.6
	MSD % Rec **	108.7	104.5	93.0	96.8	95.2
	% RPD ***	1.0	4.1	3.2	1.6	0.4

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	H2	O2	N2	CH4	CO	CO2
CCV	Spike Conc	9.4	10.8	21.4	10.3	10.2	10.2
	Result	10.4	10.3	20.1	10.1	10.2	10.1
	% Rec *	110.8	95.2	94.0	98.8	99.4	98.8

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

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Quality Control/Quality Assurance Report

Analysis Date : 05/20/2022
Analyst : ZD
Units : ppmv

Instrument ID: GCTCA#2-FID
Calibration Date: 2/15/2022

I - Opening Calibration Verification Standard - Method 25C

Analyte	xRF	DRF	%RPD*
Propane	315066	303182	3.8

II - TNMOC Response Factor - Method 25C

Analyte	xRF	CV RF	CV dp RF	CV tp RF	Average RF	% RPD***
Propane	315066	303182	300446	310223	304617	3.4

III - Method Blank - Method 25C

AAC ID	Analyte	Sample Result
MB	TNMOC	0.00

IV - Laboratory Control Spike & Duplicate - Method 25C

AAC ID	Analyte	Spike Added	LCS	LCSD	LCS % Rec **	LCSD % Rec **	% RPD***
LCS/LCSD	Propane	51.0	48.33	49.90	94.8	97.9	3.2

V - Closing Calibration Verification Standard - Method 25C

Analyte	xCF	dCF	%RPD*
Propane	315066	321936	2.2

xCF - Average Calibration Factor from Initial Calibration Curve
dCF - Daily Calibration Factor
* Must be <15%
** Must be 90-110 %
*** Must be <20%

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Atmospheric Analysis & Consulting, Inc

Quality Control/Quality Assurance Report

Date Analyzed : 05/19/2022
Analyst : ZD/MR
Units : ppmv

Instrument ID : FID #3
Calb Date : 02/01/22
Reporting Limit : 0.5 ppmv

I - Opening Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	Result	87.4	88.0	86.8	87.2	89.4	87.9
	% Rec *	88.4	88.8	87.9	88.9	91.1	88.2

II - Method Blank - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
MB	Concentration	ND	ND	ND	ND	ND	ND

III - Laboratory Control Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
Lab Control Standards	Sample Conc	0.0	0.0	0.0	0.0	0.0	0.0
	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	LCS Result	92.4	93.2	92.9	92.7	94.7	94.7
	LCSD Result	90.9	92.3	91.9	93.1	94.0	95.6
	LCS % Rec *	93.5	94.0	94.1	94.5	96.5	95.0
	LCSD % Rec *	92.0	93.1	93.1	94.9	95.8	95.8
	% RPD ***	1.6	1.0	1.1	0.4	0.8	0.9

IV - Sample & Sample Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
221076-31371	Sample	5.7	0.0	0.0	0.0	0.0	0.0
	Sample Dup	5.9	0.0	0.0	0.0	0.0	0.0
	Mean	5.8	0.0	0.0	0.0	0.0	0.0
	% RPD ***	3.3	0.0	0.0	0.0	0.0	0.0

V - Matrix Spike & Duplicate - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
221076-31371	Sample Conc	2.9	0.0	0.0	0.0	0.0	0.0
	Spike Conc	49.4	49.6	49.4	49.0	49.1	49.9
	MS Result	49.0	46.9	46.5	46.8	48.1	49.7
	MSD Result	49.8	47.8	47.3	47.7	49.9	53.5
	MS % Rec **	93.3	94.6	94.3	95.4	98.0	99.7
	MSD % Rec **	94.9	96.5	95.9	97.2	101.7	107.4
	% RPD ***	1.8	2.0	1.7	1.9	3.7	7.4

VI - Closing Continuing Calibration Verification - BTU/ASTM D-1945

AAC ID	Analyte	Methane	Ethane	Propane	Butane	Pentane	Hexane
CCV	Spike Conc	98.9	99.1	98.7	98.1	98.1	99.7
	Result	99.5	96.9	95.9	97.4	100.2	105.1
	% Rec *	100.7	97.8	97.1	99.3	102.0	105.3

** Must be 85-115%*

*** Must be 75-125%*

**** Must be < 25%*

ND = Not Detected

<RL = less than Reporting Limit

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Quality Control/Quality Assurance Report
ASTM D-5504

Date Analyzed: 5/17/2022
Analyst: ZD
Units: ppbV

Instrument ID: SCD#10
Calb. Date: 12/8/2021

Opening Calibration Verification Standard

519.8 ppbV H2S (SS1289)

H_2S	Resp. (area)	Result	% Rec *	% RPD ****
Initial	2963	520	100.0	0.9
Duplicate	3043	534	102.7	1.7
Triplicate	2967	520	100.1	0.8

527.0 ppbV H2S (SS1289)

MeSH	Resp. (area)	Result	% Rec *	% RPD ****
Initial	3457	523	99.2	0.3
Duplicate	3408	515	97.8	1.1
Triplicate	3476	526	99.8	0.8

522.0 ppbV H2S (SS1289)

DMS	Resp. (area)	Result	% Rec *	% RPD ****
Initial	3911	519	99.4	1.3
Duplicate	3801	504	96.6	1.5
Triplicate	3870	513	98.3	0.2

Method Blank

Analyte	Result
H_2S	<PQL
MeSH	<PQL
DMS	<PQL

Duplicate Analysis **Sample ID** 220865-30420

Analyte	Sample Result	Duplicate Result	Mean	% RPD ***
H_2S	<PQL	<PQL	0.0	0.0
MeSH	<PQL	<PQL	0.0	0.0
DMS	<PQL	<PQL	0.0	0.0

Matrix Spike & Duplicate **Sample ID** 220629-29435

Analyte	Sample Conc.	Spike Added	MS Result	MSD Result	MS % Rec **	MSD % Rec **	% RPD ***
H_2S	<PQL	259.9	241.5	250.4	92.9	96.4	3.6
MeSH	<PQL	263.5	254.0	259.4	96.4	98.5	2.1
DMS	<PQL	261.0	259.8	246.9	99.5	94.6	5.1

Closing Calibration Verification Standard

Analyte	Std. Conc.	Result	% Rec **
H_2S	519.8	540.7	104.0
MeSH	527.0	547.6	103.9
DMS	522.0	538.8	103.2

** Must be 95-105%, ** Must be 90-110%, *** Must be < 10%, **** Must be < 5% RPD from Mean result.*

MeSH: PQL = 10.5 ppbV, MDL = 1.12 ppbV
DMS: PQL = 11.0 ppbV, MDL = 1.12 ppbV

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221065

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name

Project Manager Name

Project Name
West Point RSP Replacement
Project Number
148032418

Send Report To (Name/Email/Address)
Stacia Dugan
(stacia.dugan@jacobs.com

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h ☑ Normal

Sampler Name
Print: Kevin Birchok
Signature: Kevin Birchok

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	Analysis Requested: VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		LAB USE ONLY: Lab ID
Treated Gas (SP 017)	801138	5/10/22	9:51		X	X	X	X		
31337										

LAB USE ONLY:
Sample Received via:
☑ FedEx
☐ UPS
☑ Courier
☐ Other
Temperature ____°C
Thermometer ID ____
Initials ____
Returned Eqmt:
Total cans: ____
Unused cans: ____
Flow Controllers: ____

Client Notes/Special Instructions:

EDD?
☑ Yes
☐ No

LAB USE ONLY
Notes:

Relinquished By Print: Signature:	**Date** Time	**Received By** Print: Signature:	**Date** Time
Relinquished By Print: Signature:	**Date** Time	**Received By** Print: Signature:	**Date** 5/17/22 Time 1049

UPS

2x cans

221065

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name

Project Manager Name

Project Name
West Point RSP Replacement
Project Number
148032418

Send Report To (Name/Email/Address)
Stacia Dugan
(stacia.dugan@jacobs.com

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h ☑ Normal

Sampler Name
Print: Kevin Birchok
Signature: Kevin Birchok

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	Analysis Requested: VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		LAB USE ONLY: Lab ID
Treated Gas (SP 003)	000837	5/10/22	9:59		X	X	X	X		
31338										

LAB USE ONLY
Sample Received via:
☑ FedEx
☑ UPS
☐ Courier
☐ Other
Temperature: °C
Thermometer ID:
Initials:
Returned Eqmt
Total cans:
Unused cans:
Flow Controllers:

Client Notes/Special Instructions:

EDD?
☑ Yes
☐ No

LAB USE ONLY
Notes:

Relinquished By	Date	Received By	Date
Print:		Print:	
Signature:	Time	Signature:	Time
Relinquished By	Date	Received By	Date 5/17/22
Print:		Print:	
Signature:	Time	Signature:	Time 1094

Atmospheric Analysis & Consulting, Inc.

CLIENT	: Jacobs Engineering
PROJECT NAME	: West Point RSP Replacement
PROJECT NO.	: 148032418
AAC PROJECT NO.	: 221065
REPORT DATE	: 05/24/2022

On May 17, 2022, Atmospheric Analysis & Consulting, Inc. received two (2) 6-Liter Silonite Canisters for Volatile Organic Compounds and Siloxanes analysis by EPA Method TO-15/TO-15M. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab ID	Return Pressure (mmHga)
Treated Gas (SP 017)	221065-31337	782.6
Treated Gas (SP 003)	221065-31338	779.8

This analysis is accredited under the laboratory's ISO/IEC 17025:2017 accreditation issued by the ANSI National Accreditation Board. Refer to certificate and scope of accreditation AT-1908. Test results apply to the sample(s) as received. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples.

The Technical Director or his designee, as verified by the following signature, has authorized release of the data contained in this hardcopy report.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

This report consists of 10 pages.

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Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 221065
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 05/17/2022
DATE REPORTED : 05/24/2022
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Treated Gas (SP 017)			Sample Reporting Limit (SRL) (MRLxDF's)	Treated Gas (SP 003)			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	221065-31337				221065-31338				
Date Sampled	05/10/2022				05/10/2022				
Date Analyzed	05/18/2022				05/18/2022				
Can Dilution Factor	1.31				1.31				
Compound	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Chlorodifluoromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Propene	799		10	13.1	791		10	13.1	1.00
Dichlorodifluoromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Chloromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Dichlorotetrafluoroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Vinyl Chloride	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Methanol	<SRL	U	10	65.5	<SRL	U	10	65.4	5.00
1,3-Butadiene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Bromomethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Chloroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Dichlorofluoromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Ethanol	<SRL	U	10	26.2	31.6		10	26.2	2.00
Vinyl Bromide	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Acetone	<SRL	U	10	26.2	<SRL	U	10	26.2	2.00
Trichlorofluoromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
2-Propanol (IPA)	<SRL	U	10	26.2	<SRL	U	10	26.2	2.00
Acrylonitrile	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,1-Dichloroethene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Methylene Chloride (DCM)	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
Allyl Chloride	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
Carbon Disulfide	<SRL	U	10	26.2	<SRL	U	10	26.2	2.00
Trichlorotrifluoroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
trans-1,2-Dichloroethene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,1-Dichloroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Methyl Tert Butyl Ether (MTBE)	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Vinyl Acetate	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
2-Butanone (MEK)	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
cis-1,2-Dichloroethene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Hexane	<SRL	U	10	6.55	10.7		10	6.54	0.50
Chloroform	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Ethyl Acetate	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Tetrahydrofuran	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,2-Dichloroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,1,1-Trichloroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Benzene	<SRL	U	10	6.55	7.19		10	6.54	0.50

Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 221065
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 05/17/2022
DATE REPORTED : 05/24/2022
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA TO-15

Client ID	Treated Gas (SP 017)			Sample Reporting Limit (SRL)	Treated Gas (SP 003)			Sample Reporting Limit (SRL)	Method Reporting Limit (MRL)
AAC ID	221065-31337				221065-31338				
Date Sampled	05/10/2022				05/10/2022				
Date Analyzed	05/18/2022				05/18/2022				
Can Dilution Factor	1.31				1.31				
Compound	Result	Qualifier	Analysis DF	(MRLxDF's)	Result	Qualifier	Analysis DF	(MRLxDF's)	
Carbon Tetrachloride	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Cyclohexane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,2-Dichloropropane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Bromodichloromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,4-Dioxane	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
Trichloroethene (TCE)	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
2,2,4-Trimethylpentane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Heptane	<SRL	U	10	6.55	21.4		10	6.54	0.50
cis-1,3-Dichloropropene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
4-Methyl-2-pentanone (MiBK)	<SRL	U	10	6.55	8.37		10	6.54	0.50
trans-1,3-Dichloropropene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,1,2-Trichloroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Toluene	<SRL	U	10	6.55	1360		10	6.54	0.50
2-Hexanone (MBK)	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
Dibromochloromethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,2-Dibromoethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Tetrachloroethene (PCE)	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Chlorobenzene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Ethylbenzene	<SRL	U	10	6.55	7.72		10	6.54	0.50
m & p-Xylene	<SRL	U	10	13.1	<SRL	U	10	13.1	1.00
Bromoform	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Styrene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,1,2,2-Tetrachloroethane	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
o-Xylene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
4-Ethyltoluene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,3,5-Trimethylbenzene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,2,4-Trimethylbenzene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
Benzyl Chloride (a-Chlorotoluene)	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,3-Dichlorobenzene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,4-Dichlorobenzene	<SRL	U	10	6.55	8.37		10	6.54	0.50
1,2-Dichlorobenzene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
1,2,4-Trichlorobenzene	<SRL	U	10	26.2	<SRL	U	10	26.2	2.00
Hexachlorobutadiene	<SRL	U	10	6.55	<SRL	U	10	6.54	0.50
BFB-Surrogate Std. % Recovery		92%				97%			70-130%

U - Compound was not detected at or above the SRL.

2225 Sperry Ave., Ventura, CA 93003 www.aaclab.com (805) 650-1642

Laboratory Analysis Report

CLIENT : Jacobs Engineering
PROJECT NO : 221065
MATRIX : AIR
UNITS : PPB (v/v)

DATE RECEIVED : 05/17/2022
DATE REPORTED : 05/24/2022
ANALYST : MB/DL

SILOXANES BY EPA TO-15

Client ID	Treated Gas (SP 017)		
AAC ID	221065-31337		
Date Sampled	05/10/2022		
Date Analyzed	05/18/2022		
Canister Dilution Factor	1.31		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	<SRL	10	13.1
Tetramethylsilane*	<SRL	10	13.1
Hexamethyldisiloxane (L2)	<SRL	10	13.1
Hexamethylcyclotrisiloxane (D3)	<SRL	10	13.1
Octamethyltrisiloxane (L3)	<SRL	10	13.1
Octamethylcyclotetrasiloxane (D4)	<SRL	10	13.1
Decamethyltetrasiloxane (L4)	<SRL	10	13.1
Decamethylcyclopentasiloxane (D5)	<SRL	10	13.1
Dodecamethylpentasiloxane (L5)*	<SRL	10	13.1
BFB-Surrogate Std. % Recovery	92%		70-130%

Client ID	Treated Gas (SP 003)		
AAC ID	221065-31338		
Date Sampled	05/10/2022		
Date Analyzed	05/18/2022		
Canister Dilution Factor	1.31		
Compound	Result	Analysis DF	SRL
Trimethylsilanol*	61.7	10	13.1
Tetramethylsilane*	<SRL	10	13.1
Hexamethyldisiloxane (L2)	<SRL	10	13.1
Hexamethylcyclotrisiloxane (D3)	46.6	10	13.1
Octamethyltrisiloxane (L3)	<SRL	10	13.1
Octamethylcyclotetrasiloxane (D4)	158	10	13.1
Decamethyltetrasiloxane (L4)	<SRL	10	13.1
Decamethylcyclopentasiloxane (D5)	657	20	26.2
Dodecamethylpentasiloxane (L5)*	<SRL	10	13.1
BFB-Surrogate Std. % Recovery	97%		70-130%

SRL - Sample Reporting Limit
ND - Not Detected
*Results and SRL are estimated

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QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 05/18/2022
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-040622-01
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Continuing Calibration Verification of the 04/22/2022 Calibration

Analyte Compounds	*Source*[1]	*CCV*[2]	*% Recovery*[3]
4-BFB (surrogate standard)	10.00	9.49	95
Chlorodifluoromethane	10.40	9.52	92
Propene	10.60	10.36	98
Dichlorodifluoromethane	10.40	9.37	90
Dimethyl Ether	10.20	8.24	81
Chloromethane	10.40	9.52	92
Dichlorotetrafluoroethane	10.30	8.98	87
Vinyl Chloride	10.50	9.54	91
Acetaldehyde	21.10	21.62	102
Methanol	18.80	18.84	100
1,3-Butadiene	10.60	9.07	86
Bromomethane	10.40	9.35	90
Chloroethane	10.30	8.54	83
Dichlorofluoromethane	10.20	9.06	89
Ethanol	11.20	10.29	92
Vinyl Bromide	10.10	9.34	92
Acrolein	11.10	9.77	88
Acetone	10.60	9.14	86
Trichlorofluoromethane	10.50	8.98	86
2-Propanol (IPA)	11.00	10.05	91
Acrylonitrile	11.20	9.99	89
1,1-Dichloroethene	10.40	9.19	88
Methylene Chloride (DCM)	10.50	9.68	92
TertButanol (TBA)	11.10	11.04	99
Allyl Chloride	10.20	8.53	84
Carbon Disulfide	10.50	10.18	97
Trichlorotrifluoroethane	10.40	9.09	87
trans-1,2-Dichloroethene	10.60	9.67	91
1,1-Dichloroethane	10.50	9.60	91
Methyl Tert Butyl Ether (MTBE)	10.50	9.04	86
Vinyl Acetate	11.00	10.71	97
2-Butanone (MEK)	10.60	9.39	89
cis-1,2-Dichloroethene	10.50	9.93	95
Hexane	10.70	8.87	83
Chloroform	10.60	9.53	90
Ethyl Acetate	10.60	9.94	94
Tetrahydrofuran	10.20	8.90	87
1,2-Dichloroethane	10.50	8.79	84
1,1,1-Trichloroethane	10.40	9.02	87
Benzene	10.60	9.25	87
Carbon Tetrachloride	10.20	8.16	80
Cyclohexane	10.50	8.61	82

Analyte Compounds (Continued)	*Source*[1]	*CCV*[2]	*% Recovery*[3]
1,2-Dichloropropane	10.50	8.48	81
Bromodichloromethane	10.40	8.27	80
1,4-Dioxane	10.40	9.12	88
Trichloroethene (TCE)	10.40	8.50	82
2,2,4-Trimethylpentane	10.00	8.68	87
Methyl Methacrylate	11.00	9.35	85
Heptane	10.50	8.58	82
cis-1,3-Dichloropropene	10.40	8.73	84
4-Methyl-2-pentanone (MiBK)	10.40	9.65	93
trans-1,3-Dichloropropene	10.50	8.81	84
1,1,2-Trichloroethane	10.50	8.66	82
Toluene	10.60	8.85	83
2-Hexanone (MBK)	10.50	9.67	92
Dibromochloromethane	10.30	8.22	80
1,2-Dibromoethane	10.60	8.63	81
Tetrachloroethene (PCE)	10.40	8.26	79
Chlorobenzene	10.60	8.94	84
Ethylbenzene	10.50	9.07	86
m & p-Xylene	21.00	17.95	85
Bromoform	10.50	8.81	84
Styrene	10.50	9.20	88
1,1,2,2-Tetrachloroethane	10.50	9.63	92
o-Xylene	10.50	9.43	90
1,2,3-Trichloropropane	11.00	8.84	80
Isopropylbenzene (Cumene)	10.30	9.08	88
α-Pinene	10.70	7.67	72
2-Chlorotoluene	10.30	8.69	84
n-Propylbenzene	10.10	9.35	93
4-Ethyltoluene	10.30	9.56	93
1,3,5-Trimethylbenzene	10.30	9.07	88
β-Pinene LR	11.00	4.08	37
1,2,4-Trimethylbenzene	10.30	9.19	89
Benzyl Chloride (a-Chlorotoluene)	10.40	8.69	84
1,3-Dichlorobenzene	10.40	8.66	83
1,4-Dichlorobenzene	10.30	8.79	85
Sec-ButylBenzene	10.10	9.09	90
1,2-Dichlorobenzene	10.60	9.06	85
n-ButylBenzene	10.20	9.61	94
1,2-Dibromo-3-Chloropropane	10.10	8.34	83
1,2,4-Trichlorobenzene	11.00	8.21	75
Naphthalene	11.50	8.59	75
Hexachlorobutadiene	11.00	8.55	78

[1] Concentration of analyte compound in certified source standard.

[2] Measured result from daily Continuing Calibration Verification (CCV).

[3] The acceptable range for analyte recovery is 100±30%.

LR - Recovery for this compound was low. Results should be considered estimated.

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 05/18/2022
MATRIX : High Purity N_2
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
CALIBRATION STD ID : MS1-040622-01
ANALYST : MB/DL

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Laboratory Control Spike Analysis

System Monitoring Compounds	*Sample Concentration*	*Spike Added*	*LCS[1] Recovery*	*LCSD[1] Recovery*	*LCS[1] % Recovery[2]*	*LCSD[1] % Recovery[2]*	*RPD[3]*
4-BFB (surrogate standard)	0.0	9.80	9.49	9.91	96.8	101.1	4.3
1,1-Dichloroethene	0.0	10.40	9.19	9.18	88	88	0.1
Methylene Chloride (DCM)	0.0	10.50	9.68	9.90	92	94	2.2
Benzene	0.0	10.60	9.25	9.21	87	87	0.4
Trichloroethene (TCE)	0.0	10.40	8.50	8.55	82	82	0.6
Toluene	0.0	10.60	8.85	8.94	83	84	1.0
Tetrachloroethene (PCE)	0.0	10.40	8.26	8.47	79	81	2.5
Chlorobenzene	0.0	10.60	8.94	8.79	84	83	1.7
Ethylbenzene	0.0	10.50	9.07	9.19	86	88	1.3
m & p-Xylene	0.0	21.00	17.95	17.70	85	84	1.4
o-Xylene	0.0	10.50	9.43	9.32	90	89	1.2

[1] Laboratory Control Spike (LCS) / Laboratory Control Spike Duplicate (LCSD)

[2] The acceptable range for analyte recovery is 100±30%.

[3] Relative Percent Difference (RPD) between LCS recovery and LCSD recovery (acceptable range is <25%).

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 05/18/2022 | **INSTRUMENT ID : GC/MS-02**

MATRIX : High Purity He or N_2 | **ANALYST : MB/DL**

UNITS : PPB (v/v)

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Method Blank Analysis

Analyte Compounds	*MB 051822*	*Reporting Limit (RL)*
4-BFB (surrogate standard)	89%	100±30%
Chlorodifluoromethane	<RL	0.5
Propene	<RL	1.0
Dichlorodifluoromethane	<RL	0.5
Dimethyl Ether	<RL	0.5
Chloromethane	<RL	0.5
Dichlorotetrafluoroethane	<RL	0.5
Vinyl Chloride	<RL	0.5
Acetaldehyde	<RL	5.0
Methanol	<RL	5.0
1,3-Butadiene	<RL	0.5
Bromomethane	<RL	0.5
Chloroethane	<RL	0.5
Dichlorofluoromethane	<RL	0.5
Ethanol	<RL	2.0
Vinyl Bromide	<RL	0.5
Acrolein	<RL	1.0
Acetone	<RL	2.0
Trichlorofluoromethane	<RL	0.5
2-Propanol (IPA)	<RL	2.0
Acrylonitrile	<RL	0.5
1,1-Dichloroethene	<RL	0.5
Methylene Chloride (DCM)	<RL	1.0
TertButanol (TBA)	<RL	0.5
Allyl Chloride	<RL	1.0
Carbon Disulfide	<RL	2.0
Trichlorotrifluoroethane	<RL	0.5
trans-1,2-Dichloroethene	<RL	0.5
1,1-Dichloroethane	<RL	0.5
Methyl Tert Butyl Ether (MTBE)	<RL	0.5
Vinyl Acetate	<RL	1.0
2-Butanone (MEK)	<RL	1.0
cis-1,2-Dichloroethene	<RL	0.5
Hexane	<RL	0.5
Chloroform	<RL	0.5
Ethyl Acetate	<RL	0.5
Tetrahydrofuran	<RL	0.5
1,2-Dichloroethane	<RL	0.5
1,1,1-Trichloroethane	<RL	0.5
Benzene	<RL	0.5
Carbon Tetrachloride	<RL	0.5
Cyclohexane	<RL	0.5

Analyte Compounds (Continued)	*MB 051822*	*Reporting Limit (RL)*
1,2-Dichloropropane	<RL	0.5
Bromodichloromethane	<RL	0.5
1,4-Dioxane	<RL	1.0
Trichloroethene (TCE)	<RL	0.5
2,2,4-Trimethylpentane	<RL	0.5
Methyl Methacrylate	<RL	0.5
Heptane	<RL	0.5
cis-1,3-Dichloropropene	<RL	0.5
4-Methyl-2-pentanone (MiBK)	<RL	0.5
trans-1,3-Dichloropropene	<RL	0.5
1,1,2-Trichloroethane	<RL	0.5
Toluene	<RL	0.5
2-Hexanone (MBK)	<RL	1.0
Dibromochloromethane	<RL	0.5
1,2-Dibromoethane	<RL	0.5
Tetrachloroethene (PCE)	<RL	0.5
Chlorobenzene	<RL	0.5
Ethylbenzene	<RL	0.5
m & p-Xylene	<RL	1.0
Bromoform	<RL	0.5
Styrene	<RL	0.5
1,1,2,2-Tetrachloroethane	<RL	0.5
o-Xylene	<RL	0.5
1,2,3-Trichloropropane	<RL	0.5
Isopropylbenzene (Cumene)	<RL	0.5
α-Pinene	<RL	0.5
2-Chlorotoluene	<RL	0.5
n-Propylbenzene	<RL	0.5
4-Ethyltoluene	<RL	0.5
1,3,5-Trimethylbenzene	<RL	0.5
β-Pinene	<RL	0.5
1,2,4-Trimethylbenzene	<RL	0.5
Benzyl Chloride (a-Chlorotoluene)	<RL	0.5
1,3-Dichlorobenzene	<RL	0.5
1,4-Dichlorobenzene	<RL	0.5
Sec-ButylBenzene	<RL	0.5
1,2-Dichlorobenzene	<RL	0.5
n-ButylBenzene	<RL	0.5
1,2-Dibromo-3-Chloropropane	<RL	0.5
1,2,4-Trichlorobenzene	<RL	2.0
Naphthalene	<RL	2.0
Hexachlorobutadiene	<RL	0.5

Atmospheric Analysis & Consulting, Inc.

QUALITY CONTROL / QUALITY ASSURANCE REPORT

ANALYSIS DATE : 05/18/2022
MATRIX : Air
UNITS : PPB (v/v)

INSTRUMENT ID : GC/MS-02
ANALYST : MB/DL
DILUTION FACTOR[1] : x21.09

VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

Duplicate Analysis of AAC Sample ID: 221064-31336

Analyte Compounds	*Sample*	*Duplicate*	*RPD[2]*
4-BFB (surrogate standard)	9.60	9.75	1.6
Chlorodifluoromethane	<SRL	<SRL	*NA*
Propene	601	565	6.3
Dichlorodifluoromethane	<SRL	<SRL	*NA*
Dimethyl Ether	<SRL	<SRL	*NA*
Chloromethane	<SRL	<SRL	*NA*
Dichlorotetrafluoroethane	<SRL	<SRL	*NA*
Vinyl Chloride	<SRL	<SRL	*NA*
Acetaldehyde	<SRL	<SRL	*NA*
Methanol	<SRL	<SRL	*NA*
1,3-Butadiene	<SRL	<SRL	*NA*
Bromomethane	<SRL	<SRL	*NA*
Chloroethane	<SRL	<SRL	*NA*
Dichlorofluoromethane	<SRL	<SRL	*NA*
Ethanol	<SRL	<SRL	*NA*
Vinyl Bromide	<SRL	<SRL	*NA*
Acrolein	<SRL	<SRL	*NA*
Acetone	<SRL	<SRL	*NA*
Trichlorofluoromethane	<SRL	<SRL	*NA*
2-Propanol (IPA)	<SRL	<SRL	*NA*
Acrylonitrile	<SRL	<SRL	*NA*
1,1-Dichloroethene	<SRL	<SRL	*NA*
Methylene Chloride (DCM)	<SRL	<SRL	*NA*
TertButanol (TBA)	<SRL	<SRL	*NA*
Allyl Chloride	<SRL	<SRL	*NA*
Carbon Disulfide	<SRL	<SRL	*NA*
Trichlorotrifluoroethane	<SRL	<SRL	*NA*
trans-1,2-Dichloroethene	<SRL	<SRL	*NA*
1,1-Dichloroethane	<SRL	<SRL	*NA*
Methyl Tert Butyl Ether (MTBE)	<SRL	<SRL	*NA*
Vinyl Acetate	<SRL	<SRL	*NA*
2-Butanone (MEK)	<SRL	<SRL	*NA*
cis-1,2-Dichloroethene	<SRL	<SRL	*NA*
Hexane	12.9	11.4	12.2
Chloroform	<SRL	<SRL	*NA*
Ethyl Acetate	<SRL	<SRL	*NA*
Tetrahydrofuran	<SRL	<SRL	*NA*
1,2-Dichloroethane	<SRL	<SRL	*NA*
1,1,1-Trichloroethane	<SRL	<SRL	*NA*
Benzene	<SRL	<SRL	*NA*
Carbon Tetrachloride	<SRL	<SRL	*NA*
Cyclohexane	<SRL	<SRL	*NA*

Analyte Compounds (Continued)	*Sample*	*Duplicate*	*RPD[2]*
1,2-Dichloropropane	<SRL	<SRL	*NA*
Bromodichloromethane	<SRL	<SRL	*NA*
1,4-Dioxane	<SRL	<SRL	*NA*
Trichloroethene (TCE)	<SRL	<SRL	*NA*
2,2,4-Trimethylpentane	<SRL	<SRL	*NA*
Methyl Methacrylate	<SRL	<SRL	*NA*
Heptane	22.4	21.3	4.8
cis-1,3-Dichloropropene	<SRL	<SRL	*NA*
4-Methyl-2-pentanone (MiBK)	12.0	11.6	3.6
trans-1,3-Dichloropropene	<SRL	<SRL	*NA*
1,1,2-Trichloroethane	<SRL	<SRL	*NA*
Toluene	247	242	2.0
2-Hexanone (MBK)	<SRL	<SRL	*NA*
Dibromochloromethane	<SRL	<SRL	*NA*
1,2-Dibromoethane	<SRL	<SRL	*NA*
Tetrachloroethene (PCE)	<SRL	<SRL	*NA*
Chlorobenzene	<SRL	<SRL	*NA*
Ethylbenzene	12.9	12.2	5.0
m & p-Xylene	<SRL	<SRL	*NA*
Bromoform	<SRL	<SRL	*NA*
Styrene	<SRL	<SRL	*NA*
1,1,2,2-Tetrachloroethane	<SRL	<SRL	*NA*
o-Xylene	<SRL	<SRL	*NA*
1,2,3-Trichloropropane	<SRL	<SRL	*NA*
Isopropylbenzene (Cumene)	<SRL	<SRL	*NA*
α-Pinene	116	117	1.1
2-Chlorotoluene	<SRL	<SRL	*NA*
n-Propylbenzene	<SRL	<SRL	*NA*
4-Ethyltoluene	<SRL	<SRL	*NA*
1,3,5-Trimethylbenzene	<SRL	<SRL	*NA*
β-Pinene	62.4	60.7	2.7
1,2,4-Trimethylbenzene	<SRL	<SRL	*NA*
Benzyl Chloride (a-Chlorotoluene)	<SRL	<SRL	*NA*
1,3-Dichlorobenzene	<SRL	<SRL	*NA*
1,4-Dichlorobenzene	19.8	19.2	3.2
Sec-ButylBenzene	<SRL	<SRL	*NA*
1,2-Dichlorobenzene	<SRL	<SRL	*NA*
n-ButylBenzene	<SRL	<SRL	*NA*
1,2-Dibromo-3-Chloropropane	<SRL	<SRL	*NA*
1,2,4-Trichlorobenzene	<SRL	<SRL	*NA*
Naphthalene	<SRL	<SRL	*NA*
Hexachlorobutadiene	<SRL	<SRL	*NA*

[1] Dilution factor is the product of the Canister Dilution Factor and the Analysis Dilution Factor.

[2] Relative Percent Difference (RPD) between Sample analysis and Duplicate analysis (acceptable range is <25%).

SRL - Sample Reporting Limit (minimum)

221065

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AAC Project No.:

Client/Company Name

Project Manager Name

Project Name
West Point RSP Replacement
Project Number
148032418

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(stacia.dugan@jacobs.com

Send Invoice To (Name/Email/Address)
Karla Kasick
(karla.kasick@jacobs.com)

PO Number

Turnaround Time
☐ Rush 24 h ☐ Same Day
☐ Rush 48 h ☐ 5 Days
☐ Rush 72 h ☑ Normal

Sampler Name
Print: Kevin Birchok
Signature: Kevin Birchok

Analysis Requested

Client Sample Name	Sample ID	Sampling Date	Sampling Time	Container Type/Qty	VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		Lab ID
Treated Gas (SP 017)	801138	5/10/22	9:51		X	X	X	X		
31337										

LAB USE ONLY

Sample Received via:
☐FedEx
☐UPS
☐Courier
☐Other_____

Temperature
_____°C
Thermometer ID _____
Initials _____

Returned Eqmt
Total cans: _____
Unused cans: _____
Flow Controllers: _____

Client Notes/Special Instructions:

EDD?
☑Yes
☐No

LAB USE ONLY
Notes:

Relinquished By	Date	Received By	Date
Print:		Print:	
Signature:	Time	Signature:	Time
Relinquished By	Date	Received By	Date 5/17/22
Print:		Print:	
Signature:	Time	Signature:	Time 1049

UPS

2x coolers

221065

CHAIN OF CUSTODY AND ANALYSIS REQUEST – Chain of Custody is a LEGAL DOCUMENT. Complete all relevant fields.

Atmospheric Analysis and Consulting · Phone: 805-650-1642 · Email: info@aaclab.com · 2225 Sperry Ave, Ventura, CA 93003

AAC Project No.:

Client/Company Name **Project Manager Name**	**Project Name** West Point RSP Replacement **Project Number** 148032418	**Analysis Requested**					**Send Report To** (Name/Email/Address) Stacia Dugan (stacia.dugan@jacobs.com
Turnaround Time ☐ Rush 24 h ☐ Same Day ☐ Rush 48 h ☐ 5 Days ☐ Rush 72 h ☑ Normal	**Sampler Name** **Print:** Kevin Birchok **Signature:** Kevin Birchok	VOCs by EPA TO-15	NMOC by EPA 25C	Siloxanes by EPA TO-15M	Complete Analysis and BTU by ASTM D3588		**Send Invoice To** (Name/Email/Address) Karla Kasick (karla.kasick@jacobs.com) **PO Number**

Client Sample Name	**Sample ID**	**Sampling Date**	**Sampling Time**	**Container Type/Qty**						**LAB USE ONLY** **Lab ID**	**Sample Received via:** ☐FedEx ☐UPS ☐Courier ☐Other_____
Treated Gas (SP 003)	000837	5/10/22	9:59		X	X	X	X			
31338											**Temperature** _____ °C Thermometer ID _____ Initials _____
											Returned Eqmt Total cans: _____ Unused cans: _____ Flow Controllers: _____

Client Notes/Special Instructions:

EDD? ☑Yes ☐No

LAB USE ONLY
Notes:

Relinquished By **Print:** **Signature:**	**Date** **Time**	**Received By** **Print:** **Signature:**	**Date** **Time**
Relinquished By **Print:** **Signature:**	**Date** **Time**	**Received By** **Print:** **Signature:**	**Date** 5/17/22 **Time** 1094

West Point Treatment Plant
Raw Sewage Pump Replacement Project

Boiler Replacement
Notice of Construction Permit Application
Subtask 3260.2

April 4, 2023

King County Department of Natural Resources and Parks
Wastewater Treatment Division

West Point Treatment Plant
Raw Sewage Pump Replacement Project

Project No:	W3X90000
Document Title:	Boiler Replacement, Notice of Construction Permit Application
Revision:	Draft
Date:	April 4, 2023
Client Name:	King County Department of Natural Resources and Parks Wastewater Treatment Division
Project Manager:	Karla Kasick, PE/Jacobs Engineering Group Inc.
Author:	Stacia Dugan/Jacobs Engineering Group Inc.

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Document History and Status

Revision	Date	Description	By	Review	Approved
1	8.17.22	Draft Submittal	S. Dugan	M. Neumann	K. Kasick
2	10.04.22	Final Submittal	S. Dugan	--	K. Kasick
3	04.04.23	Updated Draft Submittal	S. Dugan	K. Kasick	NA

West Point Treatment Plant
Raw Sewage Pump Replacement Project

Boiler Replacement

West Point Treatment Plant
Raw Sewage Pump Replacement Project
Subtask 3260.2

April 4, 2023

King County Department of Natural Resources and Parks
Wastewater Treatment Division

Owner's Authorized Representative:

Mizanur Rahman, Project Manager
King County Department of Natural Resources and Parks, Wastewater Treatment Division
201 South Jackson Street
M.S. KSC-NR-0507
Seattle, WA 98104
(206) 477-5233

Contents

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Acronyms and Abbreviations

Chemicals

CO	carbon monoxide
H_2S	hydrogen sulfide
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
O_2	oxygen
SO_2	sulfur dioxide
VOC	volatile organic compound

Measurements

Btu	British thermal unit(s)
Btu/hr	British thermal unit(s) per hour
hp	horsepower
lb/hr	pound(s) per hour
lb/MMBtu	pound(s) per million British thermal unit(s)
lb/yr	pound(s) per year
MGD	million gallon(s) per day
MMBtu/hr	million British thermal unit(s) per hour
PM_x	particulate matter less than x micrometers in aerodynamic diameter
ppm	parts per million
ppmvd	parts per million by volume, dry
psi	pounds per square inch
psig	pounds per square inch gauge
scfm	standard cubic feet per minute
tpy	tons per year

General

ASIL	acceptable source impact level
BACT	best available control technology
CFR	Code of Federal Regulations
County	King County
Ecology	Washington State Department of Ecology
GAP	Greenhouse Gas Assessment for Projects
GHG	greenhouse gas
HAP	hazardous air pollutant
MACT	Maximum Achievable Control Technology

NOC	notice of construction
NSR	new source review
PSCAA	Puget Sound Clean Air Agency
RCW	Revised Code of Washington
RSP	raw sewage pump
SQER	small quantity emission rate
TAP	toxic air pollutant
tBACT	toxic best available control technology
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WPTP	West Point Treatment Plant

1. Introduction

King County (County) Department of Natural Resources and Parks, Wastewater Treatment Division, West Point Treatment Plant (WPTP) in Seattle, Washington currently has an Title V Air Operating Permit, No. 10088 issued by the Puget Sound Clean Air Agency (PSCAA). The County and Jacobs Engineering Group, Inc. has prepared this Notice of Construction Application for Order of Approval (NOC) for submittal to the PSCAA. The County is in the design stage to replace the Raw Sewage Pump (RSP) engines with electric motor prime movers at the WPTP. The RSP engines currently supply heat to the secondary heat loop. Replacement of the RSP engines with electric motor prime movers will eliminate the engines' heat recovery system as a heat source for the facility. This will result in the boilers (Boilers 1, 2, and 3) being used more often to supplement the secondary heat loop. Given the advanced age of the existing boilers and recent boiler repairs necessitated by corrosion of Boiler 2, the will replace the existing boilers with new, contemporary units that are intended to increase efficiency, operational flexibility, and reliability of this critical plant system.

The worst-case scenario was used to determine the total boiler capacity needed from the new boilers. The scenario assumes the maximum heat load required by the plant without heat input from the cogeneration system. This could occur if the cogeneration system was out of service. Based on this worst-case scenario, the boiler capacity needed for meeting the total WPTP heat load was estimated to be 900 horsepower (hp). A new boiler total capacity of 1,000 hp was selected. The existing boilers have a total hp of 1,125.

Even though the total hp from the new boilers will be less than the existing boilers, the new boiler installation will trigger PSCAA's new source review (NSR) requirements. The NSR process requires the source to submit a NOC application and receive an Order of Approval issued by PSCAA. This document is intended to serve as the NOC application. PSCAA's Notice of Construction Application for Order of Approval Form 50-125P is included in Appendix A.

The RSP engine replacement is scheduled to begin in 2026. Replacement of the hot water boilers could begin as early as March/April 2025 so that enough boilers are online by September 2026 to meet the average winter demand of the facility when the RSP engine replacement work is in construction.

Since the RSP engines are being removed and replaced with electric motors that have no air emissions, a NOC permit should not be required. However, the County will request a permit modification to reflect the change in equipment. In addition, the removal of the RSP engines may result in reducing the facility's potential to emit to minor source levels. Therefore, the County may request to be removed from the Title V program at that time.

1.1 Purpose

The purpose of this NOC application is to provide the PSCAA with the information required to permit four new replacement boilers. The two 100 hp and two 400 hp boilers will be replacing the existing two 265 hp boilers and one 595 hp boiler.

1.2 Site Description

WPTP is located at 1400 Discovery Park Boulevard, Seattle, Washington. The facility is a secondary municipal wastewater treatment plant that uses high-rate, oxygen-activated sludge technology. WPTP treats wastewater from homes and businesses in Seattle, Shoreline, north Lake Washington, north King County and parts of south Snohomish County. Seattle's combined stormwater/wastewater sewer system also flows into WPTP.

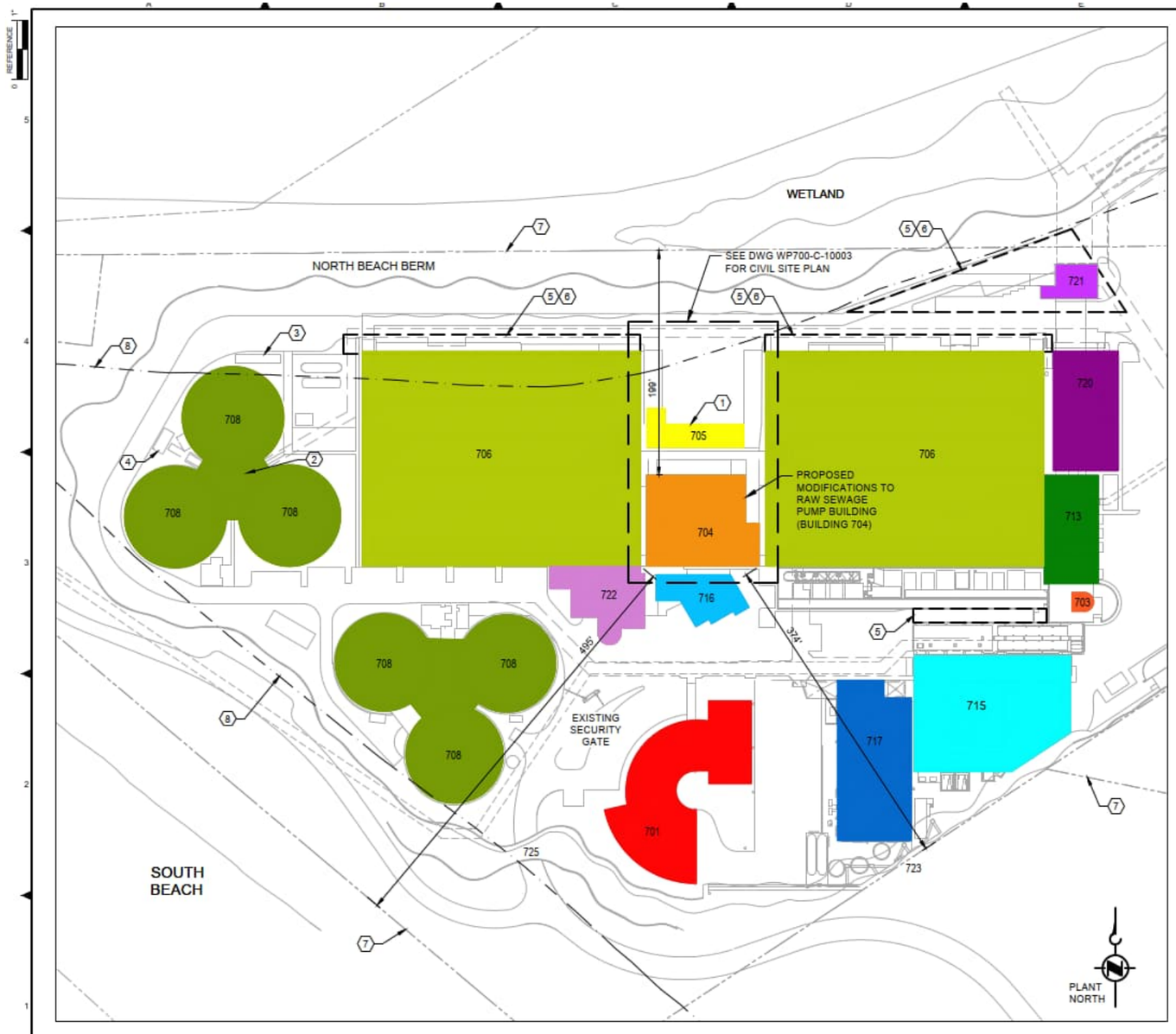
The facility has an average annual design flow capacity of 143 million gallons per day (MGD) of wastewater. Currently, approximately 90 million gallons a day of wastewater is treated at this facility during the dry months. During the rain/storm season, WPTP provides secondary treatment for flows up to

300 MGD and provides primary treatment and disinfection for flows exceeding 300 MGD and up to 440 MGD.

The facility includes a primary treatment system; a high-purity oxygen, biological, secondary treatment system; anaerobic primary and secondary solids digestion with capture of digester gas for use as fuel; and digester gas and propane combustion sources, including internal combustion engines, boilers, and thermal oxidizing flares. A process flow diagram and additional details about the wastewater treatment process at WPTP are provided on the County's WPTP website: https://kingcounty.gov/depts/dnrp/wtd/system/west/process.aspx.The primary source of emissions at this facility is the combustion of methane gas produced by the digesters (digester gas). From combustion of that gas, the main emission products are nitrogen oxide (NO_x) and carbon monoxide (CO). Hydrogen sulfide (H_2S) is the main odor emission of concern and is also a toxic air pollutant (TAP). WPTP is required to have a Title V operating permit because it has permitted potential emissions greater than 100 tons per year of NO_x. The facility is not a major source of hazardous air pollutants (HAPs)

The existing boilers are located in the lower level of the Grit Building (705). The new boilers will be located in the same area as the existing boilers. Installation will be staged so that there are always operational boilers onsite. An aerial photograph of the Grit Building is provided on Figure 1-1. A site plan is provided on Figure 1-2.

Figure 1-1. Grit Building



ENLARGED PLAN 1
SCALE: NONE

WEST POINT TREATMENT PLANT FACILITIES REFERENCE KEY

700	YARD PIPING, CIVIL, SITE-WIDE SYSTEMS
701	ADMINISTRATION/OPERATIONS CENTER
703	INFLUENT CONTROL STRUCTURE (ICS)
704	RAW SEWAGE PUMP BUILDING (RSPB)
705	GRIT/SCREENINGS HANDLING, BOILERS
706	WEST/EAST PRIMARY SEDIMENTATION
708	DIGESTERS, PROPANE, WASTE GAS
709	PRIMARIES/DIGESTER GALLERIES
713	STORAGE, "FACILITY 713" FUTURE USE TBD
715	SOLIDS HANDLING, GALLERY, ODOR CONTROL
716	INFLUENT SCREENINGS BUILDING
717	MULTI-USE FAC (MUF), WASTE TO ENERGY (W2E)
720	BYPASS & INFLUENT CHANNELS, WASTE GAS INCINERATORS
721	FLOW DIVERSION STRUCTURE (FDS)
722	WEST POINT MAIN ELECTRICAL SUBSTATION
723	HILLSIDE RETAINING WALL
725	WEST POINT MAIN GATE
731	ADMINISTRATION ANNEX BUILDING
757	WATER REUSE SYSTEM

KEY NOTES

1. FINE GRIT HANDLING (BUILDING 705) - EXISTING HOT WATER BOILERS LOCATED ON LOWER LEVEL.
2. EXISTING MPG BLOWERS, COOLERS AND PIPING.
3. EXISTING BOOSTER BLOWERS, MOISTURE REMOVAL AND SILOXANE REMOVAL SKID.
4. EXISTING H2S REMOVAL SKID.
5. CONTRACTOR LAY DOWN AND STAGING AREAS.
6. MAINTAIN A MINIMUM 10 FT LANE WIDTH FOR TRUCK TRAFFIC AND FIRE LANES.
7. PROPERTY LINES, TYP.
8. 200' SHORELINE DISTRICT LIMIT.

ADDRESS OF PROPERTY:

WEST POINT TREATMENT PLANT
1400 DISCOVERY PARK BLVD.
SEATTLE, WA 98199

OWNER:

KING COUNTY WASTEWATER TREATMENT DIVISION
201 SOUTH JACKSON STREET
SEATTLE, WA 98104

PARCEL NO:

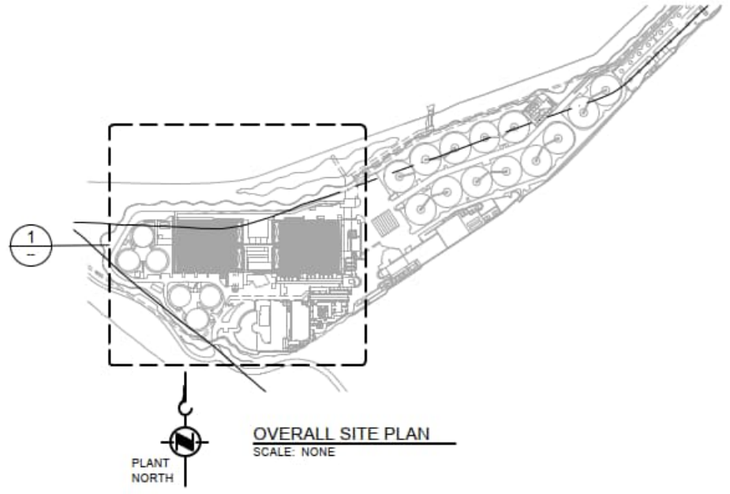
0925039004

LEGAL DESCRIPTION:

A PCL OF LD IN GL 1-2-3 SEC 9 & GL 1 OF STR 16-25-3 DAF COMM AT SW COR OF SE 1/4 STR 9-25-3 TH ALG S LN SD SEC 9 N 88-50-04 W 500 FT TH N 88-50-04 W ALG SD SEC LN 325 FT TO THE TPOB SP PT BEING A GL MDR COR TH ALG GL MDR LN S 60-03-04 E 944.48 FT TAP SD PT BEING N 60-03-04 W 250 FT ALG SD MDR LN FR A GOVT MDR GOR TH LEAVING SD MDR LN N 46-29-49 E 1755.16 FT TH N 34-16-17 E 2072.99 FT TAP SD PT BEING ON A LN INTSCT A GL MDR COR & AT R/A TO GL MDR LN SWLY THEREFROM TH N 42-10-11 W 8 FT TO SD LAST MENTIONED MDR COR TH FOLG ALG GL MDR LN THE FOLG COURSES & DIST S 47-49-49 W 494.79 FT S 38-49-58 W 594.52 FT S 27-51-06 W 926.31 FT S 60-50-53 W 329.23 FT S 79-24-52 W 1716.65 FT TH S 04-04-01 E 107.00 FT TH S 85-55-59 W 81.56 FT THE S 40-55-59 W 71.09 FT S 04-04-01 E 200.00 FT TO THE TPOB

NOTES:

1. COORDINATE USAGE OF STAGING AREA WITH PROJECT REPRESENTATIVE AND OTHER CONTRACTORS WORKING ON SITE PRIOR TO PLACING ANY MATERIAL IN THE STAGING AREAS. CONSTRUCTION STORMWATER CONTROLS ARE REQUIRED FOR ALL MATERIALS STORED IN THE CONSTRUCTION STAGING AREAS.
2. UPON COMPLETION OF THE PROJECT, THE CONSTRUCTION STAGING AREAS WILL BE RETURNED TO PRE-CONSTRUCTION CONDITIONS.
3. PROPERTY LINES ARE SHOWN IN THEIR APPROXIMATE LOCATION AND ARE NOT SURVEY ACCURATE. PROPERTY INFORMATION IS FROM KING COUNTY PARCEL VIEWER.



OVERALL SITE PLAN
SCALE: NONE

Figure 1-2. Site Plan

2. Boiler History

The existing boiler system was designed for the 1992 secondary upgrade and prior to implementing cogeneration. Boilers 1 and 2 are fed using treated digester gas or propane, and Boiler 3 is fed from untreated digester gas or propane. The boilers function as back-up sources of heat to the cogeneration plant to heat the anaerobic digesters and provide heat to the heated water system.

The heated water system at WPTP provides process and building heating throughout the plant. The original heated water loop relied on a combination of three hot water boilers and heat recovery from the four RSP reciprocating engines as heat sources. In 2011, a cogeneration system (originally known as Waste-To-Energy and sometimes known as combined heat and power) was installed in the multi-use facility building.

2.1 Existing Boiler Details

Digester gas is beneficially used as the primary fuel source for the boilers, the RSP engines, and the cogeneration engines, with propane commonly used as a secondary fuel for the boilers and the RSP engines. Digester gas has typically been supplied to the boilers as medium-pressure gas at 6.5 psig or auxiliary sludge gas at 15 psig. The three existing hot water boilers' nameplate information is listed below:

1. Boilers 1 and 2 (1992):
    a. 265 hp
    b. 11,807 input thousand British thermal units per hour (MBH) (Permit states 9.6 million British thermal units per hour [MMBtu/hr])
    c. 8,857 gross output MBH
    d. 6,877 net output MBH
    e. ~75 percent efficiency
    f. MAWP 30 psi water
    g. Manufacturer: Federal, A.L. Eastmond & Sons
2. Boiler 3 (1992):
    a. 595 hp
    b. 26,559 input MBH (Permit states 25.7 MMBtu/hr)
    c. 19,924 gross output MBH
    d. 15,469 net output MBH
    e. ~75 percent efficiency
    f. MAWP 30 psi water
    g. Manufacturer: Federal, A.L. Eastmond & Sons

Boilers 1 and 2 and are listed in the air operating permit at 9.6 MMBtu/hr and were considered to be exempt from permitting due to size. Boiler 3 is included in the air operating permit as a regulated source.

A three-way catalyst was added to the RSP engines exhaust gases in 2015 as well as a digester gas treatment system to remove siloxanes and hydrogen sulfide along with moisture and particulates. The conditioned digester gas was routed to Boilers 1 and 2 and all four RSP engines, with an option to valve in supply to Boiler 3 if desired or necessary. The gas treatment system reportedly has a capacity of 470 standard cubic feet per minute (scfm), which is estimated to be sufficient for handling an approximately 440 hp boiler in the designed configuration. During periods when heat demand exceeds the treated gas capacity, the County has the option of burning untreated gas or propane in the boilers.

A process flow diagram showing the digester gas flow for the facility with the existing boilers, RSP engines and combined heat and power (CHP) facility is presented on Figure 2-1.

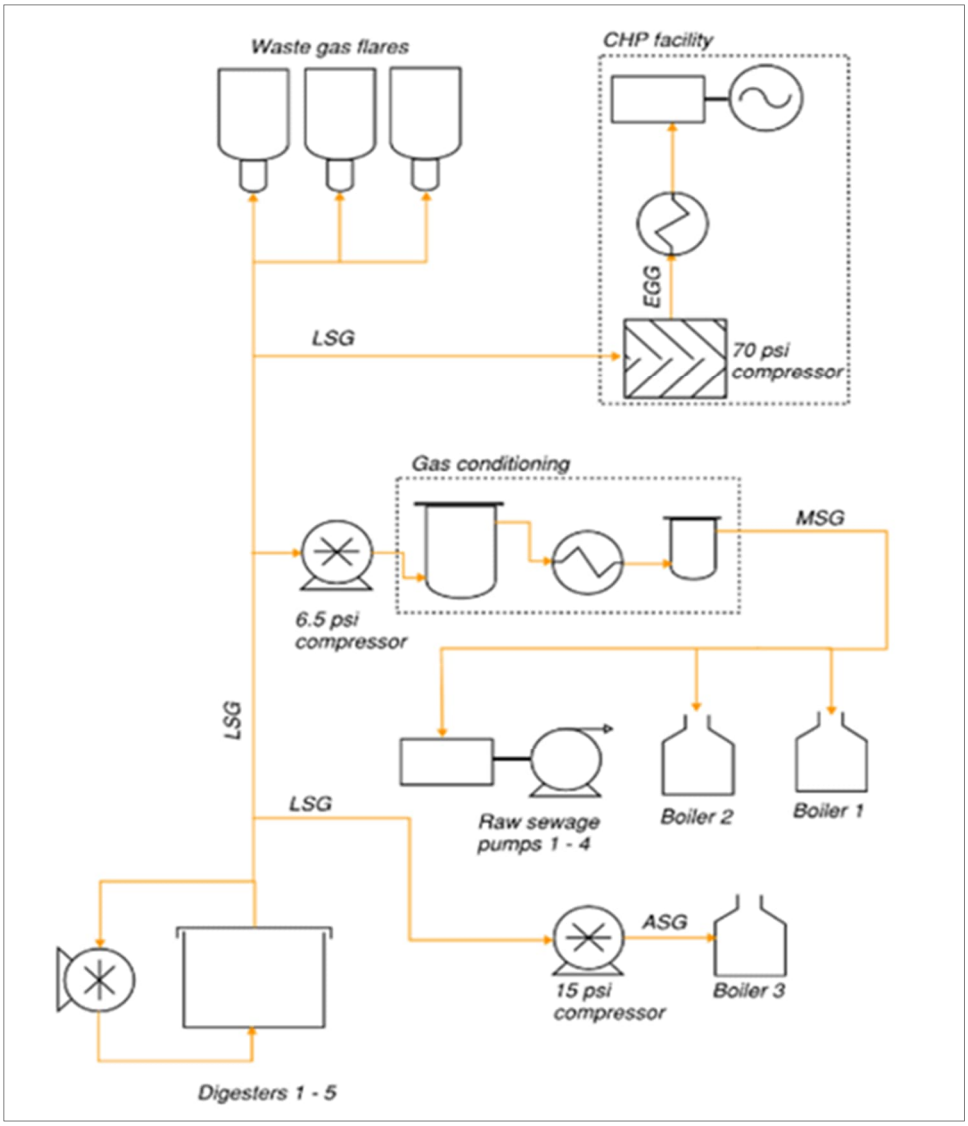


Figure 2-1. Existing Digester Gas Flow

2.2 New Boiler Design Requirements

WPTP provided boiler operating data for 2019, 2020 and 2021, including daily run times, daily average output (firing rate), and daily gas usage for both digester gas and propane for all three boilers (Jacobs 2021). Generally, Boilers 1 or 2 are used to meet plant demands, but there are numerous times when they run concurrently, especially during winter months. When operated alone, Boilers 1 and 2 often run up to 100 percent firing rate (265 hp). Summer demand can decrease usage of the boilers essentially to zero, with cogeneration meeting all plant heat demands.

In 2019 Boiler 3 ran 11 days out of the year at an average rate of 4 percent and a maximum rate of 17 percent. In 2020 it ran 29 days out of the year at an average rate of 3 percent and a maximum rate of 62 percent. In 2021 it operated 49 days out of the year with an average rate of 7 percent and a maximum rate of 87 percent. This aligns with the general understanding that Boiler 3 is too large for current plant heat demands, especially with cogeneration providing around 70 percent of the plant's heat.

Removing the RSP engines that currently supply heat to the secondary heat loop will result in the boilers being used more often to supplement the secondary heat loop. It will also result in more digester gas being available for the boilers, since the digester gas previously used by the engines will be available for use in the boilers and cogeneration engines. Current plant heat demand is provided by cogeneration (71 percent), RSP engines (13 percent), and the boilers (16 percent) on average. It is anticipated that with the removing the RSP engines, the new boilers will meet 30 percent of the heat demand on average.

Based on operational data, the existing boiler capacity needed for different operating scenarios was estimated and used to determine the future boiler capacity with the boilers compensating for the elimination of RSP heat recovery. The results are presented in Table 2-1.

Table 2-1. Boiler Capacity Required

Scenario	Current Boiler Capacity Needed (hp)[a]	Boiler Capacity Needed without RSP Heat (hp)
Maximum total demand without cogeneration	NA	900
Maximum total demand with cogeneration	350	620
Average winter demand with cogeneration	101	178
Non-winter demand with cogeneration	22	39

[a] Based on WPTP boiler usage data for 2019-2021 and provide in the August 10, 2022, email from Geneva Schlepp
Maximum total demand: maximum day recorded in data evaluated.
Average winter demand: more typical operating conditions.
Non-winter demand: demand during non-winter months.

Except for the first row (maximum total demand without cogeneration), the boiler capacity presented in Table 2-1 is based on cogeneration continuing to meet the majority of heat loop demands as it does now. The ability to meet the maximum total plant heat demand when cogeneration is not available is the worst-case scenario for establishing maximum boiler capacity needed. The proposed boiler sizing was evaluated based on the assumption that cogeneration may not available. This will assure that proper wastewater treatment and plant operations can always be maintained and allows for operating flexibility. Table 2-2 presents a summary of the existing and proposed hot water boiler sizes.

Table 2-2. Summary of Existing and New Boiler Sizes

Boiler Number	Existing Boiler Size (hp)	New Boiler Size (hp)
1	265	400
2	265	100
3	595	400
4	NA	100
Total	**1,125**	**1,000**

2.3 Description of New Boilers

The project would replace the three existing boilers with four new boilers. Boiler 1 would be replaced by a new 400 hp boiler. Boiler 2 would be replaced by two new, and smaller, 100 hp boilers. Boiler 3 would be replaced by a new, and smaller, 400 hp boiler. A benefit of replacing Boiler 2 with two smaller boilers is the increased flexibility for the County Wastewater Treatment Division to turn down a boiler when needed.

The boiler replacement project is at 60 percent design. The specific boilers have not yet been selected, so some details like make and model are not available. The County has a rigorous set of design phases. No contractors are yet bidding as that comes after the 100 percent design is completed (February 2024). Boiler specifications and vendor information will be provided to the agency when available. PSCAA Form 50-169 Boilers and Heaters is provided in Appendix A and has been prepared based on current information. This form will be updated when boiler specific information becomes available and resubmitted to the agency.

The key requirements that will be sent to the boiler manufacturers as part of the bid packet are as follows:

1. Boilers 1 and 3:
    a. 400 hp
    b. 3 Pass, low NO_x (30 parts per million [ppm]) at 3 percent excess oxygen (O_2) or better while burning digester gas and propane.
    c. Equipped with flue gas recirculation
2. Boilers 2 and 4:
    a. 100 hp
    b. 2 Pass, low NO_x (30 ppm) at 3 percent excess O_2 while burning digester gas and propane.
    c. Equipped with flue gas recirculation

The boiler sizes better match the demands of the RSP building. The two smaller 100 hp boilers have more turndown capabilities, which will allow them to meet the low demands of the building at a higher efficiency and better meet plant demands.

The higher demands can be met by the two 400 hp boilers. The burners for the larger boilers are expected to be low NO_x burners with flue gas recirculation, (see Section 4 Best Available Control Technology). The Project Team discussed the availability of duel fuel ultralow NO_x burners with boiler manufacturers. Ultralow NO_x burners currently do not appear to be able to burn untreated digester gas, which may be necessary during periods when the cogeneration system is off line and digester gas demand exceeds the digester gas treatment system capacity. It is assumed that the gas supply to the new boilers will replicate the current configuration, with propane serving as the backup and secondary fuel supply for meeting higher heat demands and for digester upset episodes. A process flow diagram showing the digester gas flow for the facility with the new replacement boilers is presented on Figure 2-2.

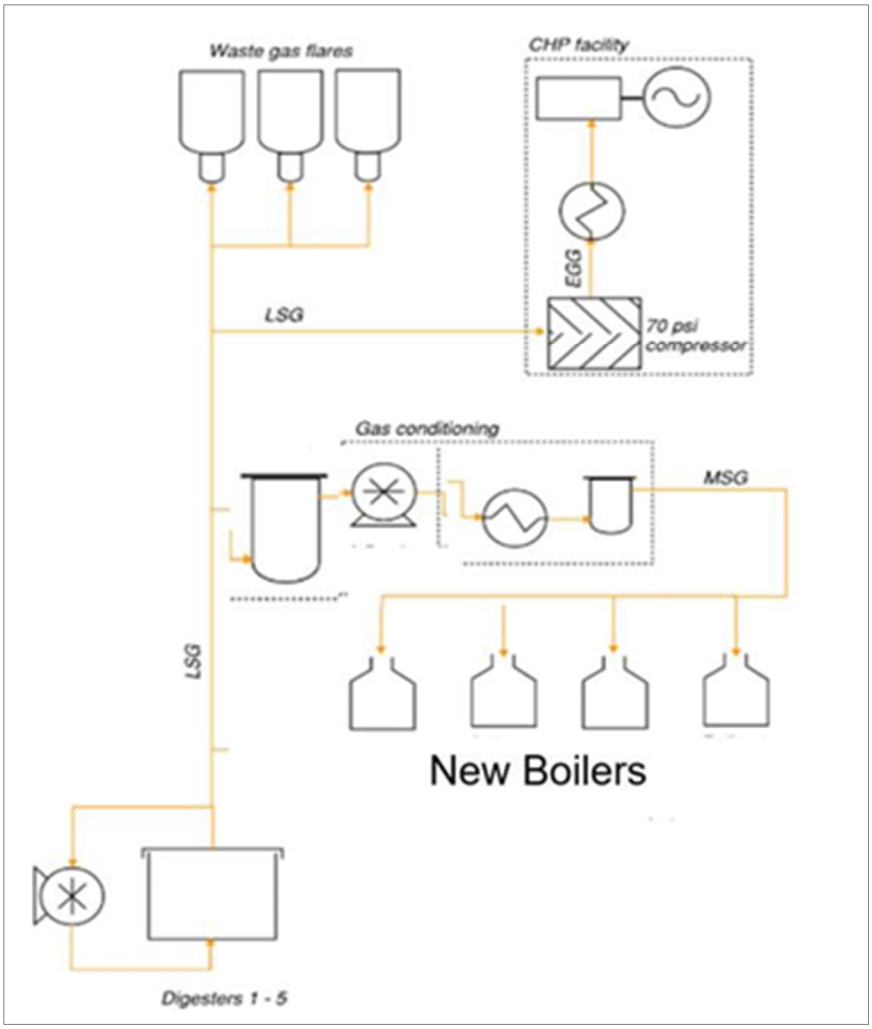


Figure 2-2. Digester Gas Flow with Replacement Boilers

WPTP does not intend to send raw digester gas to the new boilers but needs to maintain the option. However, WPTP has established a limit on the amount of H_2S allowed in the raw digester gas going to the boilers based on vendor recommendations. The low-NO_x burner vendors provided a H_2S upper limit of 200 ppmv, based on an acid dew point of approximately 220 degrees F and a need to avoid condensing H_2S in the burner. The acidic nature of the condensation could damage the burner.

The current digester gas treatment system includes two sulfur scrubbers and two siloxane scrubbers in series. There is a third standby siloxane scrubber. When using two scrubbers in series, the second scrubber is available in case there is breakthrough in the first scrubber. When the scrubbers are operated in series, the system can treat up to 470 scfm of digester gas. H_2S levels in the treated gas typically range between 15 to 60 ppm, but has occasionally reached levels up to 100 ppm.

2.4 Project Schedule

Replacement of the hot water boilers could begin as early as March/April 2025 so that enough boilers are online by September 2026 to meet the average winter demand of the facility when the RSP engine replacement work is in construction.

3. Regulatory Compliance

This section details air permitting regulations applicable to the boiler replacement at WPTP. The project involves replacing three existing dual-fuel digester gas/propane boilers. Existing Boilers 1 and 2 are rated at 265 hp, and Boiler 3 is rated at 595 hp for a total capacity of 1,125 hp. Current design parameters assumed that the replacement boilers will have a total capacity of 1,000 hp.

The following information addresses only the regulations that may be applicable to the Boiler replacement portion of the RSP Replacement Project. Emissions associated with the project include criteria pollutants HAPs, TAPs, and greenhouse gases (GHGs).

3.1 New Source Review

In the state of Washington, establishing a new source or replacing or substantially altering control equipment installed on an existing source, must go through NSR with the local permitting authority, in this case PSCAA, unless specifically exempted. The NSR process requires the source to submit an NOC application and receive an Order of Approval issued by PSCAA under PSCAA Regulation I, Article 6 prior to commencing construction. To minimize emissions and comply with all state and local emission standards, all non-exempt, new emission units must go through a technology review to determine the best available control technology (BACT). The facility must also estimate criteria and TAP emissions from the affected units and determine if there are any ambient impacts as a result of those emissions. GHG emissions are not subject to NSR per Washington Administrative Code (WAC) 173-400-110(5)(b).

3.2 State and Local Requirements

The WPTP is considered a major source of criteria pollutants and is required to have a Title V operating permit because it has permitted potential emissions greater than 100 tons per year of NO_x. The primary source of NO_x emissions is the combustion of digester gas and propane. The facility is considered to be an area source of hazardous air pollutants. Area sources are facilities that emit or have the potential to emit less than 10 tons per year of a single HAP, or less than 25 tons per year of combined HAP.

It is worth noting that the facility's actual emissions for NOx in 2021 was 11 tons per year. Future removal of the RSP engines may result in the facility's permitted potential to emit reducing to minor source levels.

3.2.1 Facility-Wide Requirements

The following regulations are general emission standards that apply to all stationary sources at a facility and will be applicable to the new boilers. These emissions standards are already included in Section 1.A of the County's WPTP Title V permit as well as the associated monitoring requirements and compliance demonstration methods.

- PSCAA Regulation I, Section 9.03 and WAC 173-400-040(1) - It shall be unlawful for any person to cause or allow the emission of any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour, which is greater than 20 percent opacity.
- PSCAA Regulation I, Section 9.07 and WAC 173-400-040 (6) - It shall be unlawful for any person to cause or allow the emission of sulfur dioxide from any source in excess of 1,000 ppm by volume on a dry basis, 1- hour average (corrected to 7 percent O_2 for fuel burning equipment and refuse burning equipment).
- PSCAA Regulation I, Section 9.09 – It shall be unlawful for any person to cause or allow the emission of particulate matter (PM) in excess of 0.05 grain per dry standard cubic foot corrected to 7 percent O_2 from fuel burning equipment using a fuel other than wood.
- WAC 173-400-050(1) limits particulate emissions to 0.1 grain per dry standard cubic foot corrected to 7 percent O_2 from combustion and incineration units.

- PSCAA Regulation I, Section 9.10(a) - It shall be unlawful for any person to cause or allow the emission of hydrochloric acid from any equipment in excess of 100 ppm on a dry basis, 1-hour average corrected to 7 percent O_2 for combustion sources.
- PSCAA Regulation I, Sections 9.11(a) and WAC 173-400-040 (5) and (6) - It shall be unlawful for any person to cause or allow the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property. Air contaminants includes odor emissions.
- PSCAA Regulation I, Section 9.20(a) - Applies to sources that received a Notice of Construction Order of Approval under PSCAA Regulation I, Article 6 and requires King County Wastewater Treatment Division to maintain equipment in good working order.

3.2.2 Operation and Maintenance Requirements

In accordance with PSCAA Regulation I, Section 7.09(b), the County Wastewater Treatment Division is required to develop and implement an operations and maintenance plan to assure continuous compliance with PSCAA Regulations I, II, and III. The requirement specifies that the plan shall reflect good industrial practice but does not define how to determine good industrial practice.

The existing boilers are maintained based on an existing operations and maintenance plan and by conducting preventive maintenance practices:

- Quarterly: Check boiler and all associated components for proper operation; flush tubes
- Annually: Drain boiler, clean internals including rodding the tubes; conduct certified boiler inspection by FM Global

These procedures will be revised when the replacement boilers are installed to reflect the new boilers and the updated operations and maintenance plan submitted to PSCAA for review.

3.2.3 PSCAA Boiler-Specific Regulations

PSCAA Regulation 1, Section 6.03 (c)(1)(A) exempts from NSR applicability, fuel-burning equipment (except when combusting pollutants generated by a non-exempt source) having a rated capacity less than 10 MMBtu/hr heat input, burning exclusively distillate fuel oil, natural gas, propane, butane, or biodiesel, that meets ASTM D6751-20a specifications (or any combination thereof). Boilers this size are considered to be too small to cause significant impacts.

A 100 hp boiler (roughly 4.46 MMBtu/hr) falls into the less than 10 MMBtu/hr range and PSCAA considered boilers burning digester gas in this size range exempt from permitting in 1992. However, digester gas is not included in the list of exempt fuels and the boilers are combusting pollutants generated by a non-exempt source, the digester, so the new boilers will need to go through NSR.

3.2.4 Toxic Air Pollutants

Under WAC 173-460 (as in PSCAA Regulation III, Section 2.05), facilities submitting an NOC application are required to complete a first-, second-, or third-tier review of the air quality impacts of TAPs to demonstrate that the proposed project does not have the potential to adversely affect the health of people in the surrounding community. WAC 173-460 establishes systematic evaluation requirements for TAP sources. TAPs include carcinogens and noncarcinogens. WAC 173-460-150 lists the regulated TAPs along with their respective averaging period, acceptable source impact level (ASIL), small quantity emission rate (SQER), and de minimis emission values. Demonstrating compliance with the relevant standards by comparing project emissions to the TAP values listed in WAC 173-460-150 is considered to be a first-tier review.

3.2.5 Policy of Replacement of Emission Units at Existing Sources

Washington State Department of Ecology (Ecology) has adopted a policy regarding the replacement of existing units. PSCAA may not have adopted this policy, but it has been included in the ambient impact analysis for TAPs. This policy verifies that replacement of emission units at existing sources triggers NSR, given sufficient potential emissions. When an emission unit is replaced at an existing source, the applicability of WAC 173-400-110 through 173-400-113 shall be based on the potential emissions of the project alone. Approved actual emissions for the unit being replaced shall not factor into the applicability determination of WAC 173-400-110, nor the determinations required under WAC 173-400-111 through 173-400-113, where applicable. If Chapter 173-460 WAC applies to an emission unit, WAC 173-460-080 does allow an applicant to propose reductions in actual emissions in an acceptable source impact analysis, including those associated with the unit being replaced.

3.3 Federal Standards

Part 50, subpart Dc, of Title 40 of the *Code of Federal Regulations* (40 CFR pt. 60, subpart Dc) applies to steam-generating units for which construction, modification, or reconstruction is commenced after June 9, 1989, and that have a maximum design heat input capacity of 100 MMBtu/hr or less but greater than or equal to 10 MMBtu/hr. A 400 hp boiler (roughly 13.4 MMBtu/hr) will need to comply with the applicable requirements of 40 CFR. pt. 60, subparts A and Dc, described in 40 CFR § 60.48c(a)(1) and (3).

The County already notified the U.S. Environmental Protection Agency (USEPA) administrator that 40 CFR pt. 60, subpart Dc applies to Boiler 3 at WPTP, as required in 40 CFR § 60.48(c) and 40 CFR § 60.7(a)(1–3). The County will notify the USEPA of the Boiler 3 removal and the addition of new boilers above 400 hp. For the new boiler the County shall submit a notification of the date of construction or reconstruction and actual startup, as provided by 40 CFR § 60.7. The County is not required to report the removal of the existing boiler but will, so that the USEPA is notified that the County will no longer be keeping records and reporting on the unit.

The National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers (40 CFR pt. 63, subpart JJJJJJ [6J]), March 21, 2011, applies to existing and new industrial boilers, institutional boilers, and commercial boilers located at area sources of hazardous air pollutants. Boilers that burn only gaseous fuels are exempt from the rule. As defined by 6J, gaseous fuels include, but are not limited to, natural gas, process gas, landfill gas, coal derived gas, refinery gas, hydrogen, and biogas. Since the boilers are located at an area source of HAPs and will only burn gaseous fuels, biogas and propane, the boilers are exempt from Subpart 6J.

For major sources of HAP emissions, USEPA has developed Maximum Achievable Control Technology (MACT) standards for publicly owned treatment works. The MACT for publicly owned treatment works is applicable only to facilities that are a major source of HAP emissions. WPTP is considered to be an area source of hazardous air pollutants and not a major source, so the MACT is not applicable.

3.4 Title V Air Permit

WPTP currently has an Title V Air Operating Permit, No. 10088 issued by PSCAA. Section VI C of the Title V Air Operating Permit, “Changes Not Requiring Permit Revisions,” from WAC 173-401-722 (effective October 17, 2002), states the following:

1) General.

a) King County Wastewater Treatment Division is authorized to make the changes described in this section without a permit revision, providing the following conditions are met:

   i) The proposed changes are not Title I modifications as defined in WAC 174-401-200(33);
   ii) The proposed changes do not result in emissions which exceed those allowable under the permit, whether expressed as a rate of emissions, or in total emissions;

iii) The proposed changes do not alter permit terms that are necessary to enforce limitations on emissions from units covered by the permit; and

iv) King County Wastewater Treatment Division provides the USEPA and the Puget Sound Clean Air Agency with written notification at least seven days prior to making the proposed changes except that written notification of a change made in response to an emergency shall be provided as soon as possible after the event.

Since the existing boilers do not have emission limits that will be affected by the project, a modification to the Title V document may not be required until the next scheduled permit renewal.

3.5 Prevention of Significant Deterioration

Federal and state regulations that are intended to prevent significant deterioration of existing air quality apply to certain new or modified air pollution sources that have the potential to be a major source of pollutants and emit more than 250 or 100 tons of specific pollutants, depending on the source category. The proposed modifications do not have such a potential; therefore, they are not a major source for prevention of significant deterioration purposes and do not need to obtain a prevention of significant deterioration permit.

3.6 Greenhouse Gas Assessment for Projects

On September 29, 2022, Ecology adopted a new rule the Climate Commitment Act Program, Chapter 173-446 WAC**.** The Climate Commitment Act includes the new Greenhouse Gas Assessment for Projects (GAP) rule, WAC 173-445. As part of the Climate Commitment Act the Washington Legislature set limits on GHG emissions and established a program to reduce GHG emissions. The GAP rule will provide methods to assess GHG emissions from projects and require a plan to eliminate, reduce, or offset the environmental impacts. The GAP rule will be evaluated as part of the State Environmental Policy Act process and not as part of NSR.

As established in the Revised Code of Washington (RCW) 70A.15.2200(5)(a), the GHG Reporting Rule statutory threshold is 10,000 metric tons carbon dioxide equivalents. Since the new boilers are replacing existing boilers, the current reporting requirements should not change and the increase in GHG emission due to the project should not exceed 10,000 metric tons which is the proposed trigger level for the future GAP rule.

3.7 State Environmental Policy Act

The project involves replacing three existing dual-fuel digester gas/propane boilers. With boilers optimally size for future heat demands, including smaller boilers to better handle periods of reduced plant heat demands. The current proposed boilers include two 400 hp and two 100 hp boilers, with a total capacity of 1,000 hp, slightly less than existing boiler capacity of1,125 hp. The exact size of the boilers may end up slightly different than currently specified as the design evolves, but will not exceed the existing total capacity of 1,125 hp.

The project does not affect the amount of digester gas available to be burned at the facility as the digesters are not being modified for this project. The WPTP has the ability to move emissions from the combustion of the digester gas in the RSP engines and the flare to the new boilers. Because boilers generally combust more completely than flares or engines, and the new boilers will have the same capacity or less than the existing boilers, the project should result in equivalent emissions of criteria pollutants, TAPs, and GHG or an overall reduction in emissions.

No major structural modifications will be needed to accommodate new boilers. The existing double-doors into the Boiler 3 room are not large enough to accommodate a new boiler and it is anticipated that the wall will need to be opened up to fit the new boiler into the room. One of the new 400 hp boilers will go into the Boiler 3 room. The other 400 hp boiler will be installed in the Boiler 1 room. The two new, smaller boilers will be installed in the same space where Boiler 2 is currently located. The existing concrete pad for Boiler 2 will be demolished and two new concrete pads will be built for the two 100 hp boilers in same

vicinity. Construction equipment will primarily be operating inside the building, so fugitive dust and emissions should be limited.

Based on the information above, the project has been determined to be exempt from further State Environmental Policy Act review.

4. Best Available Control Technology

4.1 Introduction

New air pollution sources in Washington State must control criteria pollutant emissions to the BACT level and TAP emissions to the toxic BACT (tBACT) level. WAC 173-460 and PSCAA Regulation III, Article 2 require that new sources first demonstrate they will use tBACT to control TAPs and then demonstrate that the TAP emissions will not exceed the ASILs provided in the regulation. BACT and tBACT analyses follow the same general approach and often result in the same outcome.

A BACT analysis typically includes five steps, called the "top-down" BACT approach. The five steps are as follows:

1. Identify all potential control technologies
2. Eliminate technically infeasible options
3. Rank effectiveness of control technologies
4. Evaluate control technologies on a case-by-case basis for economic, environmental, and energy impacts
5. Select the BACT

The top-down approach ranks available control technologies in descending order of control effectiveness. To be "available," a technology must be effectively demonstrated in a commercial application under comparable operating conditions. After available technologies are compiled and ranked, the technologies must be evaluated for technical feasibility, starting with the most effective technology. A control technology can be considered infeasible because of technical considerations, energy requirements, environmental impacts, or economic impacts. If the most effective technology is eliminated in this fashion, then the next most effective alternative is evaluated using these same criteria. The process is repeated until either a technology is selected or there are no remaining technologies to consider.

The five-step BACT analyses must be conducted for each proposed emission source and applicable pollutants. Control technologies identified are obtained from the industry standards and the following BACT databases:

- Bay Area Air Quality Management District Permit Handbook and BACT/Toxics Best Available Control Technology Workbook online
- California Environmental Protection Agency Air Resource Board BACT clearinghouse
- San Joaquin Valley Air Pollution Control District BACT clearinghouse
- South Coast Air Quality Management District BACT determinations
- Texas Commission of Environmental Quality BACT guidelines
- USEPA Reasonably Available Control Technology/BACT/Lowest Achievable Emission Rate Clearinghouse database

These digester gas-fired combustion units will emit NO_x, PM with diameters that are generally 10 micrometers and smaller (PM_{10}), PM with diameters that are generally 2.5 micrometers and smaller ($PM_{2.5}$), CO, sulfur dioxide (SO_2), and volatile organic compounds. The primary pollutants of concern for digester gas boilers are NO_x, CO, and SO_2.

The five-step BACT analyses must be conducted for each proposed emission source and applicable pollutants. A BACT review was completed for the emissions from the new 400 hp and 100 hp boilers.

4.2 BACT for NOx, CO, and VOCs

NO_x and CO are gaseous pollutants that are primarily formed through the combustion process. NO_x formation from combustion occurs by three mechanisms. The principal NO_x formation mechanism for the natural gas process heaters is thermal NO_x. Thermal NO_X arises from the thermal dissociation and subsequent reaction of nitrogen and O_2 molecules in the combustion air. The second mechanism of NO_x formation is prompt NO_x. Prompt NO_x formation occurs through reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel and is usually negligible when compared to the amount of NO_x formed by thermal NO_x. The third mechanism of NO_x formation is fuel NO_x. Fuel NO_x stems from the reaction of fuel-bound nitrogen compounds with O_2. However, as digester gas typically has a low fuel nitrogen content, NO_x formation by the fuel NO_x mechanism will likely be insignificant.

While exhaust gas is within the combustion unit, about 90 percent of NO_x exists in the form of nitric oxide (NO). The balance is nitrogen dioxide (NO_2), which is unstable at high temperatures. Once the flue gas is emitted into the atmosphere, most of the NO_x is ultimately converted to NO_2.

CO forms as a result of incomplete combustion of fuel. CO emissions are a function of O_2 availability, flame temperature, residence time at flame temperature, combustion zone design, and turbulence. These control factors, however, also result in high emission rates of NO_x. Conversely, a low NO_x emission rate achieved through flame temperature control can result in higher levels of CO emissions. Thus, a compromise is established whereby the flame temperature reduction is set to achieve the lowest NO_x emission rate possible while keeping the CO emission rates at acceptable levels.

Meeting CO BACT emission levels and using good combustion practices is also considered BACT for volatile organic compounds (VOCs).

Ecology's draft *Suitability of Boilers for Air Quality General Order* (USEPA 2006) is a BACT analysis focused on NO_x as an indicator criteria pollutant. It is part of the basis for what is considered generic BACT for boilers. In this analysis, Ecology evaluated the control technologies for small natural gas-fired boilers (4 to 50 million Btu/hr). Ecology's analysis indicated that selective catalytic reduction was cost prohibitive and selective non-catalytic reduction was technically infeasible for removing NO_x from natural gas-fired boilers in the 4 to 50 million Btu/hr size range. Technical feasible technology for boilers in this size range are low NO_x burners, ultralow NO_x burners and O_2 controller or flue-gas recirculation.

Dual fuel boilers are currently being used at wastewater treatment plants in Washington State, equipped with low NO_x burners capable of maintaining emission at or below 20 parts per million by volume, dry (ppmvd) NO_x at 3 percent O_2 while burning natural gas, and 30 ppmvd NO_x at 3 percent O_2 when burning digester gas or propane. While burning both natural gas and digester gas, the burners can maintain 50 ppmvd CO at 3 percent O_2 or below. A low NO_x burner is currently considered to be the top choice in a BACT analysis for burners less than 50 MMBtu/hr capable of burning mixtures of digester gas with natural gas or propane.

4.2.1.1 100 hp Boilers

The 100 hp boilers (4.46 MMBtu/hr) are considered to be small boilers. Boilers less than 10 MMBtu/hr burning exclusively distillate fuel oil, natural gas, propane, butane, biodiesel or any combination thereof, that meets ASTM D6751-20a specifications are considered exempt from permitting. Boilers burning digester gas are not exempt, but generic BACT for this size of boiler is typically low NO_x burner and good combustion practices. Low NO_x burners are capable of meeting 30 ppm NO_x at 3 percent excess O_2 while burning digester gas or propane. In addition, for small boilers (less than 50 MMBtu/hr), maximum CO emission reductions are indicated to be 50 ppm by means of good combustion practices. Because the boilers are burning digester gas, the California Air Pollution Control Officer's Association BACT Clearinghouse also requires no less than 0.3 second retention time at no less than 1,600 degrees Fahrenheit. PSCAA frequently requires 98 percent destruction efficiency of VOC's the digester gas.

4.2.1.2 400 hp Boilers

The 400 hp boilers (17.82 MMBtu/hr) are considered to be medium size boilers. Boiler manufacturer representatives were contacted to evaluate the availability, cost, and operational issues associated with ultralow NO_x burners (9 ppm natural gas, 15 ppm digester gas) to combust both digester gas and propane. Dual-fuel, ultralow NO_x technology was emerging but relatively unproven for the 10 to 50 MMBtu/hr boiler size range. In addition, burners fired on dual fuels require more sophisticated controls that become cost prohibitive for smaller boilers. Ultralow NO_x burners were recently required for two new boilers in San Jose, California, which indicates the burners are technically feasible. However, that region is non-attainment for ozone and since NO_x is a precursor for ozone, the agency may have required the lowest achievable emission rate, defined as the most stringent control technology that has been required or achieved in practice for that category of stationary source. The lowest achievable emission rate does not take into account the cost effectiveness of the emission control.

Ultralow NO_x burners require the digester gas to be cleaned of sulfur compounds and siloxanes to very low levels prior to combustion. The Project Team discussed the availability of duel fuel ultralow NO_x burners with boiler manufacturers. But at this point in time, it does not appear that ultralow NO_x duel fuel burners are technically feasible.

Low NO_x burners also last longer and perform better if the digester gas is cleaned prior to combustion. Burner vendors have indicated that the low NO_x burners can tolerate H_2S levels in the digester gas up to 200 ppm without corrosion issues caused by acidic condensation in the digester gas. The burners can tolerate H_2S levels greater than 200 ppm, but may require more maintenance. WPTP does not plan to burn untreated digester gas in the new boilers, but must maintain the option to burn untreated digester gas to plan for the following scenarios: the digester gas treatment system is off-line for maintenance or other reason; the cogeneration system is off-line for a period of time due to maintenance or other reasons; or the boilers require more digester gas than the gas treatment system can provide. WPTP has established a design limit of 200 ppm H_2S in the digester gas conveyed to the burners in order to reduce maintenance and enhance the performance of the burners.

Washington State is in compliance with the national ambient air quality standard for NO_x, so lowest achievable emission rate is not required, but BACT is. The need to be able to reliably burn treated digester gas, untreated digester gas and propane make low NO_x burners the most effective, feasible control technology.

A low NO_x burner that can meet 30 ppm NO_x (roughly 0.04 pound per MMBtu), along with good combustion practices should be selected as BACT. In addition, maximum CO emission reductions are indicated to be 50 ppm by means of good combustion practices. Good combustion practice should also be able to provide a 98 percent destruction of VOC in the digester gas.

4.2.2 Sulfur Dioxide

A digester gas treatment system was added in 2015. The conditioned digester gas from the treatment system is routed to existing Boilers 1 and 2, along with the RSP engines. Boiler 3 operates on “auxiliary” (pressurized) gas that has nominal gas conditioning to remove moisture. Since the treated digester gas that was delivered to the RSP engines will now routed to the boilers, the quality of the fuel that will be combusted in the new boilers should, in general, be improved, reducing SO_2 emissions. Therefore, BACT for SO_2 should not be triggered.

However, as stated previously, the capacity of the digester gas treatment system is 470 scfm when operating in series. The average WPTP heat demand (without cogeneration) is approximately 620 hp, meaning that approximately 660 scfm of treated gas would be needed. With cogeneration online, there is enough treated gas for the proposed boilers to meet average winter demand without adding untreated digester gas. Propane is also available when needed. Expansion of the digester gas treatment system is not being considered at this time.

5. Emission Estimates

5.1 Introduction

Emissions were estimated for criteria and TAPs identified with the replacement of the existing boilers. Emissions were calculated for the potential to emit of the new boilers, the expected actual emissions for the new boilers and the average actual emissions of the existing boiler for 2020-2021. The emission estimate workbook will be provided to the agency upon request and also includes the potential to emit for the individual boilers.

Criteria pollutant emissions consist of CO, NO_x, $PM_{2.5}$, PM_{10}, SO_2, and VOCs. Total particulate matter is assumed to be equal to PM10 which is also equal to PM2.5. Criteria pollutant emission factors were based on the BACT analysis for the replacement boilers, and USEPA AP-42 emission factors Section 1.4 Natural Gas Combustion and 1.5 Liquefied Petroleum Gas Combustion. TAP emissions from the combustion of propane were estimated using South Coast AQMD, Combustion Default Emission Factors, Revised December 2021. GHG emissions were also estimated using Emission Factors for GHG Inventories, provided by the Intergovernmental Panel on Climate Change April 2022.

Treated and Raw digester gas was sampled in February, April, and May 2022. The samples were analyzed for VOCs and siloxanes by USEPA TO-15, Heat Content and F-Factor by ASTM-D3588, Total Reduced Sulfur Compounds Analysis by ASTM D-5504 and Total Non-Methane Organic Carbon by USEPA 25C. The sampling data was used to estimate emissions of TAPs from the combustion of digester gas. If a compound was not detected in either the raw gas sample or the treated gas sample, it was assumed the compound was not present in the digester gas. If the compound was detected in at least one of the samples, it was assumed to be present in the digester gas at one-half of the sample reporting limit for all undetected samples. The sampling data for the raw and treated digester gas has been summarized and include in the emission estimates workbook. An electronic version of the emission estimates will be provided to the agency. The laboratory analysis is included in Appendix B. A safety data sheet for the propane provided to WPTP by Marathon Petroleum Propane is also included in Appendix B.

The facility monitors the H_2S content of the raw and treated digester gas once per week using a hand-held monitor. The weekly data provided was averaged from January 2020 through May 2022 for comparison to the digester gas samples sent to the lab. The average H_2S from the weekly data was 197.5 ppm for raw digester gas and 45.2 ppm for treated digester gas. The data also indicates that the H_2S levels in the treated gas typically range between 15 to 60 ppm, but has occasionally reached levels up to 100 ppm. The average H_2S content from the digester gas samples analyzed by the lab was 239 ppm for the raw digester gas and 50 ppm for the treated digester gas. The H_2S data from the 2022 sampling event analyzed by the lab was used to be conservative.

The primary fuel for the existing and replacement boilers is treated digester gas. Propane and raw digester gas can be used when treated digester gas is not available. The facility currently has 470 scfm of treated digester gas when the scrubbers are operated in series. In this analysis, emissions were calculated by assuming the facility's primary fuel would be treated digester gas up the limit of 470 scfm. The remaining fuel requirements would be fulfilled by a secondary fuel, either propane or raw digester gas. For the secondary fuel the highest emission factor from the combustion of either raw digester gas or propane was used to estimate emissions.

The Excel workbook containing the emission estimates will be provided to PSCAA along with the application.

5.2 Replacement Boilers Potential to Emit

Potential emissions were calculated assuming all four boilers operating 8760 hours per year. It was assumed the boilers were combusting all 470 scfm of treated digester gas. The remainder of the heat input was provided by either raw digester gas or propane. The highest emission factor from the combustion of either raw digester gas or propane was used to estimate emissions from the secondary fuel. Pound per hour (lb/hr) emissions for each boiler assume the boilers were combusting either the primary fuel or secondary fuel, not a mix of the two fuel types. Annual emissions were adjusted for the hours per year on each fuel type.

The potential emissions are conservative since the facility is designed with redundancy. The total new boiler capacity is 1,000 hp, but the maximum demand with the cogen in operation is only 620 hp. If coegen was off-line and the facility experienced a maximum demand day, then the heat load could be as high as 900 hp. This scenario has a very low likelihood of occurring but the facility would be prepared for this scenario. In addition, as stated in Section 5.1, data indicates that the H_2S levels in the treated gas typically range between 15 to 60 ppm, but has occasionally reached levels up to 100 ppm and average H_2S content from the digester gas samples analyzed by the lab was 50 ppm for the treated digester gas. For the potential to emit calculations it was assumed the treated digester gas has an H_2S concentration of 125 ppm which is higher than the expected range. The concentration of H_2S in the raw digester gas was assumed to be the design limit of 200 ppm.

The operating scenario is provided in Table 5-1. A summary of the emissions is provided in Table 5-2. Under this scenario, NO_x, and H_2S were the only TAPs to exceed their respective SQERs.

Table 5-1. Operating Scenario - Potential Emissions

Emission Unit	100 hp Boiler	100 hp Boiler	400 hp Boiler	400 hp Boiler
Boiler ID	Boiler 2	Boiler 4	Boiler 1	Boiler 3
Design Capacity (hp)	100	100	400	400
Heat Input Rating (MMBtu/hr):	4.46	4.46	17.82	17.82
Annual Operating Hours:	8,760	8,760	8,760	8,760
Boiler Load (% of Capacity)	100%	100%	100%	100%
Conditioned Digester Gas (% of total heat input)	100%	0%	70%	0%
Raw Digester Gas or Propane (% of total heat input)	0%	100%	30%	100%

Table 5-2. Summary of Potential Emissions

Criteria Pollutants	Emission Rate		
	lb/hr	lb/yr	tpy
Carbon Monoxide	1.72	15,098	7.5
Nitrogen Oxide	1.70	14,880	7.4
Non-Methane Organic Carbon	0.24	2,139	1.1
Particulate Matter less than 10 microns	0.34	2,977	1.5
Particulate Matter less than 2.5 microns	0.34	2,977	1.5
Sulfur Dioxide	1.11	9,743	4.9
Carbon Dioxide equivalents	5,799	50,796,373	25,398
Hydrogen Sulfide	0.02	195	0.097
Total Toxic Air Pollutants	4.65	40726	20
Total Hazardous Air Pollutants	0.11	1004	0.50

5.3 Replacement Boilers Actual Emission Based on Average Demand

Average actual emissions were calculated based on 7 months at the average winter demand of 178 hp and 5 months at the non-winter demand of 39 hp for an average load of 120 hp. Under this scenario the boilers combusted 148 scfm of treated digester gas. No raw digester gas or propane was used. The actual operating scenario is provided in Table 5-3. A summary of the actual emissions is provided in Table 5-4. Under this scenario, no TAPS exceeded the SQER.

The average H_2S content was assumed to be 50 ppm based on the digester gas samples analyzed by the lab. The concentration of H_2S in the raw digester gas was assumed to be the design limit of 200 ppm, however actual conditions should not require the combustion of raw digester gas.

Table 5-3. Operating Scenario – Actual Emissions

Emission Unit	100 hp Boiler	100 hp Boiler	400 hp Boiler	400 hp Boiler
Boiler ID	Boiler 2	Boiler 4	Boiler 1	Boiler 3
Design Capacity (hp)	100	100	400	400
Heat Input Rating (MMBtu/hr):	4.46	4.46	17.82	17.82
Annual Operating Hours:	8760	8760	8760	8760
Boiler Load (% of Capacity)	100%	20%	0%	0%
Conditioned Digester Gas (% of total heat input)	100%	100%	0%	0%
Raw Digester Gas or Propane (% of total heat input)	0%	0%	0%	0%

Table 5-4. Summary of Actual Emissions

Criteria Pollutants	Emission Rate		
	lb/hr	lb/yr	tpy
Carbon Monoxide	0.21	1,812	0.9
Nitrogen Oxide	0.20	1786	0.9
Non-Methane Organic Carbon	1.06E-05	9.31E-02	4.66E-05
Particulate Matter less than 10 microns	0.04	349	0.2
Particulate Matter less than 2.5 microns	0.04	349	0.2
Sulfur Dioxide	0.04	340	0.2
Carbon Dioxide equivalents	617	5,404,165	2,702
Hydrogen Sulfide	7.76E-04	6.8	0.003
Total Toxic Air Pollutants	**0.45**	**3,944**	**2**
Total Hazardous Air Pollutants	**7.79E-04**	**7**	**0.003**

5.4 Actual Emission for Existing Boilers 2020-2021

Actual emissions for the existing boilers were calculated based on average annual operating data recorded for 2020 and 2021. The maximum pound per hour (lb/hr) emission rates were based on the worst-case day, which was February 14, 2021. On that day, the 595 hp Boiler operated for 24 hours at 87 percent of its capacity while burning raw digester gas. The permitted NO_x emission rate for the 595 hp boiler is 0.11 lb/MMBtu which is higher than the 265 hp boilers that have low NO_x burner that can achieve 30 ppm NO_x (0.038 lb/MMBtu). In addition, the 595 hp boiler burns untreated digester gas. The maximum lb/hr and lb/day emission rates are needed for the air toxics impact analysis in Section 6.

The average H_2S content was assumed to be 50 ppm for the treated digester gas based on the digester gas samples analyzed by the lab. The concentration of H_2S in the raw digester gas was assumed to be 239 ppm based on the average of the sampling data.

The actual operating scenario is provided in Table 5-5. A summary of the actual emissions is provided in Table 5-6. Under this scenario, only NO_x and H_2S exceeded their respective SQERs.

Table 5-5. Operating Scenario – Average Actual Operation for 2020-2021

Emission Unit	265 hp Boiler	265 hp Boiler	595 hp Boiler
Boiler ID	Boiler 1	Boiler 2	Boiler 3
Design Capacity (hp)	265	265	595
Heat Input Rating (MMBtu/hr):	11.81	11.81	26.51
Annual Operating Hours:	2,342	2,928	156
Average Boiler Load (% of Capacity)	20%	37%	5%
Maximum Daily Boiler Load (% of capacity)	0%	0%	87%
Conditioned Digester Gas (% of total heat input)	86%	84%	0%
Raw Digester Gas or Propane (% of total heat input)	14%	16%	100%

Table 5-6. Summary of Actual Emissions

Criteria Pollutants	Emission Rate		
	lb/hr	lb/yr	tpy
Carbon Monoxide	1.89	763	0.4
Nitrogen Oxide	2.54	809	0.4
Non-Methane Organic Carbon	2.04E-01	17	8.70E-3
Particulate Matter less than 10 microns	0.18	131	0.1
Particulate Matter less than 2.5 microns	0.18	131	0.1
Sulfur Dioxide	0.81	181	0.1
Carbon Dioxide equivalents	3,210	3,958,784	1,979
Hydrogen Sulfide	1.6E-02	3.62	0.002
Total Toxic Air Pollutants	**5.33**	**1763**	**0.88**
Total Hazardous Air Pollutants	**9.32E-02**	**10.2**	**0.01**

6. Air Toxics Impact Analysis

The project does not affect the amount of digester gas available to be burned as the digesters are not being modified for this project. The new boilers have a total capacity of 1,000 hp, which is less than the existing boilers total heat capacity of 1,125 hp. The project has the potential to move emissions from the combustion of the digester gas in the RSP engines to the new boilers. Because of the size of the boilers and because boilers generally combust more completely than engines, the project should result in an overall reduction in emissions. However, since NSR is triggered because the replacement boilers are considered a new or modified source, the project needs to evaluate if the TAP emissions trigger any requirements of WAC 173-460 and PSCAA Regulation III Article 2.

Chapter 173-460 WAC requires an ASIL analysis for each TAP emitted by new or modified emission units with an emission increase greater than the de minimis emission levels. The ASIL analysis requirement can be satisfied for any TAP using either dispersion modeling or the SQER.

De minimis values are defined as the maximum level of emissions that do not pose a threat to human health or the environment. If emissions of a given TAP from a source do not exceed the associated de minimis emission values, then that TAP is exempt from further NSR evaluation. However, PSCAA did not adopt the section of the rule—WAC 173-460-080(1)—that discusses de minimis emission values; therefore, tBACT must be demonstrated for all new sources with an increase in toxic emissions. The boilers are implementing tBACT with the use of the low NO_x burners, digester gas treatment system and good combustion practices.

SQER is defined as a level of emissions below which dispersion modeling is not required to demonstrate compliance with ASIL values. A TAP with emissions exceeding its SQER value requires an ASIL analysis using dispersion modeling to verify that emission levels will not result in an exceedance of the associated ASIL values for its respective averaging period. For a first-tier analysis, PSCAA will not issue an NOC until the facility demonstrates that tBACT has been applied to all TAPs with an increase in emissions due to the project. In addition, each TAP must demonstrate compliance with its respective ASIL by either having an emission rate below the SQER or conducting air dispersion modeling.

As discussed in Section 3 (Regulatory Compliance) under Ecology's Policy of Replacement of Emission Units at Existing Sources, the replacement of emission units at existing sources triggers NSR, given sufficient potential emissions. However, if Chapter 173-460 WAC applies to an emission unit, WAC 173-460-080 does allow an applicant to propose reductions in actual emissions in an acceptable source impact analysis, including those associated with the unit being replaced.

The only TAPs that exceed their SQERs are NO_x and H_2S. If TAP emissions are analyzed based on current potential emission compared to future potential emission, TAP emissions would be reduced and no further analysis would be required.

Ecology's approach involves comparing the actual emission from existing units during the last 2 years to the potential emissions from the replacement units, The actual emissions from the existing boilers, based on operating data from 2020 and 2021 were used to calculate the emissions for NO_x and H_2S. The emissions for the replacement boilers was calculated based on the boilers potential to emit, (all boilers operating 8,760 hours per year). The 1-hr NO_x emissions from the new boilers results in a reduction in emissions from actual as indicated by Table 6-1.

Table 6-1. Comparison of Nitrogen Oxides to SQER

Toxic Air Pollutant	Averaging Period	Emissions (lb/averaging period)	SQER (lb/averaging period)
Nitrogen Oxides – Actual Emissions Existing Boilers	1-hr	2.5	0.87
Nitrogen Oxides – PTE New Boilers	1-hr	1.7	0.87
Change in Emissions	1-hr	-0.8	0.87

The potential emissions of H_2S from the replacement boilers is higher than the 24-hr maximum daily emissions from the existing boilers, but less than the SQER increment, as indicated in Table 6-2. The potential emissions are extremely conservative since they assume all four boilers, with a total of 1,000 hp, are operating. The increment also does not include the reduction in emissions that would be created by the replacement of the RSP engines with electric motors. In addition, during worst case conditions, where the cogen is down and the boilers must provide all of the maximum heat load, only 900 hp would be required. The impact from 900 hp is presented in Table 6-3 and does not include the reduction in emissions due to the RSP engines.

Table 6-2. Comparison of Hydrogen Sulfide to SQER

Toxic Air Pollutant	Averaging Period	Emissions (lb/averaging period)	SQER (lb/averaging period)
Hydrogen Sulfide – Actual Emissions Existing Boilers	24-hr	0.39	0.15
Hydrogen Sulfide – PTE New Boilers	24-hr	0.53	0.15
Change in Emissions	24-hr	0.148	0.15

Table 6-3. Comparison of Hydrogen Sulfide to SQER – 900 hp

Toxic Air Pollutant	Averaging Period	Emissions (lb/averaging period)	SQER (lb/averaging period)
Hydrogen Sulfide – Actual Emissions Existing Boilers	24-hr	0.39	0.15
Hydrogen Sulfide – New Boilers at 900 hp	24-hr	0.47	0.15
Change in Emissions	24-hr	0.084	0.15

Based on Ecology's policy the net difference in the actual emissions for the existing boilers and the potential emissions for the new boilers indicates a reduction in NO_x and an increase in H_2S emissions less than the SQER. Therefore, this analysis is complete and no additional dispersion modeling is required to demonstrate that ambient impacts would be acceptable.

7. References

Washington State Department of Ecology (Ecology). 2006. S*uitability of Small Natural Gas Fueled Boilers for Air Quality General Order of Approval: Evaluation of Control Technology, Ambient Impacts, and Potential Approval Criteria*. February 1, 2006.

Appendix A
PSCAA Notice of Construction Forms

Appendix B
Fuel Data and Sampling Data

SECTION 23 52 39.16

STEEL FIRE TUBE BOILERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies hot water boilers for heating systems as scheduled on Contract Drawings.

B. The general requirements equipment, as specified in Section 43 05 01, are applicable to the equipment specified in this Section.

C. Equipment List:

EQUIPMENT	EQUIPMENT NO.
Boiler 1, (400 BHP)	705-BO19FB011
Boiler 2, (100 BHP)	705-BO19FB021
Boiler 3, (400 BHP)	705-BO19FB031
Boiler 4, (100 BHP)	705-BO19FB041

1.02 REFERENCED STANDARDS

A. This Section incorporates by reference the latest revisions of the embedded standard referenced herein. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
ASME	Boiler and Pressure Vessel Code, Section IV
ASME CSD-1	Code for Controls and Safety Devises for Automatically Fired Boilers
ANSI Z21.10.3/CSA 4.3	Gas-fired Water Heaters
ANSI Z21.13/CSA 4.9	Gas-fired Low Pressure Steam and Hot Water Boilers
CSA CAN1-3.1	Industrial and Commercial Gas-fired Packaged Boilers
NFPA 85-2001	Boiler and Combustion Systems Hazards Code
UL 795	Standard for Safety Commercial-Industrial Gas Heating Equipment
SDCI	Seattle Boiler and Pressure Vessel Code

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
1. Unit(s) shall be digester gas/propane gas packaged boiler(s) consisting of a boiler, boiler fittings, burner equipment, forced draft fan, safety; controls and accessories; completely piped, wired and assembled on a steel base.
2. Boilers are located indoors in a room that is unclassified. All panels, fittings and hardware shall be a minimum NEMA 4X Stainless steel.
3. Boilers are hot water and piped primary-secondary. Boilers 2 and 4 each have a 3-way mixing valve and boiler circulation pump, and Boilers 1 and 3 each have two linked 2-way mixing valves and boiler circulation pump. Site elevation is 100 feet above mean sea level next to salt water. Minimum flue temperatures of all boilers are 220 F at low fire; at full fire, Boilers 1 and 3 must reach a minimum flue temperature of 300 F, and Boilers 2 and 4 must reach a minimum flue temperature of 315 F. Power is 460V/3 Phase/60 Hz.

4. Digester Gas has the following approximate properties:
    a. Pressure will be supplied at inlet of gas train at minimum of 2.0 psi.
    b. Methane 55 -70% by volume.
    c. Cardon Dioxide: 30 - 45% by volume.
    d. Inerts: Balance.
    e. Lower Heating Value: 540 BTU/ cu-ft.
    f. H2S Content: Less than 200 ppmv.
    g. Siloxane: Less than 100 ppbv.
    h. Moisture Content: Less than 2%.
5. Burners shall be capable of running on digester gas with propane gas as backup without needing physical changes to the burner.

B. Performance Requirements:
1. Unit(s) shall operate to meet the air pollution control district low NOx requirements.
    a. Boilers at 100 boiler horsepower (BHP): Maximum 30 PPM NOx.
    b. Boilers at 400 BHP: Maximum 30 PPM NOx.
    c. Boiler emissions is the priority over boiler efficiency. No minimum efficiency.

C. System Operation: Local boiler control panel and remote monitoring and switching.
1. The following I/O signals shall be provided at the boiler:
    a. Boiler Firing Rate Output.
    b. Boiler Hot Water On.
    c. Boiler Hot Water Call to Run.
    d. Boiler Hot Water in Remote.
    e. Boiler Hot Water Fail.
    f. Boiler Hot Water MSG Feed Open.
    g. Boiler Hot Water Propane Feed Open.
    h. Boiler Hot Water Circulation Pump Demand.
    i. Boiler Auto Fuel Select.
    j. Boiler Digester Gas Fuel Select.
    k. Monitor package boiler system status.

D. Boiler Combustion air information:
1. Each room is fitted high and low louvers directly to outside.
2. Due to ventilation requirements the rooms also get fans bringing in air at 6 ACH.

1.04 SUBMITTALS

A. Procedure: 01 33 00.

B. Provide the following submittals:
1. Shop drawings:
    a. Dimensional drawings of boilers, burner, piping, access ladders, railings and platforms, installation details, and weights of all major components.
    b. Wiring diagrams.
    c. Component lists.
2. O&M manual: 01 78 23.
3. Installation certification: Form 43 05 01-A.
4. Training certification: Form 43 05 01-B.
5. Bill of Materials, including Form 01 78 45-A.
6. Structural design drawings and calculations of the access platforms, ladders, and railings.
7. Native file and PDF version of software configuration.
8. Available BACNet and Modbus TCP data registers to allow mapping for external network monitoring.
9. Complete control description including process and instrumentation diagrams for hot water boiler package system.

1.05 QUALITY ASSURANCE

A. Vibration and critical speeds: Section 43 05 50.

B. Fabricate and label boilers to meet the requirements of ASME Boiler and Pressure Vessel Code, Section IV. Boiler/water heater shall bear the ASME “H” stamp and be National Board listed for 160 psi working pressure and 210 Degrees F.

C. Boilers with an input rating above 12 BHP (117 kW) and less than 373 BHP (3,660 kW) shall meet requirements of ASME CSD-1; and boilers with an input of 373 BHP (3,660 kW) or greater shall meet requirements of NFPA 85-2001, Boiler and Combustion Systems Hazards Code.

D. Construct boilers in accordance with the ASME Code for 30 psi water and supplied with the ASME label.

E. Boilers shall be provided with National Board Inspection. Report signed by an N.B. Inspector and furnished with and N.B. number prior to shipment.

F. Boiler shall be tested and rated in accordance with the American Boiler Manufacturers Association (ABMA) and bear the ABMA emblem.

1.06 SHIPMENT, PROTECTION, AND STORAGE

A. Shipment, protection, and storage: Section 01 67 00.

1.07 ENVIRONMENTAL CONDITIONS

A. Environmental conditions: Section 01 17 00.

B. Electrical classification: Section 26 05 00: Unclassified.

1.08 WARRANTY

A. Refer to Contract General Terms and Conditions and Section 01 78 36.

B. Each boiler pressure vessel shall be warranted against damage resulting from thermal stress for a period of 20 years from the date of shipment, provided the boiler is operated and maintained in accordance with the conditions specified in the owner’s Operating and Maintenance Manual.

C. The boilers shall be warranted to meet all the emission requirements, as required by PSCAA.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers:
   1. Cleaver Brooks.
   2. Johnson Hurst.
   3. Burnham Corporation.
   4. Approved Equal.

2.02 MATERIALS

A. Materials specified are acceptable for the application. Contractor may propose alternative materials, subject to review and approval or rejection by the County.

B. Materials of construction:

Component	Material
Access ladders, platforms, and railings	Galvanized steel per Section 05 50 00
Control panels and boxes	Stainless steel
Digester gas train	Stainless steel
Propane gas train	Steel
Pipe Connections	150# steel flanges
Pressure Vessel	Steel ASME rated and certified
Outer Jacket, shell	Sheet metal sectional lagging over 2 inch blanket insulation
Skids and lifting eyes	Heavy Steel Framed
Doors and Seals	Steel doors with fiberglass gaskets fastened by screws that thread into replaceable brass nuts

2.03 EQUIPMENT FEATURES AND COMPONENTS

A. Hot water boilers:
1. The boiler shall be built to comply with the following insurance and codes: Factory Mutual and Industrial Risk Insurance.
2. Boiler pressure vessel shall be constructed in accordance with ASME boiler code. Each boiler must receive authorized boiler inspection prior to shipment. Inspection report shall be furnished to the purchaser. And high quality copies transmitted to the county.
3. Fire tubes easy to remove and replace without welding the tube attachment.
4. Constructed as gas-tight for pressure firing.
5. Entire boiler must be skid mounted on steel skids.
6. Access door for maintenance rear, top or both.
7. Flame observation port, minimum 1 in front.
8. Steel lifting points, for hoisting boiler off truck or into place.
9. Flue gas temperature gauge, readable from the floor, 200 to 1,000 degrees F.
10. Safety relief valves; to comply with ASME code for full burner input.
11. Gas-tight hinged front flue doors.
12. Gas-tight rear smoke boxes with side cleanout opening.
13. Field installation of industrial combustion burner.
14. Operating and high limit switches.
15. Modulating burner controls.
16. Float type, Low Water Cut-Off and Auxiliary Low Water Cut-Off. Wired to the burner control circuit to prevent operation if the boiler falls below a safe level.
17. Water relief valves (shipped loose) shall be of a type and size to comply with ASME Code requirements.
18. Temperature supply water and return water gauges readable from the floor.
19. Pressure gauge readable from the floor.
20. Required for Boilers 2 and 4 only due to common stack: An automatic modulating damper installed on each boiler for overfire draft protection controlled by boiler controller. Includes feedback to controller for position of damper.
21. Coordinate the control functions with Ovation DCS I/O points as indicated on P&IDs, and within the DCS control strategies described in Section 40 65 09. Plant-wide controller calls for boiler heating demand. The boiler start/stop, boiler firing rate, fuel selection, hot water mixing valve position, and boiler circulation pump operation, are operator-adjustable through the existing Ovation DCS system. Hot water boiler control system shall be replaced functionally in-kind to existing control system.

B. Burner:

1. Field installed pilot propane gas train shall include ignition transformer, electric gas valve, full lock-up regulator, test tapping, and shut-off valve.
2. Integral forced draft burner and burner controls, part of complete package approved as a unit by Underwriters Laboratories and shall bear the UL/ULC label.
3. Boiler burner shall be built to comply with the following insurance and codes: Factory Mutual and Industrial Risk Insurance.
4. The burner shall be equipped with suitable fuel and air controls to assure smooth main flame ignition. The burner shall utilize a proportional air flow damper design, including independent low-fire and high-fire air flow shutter assemblies for ease of adjustment and consistent excess air performance throughout the firing range.
5. Fuel-air control shall be synchronized. The fuel air drive unit shall be provided with a position indicating switch interlock with the flame safeguard system to assure starting at the low fire position. The flame guard system shall further program this drive unit to provide a full open louver of sufficient time to provide a four air change pre-ignition of the combustion chamber, heat exchanger, and flue passages.
6. Pre-ignition pure air flow rate, interlocks must be provided to monitor and prove 60% air flow purge when air inlet louvers are automatically opened to obtain this rate.
7. Electronic safety combustion controls shall be supplied, complete with ultra-violet flame scanner to monitor the pilot and main flame. It shall be so utilized as to provide intermittent type gas-electric ignition and pre-ignition timer. Flame rod is not permitted for proving pilot or main flame.
8. Combustion air from within the boiler room. Not piped to the boiler from outside. All combustion air shall be furnished by the burner fan, which shall be an integral part of the burner.
9. Burner Controls: Are 120 VAC, 1 phase, 60 Hz.
    a. The full modulation of the burner shall be controlled by water temperature by means of a temperature control.
    b. An additional high limit safety temperature control of the manual reset type shall be provided to control the burner.
    c. Pre-and post- operation of the burner fan shall be provided per UL requirements.
    d. The burner shall have a flame guard type flame safe programmer, incorporating indicator lights to annunciate the current operating status of the burner.
    e. A manual restart of the burner shall be necessary in the event of shutdown due to flame failure.
    f. Burner blower three phase motors shall be controlled and protected by an automatic starter with thermal overload protection. The starter shall be inter-locked to prevent burner operation when overload relays are tripped out.
    g. Supply a burner-mounted diaphragm air flow switch to prevent energizing the main fuel valves in the event of insufficient combustion air, or to provide safety shutdown in the event of combustion air interruption.
    h. A factory-wired control cabinet shall be supplied and mounted on the burner. The control cabinet shall house the safe controller, the programming timer, burner motor starter, fuses, control circuit transformer, control switches, indicator lamps, and relays as required.
    i. Provide indicator lights at a minimum:
        1) Call for Heat.
        2) Main Fuel Valve “ON” or “OPEN”.
        3) Low Water Level.
        4) Main Flame Failure.
    j. Provide BACnet and Modbus TCP protocol communication for integration into Ovation DCS system.

C. Boiler stack:
    1. Boiler breechings and boiler stack: See Section 42 11 40.

D. Boiler base:
    1. Coordinate equipment pad size with boiler base skid size. Slab to extend 12 inches beyond boiler base on all sides. Boiler skid must be part of the boiler and be a heavy steel frame.

E. Connections:

1. Insulated hot water supply and return piping connections shall be as shown in Drawings and specified in Section 40 05 01. Assume hot water supply and return temperature is 210 F.
2. Gas piping shall be as shown in Drawings and specified in Section 40 05 01.

F. Power:
1. Provide connection to 460 VAC 3 phase 60 hertz power source for each boiler with connections to burner sequence controller panel:
   a. Wiring shall be per Section 26 05 33.
   b. Provide starters relays, transformers, and equipment for complete boiler/burner operation.
2. Emergency shutdown to be provided per AMSE CSD-1 with the added provisions:
   a. Manually operated emergency shutoff switches are shown on the boiler plan sheets. These switches are marked for easy identification. Boiler 1 and 3 are now in the same room and the emergency boiler shutoff switch will be upgraded to a two pole type such that each boiler is shutoff when pushing the switch. Boiler 2 existing emergency switches must be upgraded to two pole type such that one pole serves boiler 2 and the other pole serves boiler 4. Each emergency switch will be approved by owner.
   b. Each emergency switch must be tied in and powered by the burner and be set up to shut down all fuel systems supplying the burner.
   c. Wiring shall be line voltage.
   d. Alarms:
      1) Emergency Manual shut-down of any boiler shall cause alarm. Alarm shall be a bell mounted in the boiler room with reset switch.
      2) Coordinate the control functions with DCS I/O points as shown on P&IDs.

G. Access Ladder, Platform and Railing:
1. Platform, access ladder and railings: meets WISHA standards, WAC 296-24 and all subsections.
2. Access ladder: alternating tread stair which meets WISHA, WAC 296-24-740 and WAC 296-24-76555.
   a. Locate access ladder and platform supports to avoid obstructing egress.
   b. Locate access ladder and platform supports to avoid obstructing portions of equipment or piping that require access for cleaning and maintenance.
3. Handrail, stair rail and guardrail: meets WISHA standards, WAC 296-24-74015, WAC 296-24-750.
4. Located platform to serve each boiler and provide access for routine maintenance.
5. The access platform and any associated equipment, nonstructural elements, components, and elements permanently attached to any portion of the these, shall be anchored and braced to resist seismic forces in accordance with Section 01 73 00.
6. Platform, railing and ladder shall be designed to allow access to all regular maintenance points without removing platform frame, railing, or access ladder.
7. Platform width, minimum: 24 inches.

H. Plant-Wide Heating Loop Control Strategy: Refer to Section 40 65 09 for hot water boiler control narrative.

2.04 FINISHES

A. Boiler shall be primed and painted with manufacturer's recommended product rated for boiler surface temperature.

B. Finishes of all components ancillary to the boiler that are normally painted, shall be per Section 09 90 00.

2.05 SOURCE QUALITY CONTROL

A. Factory Tests:
1. Units shall be tested in accordance to UL 795, CAN 1-3.1, ANSI Z21.13/CSA 4.9, and ANSI Z21.10.3/CSA 4.3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all field conditions for compliance with requirements for installation tolerances and other conditions affecting boiler/water heater performance prior to installation.

3.02 INSTALLATION

A. Installation of the boilers shall be in strict accordance with the boiler manufacturer's published recommendations.

B. Install equipment in the locations shown and in accordance with the provisions of Section 43 05 60 Equipment Support Grouting.

C. Alignment: Section 43 05 61 Machine alignment.

D. Burner shall be field installed and attached to boiler by a factory certified technician.

E. Proper installation and testing of the Emergency boiler stop is the responsibility of the boiler installer.

F. Upon completion of the installation, each piece of equipment and each system shall be tested for satisfactory operation.

G. Note on loose equipment: Equipment specified in this Section that comes partially assembled or with loose equipment parts shall be installed in accordance with boiler manufacturer recommendations.

3.03 FIELD QUALITY CONTROL

A. Field Testing: 01 75 20.

B. Services of the Manufacturer. Inspection, Startup, and Field Adjustment: An authorized service representative of the unit manufacturer shall visit the site to witness the following and to certify in writing that the equipment and controls are properly installed, adjusted and readied for operation:
   1. Installation of equipment.
   2. Inspection, checking and adjusting the equipment.
   3. Startup and field testing for proper operation.
   4. Performing field adjustments to ensure the installation and operation comply with the indicated requirements.
   5. Provide written certification that the equipment has been properly installed, inspected and adjusted and in proper working order.

C. A factory trained representative of the burner manufacturer shall conduct a combustion test on both digester gas and propane gas. The fuel input rate shall be field adjusted to digester gas and propane. The equipment shall be adjusted to provide emissions as required by the Puget Sound Clean Air Agency (PSCAA).

D. Full boiler demonstration to Seattle Boiler Code Inspector for safety and controls shall be the responsibility of the installing contractor.

E. Hydrostatically test assembled boiler and piping, according to applicable sections of the ASME Boiler and Pressure Vessel Code.

3.04 CLEANING

A. General requirements:

1. Follow MPS water treatment consultant's directions regarding boiler cleaning procedures.
2. For cleaning of the system and boiler boil-out requirements, refer to Section 23 25 00.
3. Contractor must isolate boiler/water heater when any cleaning or testing of system piping is being performed.

3.05 MANUFACTURER SERVICES

A. Two visits from the unit manufacturer to the Plant 60 days prior to installation of boilers shall be scheduled. Intent of the meetings is to confirm communication with the existing control system to new local boiler controllers.

B. Factory authorized service representative to do the field assembly of components and installation of burners, including piping, electrical connects, and start-up.

C. Training
   1. Procedures: Section 01 79 00.
   2. Provide a minimum of 8 hours per training.

END OF SECTION

CBEX-3W

250-800 HP

Dimensions and Ratings

Figure 1. CBEX-3W Steam Boiler Dimensions, 250-800 HP

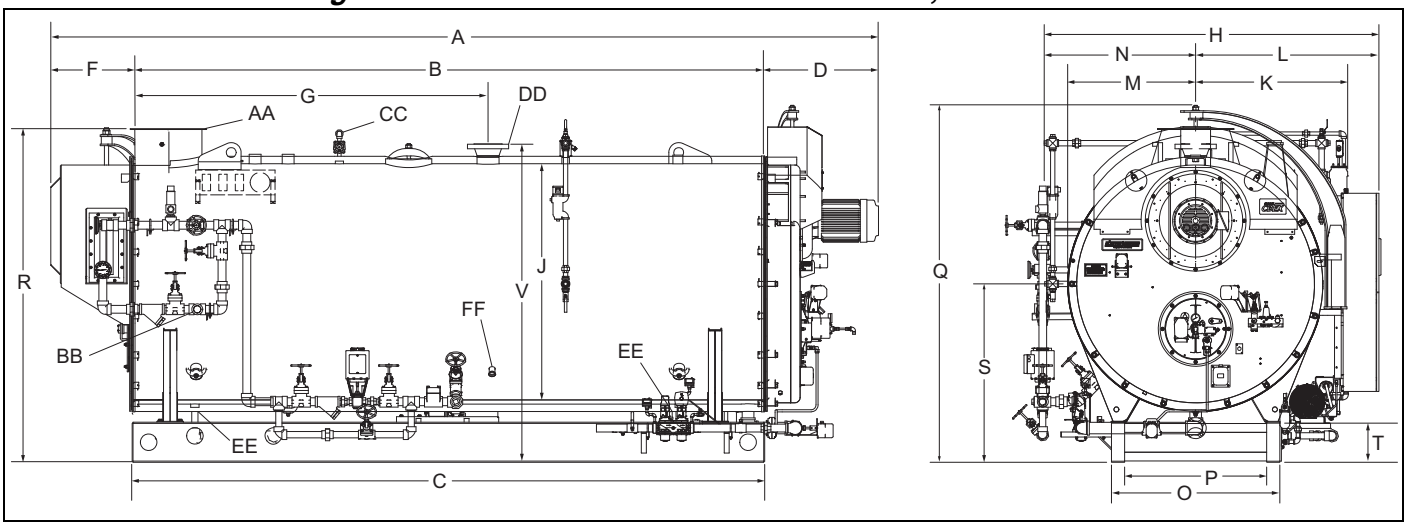


Table 1: CBEX-3W Dimensions (150 psi design)

Dimensions in inches unless noted		250	300	350	400	500	600	700	800
LENGTHS									
Overall Length (30 PPM System)	A	228.6	236.3	241.4	260.3	246.6	266.6	257.5	272.2
Overall Length (30 PPM System) with Economizer	A1	249.1	256.8	261.9	280.8	267.1	287.1	279.6	294.3
Shell (with Front and Rear Smoke Box)	B	191.5	197.5	202.9	220.9	207.3	227.3	221.8	233.8
Base Frame	C	191.5	197.5	205.0	223.0	207.3	227.3	221.8	233.8
Burner Extension (30 PPM System)	D	32.8	34.5	34.3	35.1	35.1	35.1	31.5	34.2
Front Ring to Panel	E	24	24	18	18	22	22	10	10
Rear Head Extension	F	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
Rear Head Extension with Economizer	F1	24.75	24.75	24.75	24.75	24.75	24.75	26.3	26.3
Shell Flange to Steam Nozzle	G	107.75	110.75	102.75	110	106	116	111.75	117.75
WIDTHS									
Overall Width	H	97.4	97.4	103.5	103.5	117.33	117.33	131.5	131.5
I.D. Boiler	J	72	72	78	78	92	92	106	106
Center to Water Column	K	51	51	54	54	61	61	68	68
Center to Panel	L	52.5	52.5	55.5	55.5	62.63	62.63	69.6	69.6
Center to Lagging	M	39	39	42	42	48.5	48.5	56	56
Center to Auxiliary LWCO	N	44.9	44.9	48	48	54.7	54.7	61.9	61.9
Base Outside	O	51	51	64	64	68	68	74.8	74.8
Base Inside	P	43	43	56	56	55	55	61.8	61.8
HEIGHTS									
Base to top of Front Head Bolt	Q	108	108	114	114	130.64	130.64	144.8	144.8
Base to Vent Outlet	R	101	101	107.625	107.625	122.5	122.5	135	135
Base to Boiler Centerline	S	54	54	56.25	56.25	65.5	65.5	71	71
Height of Base Frame	T	12.25	12.25	12.25	12.25	12.25	12.25	12.25	12.25
Base to Steam Outlet	V	96.4	96.4	101.75	101.75	118	118	130.6	130.6
BOILER CONNECTIONS									
Feedwater Inlet	BB	2	2	2	2	2.5	2.5	2.5	2.5
Surface Blowoff	CC	1	1	1	1	1	1	1	1
Steam Nozzle, 150 psig Design Pressure(300# Flange)	DD	6	6	6	6	8	8	8	8
Blowdown-Front & Rear	EE	1.5	1.5	1.5	2	2	2	2	2
Chemical Feed	FF	1	1	1	1	1	1	1	1
VENT STACK									
Vent Stack Diameter (Flanged)	AA	20	20	24	24	24	24	24	24
WEIGHTS AND WATER VOLUME		250	300	350	400	500	600	700	800
WITH ECONOMIZER									
Total Dry Weight, lbs.		21918	22753	26816	28716	36855	39783	46834	49287
Water Volume - Operating, Gal.		1500	1519	1734	1930	2255	2536	3621	3802
Water Volume - Flooded, Gal.		1746	1774	2082	2314	2769	3110	4405	4635
Water Weight - Operating, lbs.		12498	12657	14446	16076	18783	21129	30167	31671
Water Weight - Flooded, lbs.		14547	14777	17341	19275	23062	25903	36693	38613
Total Weight - Operating, lbs.		34416	35410	41262	44792	55638	60912	77001	80958
Total Weight - Flooded, lbs.		36465	37530	44157	47992	59917	65686	83527	87900
WITHOUT ECONOMIZER									
Total Dry Weight, lbs.		21364	22199	26208	28108	36011	38938	45724	48177
Water Volume - Operating, Gal.		1496	1514	1728	1923	2246	2526	3610	3788
Water Volume - Flooded, Gal.		1742	1769	2076	2307	2760	3099	4393	4622
Water Weight - Operating, lbs.		12462	12614	14396	16019	18712	21044	30068	31558
Water Weight - Flooded, lbs.		14511	14734	17291	19219	22991	25818	36594	38500
Total Weight - Operating, lbs.		33826	34813	40605	44127	54723	59982	75792	79735
Total Weight - Flooded, lbs.		35875	36933	43500	47327	59002	64756	82318	86676

NOTE: ***Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified dimension diagram/drawing.***

All connections are threaded unless otherwise indicated.

Table 2: Clearances

MINIMUM CLEARANCES inches	250	300	350	400	500	600	700	800
Tube Removal - Front from Head Flange	122.7	127.0	131.2	148.4	131.4	151.4	149.0	158.3
Tube Removal - Rear from Rear Head Flange w/o Econ	151.25	157.25	161.25	179.25	162.25	182.25	176.25	188.25
Tube Removal - Rear from Rear Head Flange with Econ	130.75	136.75	140.75	158.75	141.75	161.75	154.2	166.2
Front Door Swing *	82	82	89	89	102	102	118	118
Rear Door Swing without Econ *	45	45	46	46	54	54	60	60
Rear Door Swing with Econ*	66	66	67	67	75	75	82	82
Econ Minimum Removal Clearance from Boiler Center w/o Pipe**	88.22	88.22	94.11	94.11	115.25	115.25	136	136

* 250 and 800 HP are davited

**left side standard; contact CB for right side access

Table 3: Boiler Weights (including economizer)

	250	300	350	400	500	600	700	800
Total Dry Weight, lbs.	21918	22753	26816	28716	36855	39783	46834	49287
Water Volume - Operating, Gal.	1500	1519	1734	1930	2255	2536	3621	3802
Water Volume - Flooded, Gal.	1746	1774	2082	2314	2769	3110	4405	4635
Water Weight - Operating, lbs.	12498	12657	14446	16076	18783	21129	30167	31671
Water Weight - Flooded, lbs.	14547	14777	17341	19275	23062	25903	36693	38613
Total Weight - Operating, lbs.	34416	35410	41262	44792	55638	60912	77001	80958
Total Weight - Flooded, lbs.	36465	37530	44157	47992	59917	65686	83527	87900

Table 4: CBEX-3W Ratings (for 700 ft altitude) - Gas & 2 Oil

Boiler Output, HP	250	300	350	400	500	600	700	800
Firing Rate, Btu/h	10,205,793	12,246,951	14,288,110	16,329,268	20,411,585	24,493,902	28,576,220	32,658,537
Shell Diameter, in.	72	72	78	78	92	92	106	106
Motor Size (Uncontrolled)	10	10	15	15	15	25	25	40
Motor Size (60 PPM System)	10	20	20	25	30	40	40	60
Motor Size (30 PPM System)	15	20	30	40	30	50	50	75
Motor Size (9 PPM System)	15	20	20	25	30	60	60	75
Oil Pump Motor HP (No. 2 Oil Only)	1/2	3/4	3/4	3/4	3/4	3/4	1	1
Air Compressor Motor HP (No. 2 Oil Only)	5	5	5	7 1/2	7 1/2	7 1/2	7.5*	7.5*
Rated Capacity (lb-steam/hr at 212F)	8,625	10,350	12,075	13,800	17,250	20,700	24,150	27,600
Btu Output (1000 Btu/hr)	8,369	10,043	11,716	13,390	16,738	20,085	23,433	26,780
Light Oil gph (140,000 Btu/gal)	72.9	87.5	102.1	116.6	145.8	175.0	204.1	233.3
Gas CFH (1000 Btu)	10,206	12,247	14,288	16,329	20,412	24,494	28,576	32,659
Gas Therm (therm/hr)	102.1	122.5	142.9	163.3	204.1	244.9	285.8	326.6
Stack Temperature @15% EZ & 100 PSIG	404	402	396	384	394	383	390	384
Heating Surface sq-ft (Fireside)	1123.0	1269.0	1643.0	1823.0	2494.0	2794.0	2874.0	3230.0
Heating Surface sq-ft (Water side)	1101.0	1253.0	1632.0	1812.0	2482.0	2786.0	2828.0	3192.0
Furnace Volume w rear turn	95.1	98	117.7	127.6	173.4	190	211	223
Furnace Volume w/o rear turn	65.3	68.3	83.7	93.5	125.3	141.9	168.9	182

* 15 HP for 9 PPM burners with oil

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CB-8639
2/2023

Dimensions and Ratings

Nick Genovese <ngenovese@coleindust.com>
To Grove, Rick

Reply | Reply All | Forward | ...

Tue 8/16/2022 2:39 PM

You forwarded this message on 8/16/2022 3:06 PM.

Alternate Fuels.pdf
123 KB

Rick,

Please see attached and below note from CB Engineering. There are some other considerations we need to discuss moving forward. Burner technology for biogas looks like we will be limited to 30 ppm NOx emissions on all systems. (Biogas NOx expected to be lower with potentially less N content and lower combustion temp.) We may not be able to configure systems to 15 ppm or 9 ppm on biogas without going to a much more sophisticated and costly burner.

I would like to schedule a call with you and Justin to make sure our ground floor evaluations and planning are on target. He will not have availability until late next week or early the week of 8/29. In the meantime I can field as much as possible.

Thank you,

Nick Genovese
206.962.9550

COLE INDUSTRIAL, INC.

NICK GENOVESE
OUTSIDE SALES ACCOUNT MANAGER
O: (425) 774-6602 M: (206) 962-9550
NGENOVESE@COLEINDUST.COM | 1 (800) 627-2653

PARTS | RENTALS | REPAIR | SALES | SERVICE | TRAINING

To: Nick Genovese <ngenovese@coleindust.com>
Subject: General Digester Gas Info

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Nick,

- Siloxanes must be under 25 mg (microgram)/m3 (1.9 ppm by weight, or 329 g/mol)
- H2S must be under 2000 ppm for uncontrolled emissions systems
- H2S must be under 1000 ppm for low NOx applications
- Digester gas must be under 120°F for combustion stability
- H20 is typically between 3-6% (by volume)
- Rifled tube units are not allowed when running digester gas
- Individual application evaluation is recommended due to differences in stack temperatures from model/capacity to model/capacity
- No burners available for digester with NG NOx packages under 30 ppm

Typically burners with stated NG NOx limits will see lower NOx emissions when running digester gas due to lower flame temperatures.

Let me know if you need more information!

Justin Womble
Mechanical Engineer
Firetube Product Specialist
CleaverBrooks
Click here to view
The power of total integration.

Office: 229.227.5304
jwomble@cleaverbrooks.com
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Alternative Fuel Systems - sales and technical guide

SECTION 1: INTRODUCTION

Cleaver-Brooks defines alternative fuel(s) as that which is other than standard commercially available fuel; used with a burner/boiler combination. Standard, commercially available fuels include natural gas, light oil, and heavy oil. Hence, all other fuels including but not limited to digester gas, landfill gas, solvents, waste oils, hydrogen, town gas, or biogas are considered nonstandard, waste, or alternative.

Over the years, Cleaver-Brooks has offered alternative fuel systems and gained considerable experience in this field, including custom designs engineered around specific onsite requirements.

We have developed standard systems to fire digester and landfill gas. All other fuels will require up-front evaluation.

SECTION 2: DIGESTER AND LANDFILL GASES

2.1 Definition and sources

Digester gas typically refers to gas produced by the fermentation of organic matter such as manure, wastewater sludge, municipal solid waste, or any other biodegradable feedstock, under anaerobic (absence of oxygen) conditions. Digester gas is also called biogas, swamp gas, landfill gas, or sewer gas, depending on where it is produced. Each variant has different levels of methane and carbon dioxide with other minor gases. However, in general the heating value and composition of these gases is essentially known, and therefore they can be used as a fuel in Cleaver-Brooks boilers.

2.2 Characteristics of digester gas

Characteristics of digester gas vary depending on the source. Typical chemical breakdown variations and properties are presented in the following tables.

Table 1. **Typical analysis of digester gas**

Component	Chemical Formula	% Vol
Methane	CH4	50-65
Carbon Dioxide	CO2	35-50
Hydrogen Sulfide	H2S	Trace – 2
Water Vapor	H2O	3-6
Other Gases	CO, N2, O2	1-10

Table 2. **Digester and natural gas comparison**

Characteristic	Units	Digester Gas	Natural gas
Heating Value	Btu/Scf	500-600	950-1100
Specific gravity (Air = 1.0)	N/A	0.85 – 0.95	0.6 – 0.64
Hydrogen Sulfide	% Vol	Trace - 2	None
Water Vapor	% Vol	3 – 6 (Saturated)	None
Temperature	degF	75-120	Ambient
Supply Pressure	IWC	6-15	27.7 – 277 (1 – 10 PSIG)

2.3. Digester/landfill gas system evaluation

2.3.1. Digester gas has only about half the heating value of natural gas, is heavier than natural gas, and is typically supplied at a lower pressure than natural gas. These facts create the need for a system that can handle high flow rates of gas with minimum pressure drop.

2.3.2. The higher flow rates also have a major impact on burner design and performance. A special burner should be used to provide adequate gas velocities for good mixing but without excessive pressure drop.

2.3.3. Digester gas usually contains some hydrogen sulfide (H_2S), and is saturated with water. These characteristics create a corrosive environment for the gas piping, valving, exhaust breeching and stack, should condensation occur. We therefore require (contact) components be resilient to these conditions, using materials such as stainless steel, providing better corrosion resistance than carbon steel.

2.3.4. Digester gas systems are usually hot water or low pressure steam systems because they are often used for heating at the site location. These boilers produce low flue gas exit temperatures adding to the corrosive issues in the boiler system.

2.3.5. The digester gas supply is not always reliable and can be frequently interrupted. Therefore, the boiler system must be capable of responding to interruptions or inadequate supply of digester gas while continuing to meet the plant's heat demand.

2.3.6. Often natural gas is used as a primary backup when digester gas supply interruptions occur. Normally, this is accomplished by the use of a dual canister gas burner housing with a control system that can automatically change over to the backup fuel.

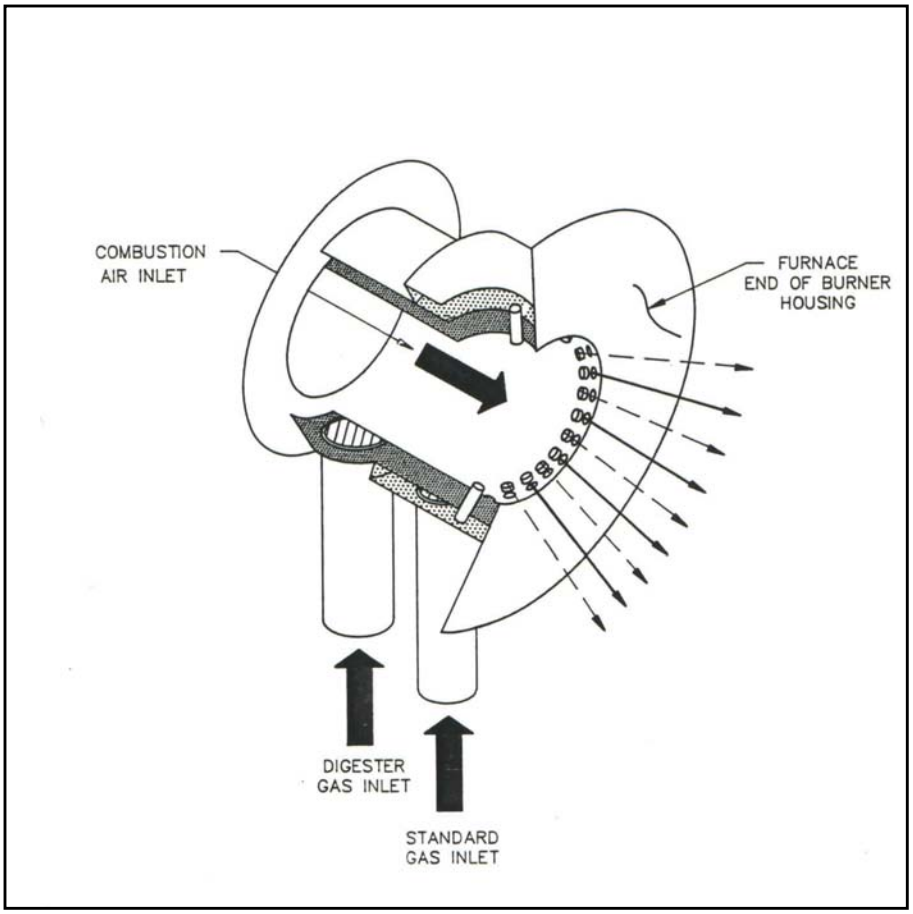

Figure I5-1. Dual Canister Burner

2.4. Components

Sulfur in any gas can be combined with hydrogen in the combustion process resulting in (corrosive) hydrogen sulfide. During cold startups, and if the combustion gas is cooled below its dew point, condensation occurs and the hydrogen sulfide condenses with the water vapor. This product is extremely damaging to carbon steel and to some gasket materials. Therefore, it is imperative the correct materials are selected to ensure long life of the equipment.

2.4.1. Gas Train - Separate gas trains are supplied for natural gas and digester gas. Corrosion resistant components are used for valves and switches on the digester gas train. In addition, all digester gas trains are supplied with two automatic safety shut off valves regardless of insurance requirements This is to ensure that the corrosive gas does not leak into the boiler when not in use. These automatic shut off valves have electric or pneumatic spring-return actuators.

2.4.2. Gas Pressure Regulator - Since digester gas is usually supplied at relatively low pressure (6-15" W.C.), the gas pressure regulator must be capable of operation at high gas flow rates with minimum pressure drop. Since most regulator suppliers' sizing data is based on natural gas, a correction factor is used to properly size the regulator.

2.4.3. Dual gas burner - For integral head firetube boilers firing digester gas with a

backup gas, Cleaver-Brooks uses our patented dual canister housing burner (see figure 1). The design of this burner system allows separate combustion control for two gases with different fuel characteristics.

The dual canister burner components are sized such that the digester gas system components are designed based on the digester gas fuel composition. The backup fuel system is separately designed based on the backup fuel composition.

Hence, different materials may be used for each fuel to ensure long component life, maximum burner efficiencies, and safety.

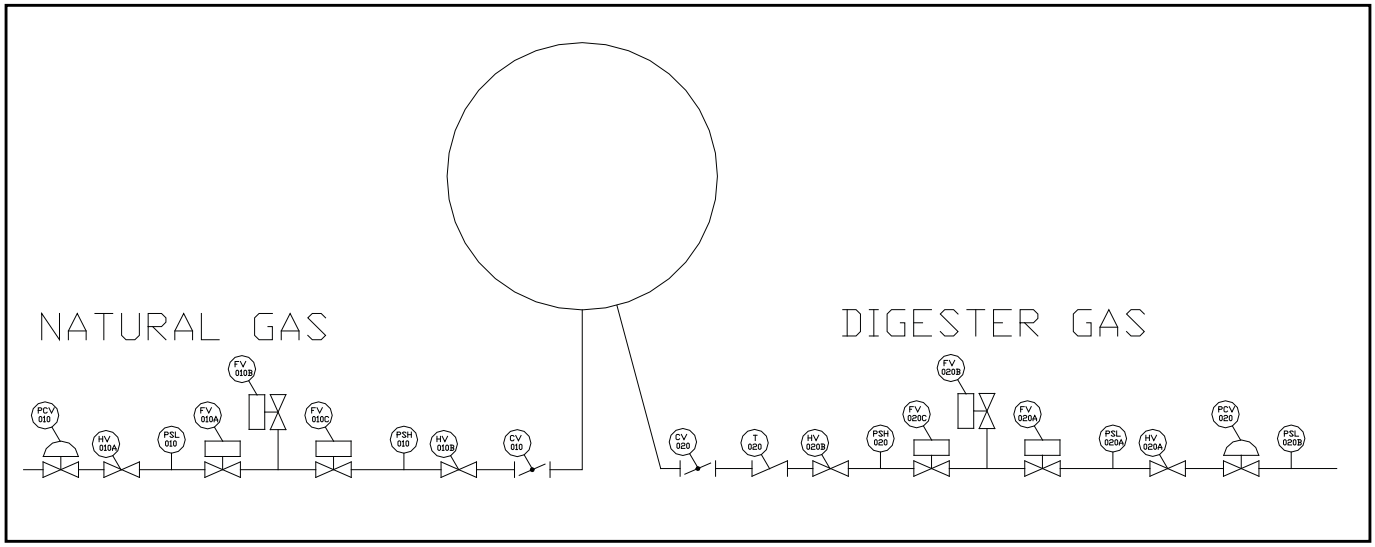

Figure I5-2. Dual Gas Train Schematic

***Table 3.* Gas Train Components**

Natural Gas Tag #	Digester Gas Tag #	Function
PCV-010	PCV-020	Gas Pressure Regulator
HV-010A	HV-020A	Manual Shut Off Valve
PSL-010	PSL-020A	Low Gas Pressure Switch
FV-010A	FV-020A	Automatic Shut Off Valve
FV-010B	FV-020B	Vent valve
FV-010C	FV-020C	Automatic Shut Off Valve
PSH-010	PSH-020	High Gas Pressure Switch
HV-010B	HV-020B	Manual Shut Off Valve
CV-010	CV-020	Firing Rate Modulating Valve
NA	PSL-020B	Automatic Fuel Changeover Switch *
NA	T-020	Flame Arrester with Check Valve*

* Optional components

2.5. Control Schemes

Over the years Cleaver-Brooks has used many different control schemes for firing digester gas. Most of these schemes were customized to the specific customer needs. Control scheme selection can be based on a number of factors including digester gas pressure, boiler size, number of boilers in a plant, and availability of digester gas. The most common control schemes are described below.

2.5.1. Automatic fuel changeover - The purpose of this control scheme is to automatically switch from digester gas to a back up fuel whenever digester gas supply becomes insufficient to meet the control settings. This option requires an automatic fuel changeover pressure switch, which is typically installed prior to the digester gas pressure regulator. When the boiler demand exceeds availability of the digester gas fuel, digester gas pressure drops, tripping the changeover pressure switch. The controls will modulate to the minimum firing position. Once minimum burner position is proven, the burner shuts down and then re-starts, firing the back up fuel. When digester gas pressure is restored, the aforementioned sequence is reversed, and the burner re-starts, firing digester gas.

2.5.2. Preferential firing - The purpose of this control scheme is to fire all the digester gas available. In order for this control scheme to work, another boiler is required to maintain adequate steam pressure (water temperature) when the digester gas supply cannot meet heat/process load demand.

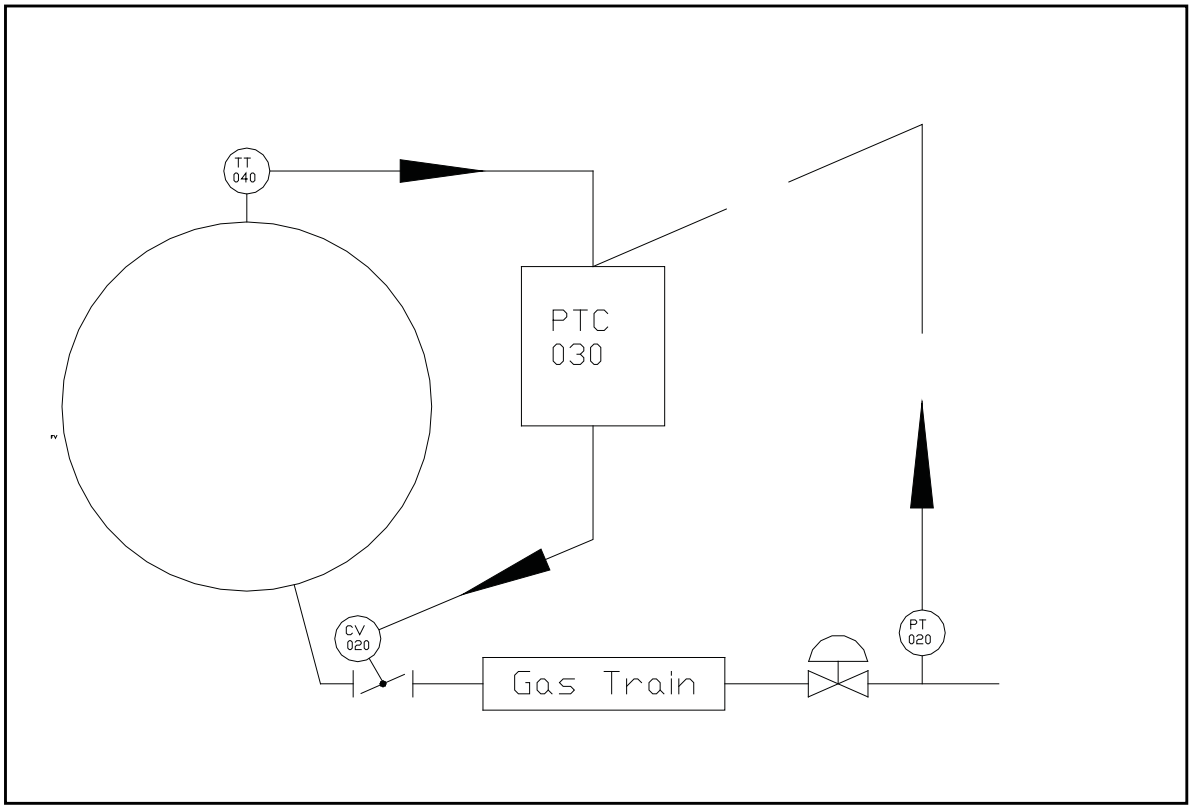

Figure I5-3. Preferential Firing Control Scheme

Pressure/Temperature controller PTC-030 receives boiler outlet temperature signal from temperature transmitter TT-040 and digester gas pressure signal from

pressure transmitter PT-020. Output to the firing rate control valve CV-020 is based on these two signals. When digester gas pressure is above set point, firing rate is based on the heat demand, i.e. boiler outlet pressure/temperature. When digester gas pressure drops below set point, firing rate signal is reduced to maintain digester gas pressure. Hence the control scheme ensures that all available digester gas can be burned. Automatic fuel changeover and low fire hold is incorporated into the control algorithm of PTC-030.

2.5.3. Simultaneous Firing - This control scheme will require up-front evaluation on a job-to-job basis.

SECTION 3. FUELS REQUIRING SPECIAL ENGINEERING.

The following is a list of fuels which will require special engineering:

- Hydrogen
- Refinery gases
- Contaminated air
- Coke oven gas
- Solvents
- Waste oil

SECTION 4. UNACCEPTABLE FUELS.

The following fuels are not acceptable for use in Cleaver-Brooks boilers:

- Solid fuels
- Acids
- Radioactive material
- Caustics

July 28, 2023

Attn: Madeline McFerran, P.E.
Engineer II
Puget Sound Clean Air Agency
1904 3rd Ave #105, Seattle, WA 98101

Subject: West Point Treatment Plant NOC Response

Dear Ms. McFerran

On June 21, 2023, you sent an email to Jesse Collins requesting additional information regarding the permit application for the four replacement boilers of Boilers 1, 2, and 3 at West Point. Your questions are provided below along with King County's responses.

1. Regarding SEPA: which existing determinations are proposed to cover the installation of the four new boilers? Section 3.7 of the application specifies that "the project has been determined to be exempt from further State Environmental Policy Act review" however the SEPA regulations for any project requiring an air permit (Notice of Construction Order of Approval in this case) must also have a SEPA review and determination (WAC 197-11-800(1)(a)(iii) and 197-11-800(2)(a)(iii)). Please provide the determinations which would cover the boilers under review.

   Response: No threshold determinations have been made that cover the boiler replacements. WTD previously determined the Raw Sewage Pump Upgrade Project Categorically Exempt under WAC 197-11-800(3), repair, remodeling and maintenance activities of an existing facility. WAC 197-11-800(3) does not require a SEPA for air permits. The existing Raw Sewage Pump building is part of, and located wholly within, the West Point Treatment Plant facility. No work is proposed outside of the existing facility as part of this project.

2. Regarding H2S composition in the untreated digester gas:

a. How will the facility ensure that 200 ppm is the maximum content of H2S being routed to the boilers?

When the 3 Varec flares were reviewed under NOC 11302 and when the temporary flare was reviewed under NOC 12304 (and then updated in NOC 12323) H2S content data from 2000-2017 had been reviewed and the average content reported was 196 ppm while the 90th percentile was 400 ppm. This item also could change depending on SO2 BACT discussed in item.

Response: The digester gas system is equipped with a gas conditioning system. The system includes an iron sponge process for removing H2S from the digester gas and a siloxane removal system. The only time that the H2S concentration could exceed 200 ppm is when the gas conditioning system is not operating due to maintenance or other issues. WPTP periodically monitors the gas conditioning system using dragger tubes to measure the H2S concentration in the digester gas at the inlet and outlet of the system. If the gas conditioning system is off-line due to maintenance or other unforeseen issue, the facility is able to monitor the raw digester gas using dragger tubes to confirm that the H2S concentrations are less than 200 ppm. The concentration of H2S in digester gas changes slowly, so monitoring once a day when the

gas conditioning system is inoperable is sufficient. The boilers can also operate on propane so switching to an alternative fuel is available if the gas conditioning system is down and/or the H2S in the raw digester gas is above 200 ppm.

b. For TAP analysis since the averaging period for H2S is 24-hour and the H2S composition can vary, the analysis should be updated to utilize the maximum H2S composition in the digester gas that would be seen in a given 24-hour period rather than an average over a longer time period.

Response: The replacement of the boilers does not affect the capacity of WPTP or the amount of digester gas produced. The existing three boiler system capacity are larger than the new boiler system capacity (1,125 hp versus 1,000 hp). The existing larger boiler has the ability to burn raw digester gas. The new boilers will primarily burn treated digester gas. Occasionally, untreated digester gas with a H2S concentration less than 200 ppm may be needed to supplement. This would only occur on a cold day and co-generation is off-line.

Treated digester gas has an average H2S concentration around 50 ppm. The analysis assumed a treated gas concentration of 125 ppm. 125 ppm was based on the highest observed concentration of 607 ppm H2S in the raw gas that occurred in August 2021 and a conservative assumption of only 80 percent control for a concentration of 120 ppm. H2S concentrations are the highest in the summer; summer has the least demand on the boilers. The average non-winter demand is 39 hp (or 48 scfm or 1.7 MMBTU of biogas)

Wastewater treatment facilities are designed with a high degree of redundancy in order to be prepared for emergencies or environmental disasters. The only time all four boiler would potentially be operating at the same time would be during cold temperatures and with the cogeneration facility off-line, which would likely be an emergency situation and not planned. The cogeneration facility is permitted to burn untreated digester gas and does not have a limit on the H2S content of the digester gas. During this situation, since the cogeneration facility would be down, it would not be burning untreated digester gas. The boilers would be burning mostly treated and some untreated digester gas. In winter, the raw unconditioned digester gas is frequently under 100 ppm. Throughout winter and spring the H2S concentration rarely exceeds 200 ppm in the raw gas. The boilers have a design limit of 200 ppm H2S, so if the H2S concentration in the raw digester gas happened to be greater than 200 ppm H2S, the boilers would switch to propane.

The chance that the worst-case scenario used for the TAP analysis would actually occur is extremely small and would likely be an emergency situation. Overall, the future replacement of the RSP engines with electric motors and the replacement of the old boilers with new more efficient low-NOx boilers should result in lower emission from the facility and better use of the digester gas.

3. Regarding BACT, please include SO2 BACT discussion. The new boilers are considered a new source of SO2. Even if only treated digester gas were being routed to the new boilers, netting is only allowable in PSCAA NSR for purposes of the WAC 173-460 TAP review; SO2 emissions are still subject to BACT review. I expect that the digester gas treatment system will be part of the BACT discussion and since the boilers still need to have flexibility to handle untreated digester gas there should be discussion of SO2 BACT in that circumstance as well. The application specifies that expansion of the digester gas treatment system is not being considered at this time, however treatment of any digester gas combusted in the boilers would be part of the BACT analysis. We have seen some iron sponge technologies at small WWTPs which might have applicability here.

Response: The project did not affect the capacity of the WWTP or the amount of digester gas produced. The facility is already equipped with a digester gas treatment system that includes an iron sponge. Burning

of untreated gas will typically only occur when the treatment system is nonoperational due to maintenance or other issue. If the treatment system is nonoperational, the concentration of H2S in the digester gas will be monitored as stated above for Question 2a.

The volume of digester gas combusted can potentially exceed the capacity of the conditioning system but these events are rare and typically occur only during winter months when influent flowrates are high and H2S concentrations are low. During these high influent flow rates, the raw unconditioned digester gas is frequently under 100 ppm. Throughout winter and spring, the H2S concentration of the raw gas rarely exceeds 200 ppm.

Based on no change in digester gas production, the infrequency of events when the digester gas exceeds the gas conditioning system and the low concentrations of H2S during these events, WPTP believes that expanding the gas treatment system would not be cost effective for the infrequent occurrences.

4. This item doesn't require any immediate action from you but is a placeholder for the updated boiler information that will be provided, once available.

WPTP has selected three potential boiler manufacturers for the contractor to select from. We will not know the exact boiler selected by the contractor until next year after the contractor has been selected.

Yours sincerely,

Jesse Collins
Wastewater Engineer, Mechanical, Principal

206-477-6449
jesse.collins@kingcounty.gov

Copies to: Mizanur Rahman
Mike Tseng
Hillary Jones
Alton Gaskill
Karla Kasick
Stacia Dugan