November 10, 2023
Project No. 04223001.20

Air Permit Coordinator
Puget Sound Clean Air Agency
1904 3rd Avenue, Suite 105
Seattle, WA 98101

**Subject: Revision to Notice of Construction Application (Submitted February 15, 2023)
Enclosed Permanent Flare
LRI Landfill**

To Whom It May Concern:

SCS Engineers is submitting this revised Notice of Construction (NOC) application on behalf of Pierce County Recycling, Composting, and Disposal, LLC (dba LRI) to the Puget Sound Clean Air Agency (PSCAA). LRI owns and operates the LRI Landfill in Graham, Washington. This NOC application is for the operation of a proposed enclosed permanent flare of 4,000 standard cubic feet per minute (scfm) capacity to manage landfill gas generated by the landfill. This flare will replace the 2,200 scfm temporary flare (Flare #3) that was placed in operation December 2022. The NOC application for the temporary flare was submitted separately and is still under review.

The fee for this application has already been submitted with the previously submitted application for this device. Please contact me at 425-213-3617 or by email at tberndahl@scsengineers.com should you have any questions about this application.

Sincerely,

Travis Berndahl, EIT
Project Engineer
SCS Engineers

Karam Singh, PE
Project Director
SCS Engineers

Encl. Attachment A: PSCAA NOC Forms
Attachment B: Project Description
Attachment C: Process Flow Diagram
Attachment D: Emission Calculations
Attachment E: Model Outputs
Attachment F: PSD Applicability
Attachment G: BACT Analysis
Attachment H: Flare Location
Attachment I: State Environmental Policy Act (SEPA) Environmental Checklist

Attachment A – PSCAA NOC Forms

AGENCY USE ONLY	NOC#:	REG#:	Date Fee Pd:	Eng. Assigned:

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
Pierce County Recycling, Composting and Disposal, LLC dba LRI

Equipment Installation Address	City	State	Zip
30919 Meridian E	Graham	WA	98338

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

☒ Yes. Current Registration or AOP No. 11993 ☐ No, not registered ☐ Unknown

Business Owner Name
Pierce County Recycling Composting and Disposal, LLC dba LRI

Business Mailing Address	City	State	Zip
17925 Meridian E	Puyallup	WA	98375

Type of Business
Municipal Solid Waste Landfill

Is the installation address located within the city limits?

☐ Yes ☒ No

NAICS Code	NAICS Description
562212	Solid Waste Landfill

Contact Name (for this application)	Phone	Email
Kevin Green	253-847-7555	kevin.green@wasteconnections.com

Description for Agency Website

Provide a 1-2 sentence simple description of this project. See examples www.pscleanair.gov/176

Proposed addition of a 4,000 scfm enclosed combustor (Flare #4) to the LRI landfill. Flare #4 is proposed to replace the currently operating 2,200 scfm temporary flare (Flare #3) which will be taken offline and removed from the site.

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) Payment was made with the initial submittal -this is a re-submittal.

☐ 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

Contact Name:	Contact Number:

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
1	Landfill Gas Flares	☒ Yes ☐ No	1	Sulfur Treatment System
		☐ Yes ☐ No		
		☐ 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.

Kevin Green (signature) | 11/6/2023

Signature | Date

Kevin Green | District Manager

Printed Name | 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

Additional Notice of Construction
Application Requirements for

FLARES

General

Equipment or Process Being Controlled *[Specify the source(s) of the contaminants to be controlled. If the source(s) are also new, complete the applicable permit forms]*

Identify which of the following categories the project fits into:

1. New Construction *(New construction also includes existing, unpermitted equipment or processes*)
2. Reconstruction *(Reconstruction means the replacement of components of an existing facility to such an extent that the fixed capital cost of the new components exceeds 50% of the fixed capital cost that would be required to construct a comparable entirely new facility)*
3. **Modification** *(Modification means any physical change in, or change in the method of operation of, a source, except an increase in the Hours of Operation or production rates (not otherwise prohibited) or the use of an alternative fuel or raw material that the source is approved to use under an Order of Approval or operating permit, that increases the amount of any air contaminant emitted or that results in the emission of any air contaminant not previously emitted)*
4. Amendment to Existing Order of Approval Permit Conditions

Estimated Hours of Operation (hr/day, day/wk, wk/yr) *[Estimate the hours of operation for the new flare - not necessarily the entire facility]* ***24 hr/day, 7 day/week, 52 week/year***

Estimated Installation Date *[Estimate the date when the new flare will be put into service]*
December 2024

Waste Gas Stream Characteristics *[If the heat content of the gas stream is <300 Btu/scf (or <200 Btu/scf if nonassisted), supplementary fuel will be required]*

Flowrate (acfm) *[Specify the airflow in actual cubic feet per minute]* **4,000 scfm**

Temperature (°F) *[Specify the temperature of the waste gas going to the flare in degrees Fahrenheit.]* **100 deg. F (approximate with seasonal variations)**

Pollutant Concentrations (lb/hr or ppmv of each pollutant) *[Specify the pollutant concentrations in the waste gas going to the flare in pounds per hour or parts per million by volume]* **See the Emission Calculations attached.**

Heat Content (Btu/scf) *[Specify the heat content of the waste gas going to the flare in British thermal units per standard cubic foot.]* **476 btu/scf at 50% Methane**

Oxygen (% by volume) *[Specify the oxygen content of the waste gas going to the flare in percent by volume]* **0.1 to 3 percent by volume on average**

Molecular Weight (lb/lb-mol) *[Specify the volume weighted average molecular weight of the waste gas in pounds per pound-mole]* **30.03 lb/lb-mol**

Design *[Most design information is available from the manufacturer or vendor. Submittal of a brochure, scale drawing or process and instrumentation diagram will facilitate the review of the permit application]* **See design documents attached**

Make & Model *[Specify the manufacturer and model of the flare - not the serial number]* **Enclosed Landfill Flare System from Parnel Biogas Inc. - 4,000 scfm rated capacity**

Flare Height (ft) *[Specify the height of the flare tip above ground - not above sea level]* **50 Feet**

Type of Assist System *[Specify steam assisted, air assisted, or unassisted]* **Unassisted**

Type of Ignition System *[Specify instantaneous spark, continuous spark or natural gas pilot. If pilot lights are used, specify the number of pilots]* **Propane Pilot**

Type of Monitor to Determine the Presence of a Pilot Flame *[Specify 'none', thermocouple, infrared, or optical sensor]* **Optical Sensor/UV Scanner**

Cross-Sectional Area of Flare Tip (ft2) *[Specify the unobstructed area of the flare tip in square feet]* **12 foot Diameter Enclosed Flare = 453 ft2**

Flared Gas Exit Velocity (ft/s) *[Specify the velocity at which the flared gas exits the flare in feet per second]* **60 ft/sec**

For Steam Assisted Flares, the Steam Flowrate (lb/min) *[Specify the amount of any steam supplied to the flare in pounds per minute] -* **Not Applicable**

For Flares with Supplementary Fuel, the Type of Fuel and its Flowrate (scfm) *[Specify the amount of any supplementary fuel supplied in standard cubic feet per minute]* **No Supplementary Fuel**

Method Used to Design/Size the Flare *[Specify the method used to select this design and size of flare. If design calculations were performed, they should be submitted. If the design and sizing was based on similar (successful) applications, list the owners and the city and state where they are located]* **Size of flare in scfm is based on U.S. EPA LandGEM software models showing projected landfill gas production from landfill in the coming years. Models are submitted to PSCAA as part of the GCCS Design Plans (latest revision in 2022).**

Distance to Nearest Property Line (ft) *[Specify the distance from the base of the stack to the nearest property line]* **500 feet**

Height, Length and Width of Buildings (ft) *[Specify the approximate dimensions of any buildings that are >40% of the stack height and are located within 5 building heights from the stack]* **No buildings within this range**

Operation and Maintenance (Describe Preventive Maintenance): **This flare will be operated and maintained per manufacturer recommendations. Landfill gas data will be monitored routinely per LRI Landfill's GCCS Operations and Maintenance Plan.**

Attachment B – Project Description

DETAILED PROJECT DESCRIPTION

Pierce County Recycling, Composting and Disposal, LLC (dba LRI) operates the LRI 304th Street Landfill (Landfill) in Graham, Washington. The Landfill has two flares in operation – 3,000 scfm (enclosed) Flare #1 and one temporary flare – 2,200 scfm (candlestick) Flare #3. In this application LRI proposes that the temporary flare be removed from service no later than 60 days after the permanent flare commences operation.

Through this application, a 4,000 scfm enclosed permanent flare (Flare #4) is proposed that will replace Flare #3 such that the total LFG flaring capacity for the Landfill will become 7,000 scfm (Flare #1 and Flare #4 combined). The proposed flare will be procured from a manufacturer renowned in building landfill gas flare systems – such manufacturer as Perennial Energy, Inc., John Zink Hamworthy Combustion, Parnel Biogas, Inc., etc. with performance specifications meeting landfill industry standards and landfill gas control system standards.

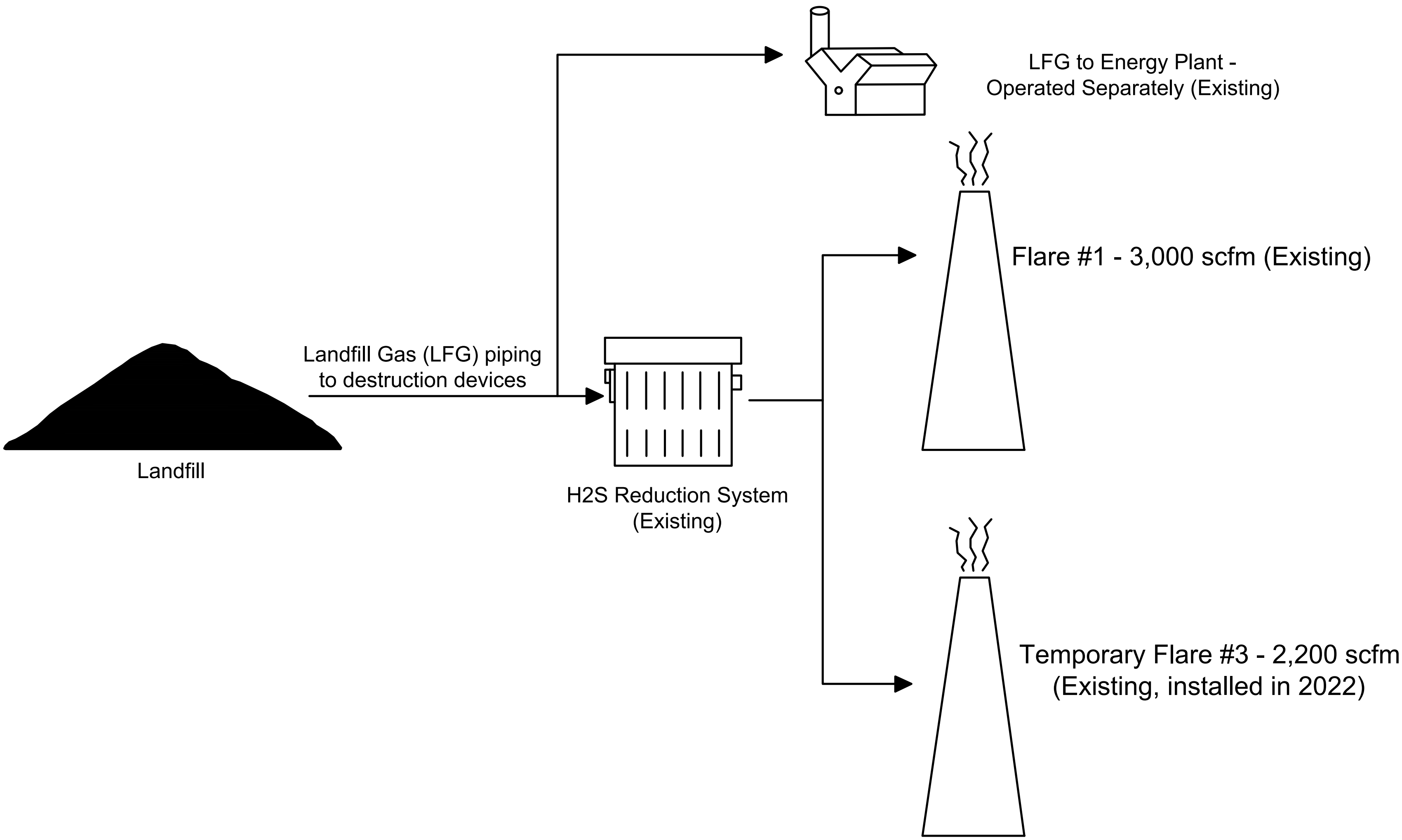
As described in Attachment F, the installation of Flare #4 will not be subject to PSD permitting requirements.

As described in NOC#12301, LRI has voluntarily installed an H2S treatment system for landfill gas prior to the flare. The TRS limit (12-month rolling average) LRI proposed in NOC#12301 is 300ppmv. TRS samples are collected and analyzed by an accredited laboratory at least monthly to ensure this value is not exceeded. Because PSCAA has not yet acted on NOC #12301, this application proposes the same H2S treatment system as BACT for the control of SO2 emissions from Flare #4. See Attachment G.

The process flow diagram attached further explains the route of LFG from the GCCS field to: (a) separately permitted LFG to energy plant; and (b) H2S reduction system and then subsequently to Flare #1 and Flare #4. The proposed project will not have an impact on any existing operations and will only increase the landfill's capacity to collect and flare LFG. In addition to the control measures mentioned above, air pollution control best practices will be followed.

We have included a State Environmental Policy Act (SEPA) checklist for this specific project.

Attachment C – Process Flow Diagram



SCS ENGINEERS
Environmental Consultants and Contractors
2405 140th Avenue NE, Suite 107
Bellevue, Washington 98005
(425) 746-4600 FAX: (503) 684-6948

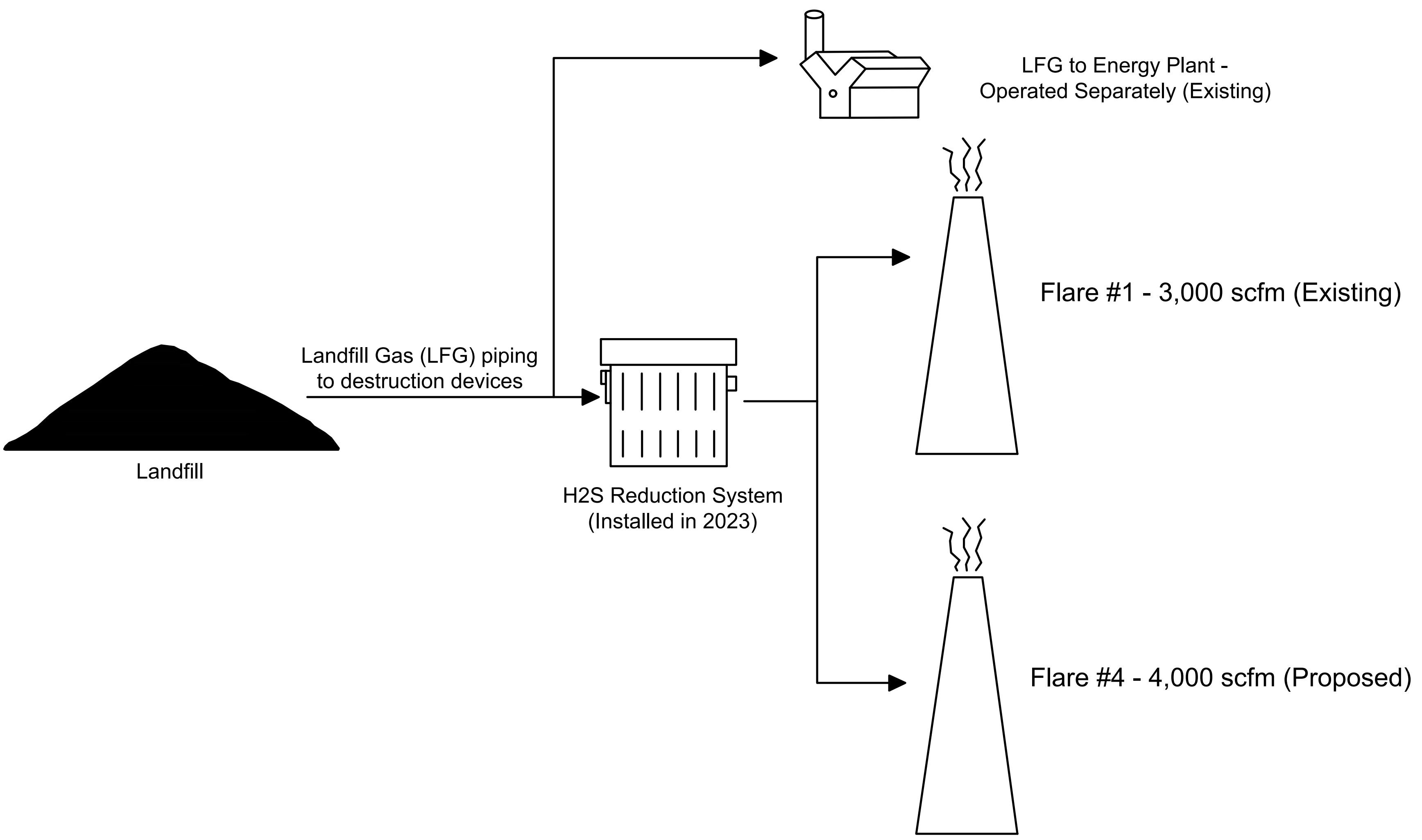
PROJECT NO.	DES BY
04223001.20	TAB
SCALE: NO SCALE	CHK BY: TAM
CAD FILE: FIGURE 1	APP BY: KS

CURRENTLY OPERATING CONDITIONS PROPOSED IN THE NOC #12301 - A SEPARATE APPLICATION

LRI LANDFILL
NOTICE OF CONSTRUCTION: ENCLOSED FLARE
EXISTING PROCESS FLOW DIAGRAM

DATE: OCTOBER 2023

FIGURE: 1



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PROJECT NO. 04223001.20	DES BY TAB	
SCALE NO SCALE	CHK BY TAM	
CAD FILE FIGURE 2	APP BY KS	

PROPOSED CONDITIONS

LRI LANDFILL
NOTICE OF CONSTRUCTION: ENCLOSED FLARE
PROPOSED PROCESS FLOW DIAGRAM

DATE OCTOBER 2023

FIGURE 2

Attachment D – Emission Calculations

EMISSION CALCULATIONS

Emission calculations for this project have been included as part of this application and included as Attachment D. These calculations show that the Toxic Air Contaminants (TACs) Benzene and Hydrogen Sulfide exceed the Small Quantity Emission Rate (SQER) and thus are required to be modeled against the Acceptable Source Impact Levels (ASILs) for those TAPs. These two contaminants were modeled using EPA's AERSCREEN and results show that projected ambient impact levels are lower than the ASIL for each contaminant at the property boundary. These modeling results have been included as Attachment E.

Potential Annual Emissions
Table 1
Permanent Flare (Flare #4), LRI Landfill, Pierce County, Washington

Prepared By:	AK	10/19/2023
Reviewed By:	TAB	10/20/2023

	Maximum Flow Rate to Permanent Flare #4	Total Monthly Flow		Total Monthly Flow		Heat Content		Heat Release
	scfm	m^3		ft^3		BTU	MMBTU	MMBTU/Hr
January	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
February	4,000	4,567,545	m^3	161,280,000	ft^3	76,769,280,000	76,769	114.2
March	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
April	4,000	4,893,798	m^3	172,800,000	ft^3	82,252,800,000	82,253	114.2
May	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
June	4,000	4,893,798	m^3	172,800,000	ft^3	82,252,800,000	82,253	114.2
July	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
August	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
September	4,000	4,893,798	m^3	172,800,000	ft^3	82,252,800,000	82,253	114.2
October	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
November	4,000	4,893,798	m^3	172,800,000	ft^3	82,252,800,000	82,253	114.2
December	4,000	5,056,924	m^3	178,560,000	ft^3	84,994,560,000	84,995	114.2
Total landfill gas consumption =	48,000	59,541,206	m^3/yr	2,102,400,000	ft^3/yr	1,000,742,400,000	1,000,742	1,370.9
Methane consumption (assuming 50% of LFG is CH_4), scfm =		29,770,603	m^3/yr	1,051,200,000	ft^3/yr			
average =	4,000							

gas temperature = 25 degrees C
298 degrees K

Compound	Molecular Weight	Concentration	Uncontrolled Emissions Estimate (Q_p)	Uncontrolled Emission Rate (UM_P)	Emission Rate (98.9% destruction for NMOC/VOC)	Total Emissions
	(gram/mol)	(ppmv)	(m^3/yr)	(Mg/yr)	(Mg/yr)	(tons/yr)
Non-Methane Organic Compounds (NMOC)	86.18	595	35,427.0	124.9	1.37	1.5
Volatile Organic Compounds (VOCs) = NMOC	86.18	235	13,992.2	49.3	0.54	0.6
Carbon Monoxide (CO)	28.01	—	—	—	—	75.1
Nitrogen Oxides (NO_X)	—	—	—	—	—	30.0
Particulate Matter , 10 µm (PM10)	—	—	—	—	0.5	0.6
Sulfur Dioxide (SO2) based on H_2S conc.	64.00	300	17,862.4	46.75	46.8	52

Notes:

$Q_P = 2 * Q_{CH4} * C_P/1x10^6$

$UM_P = Q_P * [(MW_P * 1 atm)/((8.205x10^{-5}) * (1000g/Kg) * (273 + T\ ^oC))]$

CO = 0.15 lb / million BTU , based on manufacturer's data

NO_X = 0.06 lb / million BTU , based on manufacturer's data

PM10 = 17 lb/million cubic feet (MMcf) of methane, based on AP-42, Table 2.4-4

NMOC = 595 ppmv from AP-42 Table 2.4-2

VOC = 235 ppmv from AP-42 Table 2.4-2 notes

NMOC/VOC = 98.9% destruction provided by manufacturer

SO2/TRS = Sulfur treatment system will reduce TRS in the landfill gas to 12-month rolling average of 300 ppmv

TABLE 2: POTENTIAL TAP EMISSIONS PART 1

CAS #	Pollutant Common Name	MW (g/mol)	AP-42 EF (ppmv)	WIAC-1 (ppmv)	WIAC 2 (ppmv)	June 2023 LFG Test Results (ppm)	EF To Use (ppmv)	Source	Uncontrolled Emissions Estimate (Q_p) (m3/yr)	Uncontrolled Emission Rate (UM_P) (Mg/yr)	Controlled Emission Rate after combustion (98.9% destruction) (Mg/yr)	Total Emissions (tpy)	Total Emissions (lb/yr)
71-55-6	1,1,1-Trichloroethane	133.41	0.48	0.168	0.168	ND	0.168	WIAC	10.00	5.46E-02	6.00E-04	6.62E-04	1.32
79-00-5	1,1,2,-Trichloroethane					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane*					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
79-34-5	1,1,2,2-Tetrachloroethane	167.85	1.11	0.07	0.005	ND	0.005	WIAC	0.30	2.04E-03	2.25E-05	2.48E-05	0.05
75-34-3	1,1-Dichloroethane	98.97	2.35	0.741	0.741	ND	0.741	WIAC	44.12	1.79E-01	1.96E-03	2.16E-03	4.33
75-35-4	1,1-Dichloroethene	96.94	0.2	0.092	0.092	ND	0.092	WIAC	5.48	2.17E-02	2.39E-04	2.63E-04	0.53
120-82-1	1,2,4-Trichlorobenzene					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
95-63-6	1,2,4 trimethylbenzene	120.19				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
106-93-4	1,2-Dibromoethane	187.88	0.001	0.046	0.005	ND	0.005	WIAC	0.30	2.29E-03	2.52E-05	2.77E-05	0.06
107-06-2	1,2-Dichloroethane	98.96	0.41	0.12	0.12	ND	0.12	WIAC	7.14	2.89E-02	3.18E-04	3.51E-04	0.70
78-87-5	1,2-Dichloropropane	112.99	0.18	0.023	0.023	ND	0.023	WIAC	1.37	6.33E-03	6.96E-05	7.67E-05	0.15
106-99-0	1,3-Butadiene					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
542-75-6	1,3-Dichloropropene					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
108-67-8	1,3,5 trimethylbenzene	120.19				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
106-46-7	1,4-Dichlorobenzene	147	0.21	1.607	1.448	ND	1.448	WIAC	86.22	5.18E-01	5.70E-03	6.28E-03	12.57
123-91-1	1,4-Dioxane (1,4-Diethylene oxide)					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
540-84-1	2,2,4 trimethyl pentane	114.23				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
591-78-6	2-hexanone	100.16				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
67-63-0	2-Propanol	60.11	50.1	7.908	7.908	13.1	13.1	2023 LFG Testing	779.99	1.92E+00	2.11E-02	2.32E-02	46.49
622-96-8	4-ethyltoluene	120.19				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
67-64-1	Acetone	58.08	7.01	6.126	7.075	21.7	21.7	2023 LFG Testing	1,292.04	3.07E+00	3.38E-02	3.72E-02	74.41
107-13-1	Acrylonitrile	53.06	6.33	0.036	<0.036	ND	0.036	WIAC	2.14	4.65E-03	5.12E-05	5.64E-05	0.11
107-05-1	Allyl chloride					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
80-56-8	a-pinene	136.23				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
71-43-2	Benzene	78.11	1.91	0.972	0.972	4.97	4.97	2023 LFG Testing	295.92	9.45E-01	1.04E-02	1.15E-02	22.92
100-44-7	Benzyl chloride					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
18172-67-	b-pinene	136.23				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
75-27-4	Bromodichloromethane	163.83	3.13	0.311	<0.264	ND	0.311	WIAC	18.52	1.24E-01	1.36E-03	1.50E-03	3.01
75-25-2	Bromoform					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
1016-97-8	Butane	58.12	5.03			ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
124-38-9	Carbon Dioxide					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
75-15-0	Carbon disulfide	76.13	0.58	0.32	0.221	ND	0.221	WIAC	13.16	4.10E-02	4.51E-04	4.97E-04	0.99
630-08-0	Carbon monoxide	28.01	141			ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
56-23-5	Carbon tetrachloride*	153.84	0.004	0.007	<0.007*	ND	0.007	WIAC	0.42	2.62E-03	2.88E-05	3.18E-05	0.06
463-58-1	Carbonyl sulfide	60.07	0.49	0.183	0.183		0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
108-90-7	Chlorobenzene	112.56	0.25	0.227	0.227	ND	0.227	WIAC	13.52	6.22E-02	6.84E-04	7.54E-04	1.51
75-45-6	Chlorodifluoromethane*	86.47	1.3	0.355	0.355	ND	0.355	WIAC	21.14	7.48E-02	8.22E-04	9.06E-04	1.81
75-00-3	Chloroethane	64.52	1.25	0.239	0.448	ND	0.448	WIAC	26.67	7.04E-02	7.74E-04	8.53E-04	1.71
67-66-3	Chloroform	119.39	0.03	0.021	0.01	ND	0.01	WIAC	0.60	2.91E-03	3.20E-05	3.52E-05	0.07
74-87-3	Chloromethane	50.49	1.21	0.249	0.136	ND	0.136	WIAC	8.10	1.67E-02	1.84E-04	2.03E-04	0.41
156-59-2	cis-1,2 dichloroethene	96.94				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
98-82-8	cumene	120.19				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
110-82-7	cyclohexane	84.16				0.992	0.992	2023 LFG Testing	59.06	2.03E-01	2.24E-03	2.46E-03	4.93
124-48-1	Dibromochloromethane					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
75-71-8	Dichlorodifluoromethane*	120.91	15.7	1.751	0.964	ND	0.964	WIAC	57.40	2.84E-01	3.12E-03	3.44E-03	6.88
75-43-4	Dichlorofluoromethane*	102.92	2.62			ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
75-09-2	Dichloromethane	84.94	14.3	3.395	3.395	ND	3.395	WIAC	202.14	7.02E-01	7.72E-03	8.51E-03	17.02
115-10-6	dimethyl ether	46.07				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
77-78-1	Dimethyl sulfide	62.13	7.82	6.809	6.809		0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
74-84-0	Ethane	30.07	889	7.943	7.943		0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
64-17-5	Ethanol	46.08	27.2	118.618	64.425	57.5	57.5	2023 LFG Testing	3,423.62	6.45E+00	7.10E-02	7.82E-02	156.43
141-78-6	ethyl acetate	88.11				2.22	2.22	2023 LFG Testing	132.18	4.76E-01	5.24E-03	5.77E-03	11.55
75-08-1	Ethyl mercaptan	62.13	2.28	1.356	0.226		0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
100-41-4	Ethylbenzene	106.16	4.61	6.789	6.789	3.63	3.63	2023 LFG Testing	216.13	9.38E-01	1.03E-02	1.14E-02	22.75
75-69-4	Fluorotrichloromethane*	137.38	0.76	0.327	0.327	ND	0.327	WIAC	19.47	1.09E-01	1.20E-03	1.33E-03	2.65
142-82-5	heptane	100.21				1.66	1.66	2023 LFG Testing	98.84	4.05E-01	4.46E-03	4.91E-03	9.82
87-68-3	Hexachlorobutadiene					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
110-54-3	Hexane	86.18	6.57	2.324	2.063	0.924	20	WIAC	1,190.82	4.20E+00	4.62E-02	5.09E-02	101.76
7647-01-0	Hydrochloric Acid	36.5	42			ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
7783-06-4	Hydrogen sulfide*	34.08	35.5	23.578	23.578		300	Proposed BACT	17,862.36	2.49E+01	2.74E-01	3.02E-01	603.60
7439-97-6	Mercury (total)	200.61	0.000292				0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
67-56-1	methanol	32.04				19.9	19.9	2023 LFG Testing	1,184.87	1.55E+00	1.71E-02	1.88E-02	37.64
74-83-9	Methyl bromide (Bromomethane)*					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
78-93-3	Methyl ethyl ketone	72.11	7.09	10.557	12.694	13.9	13.9	2023 LFG Testing	827.62	2.44E+00	2.68E-02	2.96E-02	59.17
108-10-1	Methyl isobutyl ketone	100.16	1.87	0.75	0.75	1.14	1.14	2023 LFG Testing	67.88	2.78E-01	3.06E-03	3.37E-03	6.74
74-93-1	Methyl mercaptan	48.11	2.49	1.292	1.266		0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
1634-04-4	Methyl tert butyl ether					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
103-65-1	n-propyl benzene	120.2				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
95-47-6	o xylene	106.16				2.09	2.09	2023 LFG Testing	124.44	5.40E-01	5.94E-03	6.55E-03	13.10
1330-20-7	p,&m-Xylene	106.16	12.1	16.582	16.582	5.98	5.98	2023 LFG Testing	356.06	1.55E+00	1.70E-02	1.87E-02	37.48
127-18-4	Perchloroethylene (tetrachloroethylene)					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
109-66-0	Pentane	72.15	3.29	1.48E+01		ND	14.757	WIAC	878.65	2.59E+00	2.85E-02	3.14E-02	62.86
74-98-6	Propane	44.09	11.1	14.757	19.858	0	0	2023 LFG Testing	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
115-07-1	propene	42.08				16.5	16.5	2023 LFG Testing	982.43	1.69E+00	1.86E-02	2.05E-02	40.99
100-42-5	styrene	104.15				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
75-65-0	tertbutanol	74.12				ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
127-18-4	Tetrachloroethylene	165.83	3.73	1.193	1.193	ND	1.193	WIAC	71.03	4.82E-01	5.30E-03	5.84E-03	11.68
109-99-9	tetrahydrofuran	72.11				4.46	4.46	2023 LFG Testing	265.55	7.83E-01	8.61E-03	9.49E-03	18.99
108-88-3	Toluene	92.14	39.3	25.405	25.405	9.43	9.43	2023 LFG Testing	561.47	2.12E+00	2.33E-02	2.56E-02	51.30
156-60-5	trans-1,2-dichloroethene	96.94	2.84	0.051	0.051	ND	0.051	WIAC	3.04	1.20E-02	1.32E-04	1.46E-04	0.29
79-01-6	Trichloroethene	131.4	2.82	0.681	0.681	ND	0.681	WIAC	40.55	2.18E-01	2.40E-03	2.64E-03	5.28
593-60-2	Vinyl bromide					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
108-05-4	Vinyl acetate					ND	0	Non Detect	0.00	0.00E+00	0.00E+00	0.00E+00	0.00
75-01-4	Vinyl chloride	62.5	7.34	1.077	1.077	ND	1.077	WIAC	64.13	1.64E-01	1.80E-03	1.99E-03	3.97

* These toxics are considered ozone depleting substances.

TABLE 2: POTENTIAL TAP EMISSIONS PART 2

CAS #	Pollutant Common Name	Pollutant Alternate Name	MW (g/mol)	EF To Use (ppmv)	EF Source	Total Emissions (lb/yr)	HAP?	TAC?	Averaging Period	ASIL (μg/m³)	SQER (lb/averaging period)	De Minimis (lb/ averaging	Permanent Flare #4 Emission (lb/averaging period)	Permanent Flare #4 Emission (lb/averaging period)	Under deminimis?	Under SQER?
71-55-6	1,1,1-Trichloroethane	Methyl Chloroform	133.41	0.168	WIAC	1.32	Yes	Yes	24-hr	5000	370	19	0.003625199	0.003625199	UNDER	UNDER
79-34-5	1,1,2,2-Tetrachloroethane		167.85	0.005	WIAC	0.05	Yes	Yes	year	0.017	2.8	0.14	0.049547119	0.049547119	UNDER	UNDER
75-34-3	1,1-Dichloroethane	Ethylidene dichloride	98.97	0.741	WIAC	4.33	Yes	Yes	year	0.63	100	5.1	4.329610563	4.329610563	UNDER	UNDER
75-35-4	1,1-Dichloroethene	Vinylidene chloride, 1,1-dichl	96.94	0.092	WIAC	0.53	Yes	Yes	24-hr	200	15	0.74	0.001442531	0.001442531	UNDER	UNDER
107-06-2	1,2-Dichloroethane	Ethylene dichloride	98.96	0.12	WIAC	0.70	Yes	Yes	year	0.038	6.2	0.31	0.701080663	0.701080663	***OVER***	UNDER
78-87-5	1,2-Dichloropropane	Propylene dichloride	112.99	0.023	WIAC	0.15	Yes	Yes	year	0.1	16	0.81	0.153424565	0.153424565	UNDER	UNDER
67-63-0	2-Propanol	Isopropyl alcohol	60.11	13.1	2023 LFG Testing	46.49	No	Yes	1-hr	3200	5.9	0.3	0.005306901	0.005306901	UNDER	UNDER
67-64-1	Acetone		58.08	21.7	2023 LFG Testing	74.41	No	No					0.008493942	0.008493942		
107-13-1	Acrylonitrile		53.06	0.036	WIAC	0.11	Yes	Yes	year	0.0034	0.56	0.028	0.112770837	0.112770837	***OVER***	UNDER
71-43-2	Benzene	Benzene (No-Co Disposal/Ur	78.11	4.97	2023 LFG Testing	22.92	Yes	Yes	year	0.13	21	1	22.91870543	22.92	***OVER***	***OVER***
75-27-4	Bromodichloromethane		163.83	0.311	WIAC	3.01	No	Yes	year	0.027	4.4	0.22	3.008021087	3.01	***OVER***	UNDER
75-15-0	Carbon disulfide		76.13	0.221	WIAC	0.99	Yes	Yes	24-hr	800	59	3	0.002721337	0.002721337	UNDER	UNDER
56-23-5	Carbon tetrachloride		153.84	0.007	WIAC	0.06	Yes	Yes	year	0.17	27	1.4	0.063576171	0.063576171	UNDER	UNDER
463-58-1	Carbonyl sulfide	COS	60.07	0	2023 LFG Testing	0.00	Yes	Yes	24-hr	10	0.74	0.037	0	0	UNDER	UNDER
108-90-7	Chlorobenzene		112.56	0.227	WIAC	1.51	Yes	Yes	24-hr	1000	74	3.7	0.004132798	0.004132798	UNDER	UNDER
75-45-6	Chlorodifluoromethane		86.47	0.355	WIAC	1.81	No	Yes	24-hr	50000	3700	190	0.0049651	0.0049651	UNDER	UNDER
75-00-3	Chloroethane	Ethyl chloride	64.52	0.448	WIAC	1.71	Yes	Yes	24-hr	30000	2200	110	0.004675269	0.004675269	UNDER	UNDER
67-66-3	Chloroform		119.39	0.01	WIAC	0.07	Yes	Yes	year	0.043	7.1	0.35	0.070484725	0.070484725	UNDER	UNDER
74-87-3	Chloromethane	Methyl chloride	50.49	0.136	WIAC	0.41	Yes	Yes	24-hr	90	6.7	0.33	0.001110653	0.001110653	UNDER	UNDER
106-46-7	1,4-Dichlorobenzene	Dichlorobenzene, p-dichlorob	147	1.448	WIAC	12.57	Yes	Yes	year	0.091	15	0.74	12.56645999	12.57	***OVER***	UNDER
75-71-8	Dichlorodifluoromethane	Freon 12	120.91	0.964	WIAC	6.88	No	No					0.000785529	0.000785529		
75-09-2	Dichloromethane	Methylene chloride	84.94	3.395	WIAC	17.02	Yes	Yes	year	60	9800	490	17.02468525	17.02468525	UNDER	UNDER
77-78-1	Dimethyl sulfide	Methyl sulfide	62.13	0	2023 LFG Testing	0.00	Yes	No					0	0		
74-84-0	Ethane		30.07	0	2023 LFG Testing	0.00	No	No					0	0		
64-17-5	Ethanol		46.08	57.5	2023 LFG Testing	156.43	No	No					0.017856785	0.017856785		
75-08-1	Ethyl mercaptan	Ethanethiol	62.13	0	2023 LFG Testing	0.00	No	No					0	0		
100-41-4	Ethylbenzene		106.16	3.63	2023 LFG Testing	22.75	Yes	Yes	year	0.4	65	3.2	22.75069096	22.75	***OVER***	UNDER
106-93-4	1,2-Dibromoethane	EDB, Ethylene dibromide	187.88	0.005	WIAC	0.06	Yes	Yes	year	0.0017	0.27	0.014	0.055459712	0.055459712	***OVER***	UNDER
75-69-4	Fluorotrichloromethane	Freon 11, Trichlorofluorometh	137.38	0.327	WIAC	2.65	No	No					0.000302757	0.000302757		
110-54-3	Hexane		86.18	20	WIAC	101.76	Yes	Yes	24-hr	700	52	2.6	0.278785818	0.278785818	UNDER	UNDER
7783-06-4	Hydrogen sulfide		34.08	300	Proposed BACT	603.60	No	Yes	24-hr	2	0.15	0.0074	1.65369355	1.65	***OVER***	***OVER***
78-93-3	Methyl ethyl ketone	MEK	72.11	13.9	2023 LFG Testing	59.17	No	Yes	24-hr	5000	370	19	0.162122946	0.162122946	UNDER	UNDER
108-10-1	Methyl isobutyl ketone	MIBK	100.16	1.14	2023 LFG Testing	6.74	Yes	Yes	24-hr	3000	220	11	0.018468574	0.018468574	UNDER	UNDER
74-93-1	Methyl mercaptan		48.11	0	2023 LFG Testing	0.00	No	No					0	0		
127-18-4	Tetrachloroethylene	Perchloroethylene, Tetrachlo	165.83	0	Non Detect	11.68	Yes	Yes	year	0.16	27	1.3	11.67967076	11.68	***OVER***	UNDER
74-98-6	Propane		44.09	0	2023 LFG Testing	0.00	No	No					0	0		
108-88-3	Toluene	Toluene (No Co-Disposal/Ukr	92.14	9.43	2023 LFG Testing	51.30	Yes	Yes	24-hr	5000	370	19	0.140538105	0.140538105	UNDER	UNDER
156-60-5	trans-1,2-dichloroethene	t-1,2-dichloroethene, trans-1,	96.94	0.051	WIAC	0.29	No	Yes	24-hr	810	60	3	0.000799664	0.000799664	UNDER	UNDER
79-01-6	Trichloroethene	Trichloroethylene, TCE	131.4	0.681	WIAC	5.28	Yes	Yes	year	0.21	34	1.7	5.282865251	5.282865251	***OVER***	UNDER
75-01-4	Vinyl chloride		62.5	1.077	WIAC	3.97	Yes	Yes	year	0.11	18	0.92	3.973953461	3.973953461	***OVER***	UNDER
1330-20-7	p,&m-Xylene		106.16	5.98	2023 LFG Testing	37.48	Yes	No	24-hr	220	16	0.82	0.102682465	0.102682465	UNDER	UNDER
1016-97-8	Butane	n-Butane	58.12	0	Non Detect	0.00	No	No					0	0		
630-08-0	Carbon monoxide		28.01	0	Non Detect	0.00	No	Yes	1-hr	23000	43	1.1	0	0	UNDER	UNDER
75-43-4	Dichlorofluoromethane	Freon 21	102.92	0	Non Detect	0.00	No	No					0	0		
7439-97-6	Mercury (total)		200.61	0	2023 LFG Testing	0.00	Yes	Yes	24-hr	0.03	0.0022	0.00011	0	0	UNDER	UNDER
109-66-0	Pentane		72.15	14.757	WIAC	62.86	No	No					0.007175586	0.007175586		
124-38-9	Carbon Dioxide			0	Non Detect	0.00	No	No					0	0		
7647-01-0	Hydrochloric Acid		36.5	0	Non Detect	0.00	Yes	Yes	24-hr	9	0.67	0.033	0	0	UNDER	UNDER
115-07-1	propene		42.08	16.5	2023 LFG Testing	40.99	No	Yes	24-hr	3000	220	11	0.112303649	0.112303649	UNDER	UNDER
67-56-1	methanol		32.04	19.9	2023 LFG Testing	37.64	Yes	Yes	24-hr	20000	1500	74	0.103128755	0.103128755	UNDER	UNDER
156-59-2	cis-1,2 dichloroethene		96.94	0	Non Detect	0.00	No	No					0	0		
141-78-6	ethyl acetate		88.11	2.22	2023 LFG Testing	11.55	No	No					0.00131826	0.00131826		
109-99-9	tetrahydrofuran		72.11	4.46	2023 LFG Testing	18.99	No	Yes	24-hr	2000	150	7.4	0.052019305	0.052019305	UNDER	UNDER
110-82-7	cyclohexane		84.16	0.992	2023 LFG Testing	4.93	No	Yes	24-hr	6000	440	22	0.013503663	0.013503663	UNDER	UNDER
540-84-1	2,2,4 trimethyl pentane		114.23	0	Non Detect	0.00	Yes	No					0	0		
142-82-5	heptane		100.21	1.66	2023 LFG Testing	9.82	No	No					0.001121094	0.001121094		
100-42-5	styrene		104.15	0	Non Detect	0.00	Yes	Yes	24-hr	870	65	3.2	0	0	UNDER	UNDER
95-47-6	o xylene		106.16	2.09	2023 LFG Testing	13.10	Yes	Yes	24-hr	220	16	0.82	0.03588735	0.03588735	UNDER	UNDER
108-67-8	1,3,5 trimethylbenzene		120.19	0	Non Detect	0.00	No	Yes	24-hr	60	4.4	0.22	0	0	UNDER	UNDER
95-63-6	1,2,4 trimethylbenzene		120.19	0	Non Detect	0.00	No	Yes	24-hr	60	4.4	0.22	0	0	UNDER	UNDER
115-10-6	dimethyl ether		46.07	0	Non Detect	0.00	No	No					0	0		
75-69-4	trichlorofluoromethane		137.37	0.327	WIAC	2.65	No	No					0.000302757	0.000302757		
75-65-0	tertbutanol		74.12	0	Non Detect	0.00	No	No					0	0		
591-78-6	2-hexanone		100.16	0	Non Detect	0.00	No	Yes	24-hr	30	2.2	0.11	0	0	UNDER	UNDER
98-82-8	cumene		120.19	0	Non Detect	0.00	Yes	Yes	24-hr	400	30	1.5	0	0	UNDER	UNDER
80-56-8	a-pinene		136.23	0	Non Detect	0.00	No	No					0	0		
103-65-1	n-propyl benzene		120.2	0	Non Detect	0.00	No	No					0	0		
622-96-8	4-ethyltoluene		120.19	0	Non Detect	0.00	No	No					0	0		
18172-67-3	b-pinene		136.23	0	Non Detect	0.00	No	No					0	0		

Attachment E – Model Outputs

LRI NOC Application - 4000 scfm Permanent Flare

AERSCREEN Pollutant Summary						
Pollutant Common Name	Total Emissions (lb/yr)	Total Emissions (lb/hr)	Averaging Period	ASIL (ug/m^3)	AERSCREEN concentration (ug/m^3)	Under ASIL?
					Permanent Flare (1 hr concentration)	
Benzene	22.92	0.00262	Year	0.13	0.002992	**Yes**
Hydrogen Sulfide	603.6	0.0689	24-h	2	0.0794	**Yes**

*Nearest property boundary is approximately 150 meters from the flare. AERSCREEN raw output files are attached in the following pages.

```
AERSCREEN 21112 / AERMOD 22112                                         10/24/23
                                                                       15:13:59

TITLE: Benzene Emissions


------------------------------------------------------------------------------
****************************  STACK PARAMETERS  ***************************
------------------------------------------------------------------------------

SOURCE EMISSION RATE:          0.328E-03 g/s             0.260E-02 lb/hr
STACK HEIGHT:                      15.24 meters              50.00 feet
STACK INNER DIAMETER:              3.658 meters             144.00 inches
PLUME EXIT TEMPERATURE:           1158.2 K                  1625.0 Deg F
PLUME EXIT VELOCITY:              18.288 m/s                 60.00 ft/s
STACK AIR FLOW RATE:              407152 ACFM
RURAL OR URBAN:                    RURAL

INITIAL PROBE DISTANCE =           5000. meters             16404. feet



------------------------------------------------------------------------------
**********************  BUILDING DOWNWASH PARAMETERS  *********************
------------------------------------------------------------------------------

         NO BUILDING DOWNWASH HAS BEEN REQUESTED FOR THIS ANALYSIS


**************************  PROBE ANALYSIS  **************************
                 25 meter receptor spacing: 1. meters - 5000. meters


     Zo       ROUGHNESS       1-HR CONC   DIST      TEMPORAL
     SECTOR     LENGTH         (ug/m3)     (m)       PERIOD
     ----------------------------------------------------------------------
      1*         0.200       0.3292E-02   200.0      SUM
* = worst case flow sector



------------------------------------------------------------------------------
*********************  MAKEMET METEOROLOGY PARAMETERS  ********************
------------------------------------------------------------------------------

MIN/MAX TEMPERATURE:    276.5 / 299.8 (K)

MINIMUM WIND SPEED:       1.4 m/s
```

ANEMOMETER HEIGHT: 10.000 meters

SURFACE CHARACTERISTICS INPUT: AERMET SEASONAL TABLES

DOMINANT SURFACE PROFILE: Cultivated Land
DOMINANT CLIMATE TYPE: Average Moisture
DOMINANT SEASON: Summer

ALBEDO: 0.20
BOWEN RATIO: 0.50
ROUGHNESS LENGTH: 0.200 (meters)

SURFACE FRICTION VELOCITY (U*) NOT ADUSTED

METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT

YR	MO	DY	JDY	HR
10	03	25	25	01

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
-9.73	1.840	-9.000	0.020	-999.	4000.	8888.0	0.200	0.50	0.20	18.00

HT	REF TA	HT
10.0	299.8	2.0

WIND SPEED AT STACK HEIGHT (non-downwash): 20.0 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT: 11.0 meters
ESTIMATED FINAL PLUME RISE (non-downwash): 12.0 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash): 23.0 meters

METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT

YR	MO	DY	JDY	HR
10	01	06	25	12

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
18.18	0.127	0.300	0.020	55.	104.	-10.4	0.030	0.30	0.14	1.50

HT	REF TA	HT
10.0	299.8	2.0

WIND SPEED AT STACK HEIGHT (non-downwash): 1.6 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT: 15.2 meters
ESTIMATED FINAL PLUME RISE (non-downwash): 966.7 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash): 982.0 meters

********************** AERSCREEN AUTOMATED DISTANCES ********************

OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE

DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	DIST (m)	MAXIMUM 1-HR CONC (ug/m3)
1.00	0.2917E-04	2525.00	0.3548E-03
25.00	0.5953E-04	2550.00	0.3565E-03
50.00	0.1332E-03	2575.00	0.3580E-03
75.00	0.1878E-03	2600.00	0.3595E-03
100.00	0.6998E-03	2625.00	0.3609E-03
125.00	0.1853E-02	2650.00	0.3622E-03
150.00	0.2992E-02	2675.00	0.3635E-03
175.00	0.3285E-02	2700.00	0.3646E-03
200.00	0.3292E-02	2725.00	0.3657E-03
225.00	0.3142E-02	2750.00	0.3667E-03
250.00	0.2920E-02	2775.00	0.3677E-03
275.00	0.2677E-02	2800.00	0.3686E-03
300.00	0.2436E-02	2825.00	0.3694E-03
325.00	0.2210E-02	2850.00	0.3701E-03
350.00	0.2004E-02	2875.00	0.3708E-03
375.00	0.1819E-02	2900.00	0.3714E-03
400.00	0.1779E-02	2925.00	0.3720E-03
425.00	0.1732E-02	2950.00	0.3725E-03
450.00	0.1675E-02	2975.00	0.3730E-03
475.00	0.1610E-02	3000.00	0.3734E-03
500.00	0.1542E-02	3025.00	0.3737E-03
525.00	0.1474E-02	3050.00	0.3740E-03
550.00	0.1408E-02	3075.00	0.3743E-03
575.00	0.1344E-02	3100.00	0.3745E-03
600.00	0.1281E-02	3125.00	0.3747E-03
625.00	0.1230E-02	3150.00	0.3748E-03
650.00	0.1185E-02	3175.00	0.3749E-03
675.00	0.1143E-02	3200.00	0.3750E-03
700.00	0.1102E-02	3225.00	0.3750E-03
725.00	0.1062E-02	3250.00	0.3750E-03
750.00	0.1023E-02	3275.00	0.3749E-03
775.00	0.9845E-03	3300.00	0.3749E-03

800.00	0.9476E-03	3325.00	0.3748E-03
825.00	0.9121E-03	3350.00	0.3746E-03
850.00	0.8780E-03	3375.00	0.3744E-03
875.00	0.8452E-03	3400.00	0.3742E-03
900.00	0.8246E-03	3425.00	0.3740E-03
925.00	0.8058E-03	3450.00	0.3738E-03
950.00	0.7869E-03	3475.00	0.3735E-03
975.00	0.7679E-03	3500.00	0.3732E-03
1000.00	0.7490E-03	3525.00	0.3729E-03
1025.00	0.7310E-03	3550.00	0.3726E-03
1050.00	0.7147E-03	3575.00	0.3722E-03
1075.00	0.6986E-03	3600.00	0.3718E-03
1100.00	0.6830E-03	3625.00	0.3714E-03
1125.00	0.6677E-03	3650.00	0.3710E-03
1150.00	0.6526E-03	3675.00	0.3706E-03
1175.00	0.6377E-03	3700.00	0.3701E-03
1200.00	0.6231E-03	3725.00	0.3696E-03
1225.00	0.6088E-03	3750.00	0.3692E-03
1250.00	0.5948E-03	3775.00	0.3687E-03
1275.00	0.5812E-03	3800.00	0.3682E-03
1300.00	0.5678E-03	3825.00	0.3676E-03
1325.00	0.5548E-03	3850.00	0.3671E-03
1350.00	0.5422E-03	3875.00	0.3665E-03
1375.00	0.5298E-03	3900.00	0.3660E-03
1400.00	0.5178E-03	3925.00	0.3654E-03
1425.00	0.5062E-03	3950.00	0.3648E-03
1450.00	0.4950E-03	3975.00	0.3642E-03
1475.00	0.4844E-03	4000.00	0.3636E-03
1500.00	0.4741E-03	4025.00	0.3630E-03
1525.00	0.4641E-03	4050.00	0.3624E-03
1550.00	0.4543E-03	4075.00	0.3618E-03
1575.00	0.4448E-03	4100.00	0.3611E-03
1600.00	0.4356E-03	4125.00	0.3605E-03
1625.00	0.4266E-03	4150.00	0.3598E-03
1650.00	0.4179E-03	4175.00	0.3591E-03
1675.00	0.4094E-03	4200.00	0.3585E-03
1700.00	0.4011E-03	4225.00	0.3578E-03
1725.00	0.3931E-03	4250.00	0.3571E-03
1750.00	0.3853E-03	4275.00	0.3564E-03
1775.00	0.3777E-03	4300.00	0.3557E-03
1800.00	0.3703E-03	4325.00	0.3550E-03
1825.00	0.3652E-03	4350.00	0.3543E-03
1850.00	0.3655E-03	4375.00	0.3536E-03
1875.00	0.3658E-03	4400.00	0.3529E-03
1900.00	0.3659E-03	4425.00	0.3521E-03
1925.00	0.3660E-03	4450.00	0.3514E-03
1950.00	0.3661E-03	4475.00	0.3506E-03
1975.00	0.3660E-03	4500.00	0.3499E-03
2000.00	0.3659E-03	4525.00	0.3491E-03
2025.00	0.3657E-03	4550.00	0.3483E-03

2050.00	0.3654E-03	4575.00	0.3475E-03
2075.00	0.3651E-03	4600.00	0.3468E-03
2100.00	0.3647E-03	4625.00	0.3460E-03
2125.00	0.3643E-03	4650.00	0.3452E-03
2150.00	0.3638E-03	4675.00	0.3444E-03
2175.00	0.3632E-03	4700.00	0.3435E-03
2200.00	0.3627E-03	4725.00	0.3427E-03
2225.00	0.3620E-03	4750.00	0.3419E-03
2250.00	0.3613E-03	4775.00	0.3411E-03
2275.00	0.3606E-03	4800.00	0.3403E-03
2300.00	0.3599E-03	4825.00	0.3394E-03
2325.00	0.3591E-03	4850.00	0.3386E-03
2350.00	0.3583E-03	4875.00	0.3377E-03
2375.00	0.3574E-03	4900.00	0.3367E-03
2400.00	0.3565E-03	4925.00	0.3357E-03
2425.00	0.3556E-03	4950.00	0.3348E-03
2450.00	0.3546E-03	4975.00	0.3338E-03
2475.00	0.3536E-03	5000.00	0.3329E-03
2500.00	0.3530E-03		

********************* AERSCREEN MAXIMUM IMPACT SUMMARY ********************

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
FLAT TERRAIN	0.3315E-02	0.3315E-02	0.2983E-02	0.1989E-02	0.3315E-03

DISTANCE FROM SOURCE 188.00 meters

IMPACT AT THE AMBIENT BOUNDARY	0.2917E-04	0.2917E-04	0.2625E-04	0.1750E-04	0.2917E-05

DISTANCE FROM SOURCE 1.00 meters

AERSCREEN 21112 / AERMOD 22112 10/24/23
15:08:05

TITLE: H2S Emissions

*************************** STACK PARAMETERS ***************************

SOURCE EMISSION RATE:	0.869E-02 g/s	0.690E-01 lb/hr
STACK HEIGHT:	15.24 meters	50.00 feet
STACK INNER DIAMETER:	3.658 meters	144.00 inches
PLUME EXIT TEMPERATURE:	1158.2 K	1625.0 Deg F
PLUME EXIT VELOCITY:	18.288 m/s	60.00 ft/s
STACK AIR FLOW RATE:	407152 ACFM	
RURAL OR URBAN:	RURAL	
INITIAL PROBE DISTANCE =	5000. meters	16404. feet

********************** BUILDING DOWNWASH PARAMETERS **********************

NO BUILDING DOWNWASH HAS BEEN REQUESTED FOR THIS ANALYSIS

************************* PROBE ANALYSIS **************************
25 meter receptor spacing: 1. meters - 5000. meters

Zo SECTOR	ROUGHNESS LENGTH	1-HR CONC (ug/m3)	DIST (m)	TEMPORAL PERIOD
1*	0.200	0.8736E-01	200.0	SUM

* = worst case flow sector

********************* MAKEMET METEOROLOGY PARAMETERS *********************

MIN/MAX TEMPERATURE: 276.5 / 299.8 (K)

MINIMUM WIND SPEED: 1.4 m/s

ANEMOMETER HEIGHT: 10.000 meters

SURFACE CHARACTERISTICS INPUT: AERMET SEASONAL TABLES

DOMINANT SURFACE PROFILE: Cultivated Land
DOMINANT CLIMATE TYPE: Average Moisture
DOMINANT SEASON: Summer

ALBEDO: 0.20
BOWEN RATIO: 0.50
ROUGHNESS LENGTH: 0.200 (meters)

SURFACE FRICTION VELOCITY (U*) NOT ADUSTED

METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT

YR	MO	DY	JDY	HR
10	03	25	25	01

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
-9.73	1.840	-9.000	0.020	-999.	4000.	8888.0	0.200	0.50	0.20	18.00

HT	REF TA	HT
10.0	299.8	2.0

WIND SPEED AT STACK HEIGHT (non-downwash):   20.0 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT: 11.0 meters
ESTIMATED FINAL PLUME RISE (non-downwash):   12.0 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash):   23.0 meters

METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT

YR	MO	DY	JDY	HR
10	01	06	25	12

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
18.18	0.127	0.300	0.020	55.	104.	-10.4	0.030	0.30	0.14	1.50

HT	REF TA	HT
10.0	299.8	2.0

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WIND SPEED AT STACK HEIGHT (non-downwash):        1.6 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT:        15.2 meters
ESTIMATED FINAL PLUME RISE (non-downwash):      966.7 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash):    982.0 meters
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-----------------------------------------------------------------------------
*********************** AERSCREEN AUTOMATED DISTANCES ********************
                  OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE
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DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	DIST (m)	MAXIMUM 1-HR CONC (ug/m3)
1.00	0.7741E-03	2525.00	0.9416E-02
25.00	0.1580E-02	2550.00	0.9460E-02
50.00	0.3535E-02	2575.00	0.9502E-02
75.00	0.4983E-02	2600.00	0.9541E-02
100.00	0.1857E-01	2625.00	0.9578E-02
125.00	0.4918E-01	2650.00	0.9613E-02
150.00	0.7940E-01	2675.00	0.9646E-02
175.00	0.8717E-01	2700.00	0.9677E-02
200.00	0.8736E-01	2725.00	0.9706E-02
225.00	0.8338E-01	2750.00	0.9733E-02
250.00	0.7749E-01	2775.00	0.9758E-02
275.00	0.7104E-01	2800.00	0.9781E-02
300.00	0.6465E-01	2825.00	0.9803E-02
325.00	0.5866E-01	2850.00	0.9822E-02
350.00	0.5319E-01	2875.00	0.9841E-02
375.00	0.4828E-01	2900.00	0.9857E-02
400.00	0.4720E-01	2925.00	0.9872E-02
425.00	0.4597E-01	2950.00	0.9886E-02
450.00	0.4444E-01	2975.00	0.9898E-02
475.00	0.4273E-01	3000.00	0.9909E-02
500.00	0.4093E-01	3025.00	0.9918E-02
525.00	0.3911E-01	3050.00	0.9926E-02
550.00	0.3737E-01	3075.00	0.9933E-02
575.00	0.3566E-01	3100.00	0.9939E-02
600.00	0.3399E-01	3125.00	0.9944E-02
625.00	0.3265E-01	3150.00	0.9947E-02
650.00	0.3146E-01	3175.00	0.9950E-02
675.00	0.3035E-01	3200.00	0.9951E-02
700.00	0.2926E-01	3225.00	0.9952E-02
725.00	0.2818E-01	3250.00	0.9952E-02
750.00	0.2714E-01	3275.00	0.9950E-02
775.00	0.2613E-01	3300.00	0.9948E-02

800.00	0.2515E-01	3325.00	0.9945E-02
825.00	0.2421E-01	3350.00	0.9942E-02
850.00	0.2330E-01	3375.00	0.9937E-02
875.00	0.2243E-01	3400.00	0.9932E-02
900.00	0.2188E-01	3425.00	0.9926E-02
925.00	0.2139E-01	3450.00	0.9920E-02
950.00	0.2088E-01	3475.00	0.9912E-02
975.00	0.2038E-01	3500.00	0.9904E-02
1000.00	0.1988E-01	3525.00	0.9896E-02
1025.00	0.1940E-01	3550.00	0.9887E-02
1050.00	0.1897E-01	3575.00	0.9877E-02
1075.00	0.1854E-01	3600.00	0.9867E-02
1100.00	0.1813E-01	3625.00	0.9857E-02
1125.00	0.1772E-01	3650.00	0.9846E-02
1150.00	0.1732E-01	3675.00	0.9834E-02
1175.00	0.1692E-01	3700.00	0.9822E-02
1200.00	0.1654E-01	3725.00	0.9810E-02
1225.00	0.1616E-01	3750.00	0.9797E-02
1250.00	0.1579E-01	3775.00	0.9784E-02
1275.00	0.1542E-01	3800.00	0.9770E-02
1300.00	0.1507E-01	3825.00	0.9756E-02
1325.00	0.1472E-01	3850.00	0.9742E-02
1350.00	0.1439E-01	3875.00	0.9728E-02
1375.00	0.1406E-01	3900.00	0.9713E-02
1400.00	0.1374E-01	3925.00	0.9697E-02
1425.00	0.1343E-01	3950.00	0.9682E-02
1450.00	0.1314E-01	3975.00	0.9666E-02
1475.00	0.1285E-01	4000.00	0.9650E-02
1500.00	0.1258E-01	4025.00	0.9634E-02
1525.00	0.1232E-01	4050.00	0.9617E-02
1550.00	0.1206E-01	4075.00	0.9600E-02
1575.00	0.1181E-01	4100.00	0.9583E-02
1600.00	0.1156E-01	4125.00	0.9566E-02
1625.00	0.1132E-01	4150.00	0.9549E-02
1650.00	0.1109E-01	4175.00	0.9531E-02
1675.00	0.1086E-01	4200.00	0.9513E-02
1700.00	0.1065E-01	4225.00	0.9495E-02
1725.00	0.1043E-01	4250.00	0.9477E-02
1750.00	0.1022E-01	4275.00	0.9459E-02
1775.00	0.1002E-01	4300.00	0.9441E-02
1800.00	0.9827E-02	4325.00	0.9422E-02
1825.00	0.9691E-02	4350.00	0.9403E-02
1850.00	0.9700E-02	4375.00	0.9384E-02
1875.00	0.9707E-02	4400.00	0.9364E-02
1900.00	0.9712E-02	4425.00	0.9345E-02
1925.00	0.9714E-02	4450.00	0.9325E-02
1950.00	0.9715E-02	4475.00	0.9305E-02
1975.00	0.9713E-02	4500.00	0.9285E-02
2000.00	0.9710E-02	4525.00	0.9265E-02
2025.00	0.9704E-02	4550.00	0.9244E-02

2050.00	0.9697E-02	4575.00	0.9223E-02
2075.00	0.9689E-02	4600.00	0.9202E-02
2100.00	0.9679E-02	4625.00	0.9181E-02
2125.00	0.9667E-02	4650.00	0.9160E-02
2150.00	0.9654E-02	4675.00	0.9139E-02
2175.00	0.9640E-02	4700.00	0.9117E-02
2200.00	0.9624E-02	4725.00	0.9095E-02
2225.00	0.9607E-02	4750.00	0.9074E-02
2250.00	0.9590E-02	4775.00	0.9052E-02
2275.00	0.9571E-02	4800.00	0.9030E-02
2300.00	0.9551E-02	4825.00	0.9008E-02
2325.00	0.9530E-02	4850.00	0.8986E-02
2350.00	0.9508E-02	4875.00	0.8961E-02
2375.00	0.9485E-02	4900.00	0.8936E-02
2400.00	0.9461E-02	4925.00	0.8910E-02
2425.00	0.9437E-02	4950.00	0.8885E-02
2450.00	0.9411E-02	4975.00	0.8860E-02
2475.00	0.9385E-02	5000.00	0.8835E-02
2500.00	0.9369E-02		

********************* AERSCREEN MAXIMUM IMPACT SUMMARY ********************

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
FLAT TERRAIN	0.8797E-01	0.8797E-01	0.7918E-01	0.5278E-01	0.8797E-02

DISTANCE FROM SOURCE 188.00 meters

IMPACT AT THE AMBIENT BOUNDARY	0.7741E-03	0.7741E-03	0.6967E-03	0.4645E-03	0.7741E-04

DISTANCE FROM SOURCE 1.00 meters

Attachment F – PSD Applicability

PSD APPLICABILITY ANALYSIS

LRI is proposing to install an enclosed flare with a nominal capacity of 4000 SCFM, to be known as Flare #4. After a shakedown period for Flare #4, LRI will permanently remove from service Flare #3, which is a temporary, open flare with nominal capacity of 2200 SCFM. Landfill gas will be treated in an H2S scrubbing system upstream of Flare # 4 to minimize formation of SO2 in the flare. Following the project, LRI will operate a GCCS that comprises wells; gas piping; an H_2S treatment system; an enclosed flare with a nominal capacity of 3000 SCFM, known as Flare #1; and Flare #4.

The LRI stationary source is a municipal solid waste landfill. This type of stationary source is not among the listed categories at 40 CFR § 52.21(b)(1)(i)(*a*), incorporated by reference at WAC 173-400-720(4)(a)(vi), and thus it is not subject to the major stationary source threshold of 100 tons per year (tpy). It also is not among the listed categories at 40 CFR § 52.21(b)(1)(iii), incorporated by reference at WAC 173-400-720(4)(a)(vi), and thus it is not subject to the requirement to count fugitive emissions when making the major stationary source determination. Therefore, for the LRI stationary source, the applicable threshold for determining whether the facility is a major stationary source is 250 tpy and fugitive emissions are not counted in quantifying the facility's potential to emit for purposes of this determination.

As shown in Table 1, the maximum capacity of the existing LRI facility to emit regulated NSR pollutants other than SO_2, excluding fugitive emissions, is less than 250 tpy for each pollutant on a facility-wide basis.

Table 1. Potential to Emit of Existing LRI Stationary Source (tpy)

	Flare #1 (tpy)	Flare #3 (tpy)	Site Total (tpy)
Non-Methane Organic Compounds (NMOC)	0.3	2.1	2.4
Volatile Organic Compounds (VOC)	0.3	2.1	2.4
Carbon Monoxide (CO)	75.1	116.3	191.4
Nitrogen Oxides (NO_X)	22.5	25.5	48.0
Particulate Matter < 10 μm (PM10)	0.4	6.6	7.1
Particulate Matter < 2.5 μm (PM2.5)	0.4	6.6	7.1
Hydrogen Sulfide (H_2S)	0.2	0.2	0.4
Reduced Sulfur Compounds (RSC)	39.0	29.0	68.0
Total Reduced Sulfur as SO_2 Equivalent (TRS)	39.0	29.0	68.0

In the BACT analysis for this application, LRI proposes that PSCAA limit the concentration of sulfur compounds in the landfill gas to 300 ppmv (as H2S) on a rolling 12-month average. See Attachment G. LRI proposes that that limit apply to all LFG combusted in Flares #1, #3, and #4. This limit will have the effect of constraining the existing facility's non-fugitive emissions of SO_2 to 67.0 tpy (based on the combustion capacity of Flare #1 and Flare #3).[1] LRI will not begin actual construction of Flare #4 until after these limits take effect.

Table 1 shows that the PTE of the existing facility for each regulated NSR pollutant other than SO2 is less than 250 tpy. Prior to beginning actual construction, upon issuance of the approval order for Flare #4, the PTE of the existing facility will be less than 250 tpy for all regulated NSR pollutants. Thus, at the time LRI begins actual construction of the proposed physical changes, the existing LRI stationary source will have potential to emit less than 250 tpy for each regulated NSR pollutant and will be a non-major stationary source.

Table 2 below shows that upon issuance of the proposed approval order the PTE of Flare #4 will be less than 250 tpy for each regulated NSR pollutant. Because the installation of Flare #4 will occur at a non-major stationary source, and the potential to emit of Flare #4 by itself will be less than the 250 tpy threshold for defining a major stationary source, Flare #4 will not be subject to PSD permitting requirements. This is explained with citations to the PSD rule in the following paragraphs.

The preconstruction permitting requirements of the PSD program are applied through a straightforward prohibition: As provided by 40 CFR § 52.21(a)(2)(iii), incorporated by reference at WAC 173-400-720(4)(a)(vi), a person shall not begin actual construction of a new major stationary source or a major modification without first obtaining a PSD permit.

As provided by 40 CFR § 52.21(b)(2), incorporated by reference at WAC 173-400-720(4)(a)(vi), a physical change is a major modification only if it occurs at an existing major stationary source. Because the LRI stationary source will be a non-major stationary source at the time of actual construction of the proposed physical changes, those changes cannot be a major modification.

As provided by 40 CFR § 52.21(b)(1)(i)(*c*), incorporated by reference at WAC 173-400-720(4)(a)(vi), a physical change at an existing non-major stationary source is treated as a major stationary source, and is potentially subject to the prohibition on beginning actual construction, "if the change would constitute a major stationary source by itself." This is the pertinent applicability test for the proposed physical changes, i.e., construction of Flare #4 and associated ancillary equipment. Importantly, PSD applicability is based on the stationary source's status as major or non-major *as of the date on which actual construction of the physical change begins*; the status at the time of NOC application submittal is immaterial.

As described by U.S. EPA in the PSD Workshop Manual, if the existing stationary source is non-major at the time actual construction begins, then the only other pertinent fact is the potential to emit of the physical change.

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[1] In NOC #12301 LRI requested that PSCAA impose enforceable terms in the approval order for Flare #3 such that the existing facility's non-fugitive emissions of SO_2 would be constrained to less than 250 tpy. As of the date of this NOC application for Flare #4, PSCAA has not acted upon NOC # 12301. This application proposes the same control system and BACT limit for control of SO_2 from all of the flares at the landfill, including Flare #4.

Emission increases at existing nonmajor (or minor) sources must also be examined for applicability to PSD review. In such instances, the emission increase or potential to emit for each pollutant from only the modification is compared against the 100/250 criterion. An increase in emissions of any pollutant equaling or exceeding the 100/250 criterion constitutes a major stationary source subject to PSD review, even though the existing source is not major when the modification is proposed.

For example, an applicant might propose to increase the emissions of an existing PSD-listed source with the potential to emit of 70 tons per year by 150 tons per year of a regulated pollutant. This modification would be subject to PSD review. Were the source to propose a modification that would only increase emissions of that pollutant by 80 tons per year, the modification would not be subject to PSD review. The modification would, however, create a major stationary source with a potential to emit of 150 tons per year. Subsequent modifications to this source would be scrutinized as modifications to a major stationary source as discussed previously.[2]

Here, as shown in Table 2, LRI is proposing to remain a non-major stationary source even after implementation of the proposed Flare 4 physical changes.

Table 2. Potential to Emit of LRI Stationary Source with Flare 4 (tpy)[3]

	Flare 1 (tpy)	Flare 4 (tpy)	Site Total (tpy)
Non-Methane Organic Compounds (NMOC)	0.3	1.5	1.8
Volatile Organic Compounds (VOC)	0.3	1.5	1.8
Carbon Monoxide (CO)	75.1	75.1	150.2
Nitrogen Oxides (NO_X)	22.5	30.0	52.5
Sulfur Dioxide (SO_2)	38.6	51.6	90.2
Particulate Matter < 10 µm (PM10)	0.4	0.6	1.0
Particulate Matter < 2.5 µm (PM2.5)	0.4	0.6	1.0
Hydrogen Sulfide (H_2S)	0.2	0.3	0.5
Reduced Sulfur Compounds (RSC)	39.0	52.0	91.0
Total Reduced Sulfur as SO_2 Equivalent (TRS)	39.0	52.0	91.0

[2] PSD Workshop Manual (EPA-450/2-80-081)(Oct. 1980) at I-A-20.

[3] Attachment D, Emissions Calculations, shows the derivation of each of these numbers.

As shown in Table-3, as a result of the installation of Flare #4, the stationary source's potential to emit will increase by an amount that is far less than the major stationary source threshold of 250 tpy for each regulated NSR pollutant. Therefore, it is readily apparent that the physical changes are not a major stationary source and are not subject to PSD review.

Table 3. Increase in Potential to Emit of LRI Stationary Source (tpy)

	Total PTE Before Flare #4	Total PTE With Flare #4	Total Change in PTE
Non-Methane Organic Compounds (NMOC)	2.4	1.8	-0.6
Volatile Organic Compounds (VOC)	2.4	1.8	-0.6
Carbon Monoxide (CO)	191.4	150.2	-41.2
Nitrogen Oxides (NO_X)	48.0	52.5	4.5
Sulfur Dioxide (SO_2)	67.0	90.2	23.2
Particulate Matter < 10 µm (PM10)	7.1	1.0	6.1
Particulate Matter < 2.5 µm (PM2.5)	7.1	1.0	6.1
Hydrogen Sulfide (H_2S)	0.4	0.5	0.1
Reduced Sulfur Compounds (RSC)	68.0	91.0	23.0
Total Reduced Sulfur as SO_2 Equivalent (TRS)	68.0	91.0	23.0

Attachment G – BACT Analysis

SCS ENGINEERS






BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS
LRI 304th Street Landfill
Graham, Washington

Presented to:

LRI 304th Street Landfill
30919 Meridian St. E
Graham, WA 98338

Presented by:

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October 2023
File No. 04222001.23

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Appendices

1 INTRODUCTION

On behalf of LRI 304th Street Landfill (LRI or LRI Landfill), SCS Engineers (SCS) has developed the following analysis supporting a Best Available Control Technology (BACT) determination for control of the pollutants not under the exemption levels described in Washington Administrative Code (WAC) 173-400-110, Table 110(5). The Table below shows the pollutants exceeding these exemption levels and the total potential to emit (PTE) from LRI at 4,000 standard cubic feet per minute (scfm) of landfill gas (LFG) through the new proposed enclosed permanent flare (Flare #4).

Pollutants Summary

Pollutant	Exemption Level		Facility PTE[1] at 4,000 scfm		Over Exemption Level?
Carbon monoxide	5	ton/yr	75.1	ton/yr	YES
Lead	0.005	ton/yr	0	ton/yr	NO
Nitrogen oxides	2	ton/yr	30	ton/yr	YES
PM-10	0.75	ton/yr	0.6	ton/yr	NO
Sulfur dioxide	2	ton/yr	52	ton/yr	YES
Volatile Organic Compounds, total	2	ton/yr	0.6	ton/yr	NO
Toxic Air Pollutants	The de minimis emission rate specified for each TAP in WAC 173-460-150.				
1,2-Dichloroethane	0.31	lb/yr	0.70	lb/yr	YES
Acrylonitrile	0.028	lb/yr	0.11	lb/yr	YES
Benzene	1	lb/yr	22.92	lb/yr	YES
Bromodichloromethane	0.22	lb/yr	3.01	lb/yr	YES
1,4-Dichlorobenzene	0.74	lb/yr	12.57	lb/yr	YES
Ethylbenzene	3.2	lb/yr	22.75	lb/yr	YES
1,2-Dibromoethane	0.014	lb/yr	0.06	lb/yr	YES
Tetrachloroethylene	1.3	lb/yr	11.68	lb/yr	YES
Trichloroethene	1.7	lb/yr	5.28	lb/yr	YES
Vinyl chloride	0.92	lb/yr	3.97	lb/yr	YES

All of the above pollutants exceed the exemption level except for lead, PM-10 and volatile organic compounds (VOC) and thus need to be addressed for New Source Review (NSR).

As stated in Regulation I Section 6.01, PSCAA adopts by reference and enforces the Washington Department of Ecology (Ecology) definition of BACT:

[1] Refer to Attachment D: Emission Calculations for derivation of emission values.

WAC 173-400-030(13) - "Best available control technology (BACT)" means an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall the application of the "best available control technology" result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard under 40 C.F.R. Part 60 and Part 61. Emissions from any source utilizing clean fuels, or any other means, to comply with this paragraph shall not be allowed to increase above levels that would have been required under the definition of BACT in the federal Clean Air Act as it existed prior to enactment of the Clean Air Act Amendments of 1990.

BACT is triggered for Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Nitrogen Oxides (NO_X), and specific toxic air pollutants (TAPs) given the exemption levels in Table 110(5). For Flare #4, the following limits are requested, which can be justified as BACT for each pollutant:

- SO_2 limit of 300 ppmv (parts per million by volume) Hydrogen Sulfide (H_2S) on a rolling 12-month average in the LFG prior to combustion in the permanent flare based on an average of H_2S concentration tests using American Society for Testing and Materials (ASTM) Method D-5504, U.S. Environmental Protection Agency (EPA) Method 15/16, or another method approved by PSCAA.
- NO_X limit of 0.06 pounds per MMBtu (lb/MMBtu)[2].
- CO limit of 0.150 lb/MMBtu[2].

These limits can be considered "achieved in practice" (AIP). Any lower limits would need to be considered "cost-effective" and/or "technologically feasible" BACT, which allows an analysis of costs and other implementation factors associated with the more stringent levels.

LRI respectfully requests the proposed emission limits above as BACT based upon the supplemental information provided in the following analysis.

An emission limit or control technology maybe be considered "achieved in practice" for a category or class of source if it exists in any of the following regulatory documents or programs:

- United States Environmental Protection Agency (U.S. EPA) Reasonably Available Control Technology (RACT)/BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse (RBLC)
- Other Districts' and states' BACT Guidelines
- BACT requirements in NSR permits issued by other agencies such as Bay Area Air

[2] NOx and CO emission factors are provided by the manufacturer of the enclosed combustor flare (i.e., Parnel Biogas Inc.).

Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), San Joaquin Valley Air Pollution Control District (SJVAPCD), and San Diego Air Pollution Control District (SDAPCD).

2 TOP DOWN BACT

As previously stated, Regulation I Section 6.01 notes that PSCAA adopts by reference and enforces the Washington Department of Ecology (Ecology) definition of BACT.

SCS is using the commonly used and widely accepted "top-down approach" to complete this BACT analysis. Below are the five steps that are part of this top-down analysis:

1. Identify each emission unit and all available control options.
2. Evaluate the technical feasibility of each control option.
3. Rank the remaining control technologies by control effectiveness.
4. Eliminate control options based on economic, environmental and energy impacts; and
5. Select BACT.

3 TOP DOWN BACT FOR SO_2

STEP 1 - IDENTIFY CONTROL OPTIONS

Control Options for SO_2

Emissions of SO_2 at the LRI Landfill are generated via the conversion of various total reduced sulfur (TRS[3]) compounds present in LFG to SO_2 during the combustion process of flare operation. Control technologies to reduce the emissions of SO_2 from LFG flares are divided into two groups; pre-combustion controls to reduce inlet sulfur concentrations and post combustion controls to reduce emissions of the SO_2 in the exhaust. SCS searched state and federal databases, and identified the following potential control technologies to control SO_2 emissions from the permanent flare:

- Pre-Combustion Control
  - Sulfa Treat
  - FerroSorp
  - Iron Sponge
  - Activated Carbon
  - LO-CAT
- Post-Combustion Control
  - Exhaust "Scrubbing"

3 Based on site specific LFG laboratory analysis, H2S constitutes approximately 98% of the TRS by volume, and therefore, H2S and TRS have been used interchangeably in this BACT analysis.

Pre-Combustion Control

SulfaTreat

SulfaTreat is a solid scavenger system, which consists of passing the LFG either across a fixed bed or through a batch-type reactor of granular reactant. The granular material reacts with H_2S within the LFG to remove it from the gas stream. An additional moisture separator would need to be employed upstream of the process inlet to remove excess moisture from the LFG. Multiple equipment arrangement configurations are possible (e.g., parallel, series, etc.), depending on site needs including the need to minimize downtime of the treatment system. During the process, the LFG flows through the consistently sized and shaped granular SulfaTreat product in the bed, where the hydrogen sulfide (H_2S), the primary component in TRS for LFG, reacts with the product to form a stable and safe byproduct. The product consumption is dependent only on the amount of H_2S that passes through the bed. This matches the need for H_2S removal with variations in system flow conditions and outlet specifications, regardless of the total volume or other common components of the gas.

SCS is aware of the SulfaTreat technology having been used for LFG treatment, including at the Dry Bridge Road Landfill in Rhode Island, Cottage Street Landfill (7,200 parts per million by volume [ppmv] TRS inlet concentration inlet), McCommas Bluff Landfill (600 ppmv inlet concentration), Allentown Landfill (1,100 ppmv inlet concentration), and the University of New Hampshire (400 ppmv inlet concentration). SCS is not aware of any critical technical operational problems to date regarding this technology and is one of the most frequently used technologies.

FerroSorp

FerroSorp is a solid scavenger system that consists of passing the LFG across a fixed bed reactor of granular reactant. The granular material reacts with H_2S within the LFG to remove it from the gas stream. During the process, the LFG flows through the consistently sized and shaped granular FerroSorp product in the beds, where the H_2S reacts with the product to form a stable and safe byproduct. The filter media does need to be replaced once spent and spent media can be landfilled as nonhazardous waste after testing. The reactor vessels are designed in a specific configuration to ensure minimum residence time (contact time with media) as required by the manufacturer requirements. FerroSorp creates an exothermic reaction during sulfur removal that can be a fire hazard when exposed to sudden increase in oxygen. This is of concern in a system with combustible LFG passing over the media and a need for the system to be opened up routinely to replace filter media.

SCS is aware of the FerroSorp technology having been used for anaerobic digester biogas at the GreenGasUSA Lewiston Perdue Chicken Processing facility in North Carolina and LFG at BRADS Landfill in Pennsylvania.

Iron Sponge

Iron Sponge is a solid scavenger system which consists of passing the uncombusted LFG across a bed of hydrated iron oxide. Sulfur compounds within the LFG react with the iron oxide to form iron sulfides, iron mercaptides, and other materials, along with a small amount of water by-product. The filter media can be partially regenerated during operation to prolong the life of media, but will become spent and will need to be replaced. Complete replacement of the media may be required after several regenerations. Please note that the media becomes susceptible to fire as soon as it dries out and comes in contact with oxygen. This makes the change out operations challenging and dangerous. Water has to be added continuously to the exhaust media while performing change outs in order to reduce any hazard. In addition, the spent media has commonly tested as a hazardous waste for Volatile Organic Compounds (VOCs) and metals, which increases disposal costs. The iron sponge system also has an electrical demand due to its regeneration blowers.

SCS is aware of the Iron Sponge technology having been used for LFG treatment, including at the Scholl Canyon Landfill in California (40 ppmv inlet concentration, but no longer in use) and the Kearny and Cape May County Landfills in New Jersey, Pine Avenue Landfill in Niagara Falls, New York, and Ada County Landfill in Boise, Idaho. Our experience has been that handling the spent filter media has been challenging, and that the media reportedly has auto combusted once it came into contact with oxygen if not wetted down with water, making it extremely dangerous to use particularly with the flammability of LFG.

LO-CAT

LO-CAT is a wet-scrubbing liquid-redox system that essentially uses a water solution that contains a metal ion (iron) to convert H_2S into elemental sulfur, which ultimately settles out of the solution and is removed. In this process, LFG is passed through a chamber which contains a catalyst (special form of Chelated Iron). A chemical reaction occurs in this chamber, and after series of chemical reactions, fresh gas is produced. The used catalyst is sent to a catalyst regeneration chamber for rejuvenation. In this chamber, air is added to the used solution. As a result of chemical reactions in this chamber, a slurry of sulfur and fresh catalyst is produced. The catalyst is sent back to the LFG treatment chamber, and sulfur slurry is sent to a filter chamber which breaks down slurry into elemental sulfur and liquid filtrate. Liquid filtrate is sent back to the catalyst regeneration chamber for reuse. The sulfur becomes a waste product that must be managed.

LO-CAT does not use toxic chemicals, nor does it produce hazardous by-products. The catalyst in the system regenerates so the maintenance is minimal, reducing operating and maintenance costs. However, capital costs are high, and if the catalyst is fouled, replacement is expensive. Maintenance of the solution pH is important, and is accomplished through the addition of NaOH or KOH to the system. Also, a number of operating parameters must be monitored and controlled during operation, including the temperature, the water balance, and sulfur content. LO-CAT is most efficient for sulfur loads greater than 200 lb/day and doesn't become economical until sulfur loads approach 1,000 lb/day. At lower concentrations and loads, this technology is considered infeasible, and vendors will not take on such projects.

SCS is aware of the LO-CAT technology being used for LFG treatment, including at the Central Landfill in Florida (5,000 ppmv), the Warren County Landfill in New Jersey (6,000 ppmv inlet concentration), and the Cherry Island Landfill in Delaware (2,000 ppmv inlet concentration), and is not aware of any operational problems regarding this technology, other than the aforementioned capital costs.

Activated Carbon

Activated Carbon is a physical adsorption process which consists of passing the LFG across a bed of activated carbon to remove H_2S from the gas stream. The H_2S is chemically adsorbed onto the activated carbon in addition to other constituents in the gas stream such as VOCs. Because of the affinity for the activate carbon to adsorb the VOCs present in LFG, the media will load up quickly requiring frequent change outs, the cost of which can make this option cost prohibitive.

SCS is most familiar with DARCO BG-1 activated carbon from Cabot Corporation. This product is used for large scale H_2S treatment upstream of renewable natural gas (RNG) facilities and is also one of the most widely used technologies for sulfur reduction in LFG. The technology has been used at many landfills to treat all or portions of the total LFG flow, including use at individual/clusters of gas extraction wells, and/or to polish the LFG prior to additional pre-treatment units.

Post-Combustion Control

Exhaust Scrubbing

There are several technologies that have been applied to other industries for the control of post combustion SO_2 exhaust (or flue) gas emissions, most traditionally at coal and oil-fired power plants. Both “wet” and “dry” scrubbing technologies have been used for Sox exhaust gas control. These technologies utilize an alkaline or caustic solution which reacts chemically with the exhaust gas to convert SO_2 to calcium sulfate ($CaSO_3$) or some other compound.

Exhaust/flue gas SO_2 treatment has been utilized at coal and oil-fired power plants because it is less practical and much more expensive to treat these fuels prior to combustion. However, SCS is not aware of a single installation at which post-combustion control for SO_2 emissions has been utilized at a LFG flare, thus we do not believe this technology can be considered technologically feasible in this application. For this application, due to the volume of exhaust gas to be managed in comparison to the raw gas inlet volume, it is simply not practical to treat the exhaust gas instead of the raw inlet LFG. Further, there is a complete absence of data to assess costs and operational issues in using this technology for LFG. Finally, LFG contains many impurities including VOCs, semi-VOCs, and siloxanes that commonly foul post-combustion controls.

STEP 2 – ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

The following control technologies are considered to be technically infeasible and will be eliminated from further analysis.

Iron Sponge/FerroSorp

SCS experience has been that handling the spent filter media has been challenging, and that the media reportedly tended to auto-combust once it encountered oxygen, making it extremely dangerous to use particularly with the flammability of LFG. Therefore, due to the inherent danger associated with the iron sponge and FerroSorp, SCS does not consider these technologies to be feasible for the application considered herein.

Exhaust Scrubbing

No landfill gas flare projects were identified that utilize exhaust/flue gas SO_2 controls and there is no data available to assess the costs and operational issues in using this technology at a landfill flare; therefore, SCS does not consider exhaust sulfur scrubbing to be a control option that has been demonstrated to be technically feasible for the application being considered. Furthermore, due to the impurities present in LFG, such as VOC, semi-VOC, and siloxanes, extensive front-end treatment would likely be required, which would increase the costs substantially.

STEP 3 - RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS

In SCS' experience and research, sulfur treatment has historically been implemented at sites with high sulfur content (generally in the thousands of ppmv). In general, the aforementioned technologies are typically designed to treat gas to a specified outlet sulfur concentration and not to a percent removal as there are many variables that affect percent removal, and the percentage can vary throughout the life cycle of the media or catalyst. This section is intended to compare control effectiveness of the remaining technologies and then subsequently benchmark control effectiveness limit (i.e., outlet sulfur concentration) for these select technologies.

Control Effectiveness

The technically feasible control options (activated carbon, SulfaTreat, and LO-CAT) can all be designed to treat LFG with a TRS concentration of 2000 to 300 ppmv and are ranked equally effective for this project. The control efficiencies for all three of the technically feasible control technologies are equivalent. This allows them to be applied to a facility like the permanent flare in this case, which is projected to combust LFG with an annual average TRS concentration of 2,000 ppmv[4].

Benchmark Control Effectiveness Limit

Numerous permits were surveyed to identify TRS reasonably available control technology (RACT)/BACT limits on flares burning LFG. In each of these cases, RACT or BACT was triggered, and a concentration limit was selected to either avoid exceeding the RACT/BACT cost effectiveness threshold and/or to avoid becoming a major source for SO_2. Where controls have been employed, those controls have included treatment of the full LFG volume or partial treatment of areas of the landfill with the highest TRS so that the concentration limit is met.

Sulfur Reduction Limits at Other Landfill Flares

Landfill Name	State, Air Jurisdiction	Control Technology	LFG TRS Limit in ppmv & Averaging Specifics	Permit Condition and Basis
Potrero Hills Landfill	CA, BAAQMD	Controls not required, based on sulfur content in landfill gas	560 ppmv [***Shall Not Exceed***]	#10. Basis: Regulation 9-1-302 (exhaust limit on SO_2), voluntary limit on SO_2 PTE to avoid public notice, Regulation 2-2-405
Redwood Landfill	CA, BAAQMD	Activated Carbon for flare	370 ppmv [***Shall Not Exceed***]	#18. Basis: Cumulative increase, RACT, Air Toxics Hot Spots Act and Regulations 2-5-302.3 (H_2S acute health risk), 9-1-302 (exhaust limit on SO_2), and 9-2-301 (H2S limit)
Vasco Road Landfill	CA, BAAQMD	Controls not required, based on sulfur content in landfill gas	320 ppmv [***Averaging via: Rolling Annual Average of Quarterly LFG Testing]***	#12. Basis: RACT for SO_2 and Regulation 9-1-302 (exhaust limit on SO_2),
Columbia Ridge	OR, ODEQ	Controls not required, based on sulfur content in landfill gas	300 ppmv ***[Shall Not Exceed]***	Federal PSD BACT determination based on cost effectiveness analysis
Newby Island Landfill	CA, BAAQMD	Activated Carbon [used as partial control to meet sulfur limit]	300 ppmv [***Annual Average of Quarterly LFG Testing]***	#10. Basis: Cumulative Increase, Regulation 2-1-204, 2-2-303 (limit to avoid SO_2 offsets)
Sonoma Central Landfill	CA, BAAQMD	Controls not required, based on sulfur content in landfill gas	300 ppmv [***Averaging via: Shall Not Exceed]***	#7. Basis: Regulation 9-1-302 (exhaust limit on SO_2).
Keller Canyon Landfill	CA, BAAQMD	Controls not required, based on sulfur content in landfill gas	300 ppmv [***Averaging via: Shall Not Exceed]***	#34. Basis: Cumulative Increase and Regulations 9-1-302 (exhaust limit on SO_2),and 2-6-503.

[4] LRI has collected and lab analyzed LFG samples for TRS. Selected TRS value of 2,000ppm is a conservative estimate based on average of available TRS values from July 2022 to September 2023.

Landfill Name	State, Air Jurisdiction	Control Technology	LFG TRS Limit in ppmv & Averaging Specifics	Permit Condition and Basis
West Contra Costa County Landfill	CA, BAAQMD	Controls not required, based on sulfur content in landfill gas	300 ppmv [*Averaging via*: Shall Not Exceed]	#10. Basis: Regulation 9-1-302 (exhaust limit on SO_2), Cumulative Increase.

This table omits TRS limits imposed on LFG flares in California under regulatory requirements other than cases where RACT or BACT was triggered. For instance, SCAQMD Rule 431.1 sets a maximum H2S limit of 150 ppmv for all landfill gas combustors. The BAAQMD sets BACT limits, but District BACT does not consider the cost-effectiveness of a control option. See BAAQMD, Complex Permitting Handbook for BAAQMD New Source Review Permitting at 112 (September 2016). Therefore, District BACT is analogous to federal LAER, and BAAQMD BACT determinations have limited precedential value to a Washington BACT determination. Furthermore, the BAAQMD requires control devices, such as flares, meet RACT. However, the District's definition of RACT is analogous to federal BACT. As such, BAAQMD RACT determinations are relevant precedent for Washington BACT determinations.

STEP 4 - EVALUATE THE MOST EFFECTIVE OPTION BASED ON ECONOMIC, ENVIRONMENTAL, AND ENERGY IMPACTS

The remaining control technologies involve pre-treatment of LFG to reduce the TRS content of the LFG prior to combustion. The cost for implementing these technologies was evaluated and the results of this economic evaluation are presented below.

Cost Effectiveness Analysis

SCS evaluated the estimated capital and operating costs using the U.S. EPA Air Pollution Control Cost Manual to calculate the cost effectiveness of the potential emission control technologies. The cost effectiveness is defined as the ratio of the annualized cost of that abatement system over the reduction in annual pollutant emissions achieved by the system for the pollutant in question as shown below.

Cost-effectiveness = (Annualized Cost of Abatement System ($/yr))/(Reduction in Annual Pollutant Emissions (ton/yr))

Reduction in Annual Pollutant Emissions (ton/yr) = Baseline Uncontrolled Emissions – Control Option Emissions

The annualized cost of the abatement system was estimated from the installed cost of the control technology and its expected annual operating and maintenance costs, as shown below.

Annualized cost = Direct Costs + Indirect Costs

Direct Costs (Sum of the Following):

Labor
Raw Materials
Replacement Parts
Utilities

Indirect Costs (Sum of the following):
Overhead (60% of Labor Costs)
Property Tax (1% of Total Capital Cost)
Insurance (1% of Total Capital Cost)
General & Administrative (2% of Total Capital Cost)
Capital Recovery (CRF x Total Capital Cost)
where Total Capital Cost = Installed Equipment Cost

Cost Evaluation

The reduction in the annual SO_2 emissions is based on the inlet concentration of TRS, the removal efficiency of the control technology, and the maximum LFG flow rate of 4000 scfm through the permanent flare, based on the capacity of the flare and conservative model projections.

The TRS concentration of LFG entering the scrubbing system is expected to not exceed 2,000 ppmv. This is based on actual TRS levels observed in landfill gas samples. LFG sulfur scrubbing technologies selected as BACT have achieved an outlet TRS concentration of 300 ppm. The difference between a SO_2 emission rate at an inlet concentration of 2,000 ppmv and 300 ppmv is 1599.8 lbs/day or 291 tons/year at the projected annual combustion rate of 4,000 scfm.

Estimated Annual Pollutant Reduction

Technology	Flare Inlet Concentration (ppmv)	SO_2 Emissions (lb/day)	SO_2 Emissions (tons/yr)
Uncontrolled	2,000	1882.14	343.49
Controlled	300	282.32	51.52

For the remaining control technologies, SCS evaluated the estimated capital and operating costs based on the parameters specified above and under the assumption that this permanent flare will operate for 10 years.

LO-CAT

LO-CAT does not typically become economical unless the inlet has a very high sulfur concentration due to the high capital cost. Cost data from an analysis SCS conducted for the Lancaster Landfill and Recycling Center (Lancaster) in 2008 was utilized in this analysis. The

Lancaster costs were multiplied by a ratio of the inlet TRS[5] sulfur concentrations and/or maximum flow rates to estimate the costs for the LRI facility. The vendor would not supply updated cost information for this project as they are sure it will not be cost effective. A summary of the cost are below and details are provided in Appendix A.

Type of Cost	Costs
Capital Cost	$6,994,225
Direct Costs (Annual Operating and Replacement)	$1,323,756
Indirect Costs (Including Capital Recovery)	$1,461,760
Total Annualized Cost	$2,785,526

SulfaTreat

SCS obtained updated costs from Schlumberger (SLB) for the amount and costs of media required for the LRI process. These costs were used along with the cost data from an analysis SCS conducted for the Arbor Hills Landfill Gas to Energy Facility (Arbor Hills) in 2018. A summary of the cost is below and details are provided in Appendix A.

Type of Cost	Costs
Capital Cost	$2,083,020
Direct Costs (Annual Operating and Replacement)	$1,167,170
Indirect Costs (Including Capital Recovery)	$385,325
Total Annualized Cost	$1,552,495

Activated Carbon

Cost data from an analysis SCS conducted for the Chiquita Canyon Landfill in Los Angeles County, California in 2015 was used to estimate the potential costs for an activated carbon system at the LRI. A summary of the costs is in the following table and details are provided in Appendix A. This cost is highly variable because of the consumption of carbon media by VOCs, but we have conservatively assumed limited VOC impacts.

Type of Cost	Costs
Capital Cost	$2,592,237
Direct Costs (Annual Operating and Replacement)	$1,512,109
Indirect Costs (Including Capital Recovery)	$461,831
Total Annualized Cost	$1,973,940

5 Based on site specific LFG laboratory analysis, H_2S constitutes approximately 98% of the TRS by volume, and therefore, H_2S and TRS have been used interchangeably in this BACT analysis.

These estimated total costs were used to evaluate the approximate cost per pound of possible SO_2 emission reductions. As shown in the following table, SulfaTreat and Activated Carbon are control technologies that are feasible in cost, with LO-CAT being out of the feasible range.

Technology	Cost per Emissions Reduced (\$/ton SO_2)
LO-CAT	\$9,541
SulfaTreat	\$5,317
Activated Carbon	\$6,761

STEP 5 - CONCLUSIONS AND SELECTION OF BACT

There are three technologies that are technologically feasible for the reduction of sulfur content in LFG flares. The control efficiencies for all three of the technically feasible control technologies are equivalent. LO-CAT was eliminated on an economical basis leaving activated carbon and SulfaTreat financially feasible compared to the cost. Activated Carbon and SulfaTreat meet the BACT cost-effectiveness test, whereas LO-CAT has a high cost per ton for the volume and sulfur concentration of the LFG that the permanent flare will burn. Although SulfaTreat is economically feasible, the lead time to acquire and install the technology is far longer than activated carbon. Activated Carbon has the same control efficiency as LO-CAT and Sulfa treat, it's cost per ton is economically feasible and the lead time to acquire and install the technology is much shorter than SulfaTreat allowing the system to be installed quickly. LRI submits that activated carbon is BACT for control of SO_2 emissions from the permanent flare.

PROPOSED BACT LIMIT

SCS is proposing that the BACT limit be established as 300 ppmv H_2S on a rolling 12-month average in the LFG prior to combustion in the permanent flare based on an average of H_2S concentration tests using ASTM Method D-5504 or another method approved by PSCAA. SCS is recommending that these H_2S tests be performed monthly. Additionally, LFG flow to the permanent flare will be monitored to confirm an average flow rate of less than 4000 scfm on a 12-month rolling basis.

4 TOP DOWN BACT FOR NO_X

STEP 1 - IDENTIFY CONTROL OPTIONS

Emissions of NOx at the LRI Landfill are generated during the combustion process of flare operation. SCS searched state and federal databases, and identified the following potential control technologies to control NOx emissions from the permanent flare:

- Enclosed Flare
- Ultra-Low Emission Flare (ULE)

Enclosed Flare

Enclosed ground flares have burner heads enclosed inside a shell that is internally insulated or shielded. This shell reduces noise, luminosity, and heat radiation and provides wind protection, which makes enclosed ground flares less susceptible to poor performance that can occur from open-flame flares during high winds. Enclosed flares are equipped with control mechanisms to regulate combustion processes. These systems can adjust parameters such as temperature, oxygen levels, and residence time, ensuring that the combustion of gases is optimized for minimal emissions and maximum destruction efficiency and through advancements are now capable of achieving limits previously only achieved through post-combustion controls. Enclosed flares incorporate emission monitoring and control technologies to verify and reduce the release of pollutants like NOx and CO. These features contribute to their ability to achieve high destruction efficiency, while keeping emissions within acceptable limits.

SCS is familiar with enclosed flare technologies from the manufacturers Parnel Biogas, Perennial Energy and John Zink Hamworthy. These flares are being used in various landfills across the world.

ULE Flare

ULE Flares offer the lowest emissions and greatest destruction efficiency during the flaring process. These flares utilize innovative technologies, such as staged combustion and air/fuel mixture control, to achieve a marked reduction in NOx emissions, contributing to improved air quality and environmental protection.

SCS is most familiar with ZULE: Landfill Gas Ultra-Low Emission Flare System by John Zink Hamworthy. This system is engineered to adhere to environmental standards, with emission limits of just 0.025 for NOx which significantly reduces its environmental impact. This specific flare is being used at the Apex Landfill in Clark County, Nevada and multiple landfills in California.

STEP 2 – ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

There are no technically infeasible options between enclosed flares and ULE Flares.

STEP 3 - RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS

This section intends to compare control effectiveness of the technologies using LFG flowrate of 4,000 scfm and manufacturer specified emission factors (detailed in the Table below). The following table compares the control effectiveness of the two technologies based on emission factors and annual emissions.

Pollutant	Emission Factors			Total Emissions		
	Standard Enclosed Flare	ULE Flare	Unit	Standard Enclosed Flare	ULE Flare	Unit
NOX	0.06	0.025	lb/mmbtu	30.0	12.5	ton/yr

STEP 4 - EVALUATE THE MOST EFFECTIVE OPTION BASED ON ECONOMIC, ENVIRONMENTAL, AND ENERGY IMPACTS

The cost for implementing these technologies was evaluated and the results of this economic evaluation are presented below.

Cost Effectiveness Analysis

SCS evaluated the estimated capital and operating costs using the U.S. EPA Air Pollution Control Cost Manual and DCF method to calculate the cost effectiveness of the potential emission control technologies. Please refer to Appendix A for details.

Cost Evaluation

The reduction in the annual NOx emissions is based on the volume of LFG combusted per year and the efficiency of the control technologies. The difference between NOx emission rate at a flow rate of 4,000 scfm and heat content of 476 BTU/scf at 50% Methane is given below:
For 4000 scfm Flare:

Heat Content = 476 BTU/scf at 50% Methane

Volume of LFG combusted
(based on estimated site data) = 2,102,400,000 ft^3/yr

Total Heat Content = 1,000,742.40 MMBTU/yr.

Estimated Annual Emission Reduction

Pollutant	Emission Factors**			Total Emissions			Total Reduction	Unit
	Standard Enclosed Flare	ULE Flare	Unit	Standard Enclosed Flare	ULE Flare	Unit		
NOX	0.06	0.025	lb/mmbtu	30.0	12.5	ton/yr	17.5	ton/yr

Please refer to Appendix B Emission Calculations for details.
** Manufacturer given emission factor.

SCS has evaluated the estimated capital and operating costs based on the parameters specified above and under the assumption that this permanent flare will be operational for at least 10 years. The cost summary is given below. Please refer to Appendix A for detailed calculations.

	Standard Enclosed Flare	ULE Flare (Amount Est.)
Construction Cost	$ 1,479,595.26	$ 1,868,023.00
Operational Cost per year	$ 36,247.59	$ 307,306.75
Present Value[6]	$ 1,773,563.24	$ 4,360,280.75
Annualized Present Value	$ 177,356.32	$ 436,028.07

The estimated total cost for ULE Flare was used to evaluate the approximate cost of per ton of possible NOx emission reductions compared to a standard enclosed flare. The summary is given below.

ULE Flare Annual Cost Per Ton Emission Reduced Compared to Standard Enclosed Flare

Cost Effectiveness = Present value / emission reduced over equipment life
= Present Value / (tons of emission reduced per year)

NOx	$	24,897.41

Given the analysis above the standard enclosed flares are the more cost-effective control technology.

STEP 5 - CONCLUSIONS AND SELECTION OF BACT

There are two technologies that are technologically feasible for the reduction of NOx emissions. The cost effectiveness analysis above shows that ULE flare is not cost effective. LRI submits that the standard enclosed flare is BACT for control of NOx emissions from the permanent flare.

5 TOP DOWN BACT FOR CO

STEP 1 - IDENTIFY CONTROL OPTIONS

Emissions of CO at the LRI Landfill are generated during the combustion process of flare operation. SCS searched state and federal databases, and identified the following potential control technologies to control CO emissions from the permanent flare:

- Enclosed Flare

6 See Appendix A for detailed calculation.

- ULE Flare

Enclosed Flare

Enclosed ground flares have burner heads enclosed inside a shell that is internally insulated or shielded. This shell reduces noise, luminosity, and heat radiation and provides wind protection, which makes enclosed ground flares less susceptible to poor performance that can occur from open-flame flares during high winds. Enclosed flares are equipped with control mechanisms to regulate combustion processes. These systems can adjust parameters such as temperature, oxygen levels, and residence time, ensuring that the combustion of gases is optimized for minimal emissions and maximum destruction efficiency and through advancements are now capable of achieving limits previously only achieved through post-combustion controls. Enclosed flares incorporate emission monitoring and control technologies to verify and reduce the release of pollutants like NOx and CO. These features contribute to their ability to achieve high destruction efficiency, while keeping emissions within acceptable limits.

SCS is familiar with enclosed flare technologies from the manufacturers Parnel Biogas, Perennial Energy and John Zink Hamworthy. These flares are being used in multiple landfills across the world.

ULE Flare

ULE Flares offer the lowest emissions and greatest destruction efficiency during the flaring process. These flares utilize innovative technologies, such as staged combustion and air/fuel mixture control, to achieve a marked reduction in CO emissions, contributing to improved air quality and environmental protection.

SCS is most familiar with ZULE: Landfill Gas Ultra-Low Emission Flare System by John Zink Hamworthy. This system is engineered to adhere to stringent environmental standards, boasting emission limits of just 0.06 for CO, which significantly reduces its environmental impact. This specific flare is being used at the Apex Landfill in Clark County, Nevada and multiple landfills in California.

STEP 2 – ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

There are no technically infeasible options between enclosed flares and ULE Flares.

STEP 3 - RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS

The following table compares the control effectiveness of the two technologies based on emission factors and annual emissions.

Pollutant	Emission Factors			Total Emissions		
	Standard Enclosed Flare	ULE Flare	Unit	Standard Enclosed Flare	ULE Flare	Unit
CO	0.15	0.06	lb/mmbtu	75.1	30.0	ton/yr

STEP 4 - EVALUATE THE MOST EFFECTIVE OPTION BASED ON ECONOMIC, ENVIRONMENTAL, AND ENERGY IMPACTS

The cost for implementing these technologies was evaluated and the results of this economic evaluation are presented below.

Cost Effectiveness Analysis

SCS evaluated the estimated capital and operating costs using the U.S. EPA Air Pollution Control Cost Manual and DCF method to calculate the cost effectiveness of the potential emission control technologies. Please refer to Appendix A for details.

Cost Evaluation

The reduction in the annual CO emissions is based on the volume of LFG combusted per year and the efficiency of the control technologies. The difference between CO emission rate between the two technologies at a flow rate of 4,000 scfm and heat content of 476 BTU/scf at 50% Methane is given below:

For 4000 scfm Flare:

Heat Content = 476 BTU/scf at 50% Methane

Volume of LFG combusted
(based on estimated site data) = 2,102,400,000 ft^3/yr

Total Heat Content = 1,000,742.40 MMBTU/yr.

Estimated Annual Emission Reduction								
Pollutant	Emission Factors**			Total Emissions			Total Reduction	Unit
	Standard Enclosed Flare	ULE Flare	Unit	Standard Enclosed Flare	ULE Flare	Unit		
CO	0.15	0.06	lb/mmbtu	75.1	30	ton/yr	45.03	ton/yr
Please refer to Appendix B Emission Calculations for details. ** Manufacturer given emission factor.								

SCS has evaluated the estimated capital and operating costs based on the parameters specified above and under the assumption that this permanent flare will be operational for at least 10 years. The cost summary is given below. Please refer to Appendix A for detailed calculations.

	Standard Enclosed Flare	ULE Flare (Amount Est.)
Construction Cost	$ 1,479,595.26	$ 1,868,023.00
Operational Cost per year	$ 36,247.59	$ 307,306.75
Present Value[7]	$ 1,773,563.24	$ 4,360,280.75
Annualized Present Value	$ 177,356.32	$ 436,028.07

The estimated total cost for ULE Flare was used to evaluate the approximate cost of per ton of possible CO emission reductions compared to a standard enclosed flare. The summary is given below.

ULE Flare Annual Cost Per Ton Emission Reduced Compared to Standard Enclosed Flare

Cost Effectiveness = Present value / emission reduced over equipment life
= Present Value /(tons of emission reduced per year)

CO	$ 9,682.32

Given the cost effectiveness analysis above, the ULE flare is not cost effective for CO emission reduction.

STEP 5 - CONCLUSIONS AND SELECTION OF BACT

There are two technologies that are technologically feasible for the reduction of CO emissions. The cost effectiveness analysis above shows that ULE flares are not cost effective. LRI submits that the standard enclosed flare is BACT for control of CO emissions from the permanent flare.

6 TOP DOWN BACT FOR TOXIC AIR POLLUTANTS (TAPS)

As stated in Regulation I Section 6.01, PSCAA adopts by reference and enforces the Washington Administrative Code 173-400-110 that requires Toxic Air Pollutants (TAPs) or Toxic Air Contaminants (TACs) to be evaluated for BACT under NSR process unless the specific emission rate is below the de minimis established in WAC 173-460-150.

7 See Appendix A for detailed calculation.

STEP 1 - IDENTIFY CONTROL OPTIONS

Emissions of TAPs at the LRI Landfill are generated during the combustion process of flare operation. All TAPs that exceed the de minimis are VOCs. SCS searched state and federal databases, and identified the following potential control technologies to control VOC emissions (surrogate to TAPs emissions) from the permanent flare:

- Enclosed Flare
- ULE Flare

Enclosed Flare

Enclosed ground flares have burner heads enclosed inside a shell that is internally insulated or shielded. This shell reduces noise, luminosity, and heat radiation and provides wind protection, which makes enclosed ground flares less susceptible to poor performance that can occur from open-flame flares during high winds. Enclosed flares are equipped with control mechanisms to regulate combustion processes. These systems can adjust parameters such as temperature, oxygen levels, and residence time, ensuring that the combustion of gases is optimized for minimal emissions and maximum destruction efficiency. Enclosed flares incorporate emission monitoring and control technologies to verify and reduce the release of pollutants and through advancements are now capable of achieving limits previously only achieved through post-combustion controls As a bi-product VOCs have also been shown to have these features contribute to their ability to achieve high destruction efficiency, while keeping emissions within acceptable limits. Standard enclosed flares typically achieve greater than 98% VOC destruction efficiency.

SCS is familiar with enclosed flare technologies from the manufacturers Parnel Biogas Inc (PBI), which has a destruction efficiency of 98.9%, Perennial Energy Inc. (PEI) and John Zink Hamworthy. These flares are being used in multiple landfills across the world.

ULE Flare

ULE Flares offer the lowest emissions and greatest destruction efficiency during the flaring process. These flares utilize innovative technologies, such as staged combustion and air/fuel mixture control, to achieve a marked reduction in CO and VOC emissions, contributing to improved air quality and environmental protection.

SCS is most familiar with ZULE: Landfill Gas Ultra-Low Emission Flare System by John Zink Hamworthy. This system is engineered to adhere to stringent environmental standards. It has greater than 99% destruction efficiency of total non-methane organic compounds (NMOC) throughout the entire flare operating range, without any burner adjustments or flare modification. This specific flare is being used at the Apex Landfill in Clark County, Nevada and multiple landfills in California.

STEP 2 – ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

There are no technically infeasible options between Enclosed Flares and ULE Flare.

STEP 3 - RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS

Parnel Biogas Inc. (PBI) guarantees a 98.9% destruction VOC destruction efficiency on their enclosed flares. ULE Flares, specifically the ZULE by John Zink Hamworthy has greater than 99% VOC destruction efficiency. As all the TAPs in discussion are VOCs, the same control effectiveness applies. A summary of the control effectiveness is given below:

Flare Type	**Standard Enclosed Flare**	**ULE Flare**	**Total Emission Reduction (lb/yr)**	**Total Emission Reduction (tons/yr)**
Destruction Efficiency	**98.9%**	**99%**		
Pollutant	**Total Emission (lb/yr)**	**Total Emission (lb/yr)**		
1,2-Dichloroethane	0.70	0.64	0.06	3.187E-05
Acrylonitrile	0.11	0.10	0.01	5.126E-06
Benzene	22.92	20.84	2.08	1.042E-03
Bromodichloromethane	3.01	2.73	0.27	1.367E-04
1,4-Dichlorobenzene	12.57	11.42	1.14	5.712E-04
Ethylbenzene	22.75	20.68	2.07	1.034E-03
1,2-Dibromoethane	0.06	0.05	0.01	2.521E-06
Tetrachloroethylene	11.68	10.62	1.06	5.309E-04
Trichloroethene	5.28	4.80	0.48	2.401E-04
Vinyl chloride	3.97	3.61	0.36	1.806E-04

As this section intends to compare control effectiveness of the technologies ULE Flares will be ranked above standard enclosed flares given the higher VOC destruction efficiency and annual emission reduction.

STEP 4 - EVALUATE THE MOST EFFECTIVE OPTION BASED ON ECONOMIC, ENVIRONMENTAL, AND ENERGY IMPACTS

The cost for implementing these technologies was evaluated and the results of this economic evaluation are presented below.

Cost Effectiveness Analysis

SCS evaluated the estimated capital and operating costs using the U.S. Environmental Protection Agency (EPA) Air Pollution Control Cost Manual and the DCF method to calculate the cost effectiveness of the potential emission control technologies. See the attached cost calculations for more details.

Cost Evaluation

The reduction in the annual TAPs emissions is based on the removal efficiency of the control technology and the rolling 12-month average LFG flow rate of 4,000 scfm through the permanent flare, based on conservative model projections. The difference between VOC emission rate between the two technologies is only .01%. SCS has evaluated the estimated capital and operating costs based on the parameters specified above and under the assumption that this permanent flare will be operational for at least 10 years. The cost summary is given below. Please refer to Appendix A for detailed construction and operation cost calculations.

	Standard Enclosed Flare	ULE Flare (Amount Est.)
Construction Cost	$ 1,479,595.26	$ 1,868,023.00
Operational Cost per year	$ 36,247.59	$ 307,306.75
Present Value[8]	$ 1,773,563.24	$ 4,360,280.75
Annualized Present Value	$ 177,356.32	$ 436,028.07

The estimated total cost for ULE Flare was used to evaluate the approximate cost of per ton of each possible TAP emission reduction compared to a standard enclosed flare. The summary is given below.

ULE Flare Annual Cost Per Ton Emission Reduced Compared to Standard Enclosed Flare

Pollutant	**Cost Per Ton Emission Reduced**
1,2-Dichloroethane	$ 13,682,616,210.95
Acrylonitrile	$ 85,062,928,774.71
Benzene	$ 418,549,715.98
Bromodichloromethane	$ 3,189,012,766.32
1,4-Dichlorobenzene	$ 763,350,828.86
Ethylbenzene	$ 421,640,717.03
1,2-Dibromoethane	$ 172,965,514,188.11
Tetrachloroethylene	$ 821,308,908.84
Trichloroethene	$ 1,815,798,282.46
Vinyl chloride	$ 2,413,872,668.94

As the difference in emission reduction is almost negligible between the two technologies the cost per ton for each constituent is excessively high. In comparison, the cost per ton for VOCs (Volatile Organic Compounds) is $4,360,280.75. This indicates that a ULE Flare is not within the feasible range. Therefore, given the analysis above, the standard enclosed flare is the most cost-effective control technology.

8 See Appendix A for detailed calculation.

STEP 5 - CONCLUSIONS AND SELECTION OF BACT

LRI submits that the standard enclosed flare is BACT for control of TAPs emissions from the permanent flare technology as it provides a similar control efficiency while being the most cost effective.

7 SUMMARY

The conclusion that we can draw from the above information is that BACT for LFG flares is an enclosed flare that can meet the following requirements.

- NO_X limit of 0.06 lb/MMBtu.
- CO limit of 0.15 lb/MMBtu.
- SO_2 limit of 300 ppmv H_2S on a rolling 12-month average in the LFG prior to combustion in the permanent flare based on an average of H_2S concentration tests using ASTM Method D-5504, EPA Method 15/16, or another method approved by PSCAA.

Based on the above review and information, SCS believes these proposed emission limits for Flare #4 are considered BACT.

8 GENERAL COMMENTS

This report is based on available information as available to SCS Engineers. This report has been prepared for specific application to the project discussed and has been prepared in accordance with generally accepted engineering practices. No warranties, express or implied, are intended or made.

APPENDIX A

COST ANALYSIS

BACT Analysis Data for LRI Landfill

Control Device Name: SLB SulfaTreat System

Control Device Description: SulfaTreat for reduction of TRS as H_2S to 300 PPMV from 2000 PPM

Site-Wide Emissions	SOx	SOx lb/day	Site-Wide Emissions tpy
Guaranteed Uncontrolled (ppmv @0% O2)	2000	1882.14	343.49
Est. Controlled (ppmv @0% O2)	300	282.32	51.52
Reduction	85%	1599.82	292.0

Temporary Flare Maximum LFG Flow scfm	4,000

Capital Cost (for SulfaTreat System) Description	Capital Cost*	Cost for SOx Reduction	Comments
SulfaTreat Material (First Fill of Media)	$ 465,052	$ 465,052	SLB Estimate[1]
SulfaTreat System*	$ 990,000	$ 990,000	SLB Estimate[2]
Transportation*	$ 118,800	$ 118,800	SLB Estimate[2]
Sulfa Treat Installation*	$ 125,000	$ 125,000	SCS Estimate[3]
Permitting and Design	$ 100,000	$ 100,000	SCS Estimate[3]
Sales Taxes@ 6%	$ 101,931	$ 94,803	For Purchase of Major Equipment[4]
Contingency @10%	$ 190,078	$ 189,365	Based on 10% contingency[5]
Total Capital Cost		$ 2,083,020	

*Capital Cost Based on LFG flow of 4,000 scfm

Annual Operating Cost (for SulfaTreat System) and Estimated Overhaul/Media Replacement Cost	Annual Cost	Cost for SOx Reduction	Comments
Media Purchase Cost	$ 511,557	$ 511,557	SLB Estimate[1]
Disposal Cost	$ 343,504	$ 343,504	SLB/SCS Estimate[6]
Transportation	$ 31,647	$ 31,647	SLB/SCS Estimate[7]
Labor	$ 31,647	$ 31,647	SLB Estimate/SCS Estimate[7]
Maintenance	$ 80,898	$ 80,898	SCS Estimate[8]
Vessel Repair Replacement Costs	$ 59,400	$ 59,400	Mi SWACO Estimate[9]
Miscellaneous	$ 8,590	$ 8,590	SCS Estimate[10]
Contingency @10%	$ 99,925	$ 99,925	Based on 10% contingency
Total Annual Operating and Replacement Cost		$ 1,167,170	
Overhead (60% of Labor Costs)		$ 18,988	USEPA Cost Estimate Manual, Section 2.6.5.7
Property Tax (1% of Total Capital Cost)		$ 20,830	USEPA Cost Estimate Manual, Section 2.6.5.8
Insurance (1% of Total Capital Cost)		$ 20,830	USEPA Cost Estimate Manual, Section 2.6.5.8
General & Administrative (2% of Total Capital Cost)		$ 41,660	USEPA Cost Estimate Manual, Section 2.6.5.8
Capital Recovery (CRF x Total Capital Cost)	0.136 CRF	283,016	USEPA Cost Estimate Manual, Equation 2.8a[11]
Total Annual Operating Cost		$ 1,552,495	
Total Annual Cost		$ 1,552,495	

Cost Effectiveness of SulfraTreat System:				
Cost effectiveness ($/ton)	= (Annual cost $/year) / (District Standard Emissions - Emissions (w/tech feas BACT) (ton/year))			
Cost Effectiveness	$ 1,552,494.74	291.97	ton/year	**$5,317.37 /ton**
Proposed SOx Cost Effectiveness				

Notes

[1] Estimates from SLB (Schlumberger) for media costs for the LRI facility

[2] Estimates for capital costs for initial SulfaTreat purchase and installation are based on estimates obtained from SLB at $165,000 per ve requiring 6 vessels from their experience with the SulfaTreat technology.   Includes cost of initial media shipment.

[3] The design, permitting, and startup costs for the catalyst systems were estimates made by SCS Engineers from recent experience.

[4] Applied at 8.75% rate for major equipment purchases

[5] A 10% contingency was applied and considered reasonable for the uncertainties with this project

[6] Schlumberger estimate 128,000 pounds media per vessel and 6 vessels and change-out every 173 days, Mi SWACO estimate assuming $0.15/lb cleanout and SCS estimates $350/ton or $0.175/lb disposal cost as hazardous waste.

[7] SCS estimate based on $15,000 per changeout and changeout every 173 days per vessel based on Schlumberger quote.

[8] SCS estimate 5% of capital costs, less media

[9] Mi SWACO estimate using 50% of the sulfa treat system costs every 10 years plus 20% installation costs

[10] SCS estimates 0.5% of capital costs, less media plus $500 equipment rental

[11] Indirect costs based on USEPA Cost Estimation Manual, equation 2.8a. CRF = $i(1+i)^n / (1+i)^n-1$, where n = 10 years, I = 0.06 interest

BACT Analysis Data for LRI Facility

Control Device Name: LO-CAT System

Control Device Description: LO-CAT for reduction of TRS as H_2S to 300 PPMV from 2000 PPM

Site-Wide Emissions	SOx	SOx lb/day	Site-Wide Emissions tpy
Guaranteed Uncontrolled (ppmv @15% O2)	2000	1882.14	343.49
Est. Controlled (ppmv @15% O2)	300	282.32	51.52
Reduction	85%	1599.82	291.97

Temporary Flare Maximum LFG Flow scfm	4,000

Capital Cost (for LO-CAT System) Description	Capital Cost	Cost for SOx Reduction	Comments
LO-CAT System *	$ 1,120,000	$ 3,227,666	SCS Estimate[1] **
Support Equipment *	$ 448,000	$ 1,291,066	SCS Estimate[1] **
LO-CAT Installation *	$ 448,000	$ 1,291,066	SCS Estimate[2] **
Permitting and Design	$ 200,000	$ 200,000.00	SCS Estimate[2]
Sales Taxes@ 6%	$ 120,960	$ 348,588	For Purchase of Major Equipment[3]
Contingency @10%	$ 233,696	$ 635,839	Based on 10% contingency[4]
Total Capital Cost		$ 6,994,225	

*Based on Lancaster's LFG flow of 1,388 scfm

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Annual Operating Cost (for LO-CAT System) and Estimated Overhaul/Media Replacement Cost	Annual Cost	Cost for SOx Reduction**	Comments
Chemical Cost*	$ 7,770	$ 89,568	SCS Estimate[1] **
Disposal Cost*	$ 7,667	$ 88,383	SCS Estimate[5] **
Transportation*	$ 1,338	$ 15,425	SCS Estimate[1] **
Labor*	$ 33,500	$ 386,167	SCS Estimate[6] **
Maintenance	$ 349,711	$ 349,711	SCS Estimate[7]
Power*	$ 26,162	$ 301,576	SCS Estimate[8] **
Contingency @10%	$ 39,999	$ 92,925	Based on 10% contingency[4]
Total Annual Operating and Replacement Cost		$ 1,323,756	
Overhead (60% of Labor Costs)		$ 231,700	USEPA Cost Estimate Manual, Section 2.6.5.7
Property Tax (1% of Total Capital Cost)		$ 69,942	USEPA Cost Estimate Manual, Section 2.6.5.8
Insurance (1% of Total Capital Cost)		$ 69,942	USEPA Cost Estimate Manual, Section 2.6.5.8
General & Administrative (2% of Total Capital Cost)		$ 139,884	USEPA Cost Estimate Manual, Section 2.6.5.8
Capital Recovery (CRF x Total Capital Cost)	0.136 CRF	950,291	USEPA Cost Estimate Manual, Equation 2.8a[9]
Total Annual Operating Cost		$ 2,785,516	
Total Annual Cost		$ 2,785,516	

*Based on Lancaster's LFG flow of 1,388 scfm

**Multiplied by ratio of temporary flare maximum flow of 2,200 scfm to Lancaster's 1,388 scfm and the ratio of the LRI concentration of 2,000 ppm to Lancaster's 500 ppm

Cost Effectiveness of LO-CAT System:				
Cost effectiveness ($/ton)	= (Annual cost $/year) / (District Standard Emissions - Emissions (w/tech feas BACT) (ton/year))			
Cost Effectiveness	$ 2,785,516.12	291.97	ton/year	**$9,540.53 /ton**
Proposed SOx Cost Effectiveness				

Notes

[1] Estimates for capital costs for initial LO-CAT system purchase and installation are based on estimates obtained from SCS Engineers from previous estimates from Merichem

[2] The design, permitting, and startup costs for the catalyst systems were estimates made by SCS Engineers from recent experience

[3] Applied at 8.75% rate for major equipment purchases

[4] A 10% contingency was applied and considered reasonable for the uncertainties with this project

[5] SCS estimate assuming $0.15/lb cleanout plus disposal costs due to water content based upon amount of sulfur removed (lb/day)

[6] SCS estimate assumes 4 hours of operating labor per day per 5 day work week

[7] SCS estimate 5% of capital costs

[8] SCS estimates 18.1 kW required at $0.11 kW-hr for a full year (8,760 hours), 50% contingency also included

[9] Indirect costs based on USEPA Cost Estimation Manual, equation 2.8a. CRF = i(1+i)n / (1+i)n-1, where n = 10 years, I = 0.06 interest

BACT Analysis Data for LRI Facility

Control Device Name: Activated Carbon System

Control Device Description: Activated Carbon for reduction of TRS as H_2S to 300 PPMV from 2000 PPM

Site-Wide Emissions	SOx	SOx lb/day	Site-Wide Emissions tpy
Guaranteed Uncontrolled (ppmv @15% O2)	2000	1882.14	343.49
Est. Controlled (ppmv @15% O2)	300	282.32	51.52
Reduction	85%	1599.82	291.97

Temporary Flare Maximum LFG Flow scfm	4,000

Capital Cost (for Activated Carbon System) Description	Capital Cost	Cost for SOx Reduction	Comments
Activated Carbon Material (First Fill of Media) *	$ 939,860	$ 751,888	SCS Estimate[1] **
Activated Carbon System *	$ 450,000	$ 360,000	SCS Estimate[1] **
Activated Carbon Installation *	$ 1,271,200	$ 1,016,960	SCS Estimate[1] **
Permitting and Design	$ 100,000	$ 100,000	SCS Estimate[2]
Sales Taxes@ 6%	$ 159,664	$ 127,731	For Purchase of Major Equipment[3]
Contingency @10%	$ 292,072	$ 235,658	Based on 10% contingency[4]
Total Capital Cost		$ 2,592,237	

*Based on Chiquita LFG Flow of 5,000 scfm

**Multiplied by ratio of Site-Wide Maximum flow of 2,200 scfm to Chiquita's 5,000 scfm

Annual Operating Cost (for Activated Carbon System) and Estimated Overhaul/Media Replacement Cost	Annual Cost	Cost for SOx Reduction**	Comments
Media Cost*	$ 1,033,846	$ 1,033,846	SCS Estimate[1] **
Disposal*	$ 179,679	$ 179,679	SCS Estimate[5] **
Transportation*	$ 9,900	$ 9,900	SCS Estimate[6] **
Labor*	$ 9,900	$ 9,900	SCS Estimate[6] **
Power*	$ 18,000	$ 18,000	SCS Estimate[1] **
Maintenance	$ 92,017	$ 92,017	SCS Estimate[7]
Vessel Repair Replacement Costs	$ 21,600	$ 21,600	SCS Estimate[8]
Miscellaneous	$ 9,702	$ 9,702	SCS Estimate[9]
Contingency @10%	$ 137,464	$ 137,464	Based on 10% contingency[4]
Total Annual Operating and Replacement Cost		$ 1,512,109	
Overhead (60% of Labor Costs)		$ 5,940	USEPA Cost Estimate Manual, Section 2.6.5.7
Property Tax (1% of Total Capital Cost)		$ 25,922	USEPA Cost Estimate Manual, Section 2.6.5.8
Insurance (1% of Total Capital Cost)		$ 25,922	USEPA Cost Estimate Manual, Section 2.6.5.8
General & Administrative (2% of Total Capital Cost)		$ 51,845	USEPA Cost Estimate Manual, Section 2.6.5.8
Capital Recovery (CRF x Total Capital Cost)	0.136 CRF	352,202	USEPA Cost Estimate Manual, Equation 2.8a[10]
Total Annual Operating Cost		$ 1,973,940	
Total Annual Cost		$ 1,973,940	

*Based on Chiquita LFG Flow of 5,000 scfm

Cost Effectiveness of Activated Carbon System:			
Cost effectiveness ($/ton)	= (Annual cost $/year) / (District Standard Emissions - Emissions (w/tech feas BACT) (ton/year))		
Cost Effectiveness	$ 1,973,940.15	291.97 ton/year	**$6,760.84 /ton**
Proposed SOx Cost Effectiveness			

Notes

[1] Estimates for capital costs for initial activated carbon system purchase and installation are based on estimates obtained from SCS Engineers from previous estimates for the Chiquita Landfill

[2] The design, permitting, and startup costs for the system were estimates made by SCS Engineers from recent experience

[3] Applied at 8.75% rate for major equipment purchases

[4] A 10% contingency was applied and considered reasonable for the uncertainties with this project

[5] SCS estimates $0.15/lb cleanout and $350/ton or $0.175/lb disposal cost as hazardous waste

[6] SCS estimate based on $9,000 per changeout and 1.1 changeouts per year.

[7] SCS estimate 5% of capital costs, less media

[8] SCS estimate using 50% of the activated carbon system costs every 10 years plus 20% installation costs

[9] SCS estimates 0.5% of capital costs, less media plus $500 equipment rental

[10] Indirect costs based on USEPA Cost Estimation Manual, equation 2.8a. CRF = i(1+i)n / (1+i)n-1, where n = 10 years, I = 0.06 interest

Landfill Gas Blower and Flare System
Landfill Gas Collection and Control System (GCCS)
LRI 304th St Landfill
Waste Connections, Inc.

Item No.	Description	Quantity	Units	Traditional Enclosed Flare Parnel (PBI) Amount	Perennial (PEI) Amount	John Zink (JZH) Amount	Average Amount	Low Emission Flare ZULE Amount Est.
1	Performance Bond	1	LS	$ 37,043.90	not included	$ 31,068.00	$ 34,055.95	$ 31,068.00
2	Two (2) Moisture Separator Vessels and appurtenances	1	LS	$ 86,783.20	$ 102,676.00	$ 49,027.00	$ 79,495.40	$ 49,027.00
3	Blower skid assembly with four (4) blowers	1	LS	$ 375,485.74	$ 532,106.00	$ 440,488.00	$ 449,359.91	$ 440,488.00
4	Interconnecting piping, valves, flow meters, and appurtenances	1	LS	$ 273,459.56	$ 219,245.00	$ 64,999.00	$ 185,901.19	$ 64,999.00
5	Flame arrestor and appurtenances	1	LS	$ 19,930.06	$ 57,337.00	$ 13,889.00	$ 30,385.35	$ 13,889.00
6	Enclosed flare and appurtenances	1	LS	$ 348,451.00	$ 355,802.00	$ 428,779.00	$ 377,677.33	$ 769,956.00
7	Control Building, equipment, devices, and appurtenances	1	LS	$ 265,841.23	$ 226,442.00	$ 388,779.00	$ 293,687.41	$ 388,779.00
8	Additional replacement instruments for existing enclosed flare	1	LS	$ 6,993.00	$ 5,323.00	$ 42,971.00	$ 18,429.00	$ 42,971.00
9	Handling, loading and shipping (FOB)	1	LS	$ 54,330.00	$ 137,042.00	$ 91,700.00	$ 94,357.33	$ 91,700.00
10	Field testing, startup, commissioning, and training	1	LS	$ 8,000.00	$ 10,800.00	$ 28,214.00	$ 15,671.33	$ 28,214.00
	Other [A]							
	Spare parts			included	$ 13,342.00		$ 13,342.00	
Subtotal (not including performance bond)				1,439,273.79	1,660,115.00	1,548,846.00	1,544,964.26	1,890,023.00
Tax (Washington State Sales Tax of 8.0 percent)								
Total								
Deduct for alternate flow meter in lieu of specified flow meter [B]		1	LS	$ (39,000.00)	$ (73,781.00)	$ -	$ (37,593.67)	$ -
Deduct for 304 stainless steel pipe and fittings in lieu of 316 stainless steel [B]		1	LS	$ (18,000.00)	$ (56,668.00)	$ (22,000.00)	$ (32,222.67)	$ (22,000.00)
Total with Deductibles Included				$ 1,382,273.79	$ 1,529,666.00	$ 1,526,846.00	$ 1,475,147.93	$ 1,868,023.00

[A] Provide costs for any additional items that are not included in the line items provided.
On separate rows, include item number, description quantity, units, and amount for each.

[B] Do not include sales tax with deducted amount for alternates.

KHF Parnel Flare
Actual Operating Costs from KHF Personnel

				Cost in 2011 for 2500 scfm Flare	*Cost in 2023 for 2500 scfm Flare*	*Cost in 2023 for 4000 scfm Flare*	
				Electricity Costs			
Month	Site KWh usage	Actual Charges	Cost/Kwh				
Nov-10	4960	$ 812.50	$ 0.16	Normal months			
Sep-10	4880	$ 970.90	$ 0.20	May-Sept			
			$ 0.18	Average			
Blower	HP	KiloWatts	Cost per KW/hr	Operating Cost per Year 2011	Operating Cost per Year 2023	Operating Cost per Year 2023 (4000 scfm)	Comments
Turndown Gas Blower	10	7.46	$ 0.18	$ 11,762.93	$ 14,296.66	$ 18,624.30	Using aftermarket 10 HP blower.
Factory Gas Blower (not in use)	60	44.76	$ 0.18	$ -	$ -	$ -	Site has been using smaller blower for turndown
			Subtotal	$ 11,762.93	$ 14,296.66	$ 18,624.30	

				Maintenance Costs			
Task	Man Hours	Frequency per Year	Cost/ Man Hr*	Operating Cost per Year 2011	Operating Cost per Year 2023	Operating Cost per Year 2023 (4000 scfm)	* Average Tech Salary plus 30% for benefits
Clean Burner Tips and Flame Arrestor	9	2	$ 28.60	$ 514.80	$ 625.69	$ 815.09	3 guys for 3 hours includes confined space entry
Lubricate Blowers	0.25	26	$ 28.60	$ 185.90	$ 225.94	$ 294.34	
Weekly flare inspection	0.5	52	$ 28.60	$ 743.60	$ 903.77	$ 1,177.35	
Non Routine Callouts	4	6	$ 28.60	$ 686.40	$ 834.25	$ 1,086.78	
			Subtotal	$ 2,130.70	$ 2,589.65	$ 3,373.55	
				Parts Costs			
Miscellaneous Parts				$ 1,000.00	$ 1,215.40	$ 1,583.30	
Engineering Test				$ 2,000.00	$ 2,430.80	$ 3,166.61	
Source Test				$ 6,000.00	$ 7,292.40	$ 9,499.83	
			Subtotal	$ 9,000.00	$ 10,938.60	$ 14,249.74	
			Total	**$ 22,893.63**	**$ 27,824.92**	$ 36,247.59	

ZULE Ultra Low NOx John Zink Flare
Operating Costs from Waste Management

				Electricity Costs			
Blower	HP	KiloWatts	Cost per KW/hr	Operating Cost per Year 2011	Operating Cost per Year 2023	Operating Cost per Year 2023 (4000 scfm)	Comments
Gas Blower	75	55.9275	$ 0.18	$ 88,186.48	$ 107,181.85	$ 139,626.09	Assumes 200 hp blower is running at reduced load with VFD
Combustion Air Blower	75	55.9275	$ 0.18	$ 88,186.48	$ 107,181.85	$ 139,626.09	Assumes 100 hp blower is running at reduced load with VFD
			Subtotal	$ 176,372.96	$ 214,363.70	$ 279,252.17	

				Maintenance Costs			
Task	Man Hours	Frequency per Year	Cost/ Man Hr*	Operating Cost per Year 2011	Operating Cost per Year 2023	Operating Cost per Year 2023 (4000 scfm)	*Average Tech Salary plus 30% for benefits
Clean Burner Tips	9	6	$ 28.60	$ 1,544.40	$ 1,877.06	$ 2,445.26	3 guys for 3 hours includes confined space entry
Replace Combustion Air Filter	1	6	$ 28.60	$ 171.60	$ 208.56	$ 271.70	
Oil Change in Blowers	2	2	$ 28.60	$ 114.40	$ 139.04	$ 181.13	
Weekly flare inspection	0.5	52	$ 28.60	$ 743.60	$ 903.77	$ 1,177.35	
Non Routine Flare Entry	9	3	$ 28.60	$ 772.20	$ 938.53	$ 1,222.63	
Non Routine Callouts	4	12	$ 28.60	$ 1,372.80	$ 1,668.50	$ 2,173.56	
			Subtotal	$ 4,719.00	$ 5,735.47	$ 7,471.62	

				Parts Costs			
Miscellaneous Parts				$ 5,000.00	$ 6,077.00	$ 7,916.52	
Source Test				$ 8,000.00	$ 9,723.20	$ 12,666.44	
			Subtotal	$ 13,000.00	$ 15,800.20	$ 20,582.96	
			Total	**$ 194,091.96**	**$ 235,899.37**	$ 307,306.75	

Cost Summary for CO and NOx		

Flare Information:

Flare Capacity	4000	scfm
Total heat content[1]	1,000,742.40	MMBTU/yr

Emission Information:

Pollutant	Emission Factor (lb/mmbtu) Standard Enclosed Flare	Emission Factor (lb/mmbtu) ULE Flare	Total Emissions (ton/yr) Standard Enclosed Flare	Total Emissions (ton/yr) ULE Flare	Total Reduction (ton/yr)
NOx	0.06	0.025	30.02	12.51	17.51
CO	0.15	0.06	75.06	30.02	45.03

Present Value calculation based on Discounted Cash Flow (DCF) method Table 5, Part C of South Cost AQMD BACT Guidelines

PV = C + A * PVF (Equation 1)

PVF = (1-1/(1+r)n/r (Equation 2)

Annualized PV = PV/n (Equation 3)

Where,

PV = Present Value ($)
PVF = Present Value Factor based on approximate inflation
C = Capital Cost ($)
A = Annual Operating Cost
r = Rate of Interest (%)
n = Equipment Life (years)

Inputs:

	Standard	ULE Flare (Amount Est.)
Construction Cost (C)	$ 1,479,595.26	$ 1,868,023.00
Operational Cost per year (A)	$ 36,247.59	$ 307,306.75
Equipment Life (n)	10 years	10 years
Rate of Interest (r)	4%	4%

Calculate Present Value:

Present Value Factor (PVF)[2] (Eqn 2)	8.11	8.11
Present Value [2] (Eqn 1)	$ 1,773,563.24	$ 4,360,280.75
Annualized Present Value (Eqn 3)	$ 177,356.32	$ 436,028.07

Cost Effectiveness calculation based on Table 5, Part C of South Coast AQMD BACT Guidelines

Cost Effectiveness = Present value / emission reduced over equipment life

= **Annualized PV / (Total Reduction)** (Equation 4)

ULE Flare Annual Cost Per Ton	Nox	**$ 24,897.41**
	CO	**$ 9,682.32**

[1] Total heat content from emission calculation.

[2] Present Value calculation based on Table 5, Part C of BACT Guidelines (https://www.aqmd.gov/home/permits/bact/cost-effectiveness-values)

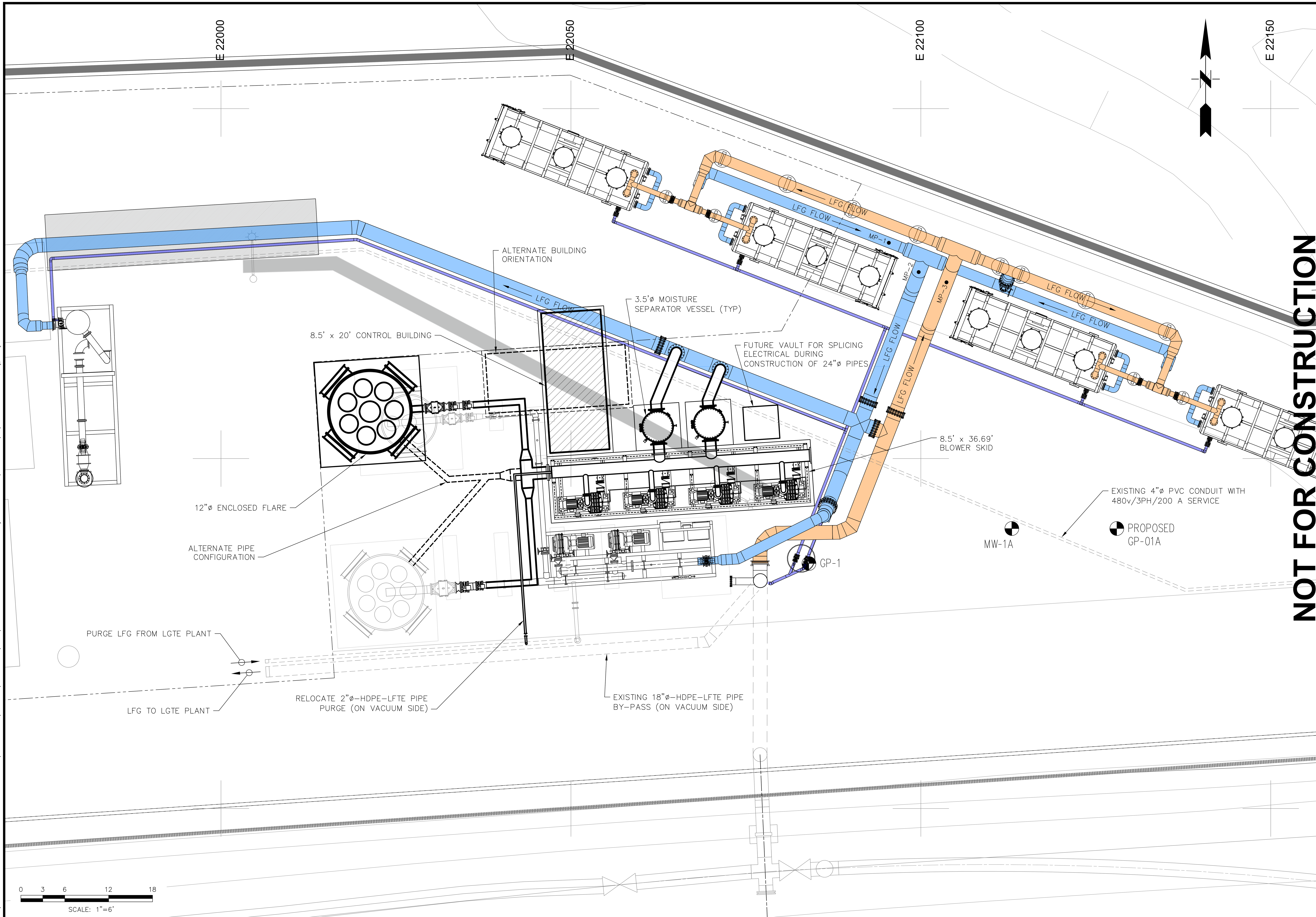
Cost Summary for TAPs				

Flare Type	**Standard Enclosed Flare**	**ULE Flare**	**Total Emission Reduction**	
Destruction Efficiency	**98.90%**	**99%**		
Pollutant Name	**Total Emission (lb/yr)**	**Total Emission (lb/yr)**	**(lb/yr)**	**(ton/yr)**
1,2-Dichloroethane	0.70	0.64	0.06	3.187E-05
Acrylonitrile	0.11	0.10	0.01	5.126E-06
Benzene	22.92	20.84	2.08	1.042E-03
Bromodichloromethane	3.01	2.73	0.27	1.367E-04
1,4-Dichlorobenzene	12.57	11.42	1.14	5.712E-04
Ethylbenzene	22.75	20.68	2.07	1.034E-03
1,2-Dibromoethane	0.06	0.05	0.01	2.521E-06
Tetrachloroethylene	11.68	10.62	1.06	5.309E-04
Trichloroethene	5.28	4.80	0.48	2.401E-04
Vinyl chloride	3.97	3.61	0.36	1.806E-04
Total VOC **(ton/yr)**	0.60	0.50	1.000E-01	

Anjualized PV for ULE $ 436,028.07

ULE Flare Annual Cost per Ton	
Pollutant	**Cost**
1,2-Dichloroethane	$ 13,682,616,210.95
Acrylonitrile	$ 85,062,928,774.71
Benzene	$ 418,549,715.98
Bromodichloromethane	$ 3,189,012,766.32
1,4-Dichlorobenzene	$ 763,350,828.86
Ethylbenzene	$ 421,640,717.03
1,2-Dibromoethane	$ 172,965,514,188.11
Tetrachloroethylene	$ 821,308,908.84
Trichloroethene	$ 1,815,798,282.46
Vinyl chloride	$ 2,413,872,668.94
Total VOC	$ 4,360,280.75

Attachment H – Flare Location



NO.	REVISION	DATE
1	ISSUED FOR CLIENT REVIEW	01/31/2023

SHEET TITLE: BLOWER-FLARE STATION PROPOSED SITE PLAN

PROJECT TITLE: PROCUREMENT OF LANDFILL GAS BLOWER AND FLARE SYSTEM

LRI LANDFILL
GRAHAM, WASHINGTON

SCS ENGINEERS
Environmental Consultants and Contractors
2405 140th Avenue NE, Suite 107
Bellevue, Washington 98005
(425) 746-4600 FAX: (503) 684-6948

PROJ. NO. 04223001.20	DWN. BY: LEL	ACAD FILE: C2
DSN. BY: TAM	CHK. BY: TAM	APP. BY: JMR

DATE: JANUARY 2023

SCALE: AS SHOWN

DRAWING NO. C2

G:\04223001.20 - LRI LFG BFS DESIGN AND PERMITTING\DELIVERABLES\DRAFTING\2023-01-31\DWGS\LRI-04223001.20 - C2A V0.03.DWG layout: PROP SITE plotted on: 2/13/2023 3:02 PM Lindsay, Larry

Attachment I - State Environmental Policy Act (SEPA) Environmental Checklist

Puget Sound Clean Air Agency
1904 Third Avenue, Suite 105 | Seattle, WA 98101-3317
Phone 206-343-8800 | 206-343-7522 Fax

ENVIRONMENTAL CHECKLIST

Because of the State Environmental Policy Act, the action for which you are filing a Notice of Construction and Application for Approval to this Agency requires the completion of an environmental checklist.

BUT: If you can answer "yes" to either of the following statements with respect to the action being proposed, the attached checklist need not be completed:

1. I have obtained a State, City, or County Permit and filled out an environmental checklist.

☐ **Yes** ☒ **No**

If yes, complete the following:

State, City or County Department: ______________________________

Date the checklist was completed: ______________________________

Attach a copy of the checklist

2. An environmental checklist or assessment has previously been filled out for another agency.

☐ **Yes** ☒ **No**

If yes, complete the following:

Agency: ______________________________

Date the checklist was completed: ______________________________

Attach a copy of the checklist

If your answers are NO to both of the above statements, you must complete the attached environmental checklist.

Prepared by:

Signature [signature]

Name Travis Berndahl

Position Project Engineer

Agency/Organization SCS Engineers

Date Submitted 11/8/2023

ENVIRONMENTAL CHECKLIST

Date: 10/27/23

Proponent: Pierce County Recycling, Composting and Disposal LLC (dba LRI)

Project, Brief Title: Permanent Enclosed Flare

Purpose of Checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use “not applicable” or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of Checklist for Nonproject Proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of Sections A, B, and C plus section D: Supplemental Sheet for Nonproject Actions.

Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Section B: Environmental Elements that do not contribute meaningfully to the analysis of the proposal.

ENVIRONMENTAL CHECKLIST

A. BACKGROUND

1. Name of proposed project, if applicable: LRI Permanent Enclosed Flare			
2. Name of Applicant Pierce County Recycling, Composting and Disposal, LLC (dba LRI)			
3. Applicant Address 30919 Meridian Ave E	City Graham	State WA	Zip 98338
Applicant Phone 253-847-7555	Applicant Email Kevin.Green@WasteConnections.com		
Contact Person Kevin Green	Title District Manager		
Company/Firm Waste Connections			
4. Date Checklist Prepared 10/27/23	**5.** Agency Requesting Checklist Puget Sound Clean Air Agency		
6. Proposed timing or schedule (including phasing, if applicable). Installation and operation by December 2024			
7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? ☐ Yes ☒ No. If yes, explain.			
8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. Emission Calculations BACT Analysis			
9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? ☐ Yes ☒ No. If yes, explain.			
10. List any government approvals or permits that will be needed for your proposal, if known. PSCAA Approval Order			

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

Installation of a new 4,000 standard cubic feet per minute (scfm) enclosed Landfill Gas flare. Approximate dimensions are 50 feet tall and 12 feet in diameter. This installation includes the removal of the operational 2,200 scfm temporary flare and connection to the existing H2S treatment system.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

30919 Meridian Ave E, Graham WA 98338 within the existing landfill gas management system areaon the north end of the landfill.

B. ENVIRONMENTAL ELEMENTS

1. EARTH
a. General description of the site: ☒ flat ☐ rolling ☐ hilly ☐ steep slopes ☐ mountains ☐ other ____
b. What is the steepest slope on the site (approximate percent slope)? 0% - the project area is flat
c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them, and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils. The types of soils observed at the project site included dense glacial till, gravelly ashy loam.
d. Are there surface indications or history of unstable soils in the immediate vicinity? ☐ Yes ☒ No. If yes, describe.
e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill. Site grading will take place associated with the new flare. Overall area to be graded is approximately 225 square feet to prepare for a new foundation for the flare to be installed on.
f. Could erosion occur as a result of clearing, construction, or use? ☐ Yes ☒ No. If yes, generally describe.
g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? Less than 1% needed to install a foundation pad
h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any: None - Not necessary

ENVIRONMENTAL CHECKLIST

2. AIR

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke, greenhouse gases) during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities, if known.

The Permanent Flare will be installed on a concrete foundational pad. Emissions from the Permanent Flare during operations are describedin the accompanying NOC Application. Project will overall result in a significant decrease in landfill emissions as the increased blower and flare capacity will result in the landfill having a high collection of LFG from the landfill.

b. Are there any off-site sources of emissions or odor that may affect your proposal? ☐ Yes ☒ No. If yes, generally describe.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Refer to attached NOC Application Attachment G.

3. WATER

a. Surface

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands) ? ☒ Yes ☐ No. If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Wetlands are located north of project's construction limits. An existing MSE retaining wall creates a physical barrier between the construction area and surface water features to the north. The project will not affect these surface water features as all construction and installation will occur above the retaining wall.

2. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? ☒ Yes ☐ No. If yes, please describe and attach available plans.

See response to 3.a.1.

3. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

No material will be placed or removed from surface water or wetlands.

4. Will the proposal require surface water withdrawals or diversions? ☐ Yes ☒ No. Give general description, purpose, and approximate quantities if known.

5. Does the proposal lie within a 100-year floodplain? ☐ Yes ☒ No. If yes, note location on the site plan.

6. Does the proposal involve any discharges of waste materials to surface waters? ☐ Yes ☒ No. If yes, describe the type of waste and anticipated volume of discharge.

b. Ground Water

1. Will groundwater be withdrawn from a well for drinking water or other purposes? ☐ Yes ☒ No. If yes, give a general description of the well, proposed uses and approximate quantities withdrawn from the well.

   Will water be discharged to groundwater? ☐ Yes ☒ No. If yes, give general description, purpose, and approximate quantities, if known.

2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals...; agricultural; etc.). Describe the general size of the systems, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

N/A

c. Water Runoff (including storm water)

1. Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? ☐ Yes ☒ No. If yes, describe.

There is no anticipated runoff associated with this project. All stormwater in this project area infiltrates into the ground.

2. Could waste material enter ground or surface waters? ☐ Yes ☒ No. If yes, generally describe.

3. Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? ☐ Yes ☒ No. If yes, describe.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, impacts, if any:

4. PLANTS				
a. Check the types of vegetation found on the site:				
Deciduous Trees:	☐ Alder	☐ Maple	☐ Aspen	☐ other (specify):
Evergreen Trees:	☐ Fir	☐ Cedar	☐ Pine	☐ other (specify):
☒ Shrubs				
☒ Grass				
☐ Pasture				
☐ Crop or Grain				
☐ Orchards, Vineyards, or other permanent crops				
☐ Other types of Vegetation (specify):				
Wet Soil Plants:	☐ Cattail	☐ Buttercup		☐ other (specify):
	☐ Bulrush	☐ Skunk Cabbage		
Water Plants:	☐ Water Lily	☐ Eelgrass	☐ Milfoil	☐ other (specify):
b. What kind and amount of vegetation will be removed or altered? None.				
c. List threatened or endangered species known to be on or near the site. None known.				
d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: None.				
e. List all noxious weeds and invasive species known to be on or near the site. None known.				

ENVIRONMENTAL CHECKLIST

5. ANIMALS			
a. Indicate birds and other animals that have been observed on or near the site or are known to be on or near the site.			
Birds:	☒ Hawk	☒ Heron	☒ other (specify): Gulls, Crows, Magpies
	☒ Eagle	☐ Songbirds	
Mammals:	☒ Deer	☒ Bear	☐ other (specify):
	☒ Elk	☒ Beaver	
Fish:	☐ Bass	☐ Salmon	☐ Trout
	☐ Hearing	☐ Shellfish	☐ other (specify):

b. List any threatened or endangered species known to be on or near the site.

None known.

c. Is the site part of a migration route? ☒ Yes ☐ No. If yes, explain.

Yes, the site lies within the western flyway for migratory birds.

d. Proposed measures to preserve or enhance wildlife, if any:

None.

e. List any invasive animal species known to be on or near the site.

None known.

6. ENERGY AND NATURAL RESOURCES

a. What kinds of energy (electric, natural gas, oil, woodstove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity will be used for energy required to operate the permanent enclosed flare and associated blowers.

b. Would your project affect the potential use of solar energy by adjacent properties? ☐ Yes ☒ No. If yes, generally describe.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

None.

ENVIRONMENTAL CHECKLIST

7. ENVIRONMENTAL HEALTH

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? ☒ Yes ☐ No.
If yes, describe:

Landfill gas contains toxic chemicals that are explosive in nature. However, this project will meet all applicable health and safety standards. Installation of flares destructs toxic chemicals in landfill gas and thus controls toxic emissions.

2. Describe any known or possible contamination at the site from present or past uses.

None known.

3. Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

Existing gas conveyance lines are located underground within the project area that contain LFG.
Existing condensate conveyance lines are located within the project area that transfer condensate from the condensate knockout to the leachate force main.
Finally, there is an existing emergency use leachate force main line located within the project area. Currently this line is unused and is only brought online in case of emergency conveyance of leachate around the north end of the site through the project area.

4. Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

None.

5. Describe special emergency services that might be required.

None.

6. Proposed measures to reduce or control environmental health hazards, if any:

N/A.

b. Noise

1. What types of noise exist in the area that may affect your project (for example, traffic, equipment, operation, other)?

Traffic noise from nearby roads and the adjacent landfill is not anticipated to affect the proposed development.

2. What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example, traffic, construction, operation, other)? Indicate what hours noise would come from the site.

The permanent enclosed flare will produce marginal noise during operation. This should be offset with the removal of the existing temporary flare resulting in no net increase in noise levels.

3. Proposed measures to reduce or control noise impacts, if any:

N/A

ENVIRONMENTAL CHECKLIST

8. LAND AND SHORELINE USE
a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? ☐ Yes ☒ No. If yes, describe. Current location contains a blower flare station equipped with the existing blowers and flare and open dirt area for vehicle turnaround. Adjacent to the project location to the north and northeast is the aforementioned MSE wall and wetlands. Adjacent to the project location to the west is the Landfill Gas to Energy plant operated and owned by a third party. Adjacent to the project to the south is the landfill. This project will not affect any of the surrounding properties.
b. Has the project site been used as working farmlands or working forest lands? ☐ Yes ☒ No. If yes, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use? The site has not been used as working farmlands and forest lands.
1. Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? ☐ Yes ☒ No. If yes, how?
c. Describe any structures on the site.
d. Will any structures be demolished? ☐ Yes ☒ No. If yes, what?
e. What is the current zoning classification of the site? RSR - Rural Sensitive Resource.
f. What is the current comprehensive plan designation of the site? Rural.
g. If applicable, what is the current shoreline master program designation of the site? If yes, specify. Not applicable.
h. Has any part of the site been classified as a critical area by the city or community? ☐ Yes ☐ No. If yes, specify. Not applicable.
i. Approximately how many people would reside or work in the completed project? 0

j. Approximately how many people would the completed project displace?

0

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Not applicable.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

Not applicable.

9. HOUSING

a. Approximately how many units would be provided, if any? Indicate whether high- middle- or low-income housing.

0

b. Approximately how many units, if any, would be eliminated? Indicate whether high- middle- or low-income housing.

0

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

10. AESTHETICS

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The Permanent Flare is 50 feet tall and constructed of steel.

b. What views in the immediate vicinity would be altered or obstructed?

None.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Not applicable.

ENVIRONMENTAL CHECKLIST

11. LIGHT AND GLARE
a. What type of light or glare will the proposal produce? What time of day would it mainly occur? The enclosed flame permanent flare will produce a flame but as it will be enclosed this light will not be visible any time throughout the day or night.
b. Could light or glare from the finished project be a safety hazard or interfere with views? No.
c. What existing off-site sources of light or glare may affect your proposal? None.
d. Proposed measures to reduce or control light and glare impacts, if any: None as it will be an enclosed flare.

12. RECREATION
a. What designated and informal recreational opportunities are in the immediate vicinity? None.
b. Would the proposed project displace any existing recreational uses? ☐ Yes ☒ No. If yes, describe.
c. Proposed measures to reduce or control impacts on recreation, including recreational opportunities to be provided by the project or applicant, if any: Not applicable.

13. HISTORIC AND CULTURAL PRESERVATION
a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? ☐ Yes ☒ No. If yes, specifically describe.
b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources. No archaeological or historic-period sites were identified for this review within the proposed construction area.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

The Permanent Flare project presents no risk of impacts to cultural or historic resources, as the flare and blower are installed on foundational concrete pads within a fill area previously constructed for this type of work. All existing piping will be used and new piping will be installed above ground.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

Halting of work if any suspected or previously unknown archaeological materials are found, with inspection of material by a qualified archaeologist or county coroner (if human burials are found).

14. TRANSPORTATION

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on-site plans, if any.

Meridian Avenue E is the main road used to access the site. No changes to access proposed.

b. Is site or affected geographic area currently served by public transit? ☐ Yes ☒ No. If yes, generally describe. If not, what is the approximate distance to the nearest transit stop?

Distance to the nearest transit stop is approximately 9 miles.

c. How many parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

No changes to parking

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? ☐ Yes ☒ No. If yes, generally describe (indicate whether public or private).

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation?
☐ Yes ☒ No. If yes, generally describe.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

No new trips are being created.

g.	Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? ☐ Yes ☒ No. If yes, generally describe.
h.	Proposed measures to reduce or control transportation impacts, if any: None

15. PUBLIC SERVICES	
a.	Would the project result in an increased need for public services (for example, fire protection, police protection, public transit, health care, schools, other)? ☐ Yes ☒ No. If yes, generally describe.
b.	Proposed measures to reduce or control direct impacts on public services, if any: None

16. UTILITIES

a. Indicate utilities currently available at the site:

☒ Electricity	☐ Natural gas	☐ Water	☐ Refuse Service
☒ Telephone	☐ Sanitary Sewer	☐ Septic System	☐ Other (specify):

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity that might be needed.

Electricity is provided to the landfill by Puget Sound Energy (PSE). Electrical conduits and associated wire have been installed as needed to provide power to the permanent flare when it is installed.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.	
Signature	[signature]
Name	Kevin Green
Position	District Manager
Agency/Organization	Waste Connections
Date Submitted	11/9/2023