

**DRAFT ENGINEERING EVALUATION  
PANGEA ENVIRONMENTAL SERVICES INC.  
PLANT NO. 24111  
APPLICATION NO. 29173**

**BACKGROUND**

On behalf of Pangea Environmental Services Inc., Hedia Petroleum Inc. has applied for an Authority to Construct for the following soil remediation project:

- S-1 Soil Vapor Extraction (SVE) System; Make: Mako; Model: Makotherm; Maximum Flowrate: 500 scfm; Maximum Permitted Flowrate: 243 scfm**  
**A-1 Thermal/Catalytic Oxidizer; Make: Mako; Model: Makotherm; Maximum Firing Rate: 0.77 MMbtu/hr; Maximum Rated Flowrate: 500 scfm;**

The above equipment will be located at 3145 South Bascom Ave., Campbell, CA. Santa Clara County Department of Environmental Health reviewed and approved the soil and groundwater remediation at the proposed site on April 12, 2018. The soil and groundwater contamination at the site was caused by a leaking gasoline underground storage tank at the proposed site.

The remediation process will be conducted using S-1 SVE system. Soil vapor extraction will be accomplished by means of a single stage vacuum pump with a maximum flowrate of 500 scfm, which will be abated by a thermal/catalytic oxidizer. The principal emissions expected from the soil vapor extraction are precursor organic compounds (POC). In addition, secondary emissions of carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), sulfur dioxides (SO<sub>2</sub>), and particulate matter less than 10 microns (PM<sub>10</sub>) and 2.5 microns (PM<sub>2.5</sub>) in diameter are expected as a result of combustion of natural gas.

In order to comply with the project risk requirement set forth in Regulation 2-5-302 "New Source Review of Toxic Air Contaminants, Project Risk Requirements", the owner/operator will be required to not only limit the maximum flowrate to 243 scfm, but also ensure that stack height of S-1 is at least 18 feet above the ground level. In addition, the owner/operator will be required to source test to ensure as a start-up requirement that A-1 can meet the minimum destruction or removal efficiency (DRE) requirement of 98.5% by weight.

S-1 SVE System will be within 1,000 feet of property boundary of Camden Community Day School.

**EMISSIONS CALCULATION**

**POC Emissions due to Soil Vapor Extraction:**

For a conservative estimate of annual emissions, the District staff assumed that the system is operated for the entire year with an inlet concentration corresponding to the initial soil concentration level. Generalized assumptions follow:

- Operating conditions: Pressure = 1 Atm; Inlet Temperature = 21 °C; 1 mole occupies 24.15 L
- Influent values based on operational parameters of equipment and applicant supplied soil vapor test results: Influent volumetric flowrate limit of 243 scfm; maximum influent concentration = total petroleum hydrocarbon 4.60E+07 µg/m<sup>3</sup>, benzene 6.20E+05 µg/m<sup>3</sup>, toluene 2.10E+06 µg/m<sup>3</sup>, ethyl benzene 4.10E+05 µg/m<sup>3</sup>, xylene 2.20E+06 µg/m<sup>3</sup>;
- Abatement efficiency of 98.5% was assumed for A-1 Thermal/Catalytic Oxidizer.
- A-1 Thermal/Catalytic Oxidizer has a maximum firing rate of 0.77 MMbtu/hr.

**POC Emissions Calculations:**

$$\begin{aligned} \text{Hourly POC Emissions} &= (4.60\text{E}+07 \mu\text{g}/\text{m}^3)(1 \text{ lb}/4.54\text{E}+08 \mu\text{g})(243 \text{ scfm})(1 \text{ m}^3/35.31 \text{ ft}^3)(60 \text{ min}/\text{hr})(1-0.985) \\ &= 6.27\text{E}-01 \text{ lb}/\text{hr} \end{aligned}$$

$$\text{Daily POC Emissions} = (6.27\text{E}-01 \text{ lb}/\text{hr})(24 \text{ hr}/\text{day}) = 15.1 \text{ lb}/\text{day}$$

$$\text{Annual POC Emissions} = (15.1 \text{ lb}/\text{day})(365 \text{ day}/\text{yr}) = 5,490 \text{ lb}/\text{yr} = 2.745 \text{ TPY}$$

**Secondary Emissions Calculations:**

Secondary emissions due to natural gas combustion are calculated based on hours of operation, maximum firing rate of A-1 Thermal/Catalytic Oxidizer, and emission factors from Compilation of Air Pollutant Emission Factors (AP-42), Chapter 1.4 "Natural Gas Combustion" and based on Reasonable Available Control Technology (RACT) requirement for the secondary pollutants. Emission factors utilized for the secondary emissions calculations are presented in Table 2. The estimated secondary emission rates are presented in Table 2.

**Table 1 – Emission Factors used for the Secondary Emissions Calculation**

Pollutant	E.F. (lb/MMbtu)	Source of E.F.
NO <sub>x</sub>	2.00E-01	RACT
CO	8.00E-01	RACT
POC	5.39E-03	Compilation of Air Emissions Factors (AP-42) Section 1.4, "Natural Gas Combustion" - Table 1.4-2
PM <sub>10</sub> *	7.45E-03	AP-42 Section 1.4, "Natural Gas Combustion" - Table 1.4-2
PM <sub>2.5</sub> *	7.45E-03	AP-42 Section 1.4, "Natural Gas Combustion" - Table 1.4-2
SO <sub>x</sub>	5.88E-04	AP-42 Section 1.4, "Natural Gas Combustion" - Table 1.4-2

\*AP-42 Section 1.2, "Natural Gas Combustion" – Table 1.4-2 assumes that all particulate matter is less than 1 micrometer in diameter. Therefore, the PM emission factors presented in AP-42 were used to estimate PM<sub>10</sub> and PM<sub>2.5</sub>.

**Table 2 – Secondary Emissions from S-1 Soil Vapor Extraction System**

Hours of Operation (hr/yr)	Total Fuel Throughput (MMbtu/hr)	Fuel Heat Capacity (btu/scf)	Pollutant	Emission Factor (lb/MMscf)	Maximum Daily Emissions (lb/day)	Annual Emissions (lb/yr)
8,760	0.77	1,020	NO <sub>x</sub>	2.00E-01	3.60E-03	1.31E+00
			CO	8.00E-01	1.44E-02	5.26E+00
			POC	5.39E-03	9.71E-05	3.54E-02
			PM <sub>10</sub>	7.45E-03	1.34E-04	4.90E-02
			PM <sub>2.5</sub>	7.45E-03	1.34E-04	4.90E-02
			SO <sub>x</sub>	5.88E-04	1.06E-05	3.86E-03

**Total Emissions from S-1:**

Table 3 summarizes the cumulative increase in criteria pollutant emissions that will result from the operation of S-1.

**Table 3 – Total Criteria Pollutant Emissions from S-1 Soil Vapor Extraction**

Pollutant	Emission Rate		
	(lb/day)	(lb/yr)	(TPY)
NO <sub>x</sub>	3.60E-03	1.31E+00	0.001
CO	1.44E-02	5.26E+00	0.003
POC	1.50E+01	5.49E+03	2.745
PM <sub>10</sub>	3.67E-07	1.34E-04	0.000
PM <sub>2.5</sub>	3.67E-07	1.34E-04	0.000
SO <sub>x</sub>	1.06E-05	3.86E-03	0.000

**PLANT CUMULATIVE INCREASE**

Table 4 summarizes the cumulative increase in criteria pollutant emissions that will result at Plant No. 24111 from operation of S-1.

**Table 4 - Plant Cumulative Emissions Increase, Post 4/5/91**

Pollutant	Existing Emissions, Post 4/5/91 (TPY)	New Increase with This Application (TPY)	Cumulative Emissions (TPY)
NO <sub>x</sub>	0.000	0.001	0.001
POC	0.000	0.003	0.003
CO	0.000	2.745	2.745
PM <sub>10</sub>	0.000	0.000	0.000
PM <sub>2.5</sub>	0.000	0.000	0.000
SO <sub>2</sub>	0.000	0.000	0.000

**HEALTH RISK ANALYSIS****Table 5 - Toxic Air Contaminant Emissions Calculations**

Pollutant	Abated Emission (lb/hr)	Acute Trigger Level (lb/hr)	Abated Emission (lb/yr)	Chronic Trigger Level (lb/yr)	HRA Required? (Y/N)
Benzene	8.45E-03	6.00E-02	7.40E+01	2.90E+00	Y
Toluene	2.86E-02	8.20E+01	2.51E+02	1.20E+04	N
Ethylbenzene	5.59E-03	-	4.89E+01	3.30E+01	Y
Xylene	3.00E-02	4.90E+01	2.63E+02	2.70E+04	N
Formaldehyde	5.63E-08	1.20E-01	4.93E-04	1.40E+01	N

The facility has abated annual benzene and ethyl benzene emissions that exceed the toxic air contaminant (TAC) trigger level set forth in Regulation 2-5, Table 2-5-1, "Toxic Air Contaminant Trigger Levels". Thus, this application requires a health risk assessment. The project must pass the toxic risk screening level of less than 10 in a one million for cancer risk, 1 for chronic hazard index, and 1 for acute hazard index.

S-1 SVE system passed the HRA conducted on May 30, 2018, by the District's Toxic Evaluation Section. The increased cancer risk to the maximally exposed resident is 6.4 in a million. The chronic hazard index for the maximally exposed resident is 0.77. The increased cancer risk to the maximally exposed worker is 0.68 in a million. The chronic hazard index for the maximally exposed worker is 0.99. In accordance with the District's Regulation 2-5, this risk level is considered acceptable. Since the project exceeds project cancer risk of 1.0 in a million and chronic hazard index of 0.20, S-1 must satisfy Best Available Control Technology for Toxic (TBACT) per Regulation 2-5-301, "Best Available Control Technology for Toxics". Since S-1 will be abated by A-1 Thermal/Catalytic oxidizer, S-1 meets TBACT and thus satisfy the requirement of Regulation 2-5-301.

### **STATEMENT OF COMPLIANCE**

The owner/operator of S-1 is expected to comply with Regulation 8-47-301, "Emission Control Requirements, Specific compounds", and Regulation 8-47-302, "Organic compounds", since S-1 will be abated by A-1. The emissions from S-1 will be required to be vented to A-1 at all times of operation.

This project is located within 1,000 feet from the nearest K-12 school and is therefore subject to the public notification requirements of Regulation 2-1-412.

### **BEST AVAILABLE CONTROL TECHNOLOGY (BACT)**

In accordance with Regulation 2-2-301, BACT is triggered for any new or modified source with the potential to emit 10 pounds or more per highest day of POC, non-precursor organic compound (NPOC), NO<sub>x</sub>, CO, sulfur dioxides (SO<sub>2</sub>), particulate matter less than 10 micrometer (PM<sub>10</sub>) and particulate matter less than 2.5 micrometer (PM<sub>2.5</sub>). Based on the emission calculations presented in POC emissions calculation section, BACT is triggered, since the potential to emit for POC is greater than 10 pounds per day for S-1.

According to the Bay Area Air Quality Management District (BAAQMD) BACT Workbook, abatement of POC emissions from a soil vapor extraction system is technologically feasible through a carbon adsorption system or a thermal oxidizer. Since S-1 will be abated by a thermal/catalytic oxidizer and will be required to meet a minimum DRE of 98.5% by mass, S-1 is expected to satisfy BACT.

### **CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)**

This project is considered to be ministerial under the District's CEQA Regulation 2-1-311 and therefore is not subject to CEQA review. The engineering review for this project requires only the application of standard permit conditions and standard emission factors as described in the District's Permit Handbook Chapter 9.2 (Soil Vapor Extraction) and therefore is not discretionary as defined by CEQA.

### **PERMIT CONDITIONS**

#### **Permit Condition #**

1. The owner/operator shall abate the precursor organic compound (POC) emissions from S-1 Soil Vapor Extraction System with A-1 Thermal/Catalytic Oxidizer during all periods of operation. Start-up and subsequent operation of each abatement device shall take place only after written notification of operation has been received by the District's Engineering Division. The owner/operator shall operate the sources such that the soil vapor flow rate from S-1 shall not exceed 243 scfm. [Basis: Cumulative Increase; Regulation 2-5; Regulation 8-47-301 and 302;]

2. The owner/operator shall ensure that the stack height for S-1 Soil Vapor Extraction System is at least 18 feet above the ground level.  
[Basis: Regulation 2-5-302]
3. The owner/operator shall operate A-1 Thermal/Catalytic Oxidizer such that the POC abatement efficiency shall be maintained at a minimum of 98.5% by weight [Basis: Cumulative Increase, Regulation. 2-5, TBACT]
4. While operating as a Thermal Oxidizer, the owner/operator shall not operate A-1 below a minimum operating temperature of less than 1400 degrees Fahrenheit. [Basis: Cumulative Increase, Regulation 2-5, TBACT]
5. The owner/operator shall not operate A-1 Thermal/Catalytic Oxidizer as a Catalytic Oxidizer. Prior to operating A-1 Thermal/Catalytic Oxidizer as a Catalytic Oxidizer, the owner/operator shall submit a permit application to the District to obtain approval and have this condition removed [Basis: Cumulative Increase, Regulation 2-5, TBACT]
6. To determine compliance with part 4, the owner/operator shall equip the A-1 Thermal/Catalytic Oxidizer with continuous measuring and temperature recording instrumentation. The owner/operator shall collect and maintain the temperature data from the temperature recorder in a file which shall be available for District inspection upon request for a period of at least 2 years following the date on which such data are recorded.  
[Basis: Regulation 1-523]
7. To determine compliance with part 3, within ten days after start-up of the Thermal Oxidizer, and within ten days after start-up of the Catalytic Oxidizer, the owner/operator of this source shall:
  - a. Analyze inlet gas stream to determine the flow rate and concentration of POC present.
  - b. Analyze exhaust gas to determine the flow rate, and the concentration of POC, benzene, toluene, ethyl benzene, and xylene.
  - c. Calculate POC, benzene, toluene, ethyl benzene, and xylene emission rates in pounds per hour and per year based on the exhaust gas analysis and the operating exhaust flow rate.
  - d. Calculate the POC abatement efficiency based on the inlet and exhaust gas analysis. For the purpose of determining compliance with part 3, the owner/operator shall report the total POC concentration as hexane.
  - e. Submit to the District's Engineering Division the test results and emission calculations within one month from the testing date. The owner/operator shall analyze samples according to modified EPA test methods 8015 and 8020 or their equivalent to determine the concentrations of POC, benzene, toluene, ethyl benzene, and xylene.[Basis: Cumulative Increase, Regulation 2-5, TBACT]
8. The owner/operator of S-1 shall maintain the following information for each month of operation of the Activated Carbon Vessels:
  - a. Hours and time of operation.
  - b. All continuous flowrate data measured and recorded in cubic feet per minute to A-1 obtained from the continuous flowrate monitor.
  - c. Each source test data, emission test, analysis or monitoring results logged in for the day of operation they were taken.
  - d. Total throughput of soil vapor from S-1 in Standard Cubic Feet.The owner/operator of S-1 shall keep these records in a District approved log and shall be retained and made available for inspection by the District staff for at least two years following the date the data is recorded.  
[Basis: Regulation 1-523]
9. The owner/operator of S-1 shall report any non-compliance with these conditions to the Compliance and Enforcement Division at the time that it is first discovered. The owner/operator shall detail the corrective action taken and include the data showing the exceedance as well as the time of occurrence in the submittal.  
[Basis: Cumulative Increase; Regulation 2-5; TBACT]

- 10. Upon final completion of the remediation project, the owner/operator of S-1 shall notify the Engineering Division within two weeks of decommissioning the operation. [Basis: Cumulative Increase; Regulation 2-5; TBACT]

**RECOMMENDATION**

The District has reviewed the material contained in the permit application for the proposed project and has made a preliminary determination that the project is expected to comply with all applicable requirements of District, state, and federal air quality-related regulations. The preliminary recommendation is to issue an Authority to Construct for the equipment listed below. However, the proposed source(s) will be located within 1,000 feet of a school, which triggers the public notification requirements of District Regulation 2-1-412. After the comments are received and reviewed, the District will make a final determination on the permit.

I recommend that the District initiate a public notice and consider any comments received prior to taking any final action on issuance of an Authority to Construct and/or a Permit to Operate for the following source(s):

- S-1 Soil Vapor Extraction (SVE) System; Make: Mako; Model: Makotherm; Maximum Flowrate: 500 scfm; Maximum Permitted Flowrate: 243 scfm;**
- A-1 Thermal/Catalytic Oxidizer; Make: Mako; Model: Makotherm; Maximum Firing Rate: 0.77 MMBtu/hr; Maximum Rated Flowrate: 500 scfm;**

By: \_\_\_\_\_  
Alexander Sohn  
Air Quality Engineer

Date: \_\_\_\_\_