

**Engineering Evaluation:
Oak Grove Senior Housing, LLP
Portable Soil Vapor Extraction
Application No. 30715; Plant No. 24784**

Background

Rincon Consultants has applied for an Authority to Construct on behalf of Oak Grove Senior Housing LLP for a portable soil vapor extraction (SVE) system. The first proposed site for the system is to be located at 560 16th Street in Oakland, CA.

S-1 Portable Soil Vapor Extraction System consisting of a 250 max scfm Roots URAI Blower abated by;

A-1 (2) Two minimum 200 pound Activated Carbon Vessels arranged in series.

The applicant has proposed to use the Portable SVE system for sites contaminated with chlorinated and petroleum hydrocarbon vapor trapped in the soil. The system consists of max 250 cfm vacuum blower abated by two minimum 200 lb carbon vessels in series. However, the applicant does intend to use two 1,000 lb GAC vessels for the first location. Since the proposed equipment is to be used at multiple locations, emission estimates for this permit will be based on Reg 2-5 Table 2.5.1 toxic trigger levels as a worst-case scenario for tetrachloroethylene (PCE), trichloroethylene (TCE), benzene, and ethyl benzene.

The applicant will be conditioned to provide written notification at the start of the operation. Procedures are outlined in the conditions found below. Effluent volatile organic compound (VOC) concentrations will be monitored with a photoionization detector (PID) on a schedule reflecting current loading rates and predicted Carbon capacity. Monitoring schedule changes will be allowed only after District review of concentration measurements and subsequent receipt of District approval.

Emission Calculations

For a conservative estimate of yearly emissions, we shall assume that the system is operated for an entire year within 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 24.15L
- S-1 Chlorinated hydrocarbons will be abated by two 200 minimum lb activated carbon vessels in series. Soil vapor concentrations for PCE, TCE, benzene, and ethyl benzene are assumed to be approximately 90 % of Table 2.5.1 toxic trigger level.
- The organic influent flow rate of 250 scfm and abatement efficiency of 98.5% was used in the calculations. Example calculation can be seen below:

$$100,000 \frac{\mu g}{m^3} (PCE) \times 250 \frac{ft^3}{min} \times 1440 \frac{min}{day} \times \frac{1}{35.31} \frac{m^3}{ft^3} \times \frac{1}{4.54 \times 10^8} \frac{lb}{\mu g} = 2.25 \frac{lb}{day} \text{ of PCE (unabated)}$$

$$2.25 \frac{lb}{day} (PCE) \times (1 - 98.5\%) \times 365 \frac{day}{year} = 13.9 \frac{lb}{year} \text{ of PCE (abated)}$$

$$130.8 \text{ ppmv (total influent)} \times (1 - 98.5\%) = 1.96 \text{ ppmv (total effluent)}$$

Table 1 – Emissions from S-1 SVE System

Pollutant	Max Influent vapor concentration [µg/m ³]	Max Influent vapor concentration [ppmv]	Effluent vapor concentration [ppmv]	Unabated Emission [lb/day]	Abated Emission [lb/day]	Abated Emission [lb/yr]
Benzene	21,000	6.5	0.097	0.47	0.01	2.59
Ethylbenzene	240,000	54.6	0.819	5.41	0.08	29.60
PCE	100,000	14.6	0.218	2.25	0.03	12.33
TCE	300,000	55.1	0.827	6.76	0.10	36.99
Total	661,000	130.8	1.96	14.9	0.22	81.5

Because the photoionization detector (PID) is a non-specific measurement technique, mixtures of compounds give a weighted total response of all detectable compounds. Therefore, it would be difficult to accurately read a target compound within a mixture. To compensate for this, the calculated total organic effluent concentration from Table 1 will be used as the carbon breakthrough threshold for the outlet of the last vessel in series. It is assumed that this composition will remain constant throughout the soil remediation project. The total effluent concentration will need to be corrected to the single calibration gas, isobutylene, for the owner/operator to comply with a representative concentration threshold when measuring with the PID monitor.

Equation 1 from the RAE Systems PID Handbook was used to calculate the overall correction factor for the total organic mixture. Please see attached PID Handbook page 43 for reference.

$$CF_{Mix} = 1 / \left(\frac{X_1}{CF_1} + \frac{X_2}{CF_2} + \frac{X_3}{CF_3} + \dots + \frac{X_i}{CF_i} \right) \quad (1)$$

X_i is the mole fraction of the individual compounds in the mixture and CF_i is the correction factor for each compound with reference to isobutylene. Below are example calculations:

$$X_{PCE} = 2.3 \text{ unabated } \frac{lb}{day} \times 454 \frac{g}{lb} \div 165.8 \frac{g}{mol} \div 55.4 \frac{total \text{ moles}}{day} = 0.42$$

$$CF_{Mix} = \frac{1}{\frac{0.0495}{0.53} + \frac{0.416}{0.52} + \frac{0.113}{0.56} + \frac{0.421}{0.54}} = 0.53$$

Table 2 – Correction Factor to Isobutylene calculation

Pollutant	Molecular Weight (MW) [g/mol]	Unabated Emission [lb/day]	Unabated Emission [Gram/day]	Unabated Emission [moles/day]	Mole Fraction X_i	CF_i	CF Mixture
Benzene	78.1	0.473	215	2.75	0.0495	0.53	0.53
Ethylbenzene	106.2	5.41	2454	23.12	0.416	0.52	
PCE	165.8	2.30	1043	6.29	0.113	0.56	
TCE	131.4	6.76	3068	23.35	0.421	0.54	
			Total	55.5			

Table 3 – S-1 Corrected Total Effluent Concentration

Total Effluent vapor concentration [ppmv]	*CF Mixture to Isobutylene	Corrected Total Effluent vapor concentration [ppmv]
1.96	0.53	3.7

* Equation to determine corrected value: *Corrected Total Effluent = Uncorrected Total Effluent (Table 1) / Correction Factor of Mixture*

Table 3 shows the corrected total organic effluent measured as isobutylene. The corrected total will be used as the carbon change out threshold for the last carbon vessel in series.

Table 4– S-1 Criteria Organic Emissions in Tons per Year (TPY)

Compound	lb/day	lb/yr	TPY
POCs	0.19	69.2	0.035
NPOCs	0.03	12.3	0.006

PCE is considered to be non-precursor organic compound (NPOCs) per Regulation 1-234 and 40 CFR 51.100(s)(1).

Cumulative Increase

Table 5- Plant Cumulative Emissions

Compound	Current Permitted Emissions, Post 4/5/91 (TPY)	New Emission Increase with A/N 30715 (TPY)	Cumulative Emissions (TPY)
¹ POCs	0	.035	.035

¹ POC = Pre-cursor Organic Compound

Toxic Risk Screening

Table 6 – S-1 Regulation 2 Rule 5 Toxic Review

Toxic Pollutant	Abated Emission (lb/hr)	Abated Emission (lb/yr)	Acute Trigger lb/hr	Chronic Trigger lb/yr	HRA required
Benzene	2.96E-04	2.59	0.06	2.90	N
Ethylbenzene	3.38E-03	29.60	-	33.00	N
PCE	1.41E-03	12.33	44.00	14.00	N
TCE	4.22E-03	36.99	-	41.00	N

Estimates in Table 6 are considered the worst-case scenario for this project. This source is not expected to exceed applicable toxic trigger levels per Table 2-5-1. This will be enforced by the permit conditions below.

New Source Review

In accordance with Regulation 2-2-301, Best Available Control Technology (BACT) is triggered for any new or modified source with the potential to emit 10 pounds or more per highest day of POC, NPOC, nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxides (SO₂), particulate matter less than 10 micrometer (PM₁₀) and particulate matter less than 2.5 micrometer (PM_{2.5}).

The proposed project does not have the potential to emit more than 10 pounds per day for any criteria pollutant. Therefore, BACT is not required for this project.

California Environmental Quality Act (CEQA)

The project is considered to be ministerial under the Districts proposed 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 and therefore is not discretionary as defined by CEQA. This project is in compliance with Chapter 9.2 of the permit handbook.

Compliance

Based on the information submitted, this operation is expected to be in compliance with Regulation 8-47-301, Emission Control Requirements, Specific compounds, and 8-47-302, Organic compounds. The POC and NPOC emissions will be vented through a Carbon adsorption system at all times of operation.

This project is within 1,000 feet of Oakland School of the Arts and is subject to the public notification requirements of Regulation 2-1-412.

Prevention of Significant Deterioration (PSD), New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAPS) are not triggered.

Permit Conditions

Permit Condition # 27352

1. The operator of this source shall notify the District at least 3 days prior to start-up of operation at any new location. The notification shall include:
 - a. Application Number 30715 and Plant Number 24784.
 - b. Street address, including zip code, for the location where the equipment will be operated.
 - c. The name and telephone number of a contact person where the equipment will be operated.
 - d. The date of initial start-up and estimated duration of operations at that location.
 - e. The distance from the source to the outer boundary of the nearest K-12 school, or indication that the distance is greater than 1000 feet.

In the event that the start-up is delayed less than 5 days, the operator may provide telephone notice of said change to the assigned Plant Engineer in the Engineering Division. If the start-up is delayed more than 5 days, written notification must be resubmitted.

2. The owner/operator of this source shall not operate or retain it at any single location for a period in excess of 12 consecutive months, following the date of initial operation. If this portable source remains at any fixed location for more than 12 months, the multi-location permit will automatically revert to a conventional permanent location permit and will lose its portability.

[Basis: Regulation 2-1-403]

3. The owner/operator shall operate this portable equipment, S-1, at all times in conformance with the eligibility requirements set forth in Regulation 2-1-413 for portable equipment. [Basis: Regulation 2-1-413]
4. The owner/operator shall not operate this equipment within 1000 feet of the outer boundary of any K-12 school, unless the applicable requirements of the California Health and Safety Code Section 42301.6 have been met. This will require a submittal and District approval of an application for a revised permit to operate. [Basis: Regulation 2-1-413.3]
5. The owner/operator shall abate the Non-Precursor Organic Compound (NPOC) and Precursor Organic Compound (POC) emissions from Source S-1 with A-1, SVE abatement system, consisting of two (200 lbs minimum capacity) Activated Carbon Vessels in series during all periods of operations. Startup and subsequent operation of each abatement device shall take place only after written notification of same has been received by the District's Engineering Division. Influent vapor flow rate shall not exceed 150 scfm. In no event shall the Toxic Air Contaminants (TACs) emissions to the atmosphere from S-1 exceed the respective chronic trigger levels in District's Regulation 2-5, Table 2-5-1. [Basis: Regulation 8-47-301.1,2 and 2-5].
6. The owner/operator shall take air samples from S-1 for laboratory analysis using EPA Method TO-15 upon start-up at any new equipment location. The air samples shall be taken at the following S-1 locations:
 - a. At the inlet to the first Carbon vessel in series.
 - b. At the outlet of the Carbon vessel that is last in series prior to venting to the atmosphere.
7. During operation of A-1 Activated Carbon Vessels, the owner/operator of this source shall monitor with a photo-ionization detector (PID), flame-ionization detector (FID), or other method approved in writing by the District's Source Test Manager at the following locations:
 - a. At the inlet to the second to last Carbon vessel in series.
 - b. At the inlet to the last Carbon vessel in series.
 - c. At the outlet of the Carbon vessel that is last in series prior to venting to the atmosphere.

When using an FID to monitor breakthrough, readings may be taken with and without a Carbon filter tip fitted on the FID probe. Concentrations measured with the Carbon filter tip in place shall be considered methane for the purposes of these permit conditions.
8. The owner/operator shall record these monitor readings in a monitoring log at the time they are taken. The owner/operator shall use the monitoring results to estimate the frequency of carbon change-out necessary to maintain compliance with parts number 9 and 10, and shall be conducted on a daily basis for the first week of operation. After demonstrating continuous compliance for the first week, the owner/operator may switch to monitoring to a weekly schedule. The owner/operator of this source may propose for District review, based on actual measurements taken at the site during operation of the source, that the monitoring schedule be changed based on the decline in organic emissions and/or the demonstrated breakthrough rates of the carbon vessels. Written approval by the District's Engineering Division must be received by the owner/operator prior to a change to the monitoring schedule. [Basis: Cumulative Increase, Regulation 2-5, TBACT]
9. The second to last Carbon vessel shall be immediately changed out with unspent carbon upon breakthrough, defined as the detection at its outlet in excess of the higher of the following limits:
 - a. 10 % of the inlet stream concentration to the carbon bed.
 - b. 10 ppmv (measured as Isobutylene).

10. The last Carbon vessel shall be immediately changed out with unspent Carbon upon detection at its outlet of 3.7 ppmv or greater (measured as Isobutylene).
11. The owner/operator of this source shall maintain the following information for each month of operation of the Activated Carbon Vessels:
 - a. Hours and time of operation.
 - b. Each emission test, analysis or monitoring results logged in for the day of operation they were taken.
 - c. Tetrachloroethylene, Trichloroethylene, Benzene, Ethylbenzene emissions in pounds.
 - d. The number of Carbon vessels removed from service.

Such records shall be retained and made available for inspection by the District for two years following the date the data is recorded. [Basis: Regulation 1-523]

12. Within 30 days after the end of every calendar year, the operator of this source shall provide the assigned Plant Engineer in the Engineering Division a year end summary showing the following information:
 - a. The location(s) at which the equipment was operated including the dates operated at each location.
 - b. The total throughput of contaminated soil vapor for the previous four quarters (indicated in cubic feet).
 - c. The total Tetrachloroethylene, Trichloroethylene, Benzene, Ethylbenzene emissions for the previous four quarters (indicated in pounds).
[Basis: Regulation 1-523]

13. 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 of S-1 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]

14. The owner/operator of S-1 shall maintain a file containing all measurements, records and other data that are required to be collected pursuant to the various provisions of this conditional Permit to Operate. All measurements, records and data required to be maintained by the operator shall be retained for at least two years following the date the data is recorded. [Basis: Regulation 1-523]

15. Upon final completion of the remediation project, the operator of Source 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 is located within 1000 feet of a school, which triggers the public notification requirements of District Regulation 2-1-412. After the comments are received from the public 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 an Authority to Construct for the following source

S-1 Portable Soil Vapor Extraction System consisting of a 250 max scfm Roots URAI Blower abated by;

A-1 (2) Two minimum 200-pound Activated Carbon Vessels arranged in series.

by 

Ali Roohani

November 23, 2020