

ENGINEERING EVALUATION REPORT

Plant Name:	Union Oil Company of California
Application Number:	26034
Plant Number:	22319

APPLICATION

This application is for an Authority to Construct/Permit to Operate for a soil vapor extraction (SVE) operation located at 5 El Camino Real, Millbrae, CA 94030. The applicant is requesting an Authority to Construct/Permit to Operate for the following equipment:

S-1 Soil Vapor Extraction Operation, Rotary Claw Busch MM 1322, 10 HP, 300 SCFM

Abated by

A-1 Thermal/Catalytic Converter Oxidizer, PRM Model Therm-OX300, 300 SCFM

Or

**A-2 Carbon Adsorption System, Product Recovery System VP2000 Carbon GAC
Vessel, 1,000 SCFM per vessel maximum throughput, Three Vessels Connected in Series**

BACKGROUND

On behalf of Union Oil of California, Stantec Consulting Services, Inc has applied for an Authority to Construct/Permits to Operate for a soil vapor extraction (SVE). Both soil and groundwater will be extracted simultaneously using a dual phase extraction system (DPE) under a high vacuum. This will be accomplished by means of a regenerative vacuum blower (S-1) with a maximum operating capacity of 300 SCFM. Soil vapor will be extracted with vapor abatement achieved by either use of a thermal/catalytic converter oxidizer operating in thermal mode with integral heat recovery, or a thermal/catalytic converter oxidizer operating in catalytic mode, or a minimum of three 2,000 pound activated carbon vessels operating in series. Any liquid condensate from the SVE unit will be collected in 55 gallon drums and transported offsite for treatment. Emission monitoring for operation of the equipment will be conducted according to established Source Test methodology. If emissions are abated using activated carbon vessels, the facility will obtain the required permits from the local wastewater utility district.

The applicant will be required to provide written notification at the start of each phase of abatement. During operations using carbon adsorption abatement, the carbon unit influent and effluent VOC concentrations will be monitored using a portable flame-ionization detector (OVA-FID) on a schedule reflecting current loading rates and predicted carbon capacity. To ensure proper operation of equipment and verify attainment of steady-state conditions, carbon performance will be required to be monitored daily. The applicant may then elect to change their monitoring schedule based on measured influent concentrations and calculated carbon loading. Monitoring schedule changes will be allowed only after District review of concentration measurements and subsequent receipt of District approval.

EMISSIONS CALCULATIONS

Precursor Organic Compounds

For a conservative estimate of yearly emissions, it is assumed that the soil vapor extraction operation is operated for the entire year with an inlet concentration corresponding to the initial soil concentration level. Generalized assumptions are as follows:

- Operating conditions: Pressure = 1 Atm; Inlet Temperature = 21°C; (V/n =RT/P) 387 ft³.
- Molecular weight of TPHg = 102 g/mole (value for "weathered gasoline")
- Influent values based on operational parameters of equipment and applicant supplied soil vapor test results: influent rate 300 scfm throughout; maximum influent concentration = 15,000 ppmv TPH(g), Benzene 54 ppmv, Toluene 190 ppmv, Ethylbenzene 73 ppmv, MTBE 33 ppmv, and Mixed Xylenes 285 ppmv; destruction efficiency = 97% throughout.

- **Emissions of Precursor Organic Compounds from SVE Operations: TPH (g)**

At 15,000 ppmv of total purgeable hydrocarbons from gasoline [TPH(g)], total precursor organic compound (POC) emissions from SVE operations are calculated as follows:

$$15,000 \times 10^{-6} * 300 \text{ ft}^3/\text{min} * 1440 \text{ min}/\text{day} * 365 \text{ days}/\text{yr} * 28.32 \text{ L}/\text{ft}^3 / 24.15 \text{ L}/\text{g mole} * 102 \text{ g}/\text{g mole} / 453.6 \text{ g}/\text{lb} * (1 - 0.97) = 51.26 \text{ lbm}/\text{day} \text{ (abated)} = 18,711 \text{ lbm}/\text{year} \text{ (abated)} = 9.355 \text{ tpy} \text{ (abated)}$$

Toxic Pollutant Emissions

Total toxic pollutant emissions are as follows:

TABLE 1 – TOXIC POLLUTANT EMISSIONS

Efficiency	97.0%
Air Flow Rate CFM	300
Days/Year	365

Toxic Air Contaminants (TACs)	MW [g/mol]	ppmv	Unabated lbm/day	Abated lbm/day	Abated lbm/year	Abated tons/year
Benzene	78.1	54	4.711	0.141	51.582	0.026
Toluene	92.1	190	19.552	0.587	214.093	0.107
Ethyl Benzene	106.2	73	8.656	0.260	94.782	0.047
Xylenes	106.2	285	33.790	1.014	370.004	0.185
MTBE	88.2	33	3.249	0.097	35.574	0.018

Emission equations:

Benzene	$(54 \times 10^{-6}) \times (300 \text{ ft}^3/\text{min}) \times (1440 \text{ min}/\text{day}) \times (28.32 \text{ L}/\text{ft}^3) / (24.14 \text{ L}/\text{g mole}) \times (78.11 \text{ g}/\text{g mole}) / (453.6 \text{ g}/\text{lb}) = 4.71 \text{ lbm}/\text{day}$
Toluene	$(190 \times 10^{-6}) \times (300 \text{ ft}^3/\text{min}) \times (1440 \text{ min}/\text{day}) \times (28.32 \text{ L}/\text{ft}^3) / (24.14 \text{ L}/\text{g mole}) \times (92.13 \text{ g}/\text{g mole}) / (453.6 \text{ g}/\text{lb}) = 19.55 \text{ lbm}/\text{day}$
Ethyl benzene	$(73 \times 10^{-6}) \times (300 \text{ ft}^3/\text{min}) \times (1440 \text{ min}/\text{day}) \times (28.32 \text{ L}/\text{ft}^3) / (24.14 \text{ L}/\text{g mole}) \times (106.16 \text{ g}/\text{g mole}) / (453.6 \text{ g}/\text{lb}) = 8.66 \text{ lbm}/\text{day}$
Xylenes	$(285 \times 10^{-6}) \times (300 \text{ ft}^3/\text{min}) \times (1440 \text{ min}/\text{day}) \times (28.32 \text{ L}/\text{ft}^3) / (24.14 \text{ L}/\text{g mole}) \times (106.17 \text{ g}/\text{g mole}) / (453.6 \text{ g}/\text{lb}) = 33.79 \text{ lbm}/\text{day}$
MTBE	$(33 \times 10^{-6}) \times (300 \text{ ft}^3/\text{min}) \times (1440 \text{ min}/\text{day}) \times (28.32 \text{ L}/\text{ft}^3) / (24.14 \text{ L}/\text{g mole}) \times (88.15 \text{ g}/\text{g mole}) / (453.6 \text{ g}/\text{lb}) = 3.25 \text{ lbm}/\text{day}$

Criteria Pollutant Emissions

The combustion of fuel from thermal/catalytic oxidizers results in secondary combustion criteria pollutant emissions. The combustion source is subject to Reasonably Available Control Technology (RACT) for control of secondary pollution emissions. RACT for thermal and catalytic oxidizers has been established as 0.2 lb/MMBTU for NO_x and 0.8 lb/MMBTU for CO. With these values, the criteria pollutants from combustion operations are as follows:

TABLE 2 – CRITERIA POLLUTANT EMISSIONS**Thermal/ Catalytic Oxidation****Secondary Criteria Pollutants of Concern**

Firing Rate MM BTU/hour	440,000	BTU/hr
Maximum # of Operating Hours	8,760	hrs/year

Pollutant	Emission Factor [lb/MMBTU]	Maximum Firing Rate [MMBTU/hr]	Hours/year [hrs]	Annual Emissions [lb/day]	Annual Emissions [lb/yr]	Annual Emissions [tons/yr]
NO_x	0.2	0.44	8760	2.11	770.88	0.385
CO	0.8	0.44	8760	8.45	3083.52	1.542
PM10	0.075	0.44	8760	0.79	289.08	0.145
SO₂	0.0006	0.44	8760	0.01	2.31	0.001
POC	0.0054	0.44	8760	0.06	20.81	0.010

Total POC emissions is the sum of POCs produced from SVE operations and POCs produced from thermal/catalytic combustion = 9.355 tons/year + 0.010 tons/year = 9.365 tons/year.

TOXIC RISK MODELING

The District considers toxic emission exposure to surrounding residential and industrial populations as a part of all proposed new source applications. A benzene emissions level of 3.8 lbs/year automatically triggers a health risk screening assessment pursuant to Regulation 2, Rule 5. At a maximum 8,760 hours per year potential operation, the application exceeds this benzene emissions level, and so requires that a health risk screening assessment be performed.

Because no representative meteorological data was available for this site, an ISCST3 model for PM₁₀ exposure using SCREEN3 meteorological data was used to estimate maximum 1-hour average ambient PM₁₀ concentrations. Since the ISCST3 model does not estimate air concentrations within a building cavity region, where potential receptors are located, the ISC-Prime model was also run. Annual average concentrations were estimated to be equal to ten percent of the predicted maximum 1-hour maximum average concentration at each receptor. Distance and directionality were used as the primary considerations to determine sites of maximum exposure. Elevated terrain was considered using 10m DEM input from the USGS Montara Mountain sub area. Model runs were made with rural dispersion coefficients to best represent the land use in the area. Stack and building parameters for the analysis were based on information provided by the applicant.

Estimates of residential risk assume potential exposure to annual average TAC concentrations occur 24 hours per day, 350 days per year, for a 70-year lifetime. Risk estimates for offsite workers assume potential exposure occurs 8 hours per day, 245 day per year, for 40 years. Risk estimates for students assume a higher breathing rate, and potential exposure is assumed to occur 10 hours per day, 36 weeks per year, for 9 years. Cancer risk adjustment factors (CRAFs) were used to calculate all cancer risk estimates. The CRAFs are age-specific weighting factors used in calculating cancer risks from exposures of infants, children and adolescents, to reflect their anticipated special sensitivity to carcinogens.

The highest risks were obtained by modeling emissions using the ISCST3 model. This model produced a maximum annual residential GLC of 2214.24 µg/m³ per g/sec, resulting in a cancer risk of approximately 9.5 in a million, a maximum annual worker GLC of 5400.53 µg/m³ per g/sec, resulting in a cancer risk of approximately 2.7 in a million, and a maximum annual student GLC of 527.38 µg/m³ per g/sec, resulting in a cancer risk of approximately 8.1 in a million. Associated health hazard indices are less than 1.0 for all cases.

The maximum calculated carcinogenic risk is below 10 in a million and the maximum calculated chronic hazard index is less than 1.0, and so the soil vapor extraction operation as proposed is acceptable under Regulation 2, Rule 5.

CUMULATIVE EMISSIONS INCREASE

Changes to the cumulative emissions inventory are as follows:

TABLE 3 - CUMULATIVE EMISSION INCREASE INVENTORY

	Current Balance (tons/yr)	Emission Increases (tons/yr)	On-Site Reductions (tons/yr)	Off-sets From DSFB (tons/yr)	New Total (tons/yr)
PM	0.000	0.145	0.000	0.000	0.145
POC	0.000	9.365	0.000	0.000	9.365
NOx	0.000	0.385	0.000	0.000	0.385
SO2	0.000	0.001	0.000	0.000	0.001
CO	0.000	1.542	0.000	0.000	1.542

BACT/TBACT REVIEW

Under Regulation 2, Rule 2, any new source which results in an increase of more than 10 lbs per day of any criteria pollutant must be evaluated for adherence to BACT and TBACT control technologies. The proposed

soil vapor extraction operations triggers BACT for POC emissions. For soil vapor extraction operations, BACT is defined as attainment of set destruction efficiencies corresponding to set influent concentration values. Operation of the catalytic/thermal oxidizer will be conditioned to ensure attainment of the following required destruction efficiencies: $\geq 98.5\%$ if inlet POC ≥ 2000 ppmv; $\geq 97\%$ if inlet POC ≥ 200 to < 2000 ppmv; and $\geq 90\%$ if POC < 200 ppmv. Operation of the carbon vessels will be conditioned to ensure attainment of an outlet POC concentration not to exceed 10 ppmv.

CEQA REVIEW

Under Regulation 2, Rule 1, Section 310, all proposed new and modified sources subject to District permit requirements must be reviewed in accordance with CEQA requirements, except for ministerial projects or projects exempt from CEQA under Section 2-1-312. The project is considered to be ministerial under Regulation 2-1-311. The engineering review for this project requires only the application of standard permit conditions and standard emission factors as outlined in Chapter 9.2 of the permit handbook. This project is therefore is not subject to CEQA review.

PUBLIC NOTIFICATION REQUIREMENTS

The proposed soil vapor extraction operation is located within 1,000 feet of one or more schools providing educational services to students enrolled in kindergarten or grades 1 through 12. Under the California Health and Safety Code §42301.6 and Regulation 2-1-412, notification of the proposed new sources will be mailed to the parents or guardians of all children enrolled in any school within one-quarter mile of the sources, and to each address within a radius of 1,000 feet of the sources, in order to give these parties an opportunity to provide public comment on the proposed actions.

PSD REVIEW

Since the facility will not have the potential to emit more than 100 tons per year of any criteria pollutant, and the facility will not have to potential to emit more than 100,000 tons per year of greenhouse gases, the facility is not a "Major Facility" as defined in Regulation 2-1-203, and is not subject to PSD permitting requirements under Regulation 2-2-304.

TITLE V REVIEW

Since the facility will not have the potential to emit more than 100 tons per year of any criteria pollutant, and the facility will not have to potential to emit more than 100,000 tons per year of greenhouse gases, the facility is not a "Major Facility" as defined in Regulation 2-1-203, and is not subject to Title V permitting requirements under Regulation 2-6-301.

COMPLIANCE DETERMINATION

Based on the information submitted, this operation is expected to comply with Regulation 8, Rule 47, "Air Stripping and Soil Vapor Extraction Operations." All emissions will be vented through either a thermal/catalytic converter oxidizer or a carbon adsorption system at all times of operation. Criteria pollutants are not expected to exceed 10 tons per year. All condensate collected from the requirement that all air stripping and soil vapor

extraction operations with a total organic compound emission greater than 15 pounds per day shall be vented to a control device which reduces the total organic compound emissions to the atmosphere by at least 90 percent by weight will be met.

There are no federal NSPS, NESHAP, or MACT regulations that apply to soil vapor extraction operations.

CONDITION

Condition #25810, setting out the operating conditions and recordkeeping requirements for operations at Source S-1 shall be made part of the source's authority to construct/permit to operate.

RECOMMENDATION

The proposed 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 sources will be located within 1000 feet of a school, which triggers the public notification requirements of Regulation 2-1-412.

I recommend that the District initiate a public notice, and consider any comments received before taking final action on issuance of an Authority to Construct for the following sources:

S-1 Soil Vapor Extraction Operation, Rotary Claw Busch MM 1322, 10 HP, 300 SCFM

Abated by

A-1 Thermal/Catalytic Converter Oxidizer, PRM Model Therm-OX300, 300 SCFM

Or

A-2 Carbon Adsorption System, Product Recovery System VP2000 Carbon GAC Vessel, 1,000 SCFM per vessel maximum throughput, Three Vessels Connected in Series

subject to Condition #25810.

By _____ Date _____
Catherine S. Fortney

COND# 25810 -----

For: S-1 Soil Vapor Extraction Operation abated by either
A-1 Thermal/Catalytic Converter Oxidizer or by
A-2 Carbon Adsorption System

1. The owner/operator shall abate the Precursor Organic Compound (POC) emissions from Source S-1, Soil Vapor Extraction (SVE) system abated by either A-1, Thermal Oxidizer/Catalytic Oxidizer, or by A-2, Carbon Adsorption System, including three (200 pound minimum capacity each) activated carbon vessels operated in series, during all periods of operation. Start-up 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. The owner/operator shall operate the source such that the soil vapor flow rate from S-1 shall not exceed 300 scfm. [basis: Cumulative Increase, Regulations 8-47-301 and 302, TBACT]
2. The owner/operator shall operate A-1, Thermal/Catalytic Oxidizer such that the POC abatement efficiency shall be maintained at a minimum of 99% by weight for inlet POC concentrations greater than or equal to 2000 ppmv (measured as hexane). For inlet concentrations below 2000 ppmv and greater than or equal to 200 ppmv, a minimum abatement efficiency of 97% shall be maintained by the owner/operator. For inlet concentrations below 200 ppmv, a minimum abatement efficiency of 90% shall be maintained by the owner/operator. The minimum abatement efficiency shall be waived if outlet POC concentrations are shown to be less than 10 ppmv (measured as hexane). In no event shall the owner/operator emit more than 0.14 lb/day of benzene, 0.26 lb/day of ethyl benzene, 0.10 lb/day of MTBE, or 51.3 lb/day of total precursor organic compound (POC) emissions.
[basis: Cumulative Increase, Regulation 2-5, TBACT]
3. While operating the A-1 Thermal/Catalytic Oxidizer in thermal mode, the owner/operator shall not operate A-1 below a minimum operating temperature of 1400 degrees Fahrenheit. While operating the A-1 Thermal/Catalytic Oxidizer in catalytic mode, the owner/operator shall not operate A-1 below a minimum operating temperature of 600 degrees Fahrenheit. [basis: Cumulative Increase, Regulation 2-5, TBACT]
4. To demonstrate compliance with part 3, the owner/operator shall equip 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 for a period of at least 2 years following the date on which such data are recorded. [basis: Regulation 1-523]

5. To demonstrate compliance with part 2, within ten days after start-up of the Thermal/Catalytic Oxidizer, the owner/operator shall:
 - a. Analyze inlet gas stream to determine the flow rate and concentration of total POC, benzene, ethyl benzene, and methyl tertiary butyl ether (MTBE) present in the inlet gas stream.
 - b. Analyze exhaust gas to determine the flow rate, and the concentration of total POC, benzene, ethyl benzene and MTBE from A-1.
 - c. Calculate total POC, benzene, ethyl benzene, and MTBE emission rates in pounds per day based on the exhaust gas analysis and the operating exhaust flow rate. The owner/operator shall decrease the vapor flow rate for S-1, if necessary, to ensure compliance with the daily emission limits in part 2.
 - d. Calculate the POC abatement efficiency based on the inlet and exhaust gas analysis. For the purpose of determining compliance with part 2, the owner/operator shall report the 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 total POC, benzene ethyl benzene, and MTBE.[basis: Cumulative Increase, Regulation 2-5, TBACT]
6. The owner/operator shall maintain the following records for each month of operation of the Thermal/Catalytic Oxidizer:
 - a. Days and hours of operation.
 - b. Each emission test, analysis or monitoring results logged in for the day of operation they were taken.
 - c. Total throughput of soil vapor from source S-1 in Standard Cubic Feet.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]
7. During operation of A-2, Activated Carbon Vessels, the owner/operator shall monitor emissions 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.

Such monitoring shall be done on a daily basis. 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 purpose of these permit conditions. [basis: Cumulative Increase, Regulation 2-5, TBACT]

8. The owner/operator shall record the emissions measured in part 7 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 9 and 10. Based on actual measurements taken at the site during source operations, the owner/operator may propose 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 any change to the monitoring schedule. [basis: Cumulative Increase, Regulation 2-5, TBACT]
9. The owner/operator shall immediately change out the second to last carbon vessel with unspent carbon upon breakthrough, defined as the detection at its outlet of the higher of the following:
 - a. 10 % of the inlet stream concentration to the carbon bed.
 - b. 10 ppmv (measured as hexane).[basis: Cumulative Increase, Regulation 2-5, TBACT]
10. The owner/operator shall immediately change out the last Carbon Vessel with unspent carbon upon detection at its outlet of 10 ppmv (measured as hexane). [basis: Cumulative Increase, Regulation 2-5, TBACT]
11. The owner/operator 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. The number of carbon vessels replaced or removed from service and the location of the vessels in A-2, the date the vessel was removed, the weight of carbon in any new vessels, the date the new vessel

was placed in service, and the location of the new vessel in A-2.

- d. Total throughput of soil vapor from source S-1 in Standard Cubic Feet.
- e. Total throughput of groundwater through Source S-1 in thousands of gallons.

The owner/operator shall retain and make available for inspection by the District such records for two years following the date the data is recorded. [basis: Regulation 1-523]

- 12. The owner/operator 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]
- 13. The owner/operator 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 Authority to Construct/Permit to Operate. All measurements, records and data required to be maintained by the owner/operator shall be retained for at least two years following the date the data is recorded. [basis: Regulation 1-523]
- 14. Upon final completion of the remediation project, the owner/operator of Source S-1 shall notify the Engineering Division within two weeks of decommissioning the operation. [basis: Cumulative Increase, Regulation 2-5, TBACT]