**Engineering Evaluation**
**Polk Street Associates**
**2101 Polk Street, San Francisco, California 94109**
**Plant No. 25232 (Site No. E5232)**
**Application No. 31762**
**Project Description: Sub-Slab Depressurization System**

## Background

On behalf of Polk Street Associates, AEI Consultants has applied for an Authority to Construct for the following equipment:

**S-1 Sub-Slab Depressurization System**
**Liquid Ring Blower, Make: Fuji Electric, Model: VFC508P-2T, Maximum 154 SCFM**
**Abated by A-1, Activated Carbon Vessels**

**A-1 Activated Carbon Vessels**
**Minimum of Two (2) 200-LBS Activated Carbon Vessels, Arranged in Series**
**Make: Evoqua, Model: VSC-200**

The site consists of an occupied commercial building located on the northwest corner of the intersection of Broadway Street and Polk Street in a mixed commercial and residential area of San Francisco. The property was historically occupied by dry cleaning operations. Lab analysis of soil vapor samples collected in March 2022 found the presence of tetrachloroethene (PCE) in soil vapor beneath the site. To mitigate vapor intrusion into the building, the facility is proposing to install S-1, Sub-Slab Depressurization (SSD).

S-1 will include a liquid ring blower with a maximum rated capacity of 154 CFM. Contaminated soil vapor will be routed through a series of two (2) 200-lb activated carbon vessels to remove volatile organic compounds (VOC) before reaching the atmosphere. Emissions are based on laboratory results of soil vapor submitted in this application for the site. S-1 will be located within 1,000 ft of a K-12 school and is subject to a public notice.

Procedures are outlined in the conditions found below. Effluent volatile organic compound (VOC) concentrations will be monitored with a photo-ionization detector (FID) on a schedule reflecting current loading rates and predicted carbon capacity. A PID is proposed instead of a flame-ionization detector (FID) because PCE is the only compound found above detection limits in soil vapor sampling. Monitoring schedule changes will be allowed based on monitoring data collected.

## Emission Calculations

Tetrachloroethene, a non-precursor organic compound (NPOC) and toxic air contaminant (TAC), was the only pollutant found in soil vapor samples above the method detection limit (MDL). Other compounds commonly found at dry cleaning sites will be included for a conservative estimate of potential emissions. This data will be used to estimate precursor organic compound (POC), NPOC, and TAC emissions. It is assumed that the equipment can operate 24 hours a day, 365 days a year. The following are assumptions used to estimate emissions.

- Operating conditions: Pressure = 1 Atm; Inlet Temperature = 21$^{O}$C; 1 mole occupies 24.15 Liters (or 386.8 ft3/lb-mol)

- The inlet concentration of pollutants corresponds to the maximum concentration found from lab analysis of soil vapor for pollutants that were found in concentrations above the MDL. Inlet concentrations of other common dry-cleaning pollutants that were not detected will correspond to half of the MDL.
- Hydrocarbons will be abated by two (2) 200-lb minimum activated carbon vessels in series.
- POC/NPOC cumulative emissions are based on a 10-ppmv total organic effluent concentration since the last carbon threshold changeout level on the last abatement vessel will be limited 10 ppmv, adjusted to methane (CH4).
- Toxic Air Contaminants (TAC) emissions will be based on soil vapor data submitted with this application.
- The organic influent flow rate of 154 scfm was used in the calculations.
- An abatement efficiency of 91.6% and 98.5% will be assumed for NPOC and POC, respectively. The NPOC abatement efficiency was back calculated based on a maximum effluent concentration of 10 ppmv (adjusted to methane) for NPOC.

**Table 1. Emissions Review for Sub-Slab Depressurization System (S-1)**

| Pollutant | CAS | Pollutant Designation | | | Inlet Conc. ($\mu g/m^3$) | Unabated Emission Rates | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | POC | NPOC | TAC | | Hourly (lbs/hr) | Daily (lbs/day) | Annual (lbs/yr) | Annual (tons/yr) |
| 1,1-Dichloroethene* | 75-35-4 | X | | X | 125 | 7.20E-05 | 1.73E-03 | 0.63 | 3.16E-04 |
| Methylene Chloride* | 75-09-2 | | X | X | 500 | 2.88E-04 | 6.92E-03 | 2.52 | 1.26E-03 |
| Tetrachloroethene | 127-18-4 | | X | X | 78,000 | 4.50E-02 | 1.08 | 393.8 | 0.197 |
| Trichloroethene* | 79-01-6 | X | | X | 250 | 1.44E-04 | 3.46E-03 | 1.26 | 6.31E-04 |
| Vinyl Chloride* | 75-01-4 | X | | X | 250 | 1.44E-04 | 3.46E-03 | 1.26 | 6.31E-04 |

| Pollutant | CAS | Pollutant Designation | | | Abatement Efficiency (% w/w) | Abated Emission Rates | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | POC | NPOC | TAC | | Hourly (lbs/hr) | Daily (lbs/day) | Annual (lbs/yr) | Annual (tons/yr) |
| 1,1-Dichloroethene* | 75-35-4 | X | | X | 98.5% | 1.08E-06 | 2.59E-05 | 9.47E-03 | 4.73E-06 |
| Methylene Chloride* | 75-09-2 | | X | X | 91.6% | 2.42E-05 | 5.81E-04 | 0.21 | 1.06E-04 |
| Tetrachloroethene | 127-18-4 | | X | X | 91.6% | 3.78E-03 | 9.06E-02 | 33.08 | 0.017 |
| Trichloroethene* | 79-01-6 | X | | X | 98.5% | 2.16E-06 | 5.19E-05 | 1.89E-02 | 9.47E-06 |
| Vinyl Chloride* | 75-01-4 | X | | X | 98.5% | 2.16E-06 | 5.19E-05 | 1.89E-02 | 9.47E-06 |

**Notes**:

1. Influent data was obtained from lab data of soil vapor sampling performed at the site.
2. Pollutants marked with (*) were not detected above the MDL. Half of the MDL was used as the influent concentration.
3. It is assumed that equipment will operate 24 hours a day, 365 days a year.

Effluent emissions from S-1 will be limited to 10 ppmv (as methane). However, a PID will be used for monitoring and PIDs cannot be calibrated to methane. Therefore, volumetric concentrations as methane will be adjusted to hexane using the following method.

**Molar Weight of Applicable Compounds:**
Hexane (C6): 86.18 lb/lbmol
Methane (CH4): 16.04 lb/lbmol

**Adjustment Factor (AF) =** $\frac{16.04\ lb/lbmol}{86.18\ lb/lbmol} = 0.19$

$$Volumetric\ Concentration\ (ppmv\ C6) = Volumetric\ Concentration\ (ppmv\ CH4) * AF$$

$$10\ ppmv\ CH4 * 0.19 = 1.86\ ppmv\ C6$$

NPOC is the primary pollutant category that is expected to be emitted from S-1 and emission monitoring will be based on NPOC emissions. However, an equivalent POC limit will be set to allow for flexibility in the event that POC is found when the system is started up. Table 2 provides a summary of emissions of POC and NPOC emissions.

| | Table 2. Organic Emissions Review – Sub-Slab Depressurization System | | | | | |
|---|---|---|---|---|---|---|
| **Pollutant** | **Effluent Volumetric Concentration (ppmv as CH4)** | **Effluent Volumetric Concentration (ppmv as C6)** | **Hourly Emission Rate (lb/hr)** | **Daily Emission Rate (lb/day)** | **Annual Emission Rate (lb/yr)** | **Annual Emission Rate (ton/yr)** |
| POC | 10 | 1.86 | 3.83E-03 | 9.20E-02 | 33.57 | 0.017 |
| NPOC | 10 | 1.86 | 3.83E-03 | 9.20E-02 | 33.57 | 0.017 |

## Cumulative Increase

| Table 3. Cumulative Increase | | | |
|---|---|---|---|
| **Pollutant** | **Current Permitted Emissions, Post 4/5/1991 (ton/yr)** | **Application New Emissions Increase (ton/yr)** | **New Cumulative Increase (ton/yr)** |
| POC | 0.000 | 0.017 | 0.017 |

## Toxic Risk Screening

A project is subject to Regulation 2, Rule 5 if emissions of toxic air contaminants (TAC) exceed any acute or chronic trigger levels in Table 2-5-1 of Regulation 2-5. This is new facility so there are no related sources to include in the project. Therefore, the project review of TAC emissions will include only the emissions from S-1. Table 4 provides a summary of the project TAC emissions.

| Table 4. Project Toxic Air Contaminant Emissions | | | | | | |
|---|---|---|---|---|---|---|
| **Pollutant** | **CAS #** | **Hourly Emission Rate (lb/hr)** | **Acute Trigger Level (lb/hr)** | **Annual Emission Rate (lb/yr)** | **Chronic Trigger Level (lb/yr)** | **Exceeds Acute or Chronic Trigger Level?** |
| 1,1-Dichloroethene* | 75-35-4 | 1.08E-06 | | 9.47E-03 | 2.70E+03 | No |
| Methylene Chloride* | 75-09-2 | 2.42E-05 | 3.10E+01 | 0.21 | 8.20E+01 | No |
| Tetrachloroethene | 127-18-4 | 3.78E-03 | 4.40E+01 | 33.08 | 1.40E+01 | Yes |
| Trichloroethene* | 79-01-6 | 2.16E-06 | | 1.89E-02 | 4.10E+01 | No |
| Vinyl Chloride* | 75-01-4 | 2.16E-06 | 4.00E+02 | 1.89E-02 | 1.10E+00 | No |

**Notes:**

1. Compounds with an (*) were not detected above the MDL in the lab analysis of soil vapor.

This project is expected to exceed the chronic trigger level for PCE and is therefore subject to the requirements of Regulation 2-5. A Health Risk Assessment (HRA) was conducted with an initial assumption of 90% abatement efficiency, which corresponded to an annual PCE emission rate of 39.38 lbs/year. The results of the HRA are summarized in Table 5 below.

| Table 5. Health Risk Assessment Results | | | |
|---|---|---|---|
| **Receptor** | **Cancer Risk** | **Chronic Hazard Index** | **Acute Hazard Index** |
| Resident | 2.5 in a million | 0.0050 | N/A |
| Worker | 0.33 in a million | 0.0081 | N/A |
| Student | 0.051 in a million | 0.00036 | N/A |
| PMI | N/A | N/A | 0.00046 |

The results from the HRA indicate that the maximum project cancer risk (resident) is estimated at 2.5 in a million, the maximum project chronic hazard index (worker) is estimated at 0.0081, and the maximum project acute hazard index is 0.00046. These risk values comply with the Regulation 2-5-302 project risk requirements.

Because the maximum project cancer risk for any receptor exceeds 1.0 in a million, the facility will be required to implement Best Available Control Technology for Toxics (TBACT) controls. TBACT requirements will be summarized in the following section, but the result of TBACT controls will reduce annual PCE emissions to the emission rate in Table 4, which is a reduction of 16%. Therefore, the maximum cancer risk (resident) will be lowered to 2.1 in a million.

## Best Available Control Technology for Toxics (TBACT)

Pursuant to Regulation 2-5-301, a new or modified source is subject to TBACT if the source cancer risk exceeds 1.0 in a million and/or if the chronic hazard index exceeds 0.20.

The estimated cancer risk for S-1 exceeds 1.0 in a million and therefore the source is subject to TBACT for emissions of POC and NPOC. Section 9 of the Air District's BACT/TBACT Workbook has guidelines for Soil Vapor Extraction operations. If technologically feasible and cost-effective, TBACT 1 for POC requires the effluent volumetric concentration of POC to be less than or equal to 10 ppmv (adjusted to methane); or POC must be abated with a capture/destruction efficiency of at least 98.5%. The typical technology to achieve this requirement is by at least two (2) activated carbon vessels in series or a thermal oxidizer. TBACT 1 for NPOC requires the effluent volumetric concentration of NPOC to be less than or equal to 10

ppmv (adjusted to methane). The typical technology to achieve this requirement is at least two (2) activated carbon vessels in series.

The applicant satisfies the TBACT technology requirement with the proposed use of two (2) activated carbon vessels in series. Furthermore, the applicant has agreed to the TBACT 1 emission control requirements for POC and NPOC. The TBACT emission control requirements will be reflected in the permit conditions below.

## Offsets

Pursuant to Regulation 2-2-302, offsets must be provided for any new or modified source at a facility that emits, or is permitted to emit, more than 10 tons per year of precursor organic compounds (POCs) or nitrogen oxides ($NO_X$). Furthermore, pursuant to Regulation 2-2-303 offsets must be provided for any new or modified source at a major facility with a cumulative increase that exceeds 1.0 ton per year of $PM_{10}$, $PM_{2.5}$, or sulfur dioxide ($SO_2$).

The facility is not expected to have a PTE greater than 10 tons per year of POC or $NO_X$, nor is the facility a major facility of $PM_{10}$, $PM_{2.5}$, and $SO_2$. Therefore, the requirements of Regulations 2-2-302 and 2-2-303 do not apply.

## Best Available Control Technology (BACT)

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 ($SO_2$), particulate matter less than 10 micrometer ($PM_{10}$) and particulate matter less than 2.5 micrometer ($PM_{2.5}$).

NPOC and POC emissions are expected to be below 10 lb/day. Therefore, a BACT review is not required.

### California Environmental Quality Act (CEQA)

This project is classified as ministerial under the District Regulation 2-1-311, because the engineering review for this project requires only the application of standard emission factors and established formulas as specified in Chapter 9.2 of the District's Permit Handbook. This review follows objective procedures and applies standard permit conditions; and therefore, the review of this project is not discretionary as defined by CEQA. Since this project is ministerial, it is not subject to CEQA review requirement of Regulation 2-1-310, and no further CEQA analysis is required.

## Statement of Compliance

### Regulation 8, Rule 47 – Air Stripping & Soil Vapor Extraction Operations

Based on the information submitted, this operation is expected to meet the 90% control requirement of Regulations 8-47-301 and 8-47-302. Emissions will be vented through a carbon adsorption system at all times of operation.

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

## Public Notification (Regulation 2-1-412)

S-1 is not located in an overburdened community (OBC), but will be located within 1,000 feet of St. Brigid School (Grades K-8). Additionally, Sherman Elementary School (K-5) and Spring Valley Science School (K-5) are both located within 0.25 miles from S-1. The project is therefore subject to public notification requirements of Regulation 2-1-412 due to an increase in toxic emissions. A public notice will be sent to all parents of students of the above-mentioned schools, and all residents within 1,000 feet of the facility. There will be a 30-day public comment period.

## Permit Conditions

### Permit Condition #27792

1. The owner/operator shall abate the precursor organic compound (POC)/non-precursor organic compound (NPOC) emissions from the soil vapor extraction system (S-1) with the Activated Carbon Vessels (A-1), consisting of a minimum of two (2) 200 lbs activated carbon vessels in series, during all periods of operation. The influent vapor flow rate shall not exceed 154 scfm. [Basis: Regulations 8-47-301, 8-47-302, and Toxics].

2. The owner/operator shall operate A-1 in a manner such that the abatement efficiency of POC shall be maintained at a minimum of 98.5% by weight. The minimum POC abatement efficiency shall be waived if outlet POC concentrations are shown to be less than or equal to 10 ppmv (as methane). Additionally, the owner/operator shall operate A-1 in a manner such that the outlet concentration of NPOC does not exceed 10 ppmv (as methane). In no event shall the tetrachloroethene emission rate exceed 33.08 pounds per year. [Basis: TBACT, Toxics]

3. Except as provided in Part 2 of this condition, in no event shall the toxic air contaminant (TAC) emissions from S-1 exceed the trigger levels listed in Table 2-5-1 of Regulation 2, Rule 5. [Basis: Toxics].

4. Upon initial start-up, the owner/operator shall take air samples from S-1 for laboratory analysis using EPA Method TO-15. The air samples shall be taken at the following 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.

   The owner/operator shall use the results from the laboratory report to calculate TAC emissions emitted to the atmosphere, using the maximum design flowrate of S-1. The owner/operator shall submit the laboratory report and calculated TAC emissions within 21 days of the initial startup, to demonstrate compliance with Parts 2, 3, and 8 of this condition. [Basis: Regulation 2-1-403]

5. During operation of A-1, the owner/operator shall monitor with a photo-ionization detector (PID) 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 last carbon vessel in series, prior to venting to the atmosphere.

   [Basis: Regulations 1-523 and 2-1-403]

6. The owner/operator shall conduct monitoring on a daily basis in accordance with Part 5 of this condition. 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 2, 7, and 8 of this condition.

    a. If the owner/operator can demonstrate two (2) weeks of consecutive daily monitoring readings lower than 0.93 ppmv (measured as hexane) at the outlet of the last carbon vessel in series, the monitoring frequency may be reduced to weekly.
    b. After the monitoring frequency has been reduced to weekly, if the owner/operator can demonstrate one (1) month of consecutive weekly monitoring readings lower than 0.93 ppmv (measured as hexane) at the outlet of the last carbon vessel in series, the monitoring frequency may be reduced to once every two (2) weeks.
    c. After the monitoring frequency has been reduced to once every two (2) weeks, if the owner/operator can demonstrate one (1) month of consecutive bi-weekly readings lower than 0.93 ppmv (measured as hexane) at the outlet of the last carbon vessel in series, the monitoring frequency may be reduced to monthly.
    d. If any subsequent results from monitoring exceed 0.93 ppmv (measured as hexane) at the outlet of the last carbon vessel in series, the owner/operator shall revert to daily monitoring. If monitoring reverts back to daily, the owner/operator may reduce the monitoring frequency in accordance with Parts 6(a) through (c) of this condition.

    [Basis: Cumulative Increase, Toxics, and Regulations 1-523 and 2-1-403]

7. 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. 1.86 ppmv (measured as hexane).

    [Basis: Cumulative Increase and Regulations 1-523 and 2-1-403]

8. The last carbon vessel shall be immediately changed out with unspent carbon upon detection at its outlet of 1.86 ppmv or greater (measured as hexane). [Basis: Cumulative Increase and Regulations 1-523 and 2-1-403]

9. The owner/operator shall maintain the following information for each month of operation:

    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 removed from service.
    d. 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 (2) years following the date the data is recorded. [Basis: Recordkeeping]

10. The owner/operator shall report any noncompliance 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: Regulation 2-1-403]

11. 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 condition. All

measurements, records and data required to be maintained by the operator shall be retained for at least two (2) years following the date the data is recorded. [Basis: Regulation 1-523]

Upon final completion of the remediation project, the operator shall notify the Engineering Division within two weeks of decommissioning the operation. [Basis: Regulation 2-1-403]

## 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/Permit to Operate for the equipment listed below. However, the proposed source will be located within 1,000 feet of at least one 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/Permit to Operate for the following source:

**S-1 Sub-Slab Depressurization System**
**Liquid Ring Blower, Make: Fuji Electric, Model: VFC508P-2T, Maximum 154 SCFM**
**Abated by A-1, Activated Carbon Vessels**

**A-1 Activated Carbon Vessels**
**Minimum of Two (2) 200-LBS Activated Carbon Vessels, Arranged in Series**
**Make: Evoqua, Model: VSC-200**

By: _____ Date: 10/5/22

Cameron Fee
Air Quality Engineer I