555 GRAND STREET
BROOKLYN NEW YORK
Block 2741 Lot 47

SOIL VAPOR EXTRACTION
REMEDIAL DESIGN WORK PLAN

SEPTEMBER 2018

Prepared for:
555 Grand Units, LLC
183 Wilson Street, Suite 132
Brooklyn, NY 11211

Prepared By:

AMC Engineering PLLC
18-36 42nd Street
Astoria, NY 11105
Phone: (516) 417-8588

CERTIFICATIONS

I, Ariel Czemerinski, certify that I am currently a NYS registered professional engineer and that this Soil Vapor Extraction Design Document was prepared in accordance accepted engineering practices.

076508	9/15/2019	
NYS Professional Engineer #	Date	Signature

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555 Grand Street, Brooklyn

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LIST OF ACRONYMS

Acronym	Definition
AMC	AMC Engineering
AWQS	Ambient Water Quality Standards
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CQMP	Construction Quality Management Plan
DUSR	Data Usability Statement Report
EBC	Environmental Business Consultants
FER	Final Engineering Report
HDPE	High Density Polyethylene
IRM	Interim Remedial Measure
NYC	New York City
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PS	Public School
PVC	Polyvinyl Chloride
RAO	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RSCOs	Recommended Site Cleanup Objectives
SCG	Standards, Criteria, and Guidelines
SMMP	Soil/Materials Management Plan
SMP	Site Management Plan
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

1.0 SITE BACKGROUND

AMC Engineering, PLLC (AMC) has been retained by 555 Grand Units, LLC, to conduct environmental remediation activities for a commercial property located 555 Grand Street in the Williamsburg section of Brooklyn (**Figure 1**). On September 1, 2015, the Site has formally entered into to the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP) and given Site Number C224185. The applicant was accepted into the program as a Volunteer. When completed, the Site will be re-developed with a new multi-family residential apartment building.

This Remedial Design Work Plan (RDWP) was prepared to provide design specifics of the soil vapor extraction (SVE) program to be implemented at the Site. This RDWP was prepared in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010.

1.1 SITE LOCATION AND DESCRIPTION

The Site address is 555 Grand Street, Brooklyn, New York 11211. It is located on the north side of Grand Street between Union Avenue and Lorimer Street in Brooklyn, New York (**Figure 1**). The site is designated as Block 2779 Lot 31 on the Brooklyn Tax Map. The Site consists of a single tax parcel with 25.25 feet of street frontage on Grand Street and is 100 feet deep for a total of 2,525 square feet (**Figure 2**). The lot is currently developed with a three story mixed use (first floor retail, residential upper flows) building with a basement which covers approximately 100% of the lot.

1.2 PROJECT BACKGROUND

Historic records show the subject site as being developed with the current three-story mixed use commercial residential building in 1887. According to historical city directories, the Site has been occupied by multiple commercial tenants such as, Slavin Building Co, Louis Lewitsky Dry Goods, Lewis Miracle Dollar Store, Rama Building Corp, Louis Bargain Department Store, Mayflower Bargain Store, Joel Bargain Store and Tru Val Cleaners. The Tru Val Cleaners has been on-site since at least 1999 according to the owners of the Site. In addition, the Site has been occupied by multiple commercial tenants since 1928. Historic sources and owner interviews indicate that Tru Val Cleaners was formerly located at 568 Grand Street from approximately 1960 to 2000.

2.0 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

The field work portion of the Remedial Investigation (RI) was conducted by Environmental Business Consultants (EBC) in December 2014. The investigation is summarized in the sections below. Further details are provided in the Remedial Investigation Report (EBC February 2015).

2.1 GEOLOGICAL CONDITIONS

Subsurface soils at the Site consists of a mixture of a silty non-native fill, to a depth of approximately 2 feet below basement grade followed by sandy-silt to a depth of approximately 4 feet below basement grade. Groundwater is present under water table conditions at a depth of approximately 22.5 feet below the surface and is expected to flow east.

According to the USGS topographic map for the area (Brooklyn Quadrangle), the elevation of the property is 28 feet above the National Geodetic Vertical Datum (NGVD). The area topography gradually slopes to the northwest.

2.2 CONTAMINATION CONDITIONS

CVOC contamination at the Site consists mainly of PCE in soil gas though TCE was also reported at elevated levels. The recent historical use of the site as a dry cleaner and the high PCE detections in soil gas is evidence that the CVOC contamination at the site is related to an on-site release. Based on recent observations made when the dry cleaner was in operation, it is evident that spent solvent was stored on-site in 10-gallon containers. Although the spent solvent was stored on the first floor next to the dry cleaning machine, new solvent or spent solvent may have been stored in the basement in the past. Access to the basement is through double steel doors in the sidewalk making it a convenient space for the pickup and delivery of stored supplies.

The most likely release scenario would include small surface spills from the storage of new or spent solvent in the basement. The spill(s) may have been just large enough to penetrate the concrete slab, without significantly impacting soil beneath the slab beyond a few inches. The solvent in the concrete would off-gas to indoor air with concentrations declining over time as the solvent in the concrete was depleted. Solvent at the base of the concrete would be trapped beneath the slab resulting in high PCE concentrations in sub-slab vapors as observed. Based on the concentration distribution, the spill(s) likely occurred in the vicinity of SG3 located near the front (south) of the building. This would be consistent with the storage of solvent in the front portion of the basement near the sidewalk access doors to facilitate pickup and delivery of the 10-galon storage containers.

No other source areas were identified or indicated during the RI. Elevated levels of SVOCs and metals reported in shallow soil beneath the basement slab are characteristic of the historic fill materials present at the site and throughout the area. Levels of PCE in groundwater were detected at slightly above standards, however these are equivalent with regional background data for the area.

2.2.1 Description of Areas of Concern

The primary area of concern is CVOC impacted soil gas beneath the existing building slab in the northwest corner of the property.

2.2.2 Soil Contamination

PCE was detected within two of the four shallow (0-2 ft) soil samples and three deep samples (6-12 ft) retained at the Site, however, neither PCE nor TCE were detected within any of the soil samples at a concentration above Unrestricted Use SCOs. No residual source in soil was identified.

SVOCs including benz(a)anthracene and benzo(b)fluoranthene were reported above restricted residential soil cleanup objectives (SCOs) in the 2-4ft sampling interval at one boring location.

One or more metals including arsenic, copper, lead and mercury were reported above restricted residential SCOs in both the 0-2 foot and 2-4 foot sampling intervals at three boring locations. The elevated levels of SVOCs and metals reported in shallow soil throughout the site is consistent with historic fill materials present throughout the area.

2.2.3 Groundwater Contamination

The groundwater sample obtained from the monitoring wells located on site indicate low levels of PCE, at a concentration slightly above NYSDE Groundwater Quality Standards. No other VOCs were detected in the groundwater sample. Several metals were reported above standards including, aluminum, iron, manganese and sodium. The concentrations and parameters reported are consistent with general background conditions documented in the area.

2.2.4 Soil Vapor Contamination

Total petroleum related volatile organic compounds were generally low and consistent with background levels. High concentrations of the chlorinated VOCs tetrachloroethylene (PCE) and elevated concentrations of trichloroethene (TCE) were detected within all three sub-slab soil gas samples collected as well as the indoor and outdoor air samples at the Site. TCE concentrations in soil gas ranged from 84.8 $\mu g/m^3$ to a high of 623 $\mu g/m^3$. TCE concentrations in indoor and outdoor air were 13.7 $\mu g/m^3$ and 3.92 $\mu g/m^3$, respectively. PCE concentrations in soil gas ranged from 7,730 $\mu g/m^3$ to 228,000 $\mu g/m^3$. PCE concentrations in indoor and outdoor air were 6,230 $\mu g/m^3$ and 3,930 $\mu g/m^3$, respectively. Both PCE and TCE were detected above the NYSDOH threshold requiring action (monitoring or mitigation).

3.0 SVE PILOT TEST

The SVE pilot test was conducted on November 3, 2015, by AMC Engineering to assist in the development of a full scale system design including horizontal extraction well spacing, blower specifications and treatment system capacity.

The objectives of the SVE pilot test were to:

- Collect vacuum and flow rate data to determine the full-scale design parameters for the SVE system;
- Determine the effective radius of influence (ROI) for the full-scale system design.

3.1 Test Summary

The test was performed by attaching a regenerative blower to a horizontal extraction well and then recording negative pressure in the nearby observation wells to establish the effective area of influence. A total of five (5), vapor monitoring points were installed into the sub-slab as shown in **Figure 3**.

The pilot test included the following components:

- One extraction line constructed of 20 feet of 4-inch diameter 10 slot (0.010-inch) PVC well screen
- One 3-inch diameter Riser constructed of solid PVC Schedule 40 pipe, followed by
- One 1HP Regenerative Blower (Rotron EN404) capable of drawing 95 cfm @ 10” WC vacuum, followed by
- Two 55gal drums fitted with vapor-phase granular activated carbon (Tigg Econosorb) arranged in series.

Vacuum readings were taken at the blower and wellhead with a diaphragm gauge, and at the observation points with a digital manometer. Flow rates were determined utilizing a vacuum/cfm chart supplied by the manufacturer. The SVE discharge was routed to an activated carbon drum to prevent nuisance odors.

3.2 Test Results

The results of the pilot test were as follows:

Table 1

Point ID	Distance (ft) from Extraction Line	Measured Vacuum (in. H_2O)
A	10	-0.22
B	12.5	-0.12
C	15	0
D	10	0
E	15	0

Measurements of vacuum / pressure at the blower / treatment system were as follows:

- Blower Inlet: -3.7” WC
- Air Flow: 95 CFM (from blower curve)
- Blower discharge: 10.13” WC
- First Stage Carbon Discharge: 6.32” WC
- Second Stage Carbon Discharge: 1.26” WC

As shown in the table above, the pilot tests conducted at points A and B had vacuum readings greater than 0.1 inches of water, which is taken as the limit of influence for soil vapor extraction. A reading of 0.01 inches of water is taken as the limit of influence for vapor mitigation through subslab depressurization. No vacuum readings were observed at Points D and E, however given the location of these monitoring points near the foundation wall, this may be attributed to the monitoring points being partially installed into a footing and not reaching the true subslab zone. No vacuum readings were observed at point C, located 15 ft from the extraction line. Therefore the limit of SVE influence in this test is between 12.5 and 15 feet. It was also noted during the test that the concrete slab was in poor condition and air flow may have been short circuiting during the test. For the purposes of this test, an effective limit of influence of 13 feet is indicated.

4.0 SVE SYSTEM DESIGN SPECIFICATIONS

4.1 SVE SYSTEM OVERVIEW

The SVE system will be installed beneath the basement slab, and converted into an active sub-slab depressurization system (SSDS) upon reaching asymptotic recovery levels. A vapor barrier will also be installed beneath the slab.

In the interim following the pilot test, the concrete cellar slab was removed and approximately four feet of soil was excavated from the cellar. Endpoint samples collected throughout the excavated area did not report any detections of PCE or TCE. It is therefore highly unlikely that any on-site CVOC source material is present for remediation with the SVE and it is probable that the system will be converted to SSD mode soon after startup.

4.2 SVE SYSTEM COMPONENTS

The data collected from the pilot test was used to determine the final design parameters for the SVE system. By extrapolating the data provided by points A and B in Table 1, the maximum radius of influence was calculated at 13 feet from the extraction line. As shown in **Figure 4**, the proposed design utilizes three horizontal extraction lines spaced 25.5 feet apart, with the furthest distance from any point to an extraction line of 12.75 feet.

The final System design is as follows:

- Three horizontal extraction line system;
- Extraction lines constructed of 20 feet of 4-inch diameter 10 slot (0.010-inch) PVC well screen;
- No. 1 morie (or equivalent) filter sand as backfill around horizontal extraction well;
- Each extraction line will be tied to the system through a 3-inch diameter PVC main line.
- Each extraction line will be isolated from the main line with a 3-inch ball valve;
- 2 hp (150 cfm) regenerative blower with particulate filter;
- Discharge treatment with vapor-phase granular activated carbon (TIGG Econsorb or equivalent GAC Vapor Phase Carbon Canisters); and,

- Installation of a 20 mil vapor barrier beneath the concrete slab.

The layout of the SVE system is shown in **Figure 4**. Design details are provided in **Figure 5**. Specifications for the vapor barrier are provided in **Appendix A**. Specifications for the SVE system components are provided in **Appendix B**.

The SVE system will not be discontinued without the written approval by the NYSDEC and NYSDOH. A proposal for conversation of the SVE system into an active SSDS through replacement of the regenerative blower with a radon type fan and removal of the vapor phase carbon treatment may be submitted by the property owner based on confirmatory data that justifies such a request. The system will remain in place and operation until permission to discontinue use is granted in writing by the NYSDEC and NYSDOH.

5.0 SYSTEM OPERATION AND MAINTENANCE

5.1 SVE START-UP PROCEDURES

Following installation of the system, the following items will be inspected to ensure proper operation:

1) Check all exposed/visible SVE piping for evidence of damage, cracks, or leaks.
2) Turn system on and off to ensure the start box is functioning properly;
3) Record vacuum reading at blower;
4) Record vacuum readings at surrounding monitoring wells;
5) Take PID readings before, in-between and after carbon vessels.

The system testing described above will be conducted if, in the course of the SVE system lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

A visual inspection of the complete system will be conducted during each monitoring event. SVE system components to be monitored include, but are not limited to, the following:

- Vacuum blower; and,
- General system piping.
- Vacuum gauges at blower.
- Control switches.
- PID Readings from influent line, between carbon drums and at the discharge stack.

The system testing described above will be conducted if, in the course of the AS / SVE system lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.2 REMEDIAL PERFORMANCE MONITORING

Air samples will initially be collected on a monthly basis to evaluate the performance of the system during the first 3 months of operation going to quarterly thereafter. PID readings will be taken from three locations: system influent (before carbon), between the carbon canisters and from the system discharge (after carbon). In addition air samples will be taken both before and after treatment through the carbon units. Air samples will be submitted to a NYSDOH certified environmental laboratory for analysis of VOCs by USEPA method TO15.

Initial effluent concentrations will be higher as accumulated vapors are removed. However, given the removal of the top 4 feet of soil throughout the cellar area and the removal of the concrete slab during construction, recovery rates and influent concentrations may be low overall.

Carbon drums will be set up in series with the between vessel PID readings / air samples utilized to determine when break through occurs at the first drum. When this occurs the drum will be changed out and shipped back to the supplier for regeneration. If nuisance odors are observed from the discharge at any time, operation of the system will be temporarily halted until the situation is remedied by changing out the carbon or through other necessary repairs / actions (loose valve / fitting, broken pipe, etc.). Carbon usage is expected to be low given the absence of impacted soil.

QA/QC

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

All sampling and analyses will be performed in accordance with the requirements of the Quality Assurance Project Plan (QAPP) prepared for the site. Main Components of the QAPP include:

- QA/QC Objectives for Data Measurement;
- Sampling Program:
- Sample Tracking and Custody;

- Calibration Procedures:
    - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
    - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.
- Analytical Procedures;
- Preparation of a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.
- Internal QC and Checks;
- QA Performance and System Audits;
- Preventative Maintenance Procedures and Schedules;
- Corrective Action Measures.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel.

5.3 REPORTING

Sample analysis will be provided by a New York State ELAP certified environmental laboratory. Laboratory reports will include Analytical Systems Protocol July 2005 (ASP) category B data deliverables for use in the preparation of a data usability summary report (DUSR). All results will be provided in accordance with the NYSDEC Environmental Information Management System (EIMS) electronic data deliverable (EDD) format.

All monitoring results will be reported to NYSDEC on a periodic basis in the Periodic Review Report. A letter report will also be prepared subsequent to each quarterly air sampling event. The report (or letter) will include, at a minimum:

- Date of event;
- Personnel conducting sampling;
- Description of the activities performed;
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (o be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether conditions have changed since the last reporting event.

Chemical labs used for all performance monitoring and final post-remedial sampling analysis will be NYSDOH ELAP laboratory certified in the appropriate categories. The FER will provide a tabular and map summary of all performance monitoring and post-remedial sample results.

5.4 PERMITS / AUTHORIZATION

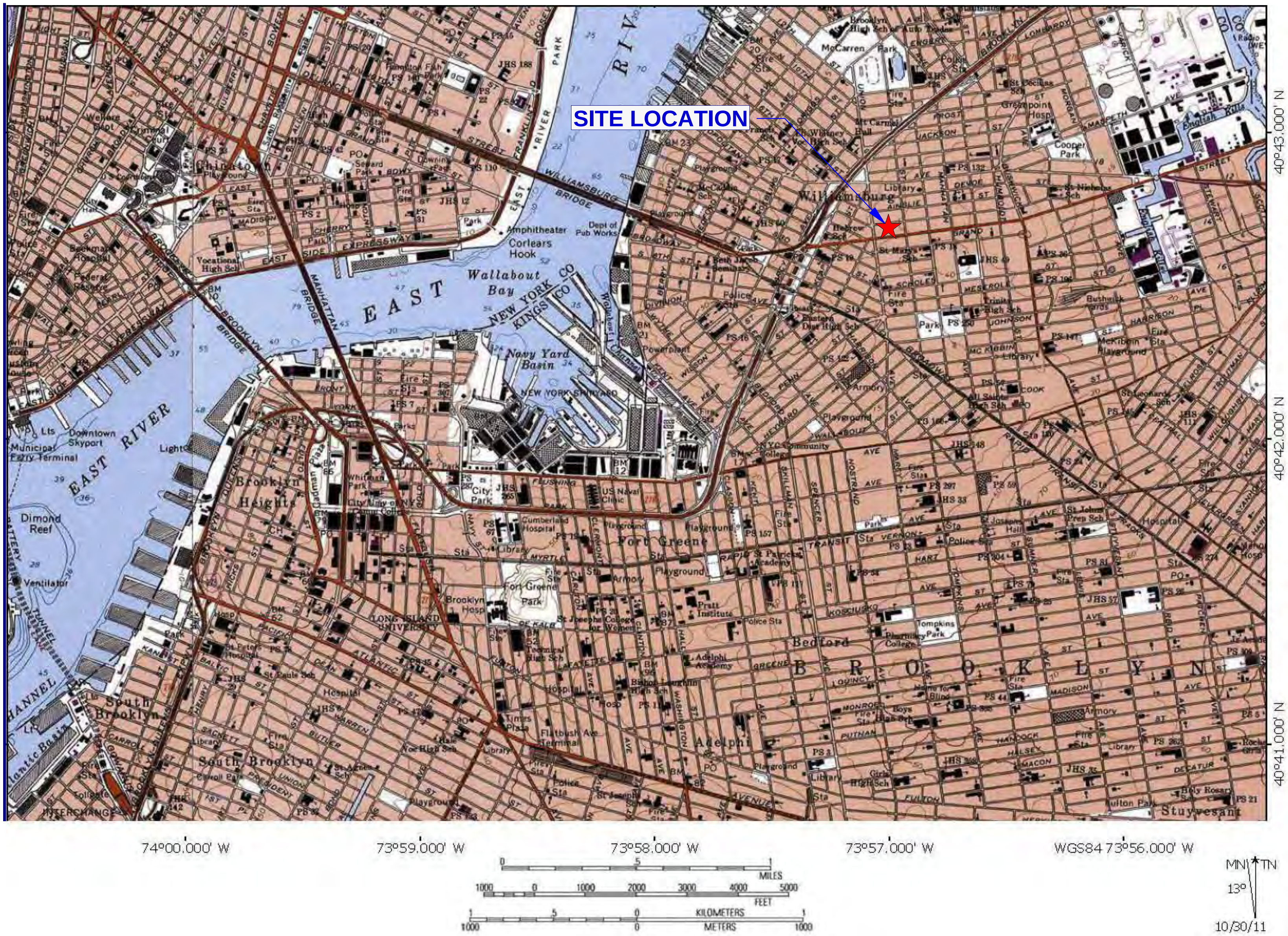
Air discharge under the NYSBCP will not require a permit from the NYSDEC. An industrial process equipment application will be filed with the NYC Department of Environmental Protection, Bureau of Environmental Compliance.

5.5 SCHEDULE

The SVE system installation is anticipated to begin immediately upon approval from the NYSDEC. The SVE extraction line installation will take approximately 1-2 weeks with backfilling and installation of the vapor barrier and slab expected to take another 2-4 weeks. Installation of the blower, carbon canisters and start up of the system will be performed 2 weeks after slab installation. The estimated duration of the SVE program is 3-6 months with conversion to an active SSD system thereafter. The anticipated schedule of milestone events is as follows:

Schedule Milestone	Estimated Completion Date
Submittal of RDWP	Week of September 10, 2018
Trench and install SVE Extraction Lines	September 28, 2018
Install Vapor Barrier and Concrete Slab	October 1, 2018
Complete Installation of Blower / Treatment System	October 15, 2018
Perform System Start-up and routine operation	1 week after system installation

FIGURES

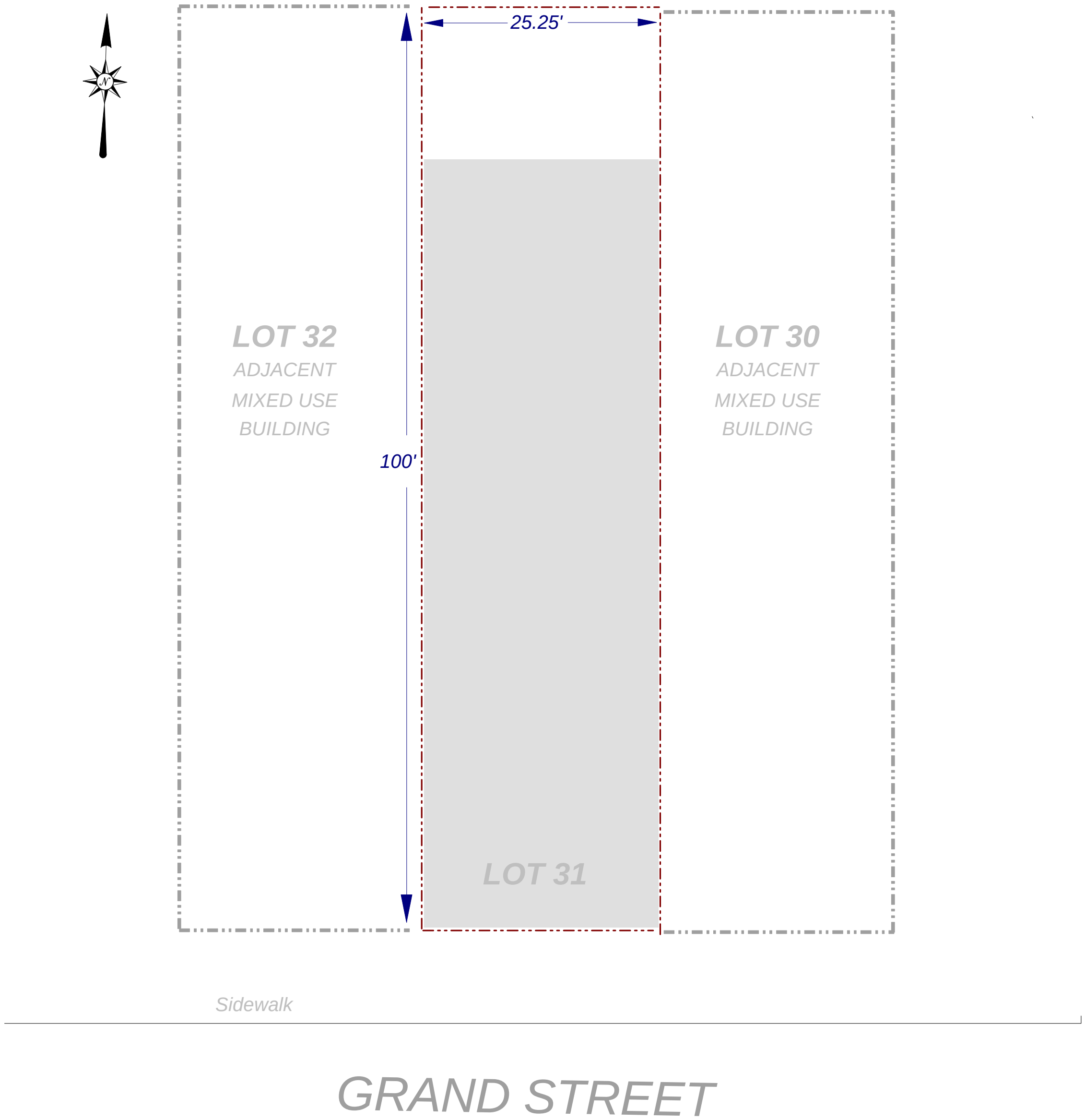


USGS Brooklyn Quadrangle 1995, Contour Interval = 10 feet

EBC
ENVIRONMENTAL BUSINESS CONSULTANTS
1808 MIDDLE COUNTRY ROAD. RIDGE. NY 11961
Phone 631.504.6000
Fax 631.924.2780

555 GRAND STREET
BROOKLYN, NY

FIGURE 1 SITE LOCATION MAP



KEY:

Property Boundary

SCALE:

0 10 20

1 Inch = 20 feet

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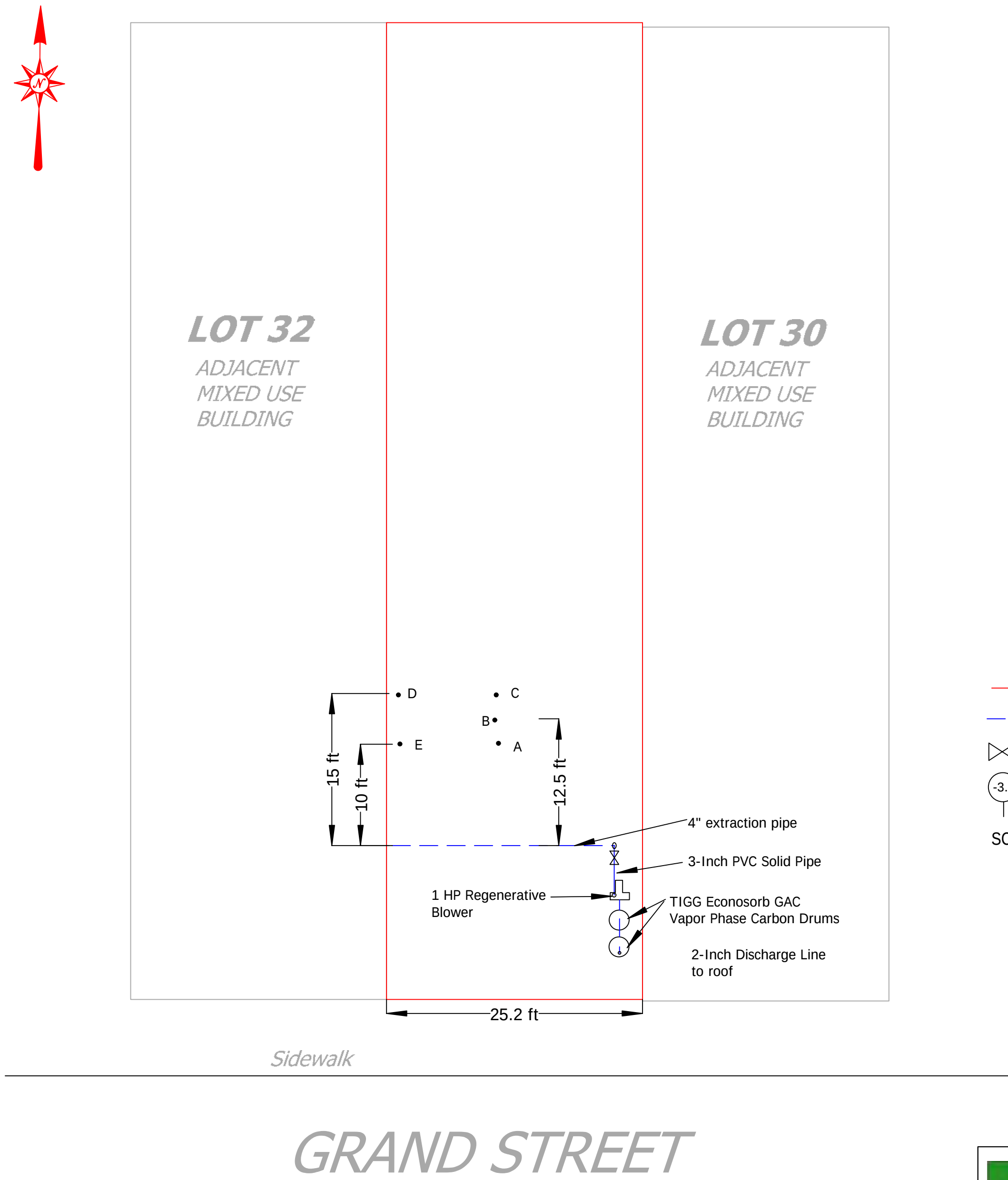
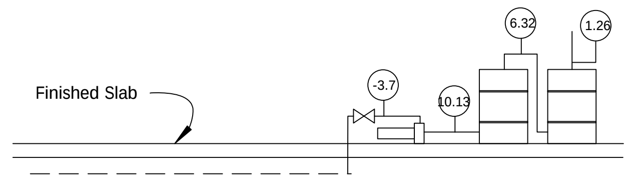
ENVIRONMENTAL BUSINESS CONSULTANTS

Phone 631.504.6000
Fax 631. 924 .2870

555 GRAND STREET
BROOKLYN, NY

FIGURE 2 SITE PLAN





Schematic Installation of SVE Pilot Test

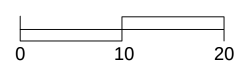
Property Boundary

4-inch PVC 10 slot Well Screen

3-inch PVC Ball Valve

-3.7 inches of water column

SCALE:



1 Inch = 20 feet

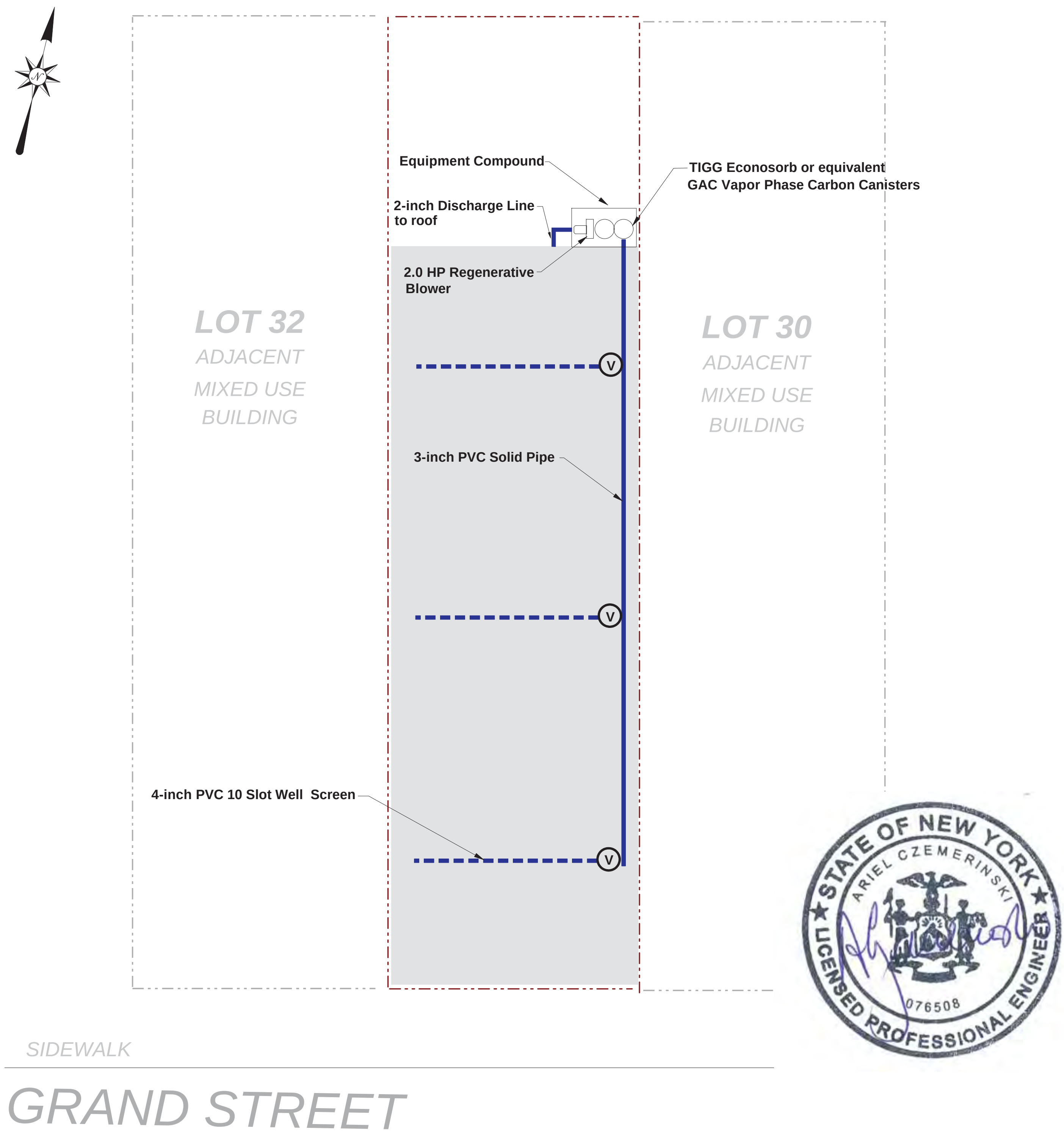
AMC ENGINEERING PLLC
99 JERICHO TPKE-STE 300J
JERICHO, NY 11753
Office: 516-417-8588
Fax: 516-706-3214

PROJECT: 555 Grand Street Brooklyn, NY 11211

DATE: DEC 28, 2015

DRAWING BY: AC

TITLE: Figure 3 - SVE Pilot Test Layout



KEY:

- Property Boundary
- 4-inch PVC 10-slot Well Screen
- (V) 3-inch PVC Ball Valve

SCALE:

0 10 15

1 Inch = 15 feet

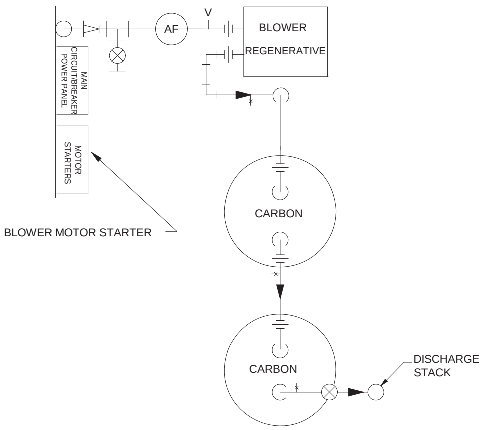
AMC Engineering
1836 42nd Street
Astoria, NY 11105

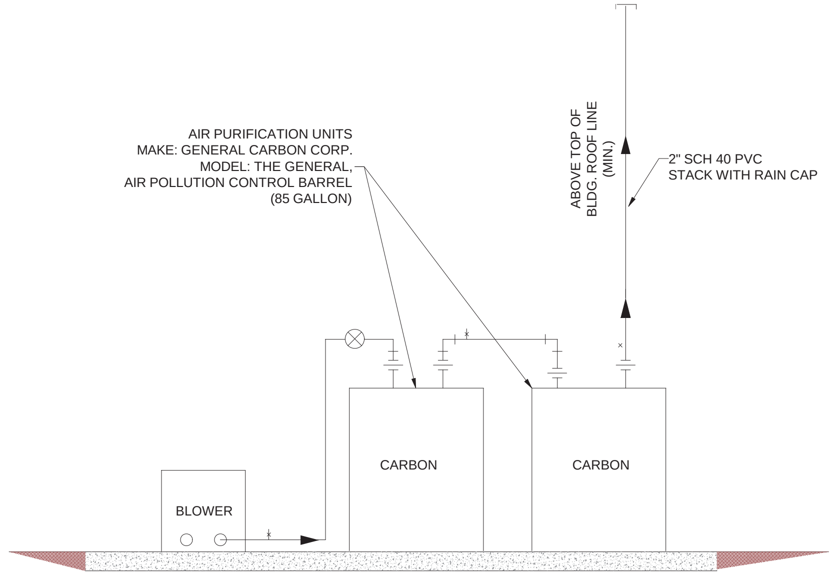
Figure No. **4**

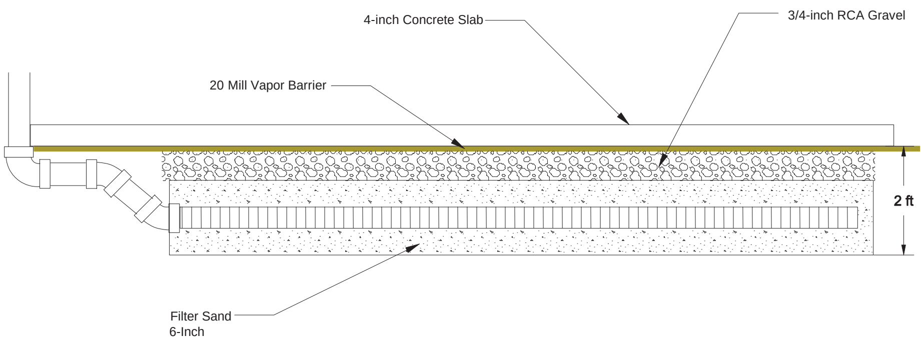
Site Name: REDEVELOPMENT PROJECT

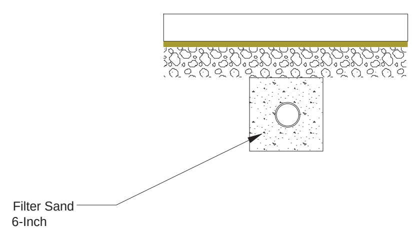
Site Address: 555 GRAND STREET, BROOKLYN, NY

Drawing Title: SVE SYSTEM LAYOUT









LEGEND

- 4"x2" SCH 40 PVC REDUCER
- FM — 2" DIA. AIR FLOW METER
- V — VACUUM GAUGE
- P — PRESSURE GAUGE
- VRV — VACUUM RELIEF VALVE
- PRV — PRESSURE RELIEF VALVE
- 2" DIA. SCH 40 PVC BALL VALVE
- BRASS SAMPLE TAP
- AF — AIR FILTER
- UNION OR QUICK CONNECT
- FLOW DIRECTION
- 3-WAY ELECTRICALLY ACTUATED BALL VALVE

AMC Engineering 1836 42nd Street Astoria, NY 11105	*Figure No.* **5**	Site Name: FORMER TOMAT SERVICE STATION Site Address: 1815-1825 OCEAN AVENUE, BROOKLYN, NY Drawing Title: SVE SYSTEM DETAILS

APPENDIX A
Vapor Barrier Specifications

VAPORBLOCK® PLUS™ VBP20

Under-Slab Vapor / Gas Barrier

RAVEN INDUSTRIES

Product Description

VaporBlock® Plus™ 20 is a seven-layer co-extruded barrier made from state-of-the-art polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission. VaporBlock® Plus™ 20 is a highly resilient underslab / vertical wall barrier designed to restrict naturally occurring gases such as radon and/or methane from migrating through the ground and concrete slab. VaporBlock® Plus™ 20 is more than 100 times less permeable than typical high-performance polyethylene vapor retarders against Methane, Radon and other harmful VOCs.

VaporBlock® Plus™ 20 is one of the most effective underslab gas barriers in the building industry today far exceeding ASTM E-1745 (Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs) Class A, B and C requirements. Available in a 20 (Class A) mil thicknesses designed to meet the most stringent requirements. VaporBlock® Plus™ 20 is produced within the strict guidelines of our ISO 9001:2008 Certified Management System.

Product Use

VaporBlock® Plus™ 20 resists gas and moisture migration into the building envelop when properly installed to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building including floors, walls and crawl spaces. When installed as a passive system it is recommended to also include a ventilated system with sump(s) that could be converted to an active control system with properly designed ventilation fans.

VaporBlock® Plus™ 20 works to protect your flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold and degradation.

Size & Packaging

VaporBlock® Plus™ 20 is available in 10' x 150' rolls to maximize coverage.   All rolls are folded on heavy-duty cores for ease in handling and installation. Other custom sizes with factory welded seams are available based on minimum volume requirements. Installation instructions and ASTM E-1745 classifications accompany each roll.

Under-Slab Vapor/Gas Retarder

Product	Part #
VaporBlock Plus 20	VBP 20

APPLICATIONS

- Radon Barrier
- Methane Barrier
- VOC Barrier
- Under-Slab Vapor Retarder
- Foundation Wall Vapor Retarder

VaporBlock® Plus™

UNDERSLAB VAPOR RETARDER / GAS BARRIER

VAPORBLOCK® PLUS™ VBP20

ISO 9001:2008 CERTIFIED MANAGEMENT SYSTEM

Under-Slab Vapor / Gas Barrier

PROPERTIES	TEST METHOD	VAPORBLOCK PLUS 20 IMPERIAL	VAPORBLOCK PLUS 20 METRIC
APPEARANCE		White/Gold	
THICKNESS, NOMINAL		20 mil	0.51 mm
WEIGHT		102 lbs/MSF	498 g/m²
CLASSIFICATION	ASTM E 1745	CLASS A, B & C	
TENSILE STRENGTH LBF/IN (N/CM) AVERAGE MD & TD (NEW MATERIAL)	ASTM E 154 Section 9 (D-882)	58 lbf	102 N
IMPACT RESISTANCE	ASTM D 1709	2600 g	
MAXIMUM USE TEMPERATURE		180° F	82° C
MINIMUM USE TEMPERATURE		-70° F	-57° C
PERMEANCE (NEW MATERIAL)	ASTM E 154 Section 7 ASTM E 96 Procedure B	0.0098 Perms grains/(ft²·hr·in·Hg)	0.0064 Perms g/(24hr·m²·mm Hg)
(AFTER CONDITIONING) PERMS (SAME MEASUREMENT AS ABOVE PERMEANCE)	ASTM E 154 Section 8, E96 Section 11, E96 Section 12, E96 Section 13, E96	0.0079 0.0079 0.0097 0.0113	0.0052 0.0052 0.0064 0.0074
WVTR	ASTM E 96 Procedure B	0.0040 grains/hr-ft²	0.0028 gm/hr-m²
RADON DIFFUSION COEFFECIENT	K124/02/95	< 1.1 x 10^{-13} m²/s	
METHANE PERMEANCE	ASTM D 1434	< 1.7 x 10^{-10} m²/d• atm 0.32 GTR (Gas Transmission Rate) ml/m²•D•ATM	

VaporBlock® Plus™ Placement

All instructions on architectural or structural drawings should be reviewed and followed.
Detailed installation instructions accompany each roll of VaporBlock® Plus™ and can also be located on our website.
ASTM E-1643 also provides general installation information for vapor retarders.

VaporBlock® Plus™ UNDERSLAB VAPOR RETARDER / GAS BARRIER

VaporBlock® Plus™ is a seven-layer co-extruded barrier made using high quality virgin-grade polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission.

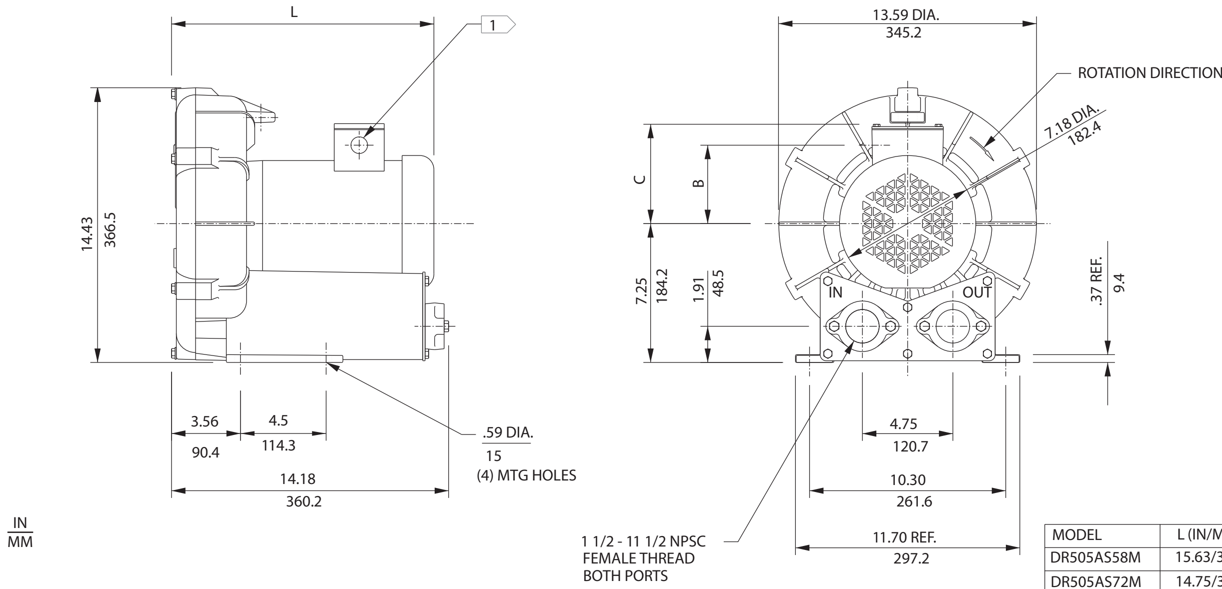
Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage.

APPENDIX B
SVE System Components

DR 505 & CP 505

ROTRON®

2.0 / 3.0 HP Regenerative Blower



MODEL	L (IN/MM)	B (IN/MM)	C (IN/MM)
DR505AS58M	15.63/397	4.63/117	5.64/143
DR505AS72M	14.75/374	4.25/108	5.25/133
DR505AS86M	14.38/365	4.37/111	5.18/131
DR505K58M	17.0/431	4.63/117	5.64/143
DR505K72M	15.63/397	4.37/111	5.18/131

NOTES
1. TERMINAL BOX CONNECTOR HOLE .88 (22) DIA.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

		Part/ Model Number						
		DR505AS58M	DR505AS72M	DR505AS86M	DR505K58M	DR505K72M	CP505FE72MLR	CP505CT72MLR
Specification	Units	037542	037543	037544	081882	037551	038239	038237
Motor Enclosure - Shaft Mtl.	-	TEFC - CS	TEFC - CS	TEFC - CS	TEFC - CS	TEFC - CS	CHEM TEFC - SS	CHEM TEFC - SS
Horsepower	-	2.0	2.0	2.0	3.0	3.0	3.0	2.0
Voltage	AC	115/230	230/460	575	115/230	230/460	230/460	230/460
Phase - Frequency	-	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Three - 60 Hz
Insulation Class	-	F	F	F	F	F	F	F
NEMA Rated Motor Amps	Amps (A)	18.2/9.1	5.4/2.7	2.3	25.6/12.8	7.6/3.8	7.6/3.8	5.4/2.7
Service Factor	-	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Max. Blower Amps	Amps (A)	24/11.5	7/3.5	3.0	28/14	8.8/4.4	8.8/4.4	6.8/3.4
Locked Rotor Amps	Amps (A)	138/69	38/19	21	194/97	88/44	88/44	38/19
NEMA Starter Size	-	1/0	00/00	00	1.5/0	0/0	0/0	00/00
Shipping Weight	Lbs	97	82	84	91	86	86	82
	Kg	44	37.2	38.1	41.3	39	39	37.2

Operating Temperaturs - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

AMETEK DYNAMIC FLUID SOLUTIONS
75 North Street, Saugerties, NY 12477
USA: +1 215-256-6601 - Europe: +49 7703 930909 - Asia: +86 21 5763 1258
Customer Service Fax: +1 215.256.1338
www.ametekdfs.com

AMETEK®
PRECISION MOTION CONTROL
DYNAMIC FLUID SOLUTIONS

Industrial / Chemical Processing Blowers

DR 505 & CP 505

ROTRON®

2.0 / 3.0 HP Regenerative Blower

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- CE compliant - Declaration of Conformity on file
- Maximum flow: 150 SCFM
- Maximum pressure: 88 IWG
- Maximum vacuum: 73 IWG
- Standard motor: 2.0 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

MOTOR OPTIONS

- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

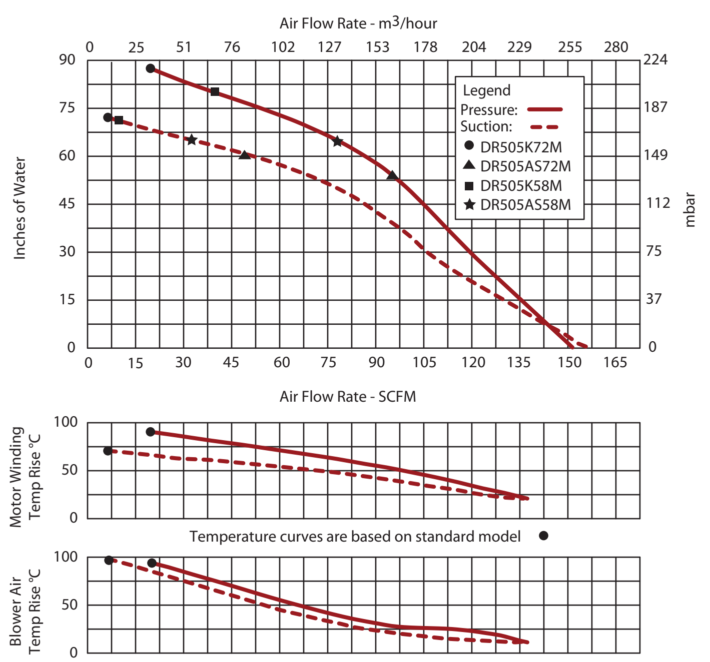
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES

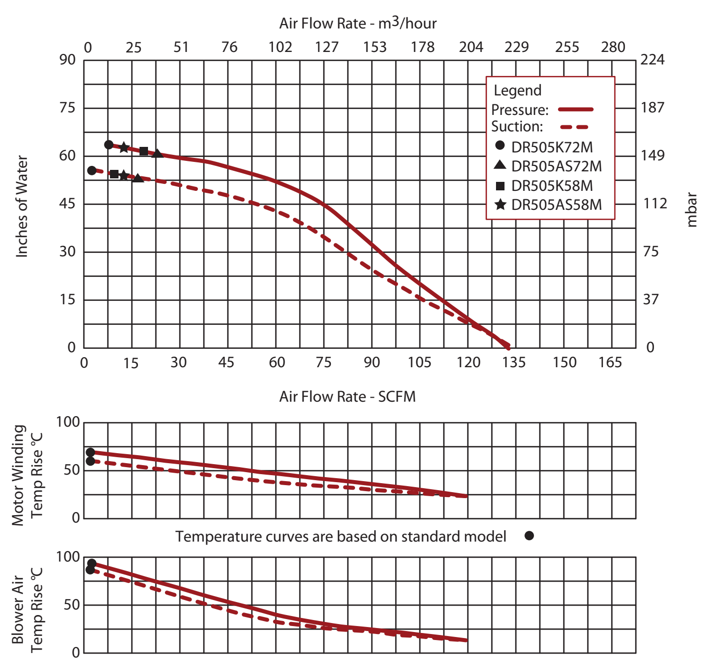
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

Blower Performance at Standard Conditions

60 Hz



50 Hz



This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

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PRECISION MOTION CONTROL
DYNAMIC FLUID SOLUTIONS

Econo V - Steel Drum Adsorbers

Modular Activated Carbon Vapor Phase Adsorbers

Solutions for Vapor Phase Remediation & Industrial Emission Control

The Econo - V steel drum activated carbon adsorption system excels at environmental remediation applications and industrial emissions control. This activated carbon adsorption drum is specifically designed fordependable performance and competitive pricing

The Econo - V GAC vapor phase adsorber is constructed of carbon steel and provides a double epoxy/phenolic lining durable enough for environmental remediation applications and industrial emission control

This GAC adsorption 55 gallon drum unit features specially constructed vapor distributors, designed

NOTES:

- Nominal flow can be used in environmental remediation activated carbon applications
- Desired contact time may allow higher or lower flow rates
- TIGG dry reactivated or virgin coal base activated carbon or coconut shell activated carbon provided as standard for environmental remediation applications
- Activated carbon fills are based on a bed density of 27 lb/ft
- Activated carbon fills can difer based on variable bed density and alternate adsorbents

E¢ONO

Modular Activated Carbon Vapor Adsorber

Model #	Nominal Flow (CFM)	Max Temp	Max Pressure (PSIG)	Inlet/ Outlet	Standard Fill (LBS)	Shipping Weight
EVP-1000	100	200	6	2"	175	225

Call a TIGG Representative Today at 800-925-0011

TIGG

http://www.tigg.com/Econo-sdrum.html

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www.TIGGtanks.com
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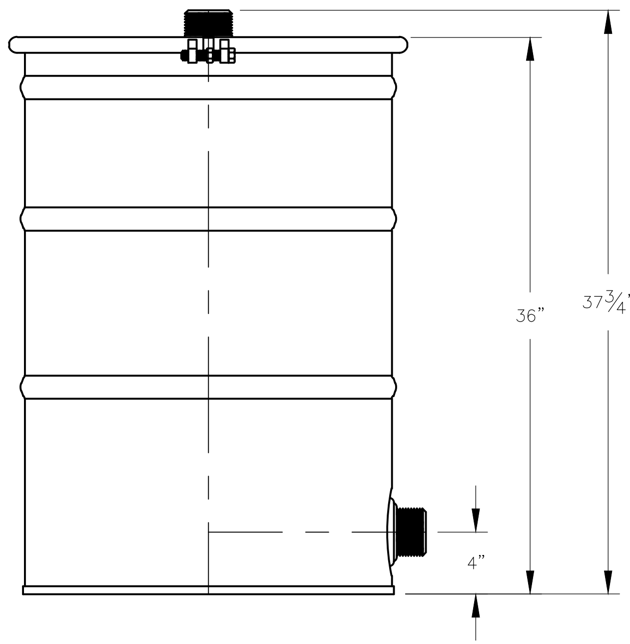
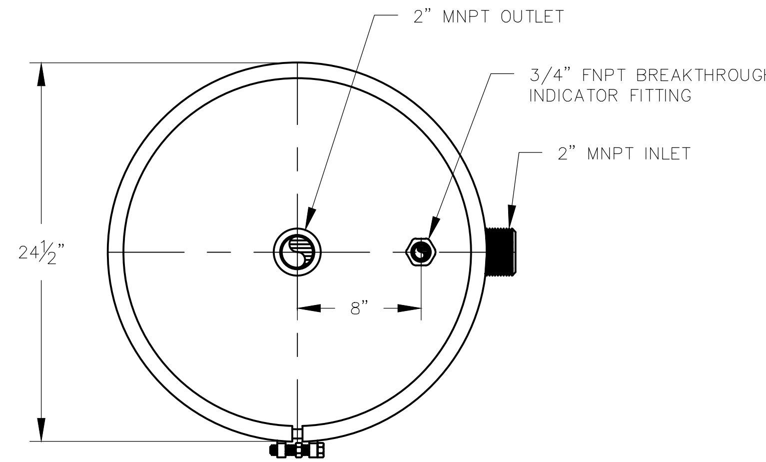
1 Willow Avenue
Oakdale, PA 15071

Purifying Air & Water



ELEVATION



PLAN

NO.	REVISION	BY	DATE
3	REMOVE DRAIN	JB	8/1/13
2	REVISE INLET ELEVATION	JB	11/2/06
1	REVISE TITLEBLOCK	JB	6/30/03

VESSEL STANDARDS

VESSEL MATERIALS : CARBON STEEL	VOLUME OF VESSEL : 7.5 FT^3
LINING : EPOXY PHENOLIC	STANDARD CARBON FILL : 175 LBS
EXTERIOR PAINT : ACRYLIC ALKYD ENAMEL	SHIP WEIGHT : 218 LBS
INTERNALS : STAINLESS STEEL SCREEN	MAXIMUM OPERATING PRESSURE : 6 PSIG
ADSORBENT OUTLET ASSEMBLY : REMOVABLE COVER	MAXIMUM OPERATING TEMPERATURE : 200°F
LIQUID DRAIN ASSEMBLY : N/A	

PROJECT
ECONOSORB–V

PROJ. NO. SALES
P.O. NO.

DRAWN BY	ZS
DESIGN BY	BL
CHKD. BY	BL
DATE	10/12/99
SCALE	NTS

TIGG corporation

PLAN & ELEVATION

DWG. NO. ECONOSORB–V–1001 REV. 3