



WORK PLAN FOR INSTALLATION OF VAPOR MITIGATION SYSTEMS

Former TransTechnology Corporation Facility
Glen Head, New York

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1 Introduction

WSP Engineering of New York, P.C., on behalf of Breeze-Eastern Corporation, has prepared this work plan for the installation of vapor mitigation systems in residential structures west of the former TransTechnology Corporation (TTC) facility at 1 Robert Lane in Glen Head, New York. The document was prepared at the request of the New York State Department of Environmental Conservation (NYSDEC) and describes the procedures to design, install, and operate the systems, where they are deemed appropriate based on the investigation results. The plan is necessarily generic in its approach. Specific designs for individual homes will be based on a number of factors (e.g., basement materials, condition of the basement floor, the types of heating systems used, etc.) that cannot be determined until after access to the home has been granted by the homeowner and the structure is evaluated by a qualified engineer. The general procedures listed herein (e.g., sub-slab communication testing, post-mitigation monitoring, long-term system maintenance, etc.) are common to all installations. WSP Engineering will provide a summary report to the NYSDEC containing the detailed design for each home (including an as-built diagram) at the conclusion of the mitigation activities.

This work plan has been prepared in accordance with the New York State Department of Health's (NYSDOH's) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006, and the ASTM Standard Practice for Installing Radon Mitigation Systems in Existing Low-rise Residential Buildings (ASTM E-2121), dated February 10, 2003. All of the work will be performed by radon system contractors certified by the National Environmental Health Association's National Radon Proficiency Program and New York-licensed electricians (in accordance with WSP Engineering designs) and under the oversight of a New York professional engineer (PE). Building and other permits required for the installation of the systems will be obtained before beginning work.

This plan consists of three sections, including this introduction. Section 2 describes the pre-construction activities, including access and communication testing; the installation of vapor mitigation systems; and the post-installation vacuum verification tests. The proposed system operation, maintenance and monitoring (OM&M) activities and the reporting schedule are presented in Section 3.

2 Vapor Mitigation Systems

According to the NYSDOH, an active sub-slab depressurization (SSD) system, when combined with careful sealing of basement infiltration points (e.g., cracks, drains, wire and pipe penetrations, etc.), is an effective method for preventing the infiltration of vapors into a building's interior. The SSD system works by venting the sub-slab through the use of sealed suction points piped to a fan or blower, which creates a negative pressure below the basement floor (Figure 1). The pressure differential between the indoor air and below the concrete slab of the basement floor reverses the normal pressure gradient (i.e., indoor air flows out instead of the soil gas flowing into the building) preventing vapors from passing from the subsurface into the building.

The SSD systems planned for the residential areas west of the TTC facility will use fan-powered vents similar to those used for radon mitigation. These systems have a well-established record for effective mitigation of sub-slab vapors. Radon-type SSD systems also have low power requirements, run with little or no noise (an important consideration in residential settings), and are capable of operating continuously for many years with little or no maintenance. The fan units are physically small (typically only 6 to 8-inches in diameter for residential applications) and, when combined with 2 or 4-inch diameter polyvinyl chloride (PVC) piping, minimize the impact to the homeowner.

Each residential system will be individually designed by a WSP Engineering PE, working with the qualified contractors, after obtaining written access and inspecting the home construction (usually during the pre-construction communication testing phase; see description below). The system design (i.e., a stamped engineering drawing) will be included as part of the local building permit application, which is required for any home modification in the Town of Oyster Bay. System construction will begin as soon as the application has been approved and the permit is obtained. WSP estimates that a minimum of 4 to 6 weeks will be required to complete the permit application process.

WSP Engineering does not anticipate, based on their apparent age and construction, that any of the homes to be mitigated will include basements with dirt floors, crawl spaces, or other openings in the basement floor. However, procedures for addressing homes without contiguous concrete floors have been included in this work plan to address the contingency in case this condition is encountered. The general procedures for each system installation are provided below.

2.1 Obtaining Access for System Installation

WSP Engineering will send, by certified mail, a cover letter (on Breeze-Eastern or Gnarus Advisors¹ letterhead) an access agreement to the appropriate property owners to request access for installation of a vapor mitigation system. The letter, which is typically sent as part of the sampling results report, will inform the property owner of the proposed mitigation activities and a tentative schedule to complete the work. Specifically, the access agreement will stipulate the conditions for granting access to conduct the proposed pre-installation testing, system construction activities, and the ongoing maintenance and monitoring activities. A generic copy of the access agreement is provided in Appendix A.

WSP Engineering will follow-up the initial mailing with telephone calls to the individual homeowners or a second certified mailing, if necessary. All attempts to contact the homeowners to obtain access for the vapor mitigation activities will be documented and no work will proceed unless the access agreement has been executed.

2.2 Vapor Mitigation System Installation

The vapor mitigation systems will be designed and installed in accordance with NYSDOH (2006) guidance and ASTM standard practices (ASTM E-2121) by qualified contractors. The process for installing an SSD system will

¹ Gnarus Advisors, LLC, of Arlington, Virginia.

vary depending on whether the basement has a complete or partial slab and whether the slab is competent or in poor condition. For buildings with a competent slab that covers the entire basement footprint, the initial step will be to seal potential subsurface vapor entry points (e.g., joints, cracks, pipe penetrations through the slab, and openings where the concrete slab meets the foundation walls) using an elastomeric joint sealant. Floor drains or dry wells, if present, may be retrofitted with Dranjer Corporation-brand passive (one-way) drain valves (or equivalent). These valves seal the floor preventing vapor migration through the drain increasing the effectiveness of the SSD system. Any significant cracks or voids in the foundation walls that cannot be addressed using the elastomer joint sealant will be sealed with expansion foam or hydraulic cement, as appropriate. Sealing openings in the floor slab and foundation walls will minimize the potential for the vacuum induced by the SSD system to short-circuit to the indoor air.

After the basement floor and foundation walls have been sealed, sub-slab communication testing will be performed to measure the ability of a vacuum field to extend through the material beneath the concrete floor. Communication testing will consist of drilling an approximately 0.5-inch diameter hole near the middle of the basement and applying a vacuum to the opening using a shop-type wet/dry vacuum to simulate the vacuum applied by a vapor mitigation fan. Next, a series of approximately 3/8-inch diameter holes will be drilled through the slab in the corners of the basement as vacuum monitoring points. A digital manometer will be used to measure the vacuum at each monitoring location. If insufficient vacuum is measured at a monitoring location, an additional hole(s) will be drilled closer to the monitoring location and placed under vacuum. This process will be repeated until an acceptable vacuum (i.e., at least 0.04 inch of water column) has been measured in each corner of the basement. At the conclusion of the test, all penetrations will be sealed with elastomeric joint sealant. The results of the communication testing will then be used to determine the appropriate number and location for the SSD vacuum points and to select the appropriate fan size.

At each designated suction point location, an approximately 5-inch diameter opening will be created through the slab and a cavity will be excavated below the slab to enhance the propagation of the vacuum field. A vertical, 4-inch diameter PVC pipe will then be installed to the bottom of the cavity with the annulus backfilled to the base of the slab with porous media (e.g., gravel) and patched with non-shrinking grout. The vertical pipes will be connected to an inline fan on the exterior of the building via additional PVC piping. The exterior exhaust stack(s) will be constructed in accordance with the applicable guidelines (i.e., exhaust at least 12 inches above the surface of the roof, in a location at least 10 feet away from any window or other opening into the conditioned spaces of the building that is less than 2 feet below the exhaust point, and 10 feet from any adjoining or adjacent buildings). Liquid-filled manometers will be installed on the vertical PVC riser(s) to measure the pressure differential, or vacuum. If two or more suction points are used, inline valves will be installed to control the air flow from each suction location.

Although not anticipated in this area of Glen Head, if crawl spaces or other substantial breaks in the concrete flooring are present, these conditions will be addressed by installing a sub-membrane depressurization (SMD) system. The installation of a SMD involves placing a synthetic ethylene propylene diene monomer (EPDM) liner on the ground in the crawl space to impede the flow of soil vapor into the home. The sheets of liner will be sealed at the seams with at least a 12-inch overlap, and sealed around any interior piers and around the perimeter foundation walls. A vacuum point consisting of a 2-inch or 4-inch diameter PVC pipe will be installed through the EPDM liner to draw vapors from beneath the membrane and discharge them to the atmosphere using an in-line fan. This results in a lower pressure beneath the membrane relative to the air pressure in the crawl space, which prevents the infiltration of subsurface vapors into the home. In some cases, homes requiring a SMD system for a crawl space will also have a SSD system to address the basement floor slab. Therefore, a common fan, conveyance piping, and discharge stack will be used, if possible, to operate both systems. SMD systems will be checked for leaks at the membrane seams, edge seals, and at locations where the membrane was sealed around obstructions (e.g., piers) after the installation is completed. Buildings with a partial basement floor slab, if present, would typically be addressed with a combination of SSD and SMD systems.

2.3 Post-Installation Activities

Post-installation communication testing will be conducted after the installation activities are completed to demonstrate that a sufficient vacuum is being induced beneath the entire slab. The test will be conducted by re-opening the 3/8-inch-diameter holes drilled through the slab for the pre-installation testing and measuring the vacuum using a digital manometer. After completing the test, the holes will be resealed with elastomeric joint sealant. All data collected during the post-installation testing will be included in the mitigation system installation summary report.

As part of the post-installation process, WSP Engineering's field personnel will explain to the homeowner how to read the system manometers and instruct them to periodically check the system for proper operation. Homeowners will be instructed to contact Breeze-Eastern or WSP Engineering if they notice a problem with their SSD system (e.g., abnormal fan noise, manometer shows no vacuum), or if a component of the SSD system becomes damaged. All completed SSD systems will be marked with contact information for Breeze-Eastern and WSP Engineering.

3 Operation Monitoring and Maintenance

Each vapor mitigation system will be inspected annually and maintenance will be performed, as appropriate, to ensure that the system continues to operate satisfactorily. During each visit, the following routine activities will be conducted:

- A visual inspection of the entire system will be conducted including the fan, piping, warning devices (liquid-filled manometers), labeling on the system, and any membranes installed as a soil vapor retarder. The fan will be inspected to ensure proper operation and continued effectiveness in providing the appropriate vacuum.
- Any leaks identified will be repaired. This will include, at a minimum, inspecting all sealed joints and cracks in the concrete floor, foundation walls, vacuum points, and soil vapor retarder membrane (where it is attached to the perimeter foundation walls and around foundation piers).
- The exhaust discharge point from the mitigation system will be inspected to verify that no new air intakes have been installed within the minimum distances specified by the NYSDOH guidance.

Non-routine maintenance activities may be conducted in the event of the following:

- The building owner or occupant reports that the warning device (liquid-filled manometer) indicates the mitigation system is not operating properly.
- The mitigation system (e.g., piping, valves, soil vapor retarder membrane, fan) becomes damaged.
- The building undergoes renovations that may reduce the effectiveness of the mitigation system.

System components requiring repair work will be identified during the inspection and addressed as soon as possible based on contractor availability. Any significant maintenance or repair activities requiring modifications to the electrical wiring will be conducted by a licensed electrician. All inspections and maintenance performed on the system will be recorded on the log sheet presented in Appendix B.

3.1 Reporting

The vapor mitigation system activities will be documented in a summary report once all of the planned installations have been completed. The report will contain a brief description of the circumstance encountered at each property, including the type and condition of the basement concrete floor; a presentation of the pre-installation communication results; a schematic as-built diagram showing the location of the suction pipes and vapor monitoring points, and an evaluation of the effectiveness of the system based on the post-installation testing. WSP Engineering will submit the report to the NYSDEC and NYSDOH no later than 6 weeks after completing the final system installation. All routine and non-routine OM&M activities and annual inspection results will be documented and reported to the agencies in the monthly progress reports.

4 Acronym List

EPDM	ethylene propylene diene monomer
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance, and Monitoring
PVC	polyvinyl chloride
SMD	sub-membrane depressurization
SSD	sub-slab depressurization
TTC	TransTechnology Corporation

Figure



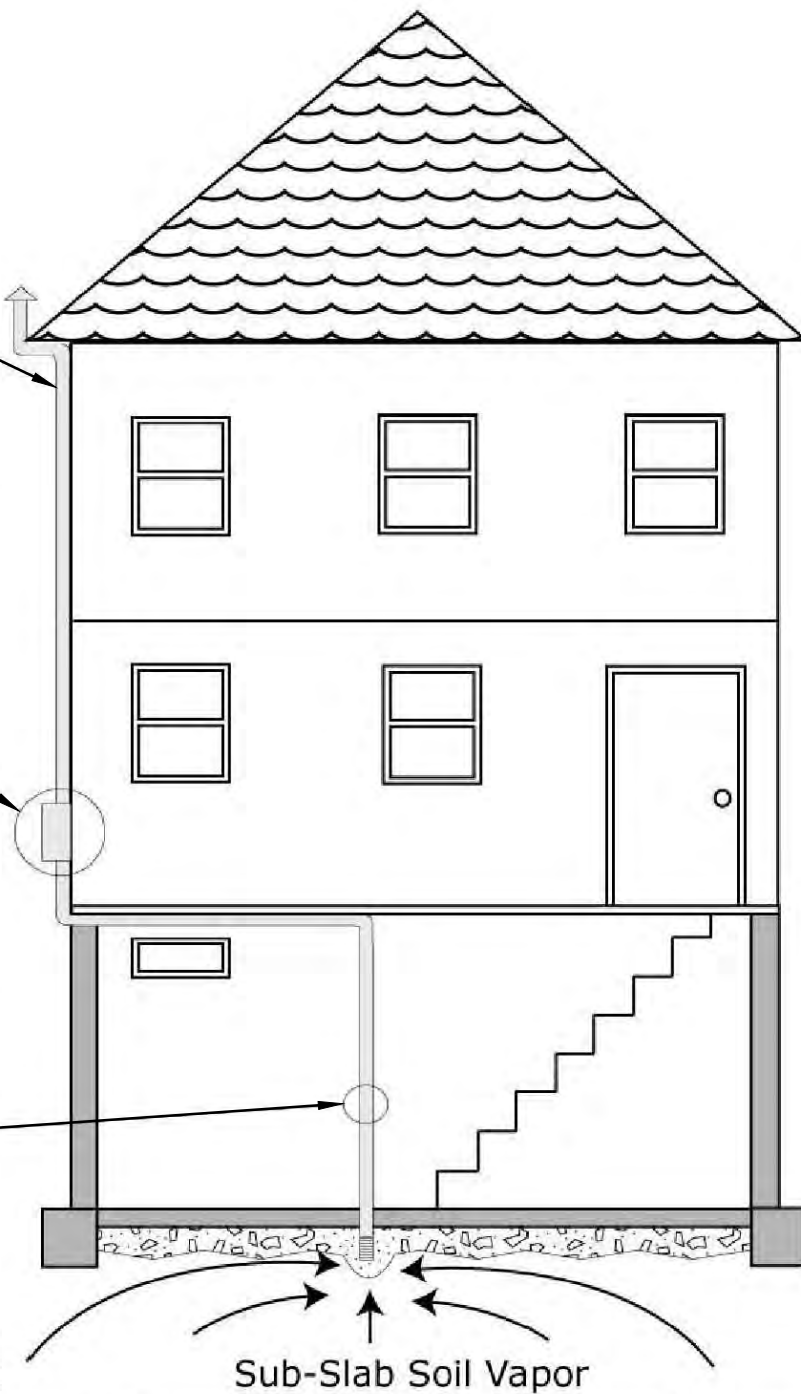
The vent pipe is routed on the side of the structure to a location above the roof line.



A fan is used to draw soil vapor from beneath the slab.



A liquid gauge, or manometer is used to verify that the system is operating properly



A sub-slab depressurization system vents contaminated soil vapor before it enters a structure. The fan draws vapor from beneath the building outside to the roof line where it is released to the outside air.

REFERENCE:

FINAL NYSDOH CEH BEEI SOIL VAPOR INTRUSION GUIDANCE TITLED, "EXAMPLE OF AN ILLUSTRATION SHOWING HOW A SSD SYSTEM WORKS", FIGURE 5.2, DATED OCTOBER 2006.

Appendix A – Homeowner Access Agreement

AGREEMENT FOR ACCESS TO PROPERTY AND STRUCTURE FOR MITIGATION SYSTEM INSTALLATION

I, _____ (Grantor), agree to allow Breeze-Eastern Corporation (Grantee) and its authorized representatives to enter my property and house located at [ADDRESS] in Glen Head, New York (Property), for the purposes of conducting the following activities (Access Work):

- Visit your house to take measurements of the basement and note any items requiring special consideration during the design of the mitigation system.
- Install a mitigation system in the basement and crawl space areas of the house.
- Seal the walls of the basement and crawl spaces with an impermeable barrier, if required.
- Connect the fan to the electricity panel associated with the house using a dedicated circuit, if appropriate.
- Repair and restore work areas to substantially their original condition.
- Conduct routine visits to maintain the system and ensure that it is working properly.

Grantor certifies that he/she is the sole owner of the Property or a representative who has been authorized by the owner of the Property to make this Agreement for Access to Property (Agreement).

The Access Work will be conducted in accordance with a work plan approved by the New York State Department of Environmental Conservation and the New York State Department of Health. In carrying out the Access Work, Grantee will use reasonable efforts to minimize disruption to the Property and will be responsible for reasonably restoring the Property to substantially the same condition that existed before the Access Work. Grantee will provide Grantor with reasonable advance notice of the schedule for the Access Work and with a copy of the sampling results within a reasonable time once they have been reviewed and approved by the New York State Department of Environmental Conservation and the New York State Department of Health.

The Access Work described above is being conducted on a precautionary basis to ensure that this house is protected against potential indoor air quality issues related to the former TransTechnology Corporation facility. Breeze-Eastern will be responsible for damages arising from the mitigation system installation and work performed on the property and within my structure.

Grantor agrees that all information related to Grantee's system installation will be provided to the New York State Department of Environmental Conservation and the New York State Department of Health. Grantor will notify Grantee at least thirty (30) days prior to transferring an interest in the Property which affects Grantee's rights or obligations hereunder.

Grantor has read and understands the above and agrees to allow Breeze-Eastern access onto my property for the purposes stated above. I understand that by signing this I am not waiving any claims I may have against Breeze-Eastern or any other party.

Signature of Property Owner or Representative

Date

Name of Property Owner or Representative (print)

Daytime Phone Number

Mailing Address (include City, State, and Zip Code)

Please (X) here if you do not grant access to your property.

Appendix B – OM&M Log Sheet

Table 1

**Checklist
Vapor Intrusion Mitigation System
Former TransTechnology Corporation Facility
Glen Head, New York**

Property: _____
Date: _____
Arrival Time: _____
Departure Time: _____

Inspector (print): _____
Inspector (sign): _____
Weather Conditions: _____

Reason for Visit: _____

Mitigation System Inspection Observations

Piping _____

Manometer(s) _____

Concrete Floor _____

Sump(s) _____

Dranjer(s) _____

Fan _____

Exhaust Stack _____

EPDM Liner¹ _____

Other _____

Location	Reading (Inches of H₂O)
Manometer 1	
Manometer 2	
Manometer 3	
Manometer 4	

System Maintenance

Description of Maintenance Needed: _____

Date Maintenance Completed: _____

¹ If applicable.

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