design/construction solutions

June 28, 2019

Mr. Kyle Forster
Environmental Engineer
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

RE: Vapor Intrusion Mitigation System Installation
Proposed Belgioioso Cheese, Inc. Facility - Glenville Business and Technology Park
Glenville, New York 12302
CHA Project No. 34604

Dear Mr. Forster,

The proposed BelGioioso Cheese (BelGioioso) facility (Site) is part of the Glenville Business and Technology Park located at 2165 Amsterdam Road, in the Town of Glenville, New York. The Site was historically part of the Scotia Depot, commissioned as a United States Navy facility, and served as a storage and supply depot for naval forces along the Atlantic Coast and Europe, and as a storage and distribution point for National Stockpile Materials. The entire former depot property is currently listed in the New York State Inactive Hazardous Waste Disposal Site Remedial Program, Site No. 447023 and consists of approximately 40.4-acres of the former depot. Historical releases at the Site have resulted in subsurface contamination.

While most of the contamination at the Site has been remediated or is currently being addressed, a potential exists at the Site for vapors resulting from the remaining contamination to migrate into new structures and impact indoor air quality. Therefore, future structures constructed on the Site that are intended for continuous human occupancy will be mitigated in accordance with the New York State Department of Environmental Conservation (NYSDEC) approved Site Management Plan (SMP) dated March 15, 2018. Specifically, the soil vapor intrusion (SVI) mitigation system will be installed as an element of the building foundation without the need to conduct additional subsurface investigation. This mitigation system will include a vapor barrier and an active sub-slab depressurization system.

This document provides the *minimal* requirements for the installation of an active vapor mitigation system and shall not be construed as full design package. The specific design and layout of the SVI mitigation system shall be the responsibility of the contractor; however, the following guidelines and attached specifications provide the minimum system requirements for such a system:

1. The installation of the SSDS shall be conducted under the direct supervision of a competent professional with specific experience in building vapor mitigation systems and environmental remediation practices.

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2. **Subgrade Consideration:** The contractor shall verify that the foundation subgrade is a minimum of two (2) feet above the high-water table (including perched water) as a high-water table will reduce the system functionality.

3. **Subgrade Preparation and Geotextile Installation:**
   a. After grading and compacting the foundation subgrade, a minimum of a 6-ounce non-woven geotextile fabric (e.g. Mirafi 160N) shall be installed over the subgrade to control the upgrades migration of fines.

   b. The geotextile shall be extended beyond the footprint of the foundation sufficiently to allow the fabric to overlap the vertical edges of the stone fill beneath the building slabs and form a closed envelope with the building foundation(s).

   c. Edges of the fabric shall overlap by a minimum of 12-inches.

   d. Specification 02240 for the geotextile fabric is included in Attachment A.

4. **Venting Stone:** A minimum of a 6-inch gas venting layer of crushed stone will be installed beneath the floor slabs of the structure(s) in accordance with Specification 02207 included in Attachment A. Where lateral piping is to be installed, a minimum of 12-inches of crushed stone shall be installed pursuant to the attached cross-section. A crushed stone with 10 percent or less fines (material passing a No. 200 sieve) is required to facilitate air movement and good communication/air movement beneath the building slab(s). The following stone material shall be utilized for the gas venting layer:

   a. Crushed stone free of organic material, elongated particles or other deleterious materials, conforming to the requirements of the New York State Department of Transportation (NYSDOT) Section 703-2 and meeting the following gradation requirements (Mixture of 50 percent NYSDOT, Size 1 and 50 percent NYSDOT, Size 2):

Sieve	Percent Passing
1 ½"	100
1”	90-100
½”	15-90
¼”	0-15

   b. Particle size analysis shall show no gap grading.

   c. The permeability of the gas venting layer shall be greater than $1x10^{-3}$ centimeters per second when compacted to a minimum of 95 percent of standard Proctor maximum dry density.

   d. All soil or stone particles shall be classified as rounded or sub-rounded (ASTM D 2488).

5. **Piping:** The piping shall be installed and inspected in accordance with Specification 02612-1 included in Attachment A, and shall consist of:

    a. Pipe Material: Schedule 40 polyvinyl chloride (PVC) Pipe (minimum). Schedule 80 PVC pipe and fusion-welded HDPE pipe are alternative acceptable piping materials depending upon specific site requirements.

    b. Pipe diameter: 4-inch

    c. Perforations for **horizontal** sub-slab pipes: Perforations shall be 1/4 to 3/8-inches in diameter, spaced six (6) inches on center, and a minimum of 3 rows no more than 120 degrees apart.

    d. Sub-slab layout:

        i. Where laterals are used, the pipe shall be no more than 6-inches beneath the concrete slab. Other utilities shall be installed beneath the collection system so that the collection pipes are closest to the slab where vapor accumulation is most likely. There should be no less than 4 inches of stone below and above the piping.
        ii. Horizontal pipes may be laid flat. However, a minimum of a 2'x2'x2' stone sump shall be installed at the location of each vertical exhaust stack.
        iii. Pipe shall be placed in parallel runs beneath **all areas intended for human occupancy** with a recommended maximum of 30 feet on-center. For buildings 30 feet or less in width, a single pipe run centered beneath building slab will suffice.
        iv. If several pipe runs are necessary, it may be desirable to connect several laterals to a common pipe header, particularly if the contractor is attempting to minimize the number of vertical exhaust stacks.
        v. The preferred layout shall attempt to maintain the collection pipes 5 feet from exterior walls.
        vi. If grade beams or other subsurface obstructions exist, a 6-inch steel sleeve or similar shall be cast in the concrete to allow the perforated pipe to be installed following form removal and reduce the potential for isolated areas that are not mitigated. Continuity of the stone media is crucial to maintain airflow. Additional vertical exhaust stacks may be added in areas where maintaining continuity is not possible (e.g. obstructions, foundation walls, etc.).

    e. Exhaust stacks:
        i. Exhaust stacks shall consist of 4-inch solid Schedule 40 PVC pipe.
        ii. A minimum of a 2'x2'x2' stone sump shall be installed at the bottom of each vertical exhaust stack beneath the slab.
        iii. Vertical exhaust pipes shall be enclosed within a pipe chase and are not permissible in the occupied/habitable space.

iv. If horizontal pipe runs are needed above grade (e.g. attic space) to route the exhaust stack penetration to a different location on the roof, the horizontal pipe shall be sloped back towards the extraction point in the slab to facilitate drainage of condensate should the system be activated in the future.

v. To avoid entry of subsurface vapors into the building, the exhaust/discharge pipe shall be:
   1. A minimum of 12 inches above the surface of the roof (preferably above the highest level of the roof).
   2. At least 10 feet above the ground level.
   3. At least 10 feet away from any opening that is less than 2 feet below the exhaust point.
   4. At least 10 feet from any adjoining or adjacent buildings, or heating, ventilation and air conditioning (HVAC) intakes or supply registers.

vi. All equipment and pipe above the slab shall be properly labeled. At least one label shall be placed at the point of discharge that states "Caution: Sub-Slab Vapor Mitigation System – Do Not Tamper or Disturb". Flow direction arrows shall also be placed on all pipes and a label stating the name of the system installer, date of the system installation, and a phone number for system service shall be affixed on or immediately adjacent to the blower unit.

vii. One fan should be installed at each vertical stack (approximately 50-foot radius of influence). The recommended fan is the Radon Away® HS5000, or equivalent (Attachment A). A 4-inch PVC quarter-turn ball valve should be installed on each stack.

6. **Vapor Barrier:**

a. A fifteen (15) mil Class A polyethylene resin vapor barrier meeting or exceeding all requirements of ASTM 1745-96, such as the Perminator™ 15-mil manufactured by W.R. Meadows, Inc. or the Stego-Wrap 15-mil manufactured by Stego Industries LLC, shall be installed over the gas venting layer and piping. The vapor barrier shall be sufficient in strength to resist tearing and puncturing during the placement of reinforcing steel and concrete for the concrete flooring systems.

b. All seams in the vapor barrier shall be sealed using a polyethylene tape with pressure sensitive adhesive (regular duct tape is not acceptable for this purpose and shall not be used).

c. The vapor barrier shall be adhered to all concrete foundations walls, grade beams, etc. to maintain a continuous seal beneath the slab. Typical details for adhering the barrier to foundation systems may be found on the vendors websites.

d. Pipe boots constructed of the vapor barrier material and the pressure sensitive tape and/or vapor proofing mastic shall be used to seal around all pipe penetrations through the barrier.

e. If it is undesirable to have the vapor barrier in direct contact with the underside of the concrete slab, it is permissible to install a 2-inch layer of cushion sand over the vapor barrier prior to pouring the concrete.

f. The vapor barrier shall be installed and inspected in accordance with Specification 07165 included in Attachment A.

7. **Concrete Slab:** All floor slab construction joints, support piles, penetrations, and other openings shall be sealed using two wraps of closed cell foam backer rod and/or an elastomeric polyurethane sealant applied to a minimum depth of one inch. Hydraulic cement can be used to seal gaps wider than 1-inch in the slab.

8. **Post Installation Testing and Balancing:** Upon installation of the SSDS, the following post installation testing and balancing should be completed to verify that the system is functioning properly.

    a. Balance sub slab pressure field extension to cover the Area of Influence by adjusting sub slab extraction line valves.
    b. Install additional extraction points as needed to provide necessary pressure field extension.
    c. Following the installation of the sub slab depressurization system, the following tests shall be performed to verify the sub slab depressurization system is operating optimally. The post installation testing shall include the following:
        i. Verify system fan is operating within manufacturer's specifications (i.e. not exceeding maximum operating pressure, etc.). If not, modify fan selection.
        ii. Verify system switches and gauges are operating correctly by turning off system fans and observing results.
        iii. Perform sub slab to room differential pressure testing with a digital micro manometer to verify pressure field extension throughout the Area of Influence.
        iv. Test locations shall be selected in a manner sufficient to demonstrate sufficient negative pressure field extension.
        v. The vapor mitigation system shall be considered successful when the sub slab to room differential pressure of -0.002 inches of water column can be continuously demonstrated.
        vi. All pressure test holes shall be permanently sealed airtight following demonstration of compliance with the Performance Criteria, unless converted to permanent monitoring points which can be sealed air tight when not in use.

9. **Post Installation Documentation:** Following the installation of the sub slab depressurization system, a Post Installation Report shall be provided by the installation contractor in electronic format. Post installation report shall include the following Items:
    a. A written description of the system installed, including make/model of fans, fan serial numbers (if any), and system fan date of manufacture.

b. A chart indicating the pressure, airflow, and valve position in each sub slab extraction line and the pressure and airflow in each exhaust stack.
c. Manufacturer paperwork (including warranty paperwork) for all fans, meters, alarms, and switches installed.
d. Photos with description of system components.
e. As built drawing of the location of fan(s), system piping, gauges, valves, alarms, etc.
f. Post installation sub slab pressure test data on drawing indicating test locations demonstrating system meets or exceeds the Performance Criteria.

The following documents are appended to this document:

1. Attachment A – Specifications for the geotextile fabric, gas venting stone layer, PVC piping, fan, and vapor barrier.
2. Attachment B – Typical assumed system layout based on a 50-foot radius of influence.
3. Attachment C - Typical cross section depicting the subgrade geotextile, gas venting stone layer, piping, and vapor barrier. The contractor is encouraged to contact the vapor barrier manufacturer to obtain typical details for adhering the sheeting to concrete foundations that are specific to the project.
4. Attachment D – System Startup and Testing guidance and an inspection checklist.

The information provided in this letter is to be considered guidance criteria for the installation of an active SSDS during the construction of the BelGioioso Cheese facility. The specific design and layout of the system shall be the responsibility of the contractor. The design criteria contained herein have been developed in conformance with industry practice and guidance for vapor intrusion mitigation systems.

For CHA:

Name: Scott M. Smith, P.E.
Title: Associate Vice President
Date: June 28, 2019
License No: 083885-1

Signature: _____

Professional Seal:

If you have any questions, please do not hesitate to contact me at (518) 453-2899.

Sincerely,

Keith Cowan, CPG
Project Manager

SM/mmp
Attachments
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ATTACHMENT A

Specifications

SECTION 02207 GAS VENTING STONE LAYER

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, furnishing, placing, compacting and testing the gas venting stone layer as specified herein.

B. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.

C. The Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

A. The latest edition of the following standards and regulations, as referenced herein, shall be applicable.

1. American Society for Testing and Materials (ASTM).

2. Standard Specification for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).

B. The Contractor shall comply with the requirements for soil erosion and sedimentation control, and other requirements of governmental authorities having jurisdiction, including the State of New York.

1.3 SUBMITTALS

A. The Contractor shall furnish representative earth materials to the testing laboratory for analysis and report, as directed by the Engineer or as outlined in the specifications.

B. Descriptive information on compaction equipment to be used for construction of the barrier layer, including equipment proposed for use in confined areas.

C. Plan detailing proposed borrow source, borrow source prequalification testing data, and estimated borrow source quantity.

D. Test reports for prequalification and construction quality control/quality assurance testing shall be submitted to both the Contractor and Engineer.

1.4 PRODUCT HANDLING

A. Soil materials shall be excavated from the borrow source, transported, conditioned, placed, and stockpiled in such a manner so as to prevent contamination, segregation, and excessive wetting. Materials that have become contaminated, excessively wet, or segregated shall not be used and shall be removed from the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed stone: free from organic material, elongated particles or other deleterious materials, conforming to the requirements of NYSDOT Section 703--2 and meeting the following gradation requirements (Mixture of 50 percent NYSDOT, Size 1 and 50 percent NYSDOT, Size 2):

Sieve	Percent Passing
1-1/2"	100
1"	90 - 100
1/2"	15-90
1/4"	0 - 15

1. Particle size analysis shall show no gap grading.

2. All soil or stone particles shall be classified as rounded or sub-rounded (ASTM D 2488)

PART 3 - EXECUTION

3.1 BORROW SOIL PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. A 100-pound minimum representative sample shall be obtained from each potential borrow source. If different material gradations are known to exist in the pit, samples shall be obtained for each material. Each sample shall be mixed thoroughly and reduced to test specimen size, in accordance with AASHTO T87. The tests shall be performed in the order shown. Failure to pass any test is grounds for disqualification and shall lead to cessation of the test program for that material.

1. Particle Size Analysis:

a. Method: AASHTO D422.
b. Number of Tests: One (1) per potential source.
c. Acceptance Criteria: Gradation within specified limits.

3.2 PLACEMENT AND COMPACTION

A. General:

1. Notify the Engineer of any unexpected subsurface condition. Do not place fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water, gross contamination, or extraneous debris.

2. Provide protection of any underground utilities during earthwork operations. Repair any damaged utilities as acceptable to the Engineer, at no additional cost to the Owner.

3. Protect all nearby structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

4. Establish all required lines, levels, contours and datum. Maintain all benchmarks and other elevation control points.

5. After acceptance of the subgrade, the geotextile fabric shall be placed prior to the placement of the gas venting layer. All joints shall be overlapped a minimum of twenty-four inches.

6. When work is suspended during periods of freezing weather, measures shall be taken to

prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced.

7. The distribution of materials throughout the venting stone layer shall be such that the layer will be free from lenses, pockets, streaks, and layers of materials differing substantially from the surrounding materials.

8. The placing of material shall be done so as to obtain a layer of uniform thickness without spaces between successively deposited loads.

9. Compaction of the layer shall proceed in a systematic, orderly, and continuous manner so that the specified coverages by the compaction equipment can be adequately addressed.

10. Compaction density should comply with the requirements stated in the specifications for the building foundation.

11. Materials which cannot be compacted by the approved rolling compaction equipment because of interferences shall be compacted with smaller approved compactors to a density equivalent to the density achieved in adjacent areas by the rolling compaction equipment and methods. Single pad vibratory base plate compactors shall weigh not less than 200 lbs. and have a vibration frequency not less than 1600 cycles per minute. Heavy vibratory compactors or equipment shall not be operated within 4 feet of any structure or over horizontal pipe locations.

    a. While not required, the Contractor may compact the entire stone surface prior to horizontal pipe installation. Once the material has been compacted the Contractor may dig a trench for the horizontal pipe placement and compact cover stone with a hand tamper, or similar, in these areas to prevent damaging the pipe.

12. No backfilling or compaction shall take place against any cast-in-place concrete footings, grade beams, or slabs prior to 7 days of initial concrete set, or against any cast-in-place concrete walls prior to achieving the desired design strength.

B. Venting Stone Layer Placement and Compaction:

1. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.

2. Rolling compaction equipment shall be heavy smooth drum vibratory equipment capable of achieving the intended result. Compaction equipment used for the Work is subject to approval by the Engineer. Any equipment not originally manufactured for compaction purposes and equipment which is not in proper working order will not be approved. Furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification and performance characteristics.

3. The Contractor shall grade partially completed fill areas for drainage and thoroughly compact and smooth the surface at the end of each workday.

4. For areas not accessible to heavy rolling compaction equipment, fill materials shall be placed in horizontal layers not to exceed 6 inches in loose thickness and compacted with smaller rolling compaction equipment or hand operated equipment, as approved by the Engineer.

5. The final surface of the layer shall be uniform and suitable for placement of the next subsequent layer.

3.3 FIELD QUALITY CONTROL

A. The Contractor's Testing Laboratory shall perform testing of venting stone layer materials to insure compliance with these specifications.

B. The Engineer may direct tests to establish gradation, Atterberg limits, permeability, maximum density, and in-place density, and water content as necessary and/or required by working conditions, or changes in borrow source material at the Contractor's expense.

C. Acceptance Criteria:

1. Grain size analyses shall show gradation of the soil material placed to be within specified limits.

3.4 CLEAN UP

A. Provide and maintain protection of newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing, if any.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

END OF SECTION 02207

SECTION 02240 GEOTEXTILE FABRIC - SEPARATION/FILTRATION/STABILIZATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, furnishing and installing separation/stabilization fabric as specified herein.

1.2 QUALITY ASSURANCE

A. The latest edition of the following standards, as referenced herein, shall be applicable.

1. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

A. Product Data:

1. Submit Manufacturer's catalog cuts, specifications and installation instructions.

2.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver sufficient materials to the site to prevent interruption of the work.

2. All materials shall be inspected by Contractor upon delivery. Contractor shall notify Engineer of any damage. Products received at the site torn, with holes, deteriorated, or otherwise damaged will not be approved and shall be returned and replaced at no expense to the Owner.

B. Storage:

1. All material shall be stored in strict accordance with the manufacturer's recommendations and as approved by the Engineer.

2. All material shall be stored so as to be protected from wind, rain, excess moisture, or sunlight. Material shall be wrapped in an opaque, protective cover until ready for use.

C. Handling:

1. All material shall be handled in strict accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

A. For material separation/filtration, fabric shall be Mirafi 160N or an approved equal.

2.2 MATERIAL PROPERTIES

A. Separation/Filtration Fabric: (To be used between soil subgrade and venting stone layer).

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for the storage, handling, installation, and seaming of geotextile fabric in accordance with the specifications and the manufacturer's recommendations, as approved by the Engineer.

3.2 SUBBASE PREPARATION

A. Surfaces to be covered with geotextile fabric shall be smooth and free of rocks, sticks, roots, sharp objects, and all debris that may damage the fabric. The surface to be covered shall be firm and unyielding, with no sudden changes or breaks in grade. There shall be no standing water or excessive moisture on the surface when the fabric is placed.

B. The compacted subbase shall be maintained in a smooth, uniform and compacted condition during installation of the fabric.

3.3 GEOTEXTILE INSTALLATION

A. The fabric shall be cleaned of all debris or other materials that may negatively affect the fabric's performance.

B. Mechanical equipment shall not be permitted to operate directly on the fabric unless authorized to do so by the manufacturer and approved by the Engineer.

C. Geotextile Placement

1. Fabric shall be placed as recommended by the manufacturer and approved by the Engineer on surfaces which have been prepared to conform with these Specifications and found acceptable for fabric installation.

2. The fabric shall be placed as smooth and wrinkle-free as possible. All laps shall be at least thirty-six inches in width without tension, stress, folds, or creases.

3. Separation fabric for the bottom of the drainage layers shall be placed so that laps are parallel to the water flow within the layer. If specific site conditions in certain areas do not allow for placement in this manner the upstream fabric shall lap over the downstream fabric.

4. In areas where wind is prevalent, fabric installation shall be started at the upwind side of the project and proceed downwind. The leading edge of the fabric shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

5. Sandbags or rubber tires may be used as required to hold the fabric in position during installation. Tires shall not have exposed steel cords or other sharp edges which may snag or cut the fabric. Materials, equipment or other items shall not be dragged across the fabric or be allowed to slide down slopes on the fabric.

6. Smoking shall not be permitted by personnel working on the fabric.

7. All areas of fabric damaged during installation as determined by the Engineer shall be repaired by the Contractor as specified at no additional cost to the Owner.

8. At time of installation, fabric will be rejected if it has defects, ribs, holes, flaws, deterioration, or damage incurred during manufacture, transportation, handling, or storage. Damaged materials shall be removed and replaced at no additional cost to the Owner.

9. Fabric shall be protected at all times during construction from contamination by surface run-off and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.

D. Seams and Overlaps of Geotextile:

1. All overlaps shall be a minimum of twenty-four inches.

2. Joints shall be sewn or bonded unless otherwise noted. Securing pins shall not be used.

3. For the gas venting system, joints need not be heatbonded.

3.4 GEOTEXTILE REPAIR

A. Should the fabric be damaged during any step of the installation, the damaged section shall be repaired by covering it with a piece of fabric which extends at least thirty-six inches in all directions beyond the damaged area. The fabric shall be secured by sewing or bonding methods approved by the Engineer.

3.5 COVER MATERIALS OVER GEOTEXTILES

A. Granular materials shall be placed on geotextiles as referenced in Specification 02207 Gas Venting Layer. During backdumping and spreading, a minimum depth of 6 inches of granular material shall be maintained at all times between the fabric and wheels of trucks or spreading equipment. All equipment used in spreading or traveling on the cover layer for any reason shall exert low ground pressures and shall be approved by the manufacturer and Engineer. Dozer blades, etc. shall not make direct contact with the fabric; however, if tears occur in the fabric during the spreading operation, the granular material shall be cleared from the fabric and the damaged area repaired as previously described.

B. The granular material shall be spread in the direction of fabric overlap. Large fabric wrinkles which may develop during the spreading operations shall be folded and flattened in the direction of the spreading. Occasionally, large folds may reduce the fabric overlap width. Special care shall be given to maintain proper overlap and fabric continuity.

C. All equipment spreading cover material or traveling on the cover layer shall avoid making sharp turns, quick stops or quick starts.

D. Fabric shall be covered as soon as possible after placement to minimize exposure to sunlight. Fabric shall not be exposed for more than 7 days.

3.6 DISPOSAL OF SCRAP MATERIALS

A. On completion of installation, the Contractor shall dispose of all trash and scrap material off-site or in a location approved by the Owner and Engineer, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner.

END OF SECTION 02240

SECTION 02612 POLYVINYL CHLORIDE PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes the installation of polyvinyl chloride piping systems.

B. All piping, fittings, and appurtenances shall be new, clean and in accordance with material specifications. In no instance will second-hand or damaged materials be acceptable.

1.2 REFERENCES

A. American Water Works Association (AWWA).

B. American Society of Testing and Materials (ASTM).

1.3 QUALITY ASSURANCE

A. Product Markings: Plainly and permanently mark each pipe length with the following information:

1. Nominal pipe size.
2. Plastic pipe material designation.
3. Standard thermoplastic pipe dimension ratio.
4. Pressure rating.
5. ASTM designation.
6. Manufacturers name or trademark and date of manufacture.
7. Potable water pipe marking or seal, if applicable.

1.4 SUBMITTALS

A. Product Data:

1. Submit manufacturer's catalog cuts, specifications and installation instructions for both pipe and pipe appurtenances.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Deliver and store pipe, fittings, specials, appurtenances and accessories and within the work limits.

2. Exercise special care during delivery and storage to avoid damage to the products.

3. Store products in locations where unnecessary handling is avoided and where they will not interfere with the Owner's operations, construction operations or public travel.

B. Handling:

1. Handle pipe, fittings, specials appurtenances and accessories carefully with approved handling devices in strict conformance with the manufacturer's recommendations.

2. Do not drop or roll products off trucks, or otherwise drag, roll or skid products.

C. Products cracked, gouged, chipped, dented or otherwise damaged will not be approved and are to be removed and replaced at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe and Fittings:

1. PVC pipe shall be four-inch diameter Schedule 40 belled end type pipe for solvent welded joints conforming to ASTM D2467, using solvent as specified in ASTM D2564. All blower discharge piping shall be resistant to ultraviolet radiation as specified in ASTM D1785 for Type II, Grade I, Schedule 40 PVC piping.

2. Piping underneath the slab will be perforated. . Perforations will be ¼ to 3/8-inches in diameter, spaced six-inches on center, and a minimum of 3 rows no more than 120 degrees apart.

B. Joints:

1. All pipe and pipe appurtenances shall be joined by solvent welding. Solvent welded joints shall be made in accordance with manufacturer's recommendations and procedures and should be volatile organic compound (VOC) free.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect all pipe and fittings prior to laying in the trench. Remove defective pipe and fittings from the site.

B. Do not backfill until inspection by the Engineer has been completed.

3.2 INSTALLATION

A. Lay pipe with bell end upstream.

B. Do not lay piping in water. Ensure that the water level in the excavation is at least 12- inches below the bottom of piping.

C. Present all conflicts between piping systems and equipment, structures or facilities to Engineer for determination of corrective measures before proceeding.

D. Completely clean all jointing surfaces and adjacent areas prior to making joint.

E. Field cut pipe for shorter than standard pipe lengths. Cut ends square and perpendicular to the pipe axis. Remove and smoothly bevel ends.

F. All pipe and pipe appurtenances shall be joined by VOC-free solvent welding.

G. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

H. No piping shall be brought into position until the preceding length, valve, fitting, or special has been

bedded and secured in place.

I. Whenever pipe laying is not actively in progress, the open ends of the piping shall be closed by a temporary plug or cap to prevent soil, water and other foreign matter from entering the piping.

3.3 TESTING

A. None required.

END OF SECTION 02612

SECTION 07165 VAPOR BARRIER

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, furnishing, installing and testing the vapor barrier system as specified herein.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction.

B. The latest edition of the following standards, as referenced herein, shall be applicable.

1. American Society for Testing and Materials (ASTM).
   a. ASTM E1745Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   b. ASTM E154 Standard Test Methods for Water Vapor Transmission of Materials.
   c. ASTM E96Standard Test Methods for Water Vapor Transmission of Materials.
   d. ASTM E1643Standard Practice of Installation of Water Vapor Retarders Used in Contact with Soil of Granular Fill Under Concrete Slabs.

2. American Concrete Institute (ACI)
   a. ACI 302.1 R-04 Vapor Barrier Component.

1.3 SUBMITTALS

A. The Contractor shall submit to the Engineer product data, and shop drawings describing the work to be performed. Work covered by these submittals shall not proceed until they have been approved by the Engineer.

B. Required submittals include:

1. Product data and specifications for vapor barrier components.

2. Manufacturer’s installation instructions for placement, seaming, and pipe boot installation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and handle vapor barrier components in accordance with the manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Barrier

1. Class A, 15-mil or greater, polyethylene resin vapor barrier meeting or exceeding all requirements of ASTM 1745 (Maximum water vapor transmission rate of 0.01 grains/ft^2/hour). Vapor barrier shall be Perminator™ 15-mil Underslab Vapor Barrier manufactured by W.R. Meadows, Inc., Stego-Wrap Vapor Barrier 15-mil manufactured by Stego Industries LLC, or approved equal.

2.2 ACCESSORIES

A. Seam Tape

1. High density polyethylene tape with pressure sensitive adhesive, suitable for cold weather installation. Shall be Stego® Cold Weather Tape, as manufactured by Stego Industries, LLC, or approved equal.

2. The seam tape shall have the following physical properties:

a. Minimum width of 4 inches.
b. Maximum Water Vapor Transmission Rate of 0.3 perms, ASTM E96.
c. Maximum Permeance Rate of 0.09 perms ASTM E96.

B. Vapor Proofing Mastic

1. Medium-viscosity, water-based, polymer-modified anionic bituminous/asphalt emulsion. Shall be Stego® Mastic as manufactured by Stego Industries, LLC, or approved equal.

2. The mastic shall have the following physical properties:

a. Maximum Water Vapor Transmission Rate of 0.3 perms.
b. Low Temperature Flexibility – No cracking at -20ºC, ASTM C836
c. Maximum Permeance Rate of 0.17 perms, ASTM E96.

C. Pipe Boots/Collars:

1. Construct pipe boots from vapor barrier material and pressure sensitive taper per manufacture's recommendations.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for the storage, handling, installation, and seaming of the vapor barrier in accordance with the specifications and the conditions of the manufacturer's warranty and in accordance with ASTM E1643.

3.2 SUBBASE PREPARATION

A. Surfaces to be lined with the vapor barrier shall be smooth and free of rocks, sticks, roots, sharp objects, and all debris that may puncture the barrier. The surface to be lined shall be firm and unyielding, with no sudden changes or breaks in grade. There shall be no standing water or excessive moisture on the surface when the vapor barrier is placed. The installation Contractor shall certify daily in writing that the subgrade surface on which the vapor barrier is to be installed is acceptable.

B. Moisture Content:

1. Allow no standing water or excessive moisture within the construction area.

2. Maintain moisture content of the surface soils to receive vapor barrier within three percent of the optimum moisture until covered by the vapor barrier.

3. Cover all surfaces where moisture content is critical promptly after they have been accepted for vapor barrier installation.

C. The compacted subbase shall be maintained in a smooth, uniform and compacted condition during installation of the vapor barrier.

3.3 VAPOR BARRIER INSTALLATION

A. The vapor barrier shall be cleaned of all debris or other materials that may negatively affect the membrane system.

B. Sheet Placement:

1. Sheets shall be placed as directed by the manufacturer's representative on surfaces which have been prepared to conform with these specifications and found acceptable for membrane installation.

2. Unroll the vapor barrier with the longest dimension parallel with the direction of the concrete pour for the concrete slab above the vapor barrier.

3. Lap the vapor barrier over footings and seal to foundations in accordance with the manufacturer's recommendation.

4. Overlap all joints/seams (lateral and butt) a minimum of 6 inches and seal with the manufacturer's pressure sensitive tape. All areas of adhesion must be free of dust, dirt, moisture, and frost prior to placement of seam tape.

5. No penetrations in the vapor barrier are permitted, except for permanent utilities and reinforcing steel. Seal all penetrations per manufacturer's recommendations using 15-mil Class vapor barrier material and seam tape. Pipe penetrations shall be sealed using a pipe boot constructed of the vapor material and seam tape. The boot shall extend a minimum of 6 inches beyond the pipe in all directions.

6. Repair damaged areas by cutting patches of the vapor barrier material, overlapping the damaged area by a minimum of 6 inches in all directions and taping the patch to the barrier on all four sides with a seam tape.

7. In areas where wind is prevalent, vapor barrier installation shall be started at the upwind side of the project and proceed downwind. The leading edge of the vapor barrier shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

8. Sandbags or rubber tires may be used as required to hold the vapor barrier in position during installation. Tires shall not have exposed steel cords or other sharp edges which may snag or cut the vapor barrier. Materials, equipment or other items shall not be dragged across the surface of the vapor barrier or be allowed to slide down slopes on the vapor barrier. All parties walking or working upon the vapor barrier material shall wear soft-sole shoes.

9. Smoking shall not be permitted by personnel working on the vapor barrier.

10. All areas of the vapor barrier damaged during installation as determined by the Engineer shall be repaired by the Contractor as specified at no additional expense to the Owner.

3.4 FIELD QUALITY CONTROL

A. Installation Contractor shall notify the Engineer a minimum of five (5) days prior to the installation of every vapor barrier.

B. The Engineer will conduct a visual inspection of each vapor barrier prior to the placement of the concrete slab or other material over the barrier. The Contractor must request the Engineer's inspection of the vapor barrier a minimum of 48 hours prior to covering the vapor barrier.

3.5 DISPOSAL OF SCRAP MATERIALS

A. On completion of installation, the Contractor shall dispose of all trash and scrap material off site or in a location approved by the Owner and Engineer, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner.

END OF SECTION 07165

RadonAway®
The world's leading radon fan manufacturer

HS Series

Radon Mitigation Fan

HS fans offer a proven solution for tough radon mitigation jobs, providing up to 25 times the suction of inline tube fans to deal with sand, tight soil or clay sub-slab material.

Features

- Internal condensate bypass
- Brackets for vertical mounting indoors and outdoors
- Inlet: 3.0" PVC / Outlet: 2.0" PVC
- Weight: 18 lbs.
- Size: 15.5"W x 13.3"H x 8.2"D
- Warranty: 1 year (3-year option available)

MODEL	WATTS	SOUND RATING (dBA)			RECOM. MAX. OP. PRESSURE "WC	TYPICAL CFM* vs. STATIC PRESSURE WC					
		OPEN	1/2	CLOSED		0"	10"	15"	20"	25"	35"
HS2000 with cord	174-307	56.5	56.2	51.9	14	63	37	12	-	-	-
HS3000 with cord	120-250	47.9	48.0	46.2	21	39	30	25	19	-	-
HS5000 with cord	223-385	56.0	55.3	53.1	35	44	37	33	29	25	16
HS2000E with switch box	174-307	56.5	56.2	51.9	14	63	37	12	-	-	-
HS3000E with switch box	120-250	47.9	48.0	46.2	21	39	30	25	19	-	-
HS5000E with switch box	223-385	56.0	55.3	53.1	35	44	37	33	29	25	16

* Made in the USA with U.S. and imported parts.

* CFM measured through suction.

For Further Information, Contact Your Radon Professional:

Rev C 0517
P/N 02002

ATTACHMENT B

Typical System Layout

MANUFACTURING BUILDING
96,892 SF±, FFE = 296.0

6" CONCRETE EXTERIOR SLAB ON GRADE W/6x6 W2.9xW2.9 WWF ON 6" COMPACTED GRANULAR FILL T/CONC EL 100'-0"

6" CONCRETE SLAB ON GRADE W/6x6 W2.9xW2.9 WWF ON 6" COMPACTED (95% PROCTOR) GRANULAR FILL SLOPE FLOOR TO 4" MIN THICKNESS AT DRAINS T/CONC EL 100'-0"

THICKEN SLAB FOR STAIR PAD SEE ARCH FOR LOCATION

TANK PAD T/CONC EL 100'-0"

TANK PAD T/CONC EL 101'-4" (T/FTG 95'-4")

COLD JOINT AT WALL

CONCRETE APRON 6" THICK 6x6 W2.9xW2.9 SEE SITE PLAN

CONCRETE APRON 6" THICK 6x6 W2.9xW2.9 T/CONC EL 100'-5" SEE SITE PLAN

SLOPE DOWN 1/2" FRONT TO REAR

PROVIDE SCHLUTERED FOR STAIR HERE

0 40 80
Scale in feet

APPROX. LOCATION OF HORIZONTAL PIPE
APPROX. LOCATION OF VERTICAL STACK
UNOCCUPIED ROOMS
NOTE: EXACT LOCATIONS TBD BY CONTRACTOR

CHA
III Winners Circle, PO Box 5269
Albany, NY 12205-0269
518.453.4500 • www.chacompanies.com

SUB-SLAB DEPRESSURIZATION SYSTEM

BELGIOIOSO CHEESE, INC.

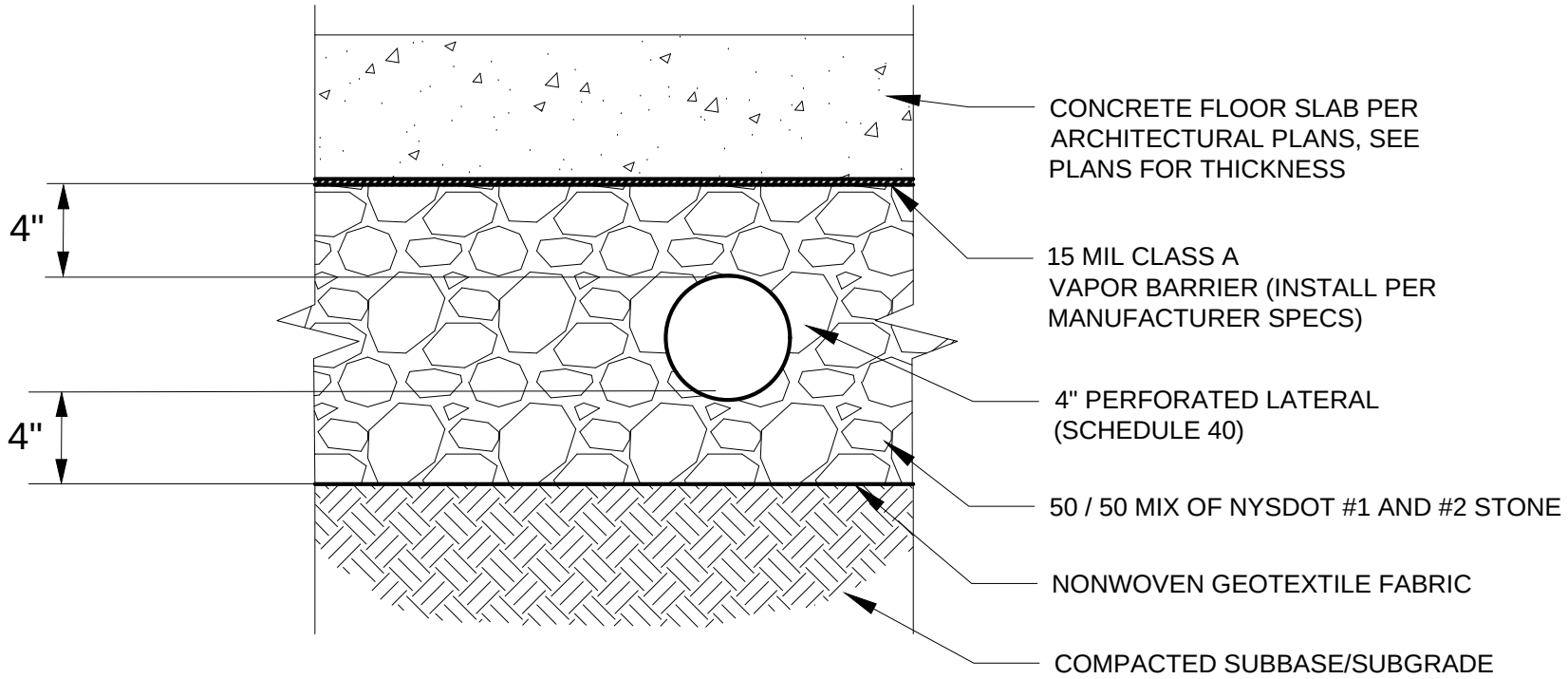
PROJECT NO. 34604

DATE: 06/2019

FIGURE 2

ATTACHMENT C

Typical Cross-Section



NOT TO SCALE

CHA
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Albany, NY 12205-0269
518.453.4500 • www.chacompanies.com

SUB-SLAB DEPRESSURIZATION SYSTEM
TYPICAL CROSS-SECTION
BELGIOIOSO CHEESE, INC.

PROJECT NO. 34604

DATE: 06/2019

FIGURE 1

ATTACHMENT D

System Startup and Testing Guidance and Inspection Checklist

System Startup & Testing

The owner's manual and specific startup recommendations for the sub-slab soil depressurization system (SSDS) will be provided to the Owner prior to occupancy of the building. Additionally, the following are the minimum requirements applicable to the startup and testing of the SSDS:

1. Prior to startup, the system(s) will be inspected to verify that all components of the system(s) (e.g. piping, fan, gauges, etc.) are properly installed. Additionally, all floor penetrations and joints within the building should be checked to verify that they have been sealed, as leaks may impact the overall efficiency of the system. It is important that all sealants and/or concrete patches be allowed sufficient time to properly cure before system startup (minimum of 24 hours).
2. Once all checks of the system are complete, the system should be turned on and allowed to operate for at least two hours prior to further testing. During this time, another check for leaks in the system appurtenances should be made. The operator should also verify that pressure and vacuum gauges on the blower system show proper operation of the fan. Additionally, all volatile organic compound (VOC) monitors and/or carbon monoxide detectors should be tested for appropriate operation.
3. There are two levels of performance testing required for the SSDS(s). The first test consists of physical testing of the pressure field after a minimum of two hours of continuous operation. To evaluate the pressure field extension (PFE), it is necessary to drill approximately ten small holes (approximately ½-inch to 1-inch diameter) through the slab at various distances and directions from the blower system, including points most remote from the blower. If permanent vacuum monitoring points are installed, the need to drill holes through the slab can be eliminated. With the blower system in operation, the sub-slab pressure in each hole should be measured, one at a time. A digital micromanometer should be utilized to monitor the PFE. While smoke tubes can be utilized to verify the drawdown effect beneath the slab, the use of a micromanometer will allow the user to verify that a minimum sub-slab pressure of -0.002 inches of water column is achieved. The ball valves installed on the piping network can be throttled/adjusted to balance the PFE as needed. If the minimum vacuum cannot be achieved at all points, the system should be inspected for leaks again. If after performing diagnostic checks the desired PFE is not achieved, it is possible that a larger blower system will need to be installed.
4. After a minimum of two weeks of operation, confirmatory air monitoring will be conducted in each structure as a second level of performance testing for the SSDS(s). This testing will include the collection of an indoor air quality sample from the lowest occupied level within the building. Specifically, an eight-hour composite sample will be collected inside the building using a 1-liter or 5-liter SUMMA® canister to collect the sample. One outdoor sample should be collected upwind to serve as an ambient background reference. All samples will be submitted to a certified laboratory analysis of VOCs via USEPA Method TO-15.

SUB-SLAB DEPRESSURIZATION SYSTEM CHECKLIST

Report No.	
Date:	Time:

Inspector(s):	Project No.
	Weather:
Type of Inspection: ☐ Routine ☐ Post Severe Condition	Temp.: Hi Low

FAN/BLOWER SYSTEM INSPECTION

ITEM/CONDITION	TRUE	FALSE	N/A	COMMENTS
The blower unit is operational.	☐	☐	☐	
There is no excessive noise emanating from the blower.	☐	☐	☐	
There is no excessive vibration emanating from the blower.	☐	☐	☐	
The blower unit is not excessively hot to the touch.	☐	☐	☐	
The blower unit housing is clean and in good condition.	☐	☐	☐	

SYSTEM PRESSURE INSPECTION

ITEM/CONDITION	TRUE	FALSE	N/A	COMMENTS
Vacuum gauge on inlet piping in good condition and shows negative pressure is being applied to sub-slab.	☐	☐	☐	
Pressure gauge on discharge piping in good condition and shows positive pressure being exhausted from blower.	☐	☐	☐	
Pressures are within acceptable normal range for system.	☐	☐	☐	Pressure Reading: ____ inches H_2O
When required, pressure field extension testing demonstrates continued sub-slab communication.	☐	☐	☐	

ELECTRICAL/ALARM INSPECTION

ITEM/CONDITION	TRUE	FALSE	N/A	COMMENTS
No observable electrical component damage.	☐	☐	☐	
All electrical disconnects/switches tested and functional.	☐	☐	☐	
Alarm sounds when blower power disconnected and pressure falls below alarm set point.	☐	☐	☐	

PIPING SYSTEM INSPECTION

ITEM/CONDITION	TRUE	FALSE	N/A	COMMENTS
All above-grade piping in good condition and free of cracks or other damage.	☐	☐	☐	
All pipe supports undamaged and functional.	☐	☐	☐	
In-line mufflers/silencers installed and functioning properly.	☐	☐	☐	
Discharge piping above roof undamaged and free of obstructions.	☐	☐	☐	
All labels present and legible	☐	☐	☐	

SUB-SLAB DEPRESSURIZATION SYSTEM CHECKLIST

Report No.	
Date:	Time:

CONCRETE SLAB/PIPING SYSTEM INSPECTION

ITEM/CONDITION	TRUE	FALSE	N/A	COMMENTS
All visible pipe penetrations appear properly sealed (e.g. not air leak noise).	☐	☐	☐	
There are no new significant, observable floor cracks or penetrations that may breach the floor tightness and effectiveness of the system.	☐	☐	☐	

ADDITIONAL NOTES & OBSERVATIONS

Signature:	Total Inspection Time: