Hudson Valley Research Park
2070 Route 52
Hopewell Junction, NY 12533-6531
D.E. Speed Zip 65A

April 28, 2010

Mr. Alex G. Czuhanich
New York State Department of Environmental Conservation
Division of Solid and Hazardous Materials
625 Broadway
Albany, NY 12233-7258

Re: Design Basis – Subslab Vapor Extraction and Treatment System
Building 330D 80K Area
IBM East Fishkill Facility, Hopewell Junction, New York
EPA ID No. NYD000707901

Dear Mr. Czuhanich:

The enclosed document presents the design basis for a subslab vapor extraction system to be installed in the 80K manufacturing area of Building 330D at the IBM East Fishkill facility. The proposed system is intended to address the confirmed source of tetrachloroethene (PCE) identified below the building slab during investigations of potential anomalous sources of PCE the indoor air of the 80K area. This document is being submitted to the New York State Departments of Environmental Conservation (NYSDEC) and Health (NYSDOH) (collectively, the Agencies) to communicate the basis for design and construction of the proposed system as a pilot test, or interim measure. We understand that construction and operation of the system can proceed once the Agencies have accepted this document.

If you wish to further discuss this document or have questions, please contact me at (845) 892-3176.

Sincerely,

David E. Speed, Ph.D.
Systems and Technology Group
International Business Machines Corporation

cc: H. Wilkie (NYSDEC)
N. Walz (NYSDOH)
S. Hawkins (IBM)

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Design Basis
Subslab Vapor Extraction and Treatment System for
VOC Source Remediation
Building 330D – 80K Manufacturing Area
IBM-East Fishkill Facility

Introduction

This document summarizes the design basis for a vapor extraction system to be installed in the 80K manufacturing area of Building 330D at the IBM East Fishkill facility. The proposed system is intended to address the confirmed source of tetrachloroethene (PCE) identified below the building slab during investigations of potential anomalous sources of volatile organic compound (VOC) presence, principally PCE, in the indoor air of the 80K area. This document and the attachments are being submitted to the New York State Departments of Environmental Conservation (NYSDEC) and Health (NYSDOH) (collectively, the Agencies) to communicate the basis for design and construction of the proposed system as a pilot test, or interim measure. We understand that construction and operation of the system can proceed once the Agencies have accepted this document.

The findings of the VOC source investigation conducted within the 80K manufacturing area, including testing of subsurface vapor extraction, were presented in IBM's 2008 Report of Findings[1]. The report was reviewed and commented on by the Agencies in a letter dated March 19, 2009. IBM submitted responses to the Agencies' comments in a December 22, 2009 letter.

The system design documented herein and on the attached Plan View (Figure 1) and Process Flow Diagram (Figure 2) represents preliminary design development at about 30% completion. Details associated with subslab extraction ports and associated piping that have already been constructed to accommodate an available manufacturing shutdown period are shown on Figure 3. Final design development is underway targeting a third quarter 2010 construction and startup.

Design Basis and System Overview

The system design is based on vapor extraction from five subslab extraction ports at a combined projected flow rate of about 250 cubic feet per minute (cfm), or 50 cfm per extraction port. Figure 1 shows the location of five subslab extraction ports installed in the 80K area. The extent of "vacuum influence" is inferred to be about 30 feet on average from each extraction port, corresponding to subslab depressurization to 0.1 inches water column (in. wc) or greater within

[1] IBM and Sanborn, Head Engineering, PC, "Report of Findings – Building 330D VOC Source Investigation and Mitigation, IBM East Fishkill Facility, Hopewell Junction, New York", December 24, 2008.

the zone of influence of each port at an applied vacuum of 55 in. wc. The anticipated zone of influence is based on prior extraction testing as documented in IBM's 2008 report.

Figure 2 shows a process flow diagram for the system. VOC-containing vapor will be withdrawn from the extraction ports using a blower to be located outside the northwest corner of Building 330D. The blower will discharge to a vapor aftercooler, followed by vapor-phase granular activated carbon (GAC). Treated vapor will then be discharged to an existing exhaust stack as shown on Figure 1. Further details regarding system components are outlined below.

Vapor Extraction Ports and Vacuum Pipe Network

The five vapor extraction ports and vacuum pipe network were installed in November 2009. Figure 3 provides a detail of the extraction ports, which consist of a ¾-in.-diameter PVC well screen that extends about 2 feet below the bottom of the floor slab. Figure 3 also shows a detail of the riser pipe from each extraction port. The risers consist of a vacuum gauge, manual flow adjustment valve, and flow monitoring port. The risers are connected to the vacuum pipe which runs above the hung ceiling to the mechanical room in Tower 7 where it will be extended outdoors and connected to the vacuum blower.

Blower and Aftercooler

The vacuum blower will be a regenerative-type blower located on a skid located outside the northwest corner of Building 330D (south of Tower 7) within an existing equipment area. Based on the extent of vacuum influence observed during the extraction test, the blower will be sized to apply at least 55 in. wc at each extraction port at a projected total flow rate of 250 cfm allowing for vacuum losses along the piping. The actual applied vacuum and flow will likely vary depending on actual subsurface conditions proximate to the new extraction ports.

The rated discharge air temperature from the regenerative blower is on the order of 120 to 140ºF. To improve the efficiency and longevity of GAC treatment, the discharge temperature will be reduced to less than 100ºF using an aftercooler.

GAC Treatment

The VOC-containing subsurface vapor will be treated using rental GAC units installed in a lead-lag configuration outside Tower 7 in a new fenced-in enclosure. At startup, IBM plans to use two parallel trains of GAC units, with each unit containing 1,800 pounds of GAC. Monitoring for VOC breakthrough and remaining adsorption capacity of the lead units will be conducted using a portable monitoring instrument, such as a photoionization detector (PID), flame ionization detector (FID), or other similar device. When the lead vessels have exhausted their capacity, the lag units will be moved to the lead position, and fresh units will be placed in the lag position.

Depending on the actual time interval between breakthrough, IBM may elect to change the size of the GAC units to improve the cost effectiveness of GAC replacement. At this time, IBM plans for spent GAC units to be sent off-site for reactivation or disposal.

Treated vapor from the GAC units will be discharged to an existing process exhaust stack located outside of Tower 7.

Controls and Operations

The vapor extraction system will be designed for continuous, unattended operation, except for routine monitoring of GAC breakthrough at a frequency to be established based on actual performance during the initial weeks following startup and thereafter. The system will be equipped with a central control panel located on or near the blower skid. System instrumentation will include alarm switches for blower and aftercooler discharge temperature, and high and low system vacuum. These switches are intended to shutdown the system and provide notification in the event of abnormal operations. In the event of an alarm shutdown, the system will send a trouble signal to the building's monitoring system, which is monitored around the clock. The actual instrumentation and alarm switches may be revised as part of final system design.

Attachments: Figure 1 – Plan View Layout
Figure 2 – Process Flow Diagram
Figure 3 – Subslab Extraction System Extraction Port and Riser Details

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Figure 1

Plan View Layout

Design Basis - Subslab Vapor Extraction and Treatment System
80K Manufacturing Area - Building 330D

IBM East Fishkill Facility
Hopewell Junction, New York

Drawn By: E. Wright/R. Hirtle
Designed By: S. Soos
Reviewed By: D. Shea
Date: April 2010

Figure Narrative

This figure shows the proposed plan view layout of the subslab vapor extraction and treatment system for the 80K manufacturing area of Building 330D. This figure is part of a package intended for submittal to the NYSDEC to inform them of IBM's intentions and communicate the design basis. Please refer to the text and other figures for additional details.

Legend

- CC-04 — Location and designation of subslab vapor extraction test port
- SS-11 — Location and designation of subslab vapor sample port
- EP-1 — Location and designation of subslab vapor extraction ports installed September 28-29, 2009
- Estimated extent of influence of each vapor extraction location
- Spencer Pipe conveyance piping
- Galvanized conveyance piping
- Spencer tubing cap (for future expansion)

Crib 2
Crib 1
Punch Room
Gowning
Screening Room
Parking Lot
MECHANICAL ROOM
BREAK
SMALL
EP-1
EP-2
EP-3
EP-4
EP-5
CC-01
CC-04
CC-05
CC-06
SS-01
SS-03
SS-08
SS-09
SS-11
SS-12
SS-13
SS-14
SS-15
SS-16
SS-17
SS-18
SS-19
SS-20
SS-21
SS-27
SS-31
SS-33
SS-38
SS-39
30' (Typ.)
Connect Treated Vapor Discharge to Existing TMAH Manifold
Subslab Vapor Extraction Blower Skid
Secondary Containment Enclosure and After-Cooler
4" (Typ.)
TMAH Exhaust System Equipment Enclosure
Existing TMAH Exhaust System Equipment Pad
Existing TMAH Exhaust Manifold and Stack
Existing TMAH Condensate Pump Station
Existing Pipe Support Foundation (Typ.)
12'
21'
62'
Proposed Pad and Driveway
Granular Activated Carbon Vessel (Typ.)

10' 5' 0 10' 20' Feet

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File:V:\RANDOLPH\2999.00 030\dwg\Subslab Vapor Extraction\Plan-View-Figure.dwg Plot Date: 4-14-10

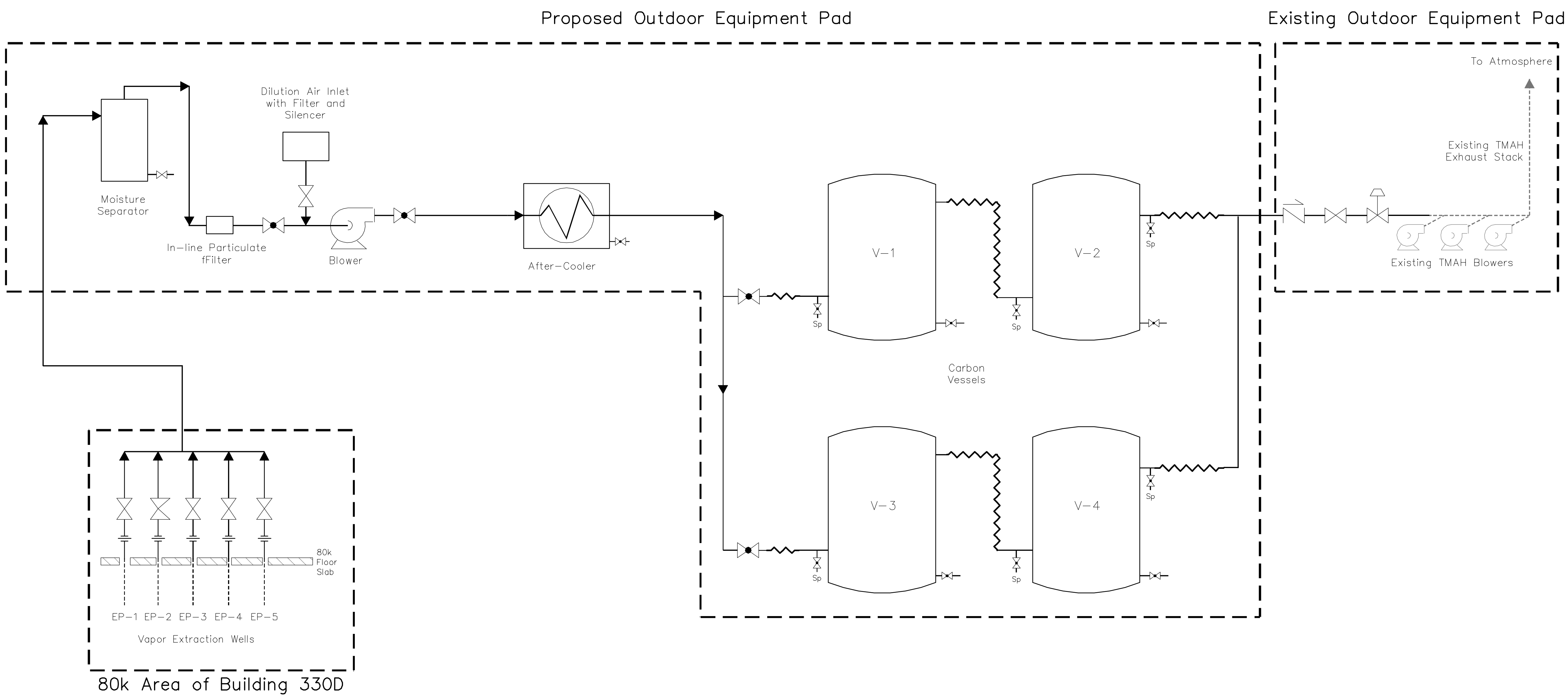

Figure 2

Process Flow Diagram

Design Basis - Subslab Vapor Extraction and Treatment System
80K Manufacturing - Building 330D

IBM East Fishkill Facility
Hopewell Junction, New York

Drawn By: R.Hirtle
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Date: April 2010

Figure Narrative

This figure shows the proposed process flow of the subslab vapor extraction and treatment system for the 80k manufacturing area of Building 330D. This figure is part of a package intended for submittal to the NYSDEC to inform them of IBM's intentions and communicate the design basis. Please refer to the text and other figures for additional details.

Legend

- Ball valve
- Actuated valve
- Gate valve
- Check valve
- Flexible conveyance pipe
- Rigid conveyance pipe
- Existing equipment

Not to Scale

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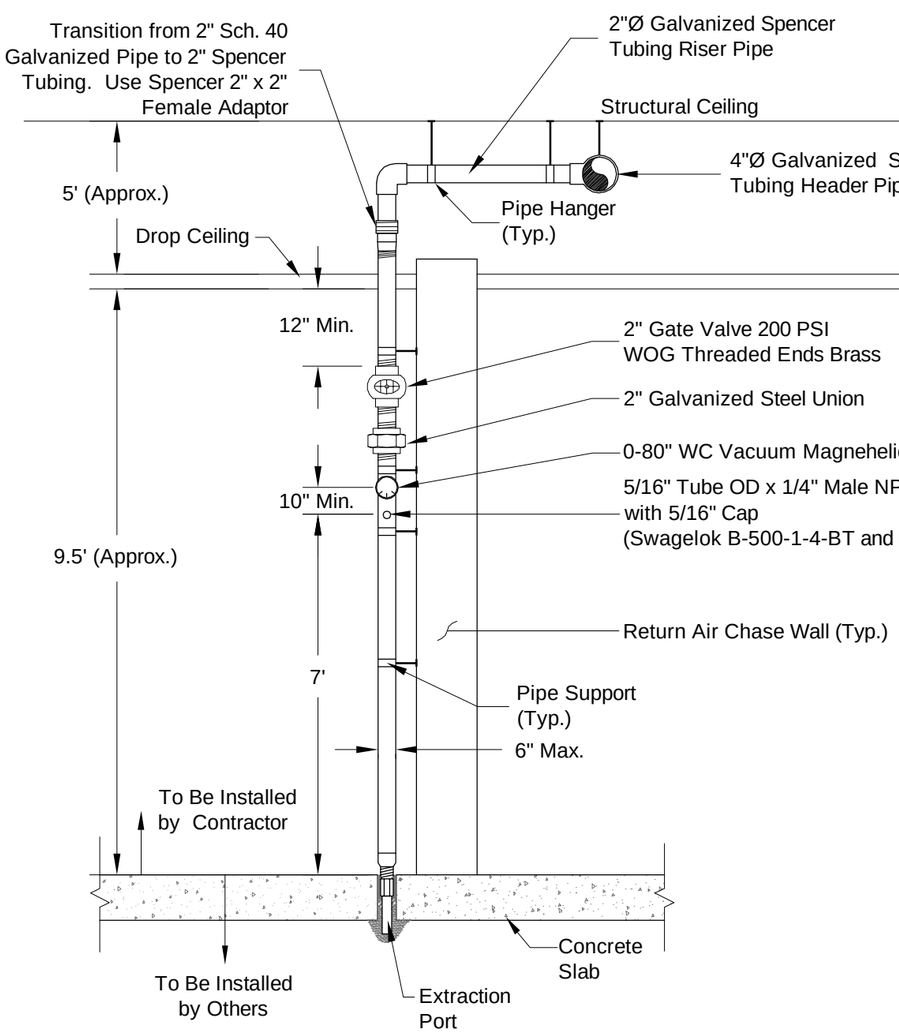


Riser Pipe Detail

Notes:

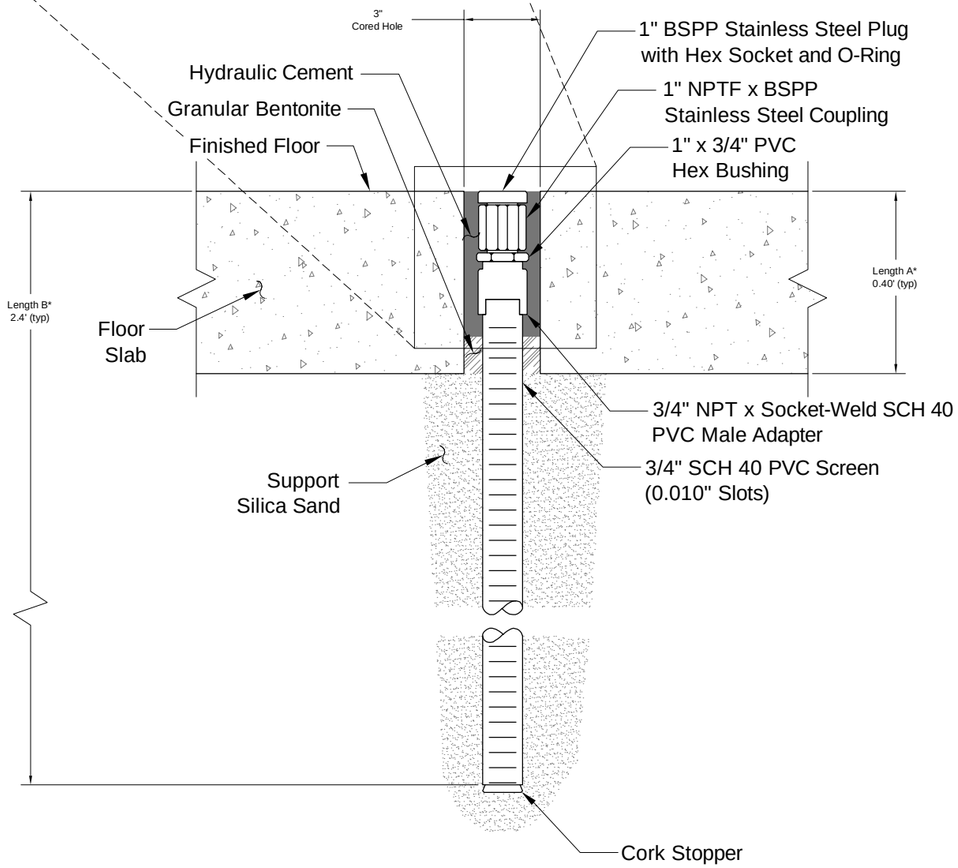
1) Magnehelic Gauge shall be Dwyer Instruments Model #2080, and shall include A-610 Pipe Mount Kit, A-310A Vent Valve on vacuum side, and pressure gauge snubber with 0.5 micron filtering disc on high pressure port.

2) Spencer Tubing and Fittings shall be expanded ends-type, joined with polyolefin shrink sleeves. Slip Couplings shall be used if straight ends are provided.

3) Threaded joints shall be made with Teflon thread sealant tape to be vacuum and/or pressure tight. Thread sealant liquids or pastes shall not be used.

* SEE TABLE BELOW FOR INSTALLATION DIMENSIONS

Extraction Port	**Length A** Concrete Thickness (ft)	**Length B** Port Depth (ft)
EP-1	0.44	2.44
EP-2	0.40	2.40
EP-3	0.40	2.30
EP-4	0.45	2.50
EP-5	0.38	2.00



Extraction Port Detail

Figure 3

Subslab Extraction System Extraction Port and Riser Details

Design Basis - Subslab Vapor Extraction and Treatment System
80K Manufacturing Area - Building 330D

IBM East Fishkill Facility
Hopewell Junction, New York

Drawn By: E. Wright
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Figure Narrative

This figure shows the extraction port and riser details of the subslab vapor extraction and treatment system for the 80K manufacturing area of Building 330D. This figure is part of a package intended for submittal to the NYSDEC to inform them of IBM's intentions and communicate the design basis. Please refer to the text and other figures for additional details.

Not to Scale

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