Quality Assurance Project Plan

Sub-Slab Sampling
East Hennepin Avenue Study Area
Minneapolis, Minnesota

Revision 1.0

Prepared for
General Mills, Inc.
Number One General Mills Blvd.
Minneapolis, MN 55426

January 2014

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Table of Contents

Introduction

Barr Engineering Co. (Barr) has prepared this Quality Assurance Project Plan (QAPP) for the Sub-Slab Sampling Project in the East Hennepin Avenue Study Area (the Study Area) in accordance with applicable USEPA Region 5 and State of Minnesota requirements, regulations, guidance, and technical standards. This includes the USEPA Interagency Data Quality Task Force environmental requirements as specified in the Uniform Federal Policy (UFP) QAPP guidance documents EPA-505-B-04-900A and EPA-505-B-04-900C.

This project-specific QAPP provides the details of the organizations and the project management, objectives, data acquisition, data assessment, oversight and data review procedures associated with the project conducted within the Study Area. Protocols for sample collection, handling, storage, chain-of-custody, laboratory and/or field analyses, data evaluation and validation, and reporting are addressed. Field activities conducted under this QAPP will be conducted in accordance with the Project Health and Safety Plan (Barr, 2013a) and Form 8 – Project Health and Safety Plan Amendment (Barr, 2013b).

General Mills, Inc. (GMI) has completed an initial vapor intrusion investigation in the Study Area to assess the potential pathway of vapors migrating from groundwater containing volatile organic compounds (VOCs), primarily trichloroethylene (TCE). During the vapor intrusion investigation activities, TCE was detected in soil gas samples collected from right-of-way locations at concentrations exceeding the Minnesota Pollution Control Agency's (MPCA's) ten times (10x) Residential Interim Intrusion Screening Value (ISV) for TCE at a depth of 8 feet below ground surface.

GMI, as directed by the MPCA, will conduct sub-slab soil vapor sampling and provide soil vapor intrusion mitigation systems, if appropriate based on results, to occupied buildings in the Study Area (Figure 1). This project-specific QAPP is intended to serve as a single reference for overall data quality relating to any of the monitoring or investigation activities performed.

Site History & Background

GMI operated a technical center and research laboratories on the northeast corner of the property located at 2010 East Hennepin Avenue (see Figure 1) from approximately 1930 to 1977. From approximately 1947 to 1962, solvents were disposed in a soil adsorption pit on the property.

Site characterization work began in 1981. Contaminated soil was removed, and groundwater in the shallow aquifer and surficial bedrock was found to be impacted with VOCs, primarily TCE. A Response Order by Consent was executed between the MPCA and GMI in 1984. Extraction and treatment of impacted groundwater began in 1985 and continued until 2010 when shutdown of the groundwater pump out systems occurred. Subsequent to the shutdown, MPCA requested an evaluation of the vapor intrusion pathway, and in 2011, a phased approach was initiated using existing groundwater monitoring data to identify potential residential and commercial / industrial receptors. In 2012 and 2013, temporary wells and soil gas monitoring points were installed in selected on-site and city right-of-way locations and groundwater and soil gas samples were collected and analyzed using active and passive methods. Active soil gas sample results were assessed using MPCA guidance to identify an area for sub-slab sampling. The vapor-intrusion investigation for this project is expected to be completed in 2013 and 2014.

QAPP Worksheet #1 – Title and Approval Page

Document Title
Quality Assurance Project Plan, Sub-Slab Sampling and Building Mitigation, East Hennepin Avenue Study Area – Minneapolis, Minnesota

Lead Organization
General Mills, Inc.

Preparer's Name and Organizational Affiliation
Ward Swanson, Barr Engineering Co., Consultant to General Mills

Preparer's Address, Telephone Number, and E-mail Address
4700 W. 77th Street, 952-832-2660 wswanson@barr.com

Preparation Date (Day/Month/Year)
11/13/2013

MPCA Project Manager:

Signature
Edward P. Olson, MPCA
Printed Name/Organization/Date

MPCA Project QA Officer:

Signature
William Scruton, MPCA
Printed Name/Organization/Date

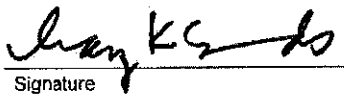
General Mills, Inc. Project Manager:

Signature

Larry Deeney, General Mills, Inc.

Printed Name/Organization/Date

Barr Engineering Co. Principal-in-Charge:

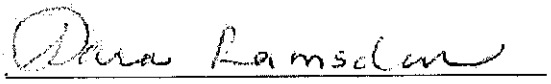


Signature

Mary Sands, Barr Engineering Co.

Printed Name/Organization/Date

Barr Engineering Project Manager:



Signature

Sara Ramsden, Barr Engineering Co.

Printed Name/Organization/Date

Pace Analytical Project Manager:

Signature

Chris Bremer, Pace Analytical Services, Inc.

Printed Name/Organization/Date

Pace Analytical Quality Manager:

Signature

Melanie Ollila, Pace Analytical Services, Inc.

Printed Name/Organization/Date

QAPP Worksheet #2 – QAPP Identifying Information

East Hennepin Avenue Study Area

Minneapolis, Minnesota

1. This QAPP was prepared in accordance with the requirements of:

Intergovernmental Data Quality Task Force Documents Uniform Federal Policy for Quality Assurance Project Plans, UFP-QAPP Manual Part 1 and UFP-QAPP Workbook Part 2A.

USEPA Requirements for Quality Assurance Project Plans (EPA-QA/R-5) and USEPA Guidance for Quality Assurance Project Plans (EPA-QA/G-5).

The above documents are compared in Table 1.

2. Identify regulatory program:

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as reauthorized by Superfund Amendments and Reauthorization Act.

Minnesota Environmental Response Liability Act (MERLA) of 1983

3. Identify approval entity: MPCA

4. This QAPP is a project-specific QAPP.

5. List dates of scoping sessions that were held:

Not Applicable.

6. List dates and titles of QAPP documents written for previous site work, if applicable:

Quality Assurance (QA)/Quality Control (QC) - March 25, 1985

7. List organizational partners (stakeholders) and connection with lead organization:

Regulatory Oversight – MPCA

Consulting Engineers – Barr Engineering Co.

Analytical Laboratory – Pace Analytical Services, Inc. (Pace)

8. List data users:

MPCA, MDH, GMI

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:

Worksheet #9: Project Scoping Session Participants Sheet – Project ongoing since 1981 under the MPCA's jurisdiction

QAPP Worksheet #3 – Distribution List

Listed are entities to whom copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments will be distributed.

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address
Ed Olson	Remedial Project Manager	MPCA	(651) 757-2627	edward.olson@state.mn.us
Fred Campbell	Remedial Project Hydrogeologist	MPCA	(651) 757-2260	fred.campbell@state.mn.us
William Scruton	QA Officer	MPCA	(651) 757-2710	bill.scruton@state.mn.us
Larry Deeney	Project Manager	General Mills	(763) 764-3476	Larry.Deeney@genmills.com
Mary Sands	Principal-in-charge	Barr Engineering	(952) 832-2718	msands@barr.com
Sara Ramsden	Project Manager	Barr Engineering	(952) 832-2877	sramsden@barr.com
Eric Blodgett	Field Manager	Barr Engineering	(952) 842-3662	eblodgett@barr.com
Ward Swanson	QA Manager	Barr Engineering	(952) 832-2660	wswanson@barr.com
Chris Bremer	Project Manager	Pace Analytical Services	(612) 607-6390	chris.bremer@pacelabs.com
Melanie Ollila	QC Officer	Pace Analytical Services	(612) 607-6352	melanie.ollila@pacelabs.com

QAPP Worksheet #4 – Project Personnel Sign-Off Sheet

Certification that project personnel have read the text will be obtained by one of the following methods as applicable:

In the case of regulatory agency personnel with oversight authority, approval letters or e-mails will constitute verification that applicable sections of the QAPP have been reviewed. Copies of regulatory agency approval letters/e-mails will be retained in the project files and will be listed in Worksheet #29 as project records.

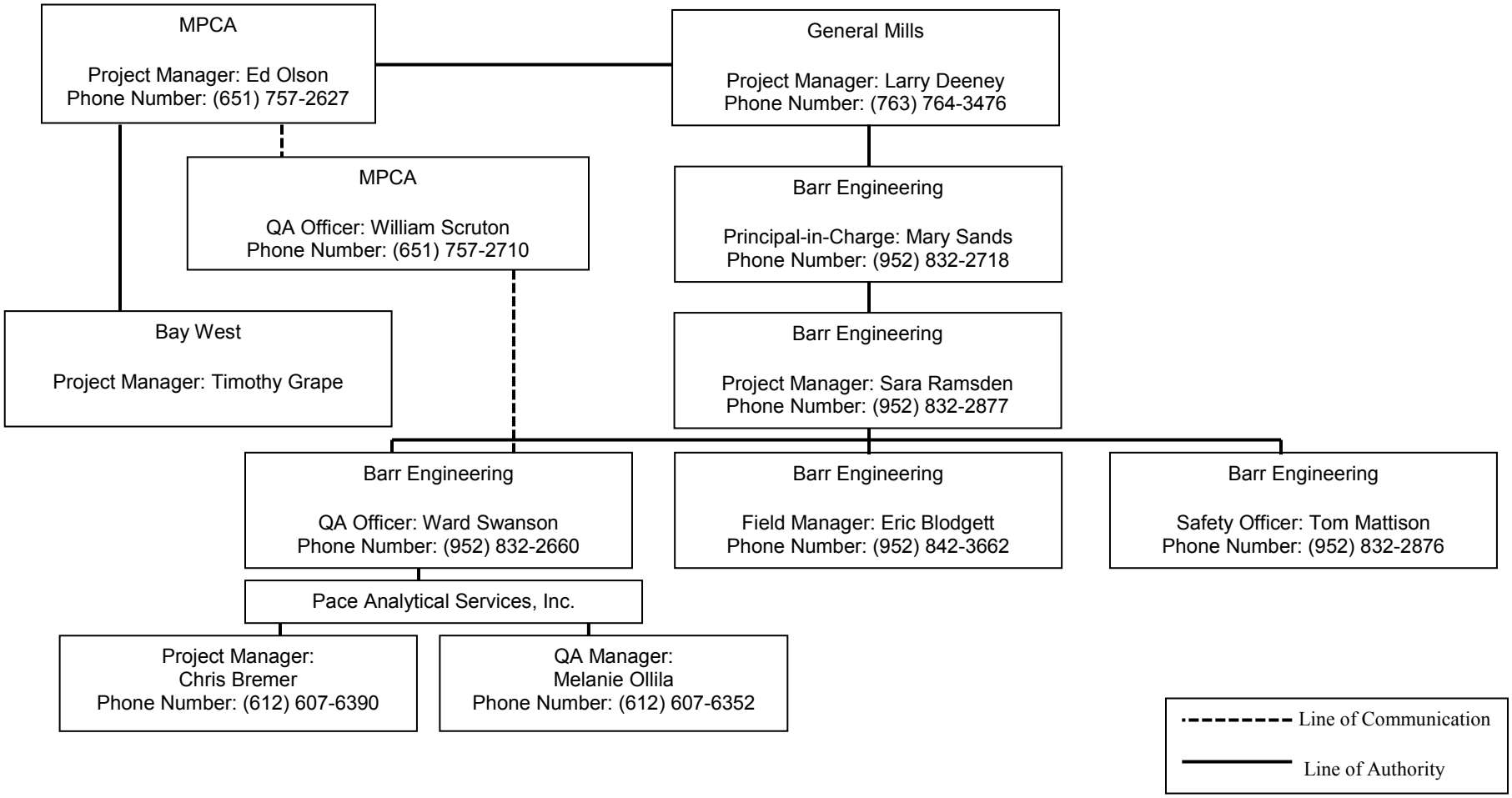
E-mails will be sent to GMI and Barr project personnel who will be requested to verify by e-mail that they have read the applicable QAPP sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project files and is identified in Worksheet #29.

A copy of the signed worksheet #4 will be retained in the project files and is identified as a project document in Worksheet #29.

Organization	Project Personnel	Title	Telephone Number	Signature	Date QAPP Read

QAPP Worksheet #5 – Project Organizational Chart

This section identifies the reporting relationships between all organizations involved in the project, including the lead organization and all contractors and subcontractor organizations. It includes the organizations providing field sampling, on-site and off-site analyses, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.



QAPP Worksheet #6 – Communication Pathways

Communication pathways for this project are shown below.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, etc.)
Regulatory Agency Interface	MPCA PM Barr PM GMI PM	Ed Olson Sara Ramsden Larry Deeney	651-757-2627 952-832-2877 763-764-3476	Barr will contact GMI PM and regulatory agency PM via email should significant issues with the implementation of this QAPP occur, when comments to the submittals occur, and when new field sampling plans are identified for implementation.
Community Interface	Southeast Como Improvement Association Barr PM GMI PM	Sara Ramsden Larry Deeney	952-832-2877 763-764-3476	GMI (and Barr) will attend community meetings and discuss plans and progress as required by regulatory agency.
Site Access	Barr PM Barr Field Manager	Sara Ramsden Eric Blodgett	952-832-2877 952-842-3662	Barr staff will coordinate with homeowners and field staff will obtain access.
Laboratory Problems/Corrective Actions	Barr QA Manager Pace Client Contacts	Ward Swanson Chris Bremer Melanie Ollila	952-832-2660 612-607-6390 612-607-6352	Barr QA Manager will be the primary contact for the laboratories should they experience issues with project samples.
Field Problems/Corrective Actions	Barr Field Manager Barr PM Barr QA Manager	Eric Blodgett Sara Ramsden Ward Swanson	952-832-3662 952-832-2877 952-832-2660	Barr field staff will contact Barr Field Manager, Barr PM, and/or QA Manager to discuss any difficulties encountered during field activities.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, etc.)
Safety Issues	Barr Field Manager Barr Safety Manager Barr PM	Eric Blodgett Tom Mattison Sara Ramsden	952-832-3662 952-832-2876 952-832-2877	Barr field staff will contact Barr Field Manager, Barr Safety Manager, or Barr PM and work may stop until all safety issues are cleared. MPCA may be contacted if safety issues delay obtaining/reporting of data.
Field Activity Modifications	MPCA PM Barr PM GMI PM	Ed Olson Sara Ramsden Larry Deeney	651-757-2627 952-832-2877 763-764-3476	GMI and Barr will propose modifications to current sampling program via periodic updates or otherwise as needed. Reduction of testing parameters or frequencies will require approval from MPCA.

QAPP Worksheet #7 – Personnel Responsibilities and Qualifications Table

This section identifies project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. This includes the project manager, QA officer, project contacts for organizations involved in the project, the project health and safety officer, field operation personnel, and the analytical services provider.

Name	Title	Organizational Affiliation	Responsibilities
Ed Olson	Remedial Project Manager	MPCA	Provides overall responsibility for oversight of the work plan. Directs other MPCA technical staff, and requests additional technical support to provide overall support for this project as necessary.
William Scruton	QA Officer	MPCA	Responsible for review and approval of this QAPP and all addenda. Reviews the field and analytical procedures and, if deemed necessary, conducts auditing.
Larry Deeney	Project Manager	General Mills	Provides final approval on behalf of GMI for submittals. Oversees sampling and mitigation activities to ensure compliance. Provides final approval for all necessary actions and adjustments necessary to accomplish project objectives.
Mary Sands	Principal in Charge/Vice President	Barr Engineering	Responsible for overall management and coordination of Barr's work on the project. Primarily ensuring that technical, financial, and schedule objectives are achieved successfully. Approval of all external report deliverables prior to submittal to GMI, and may represent the project team at various meetings. The Barr Principal in Charge may delegate these responsibilities to appropriately qualified individuals at Barr.
Sara Ramsden	Project Manager	Barr Engineering	Reports directly to GMI and is the primary point of contact and control for matters concerning the project. Coordinates and directs staff; reviews the work performed to ensure its quality, responsiveness and timeliness. The Barr Project Manager may delegate these responsibilities to appropriately qualified individuals at Barr.

Name	Title	Organizational Affiliation	Responsibilities
Ward Swanson	QA Manager	Barr Engineering	Responsible for preparing the QAPP, verifying the laboratory implements the requirements of the QAPP and addresses any QA issues. Provide technical assistance to project staff and, if deemed necessary, performs audits and data verification and validation. The Barr QA Manager may delegate these responsibilities to appropriately qualified individuals at Barr.
Eric Blodgett	Field Manager	Barr Engineering	Coordinates and directs field staff to maintain the data collection and field activities in conformance with the objectives of the sampling plan. The Barr Field Manager may delegate these responsibilities to appropriately qualified individuals at Barr.
Kevin McGilp	Sub-Slab Sampling Manager	Barr Engineering	Manages the field investigation and sampling portion of the project as defined in the QAPP ensuring adherence to the procedures of the QAPP, and Health and Safety Plans. Assists in the preparation of Reports.
Dean Myers	Mitigation Construction Manager	Barr Engineering	Manages the field investigation and mitigation portion of the project, ensuring adherence to the Work Plan and the Health and Safety Plan. Assists in the preparation of Reports.
Chris Bremer	Project Manager	Pace	Responsible for coordinating with the Field Manager, Sub-Slab Sampling Manager and/or Barr QA Manager for the sampling events. Responsible for adhering to the analysis requirements stated in the QAPP and any subsequent Work Plan and QAPP modifications. Contacts Barr QA Manager as necessary with problems that may affect data quality.

Barr and Pace résumés included in Attachment A.

QAPP Worksheet #8 – Special Personnel Training Requirements Table

This worksheet lists the main project functions and any specialized/non-routine training, certifications, or clearances required by the project

Project Function	Specialized Training By Title or Description of Course	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Field Sampling	OSHA (29 CFR § 1910.120)	Field Staff	Barr Engineering	On-file with Barr Health and Safety Officer
Laboratory Analysis	As required by laboratory Quality Assurance Manual	Laboratory Staff	Pace Analytical Services	On-file with Laboratory QA Officer
	Minnesota Department of Health Laboratory Accreditation – Method TO-15	Laboratory Staff	Pace Analytical Services	On-file with Laboratory QA Officer

QAPP Worksheet #9 – Project Scoping Session Participants Sheet

This worksheet is not applicable. This project has been on-going since 1981 under jurisdiction of the MPCA.

QAPP Worksheet #10 – Problem Definition

Previous investigation activities have identified the Study Area, where a potential vapor intrusion pathway may occur to residential and commercial/industrial receptors. To assess the vapor intrusion pathway, sub-slab soil vapor samples will be collected from occupied buildings in the Study Area. A cross-section of the site conceptual model (SCM) for the Study Area using information obtained to date is shown on Figure 2 of the QAPP. The objective of the sub-slab soil vapor sampling is to determine the nature and extent of the vapor intrusion pathway for occupied buildings located within the Study Area and mitigate the pathway in individual buildings if corresponding sub-slab soil vapor samples exceed criteria. A summary of the SCM follows:

Source Area

- Disposal of solvents from a research lab facility took place on site from about 1947 to 1962. The source location was excavated. TCE is a dense non-aqueous phase liquid.

Geology/Hydrogeology

- Approximately 50 feet of unconsolidated sediment (glacial deposits) underlie the Study Area. The deposits generally consist of fill and peat near the surface, a clay till at the base of the deposits above bedrock, with sandy alluvium in between. The primarily granular soil types in the glacial deposits above the water table are not likely to act as a barrier to vapor migration.
- The shallow water table is present in the glacial deposits at approximately 15 to 20 feet below ground surface (bgs). Shallow groundwater flows to the southwest.
- Groundwater pump out systems were used from 1985 until September 2010 to contain the plume laterally. TCE concentrations within the plume generally decreased during operation of the pump out systems.

Utilities

- Numerous buried utilities (e.g., sanitary sewer, storm sewer, water service, communications cables, natural gas, etc.) are present within the streets and in the surrounding Study Area extending onto the properties to service the buildings. There are also buried pipes, located both on site and off site, associated with the groundwater pump out systems.

Receptors/Buildings

- Historic solvent disposal at the former onsite disposal area has resulted in TCE concentrations in the shallow groundwater that exceed the MPCA's groundwater screening criteria based on the groundwater concentrations and MPCA Vapor Intrusion Guidance for the vapor intrusion pathway. There is potential for TCE to volatilize from the groundwater into the soil gas, and for the soil gas to migrate into buildings and/or utility corridors located over the plume.
- The Study Area is densely developed with primarily residential use. Numerous homes and businesses, many assumed to have basements, are located within the Study Area.

QAPP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

As stated on worksheet #10 of the QAPP, the objective of the sub-slab soil vapor sampling is to determine the nature and extent of the potential vapor intrusion pathway for occupied buildings located within the Study Area and take subsequent corrective action (including mitigation measures) if corresponding sub-slab soil vapor samples exceed criteria. The goal of sub-slab sampling is to assess the potential for vapor intrusion into buildings within the Study Area and, if appropriate based on the data, to apply mitigation measures. The information collected may lead to additional actions in the Study Area.

Inputs to the sub-slab sampling and mitigation process are defined in the Work Plan and include:

- What is the current use of the property?
- Who lives or works in the property (i.e. are high risk individuals present)?
- What is the interior structure of buildings on the property?
    - Does the property have a basement?
    - Is a sub-slab ventilation system present?
- What is the TCE concentration beneath the lowest floor in the occupied building at the property?
- Does the TCE concentration below the lowest level of the building require mitigation?

The boundaries of the Study Area are defined in the Work Plan (Figure 1-1). The properties within the Study Area boundary will be assessed, as described in the Work Plan, and a sub-slab soil vapor sample will be collected, if applicable. Sub-slab soil vapor samples will be analyzed for TCE with approximately 10% of the samples being analyzed for compounds on the Minnesota (MN) Soil Gas List using Method TO-15. The samples will be collected and analyzed according to MPCA Guidance (MPCA, 2010). Photoionization detector (PID) readings will be taken from the sampling point prior to collection to provide the laboratory with information prior to analysis and a gas meter will be used to monitor for potential health and safety issues. The basis for decisions regarding additional sampling or mitigation is provided in the decision process diagrams of the Work Plan.

The sampling design is based on the SCM and the characteristics of the properties located within the Study Area. Details of the sampling process are defined in the Work Plan and its associated SOPs.

QAPP Worksheet #12 – Measurement Performance Criteria Table

This worksheet displays the matrix, analytical group, and concentration level and identifies the data quality indicators (DQIs), measurement performance criteria (MPC), and QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems.

Matrix: Air

Analytical Group or Method: VOCs/TO-15

Concentration Level: All

Data Quality Indicator (DQI)	QC sample or measurement performance activity	Measurement Performance Criteria
Analytical Precision (laboratory)	Laboratory Duplicates	RPD ≤ 25%
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	Analyte-specific (See Table 2)
Overall accuracy/bias (laboratory)	Method Blanks	No target analyte concentrations ≥ RL
Sensitivity	Samples reported to RL	Analyte-specific - MN Soil Gas List (MPCA 2010)
Completeness	See Worksheet #34	See Worksheet #34

QAPP Worksheet #13 – Secondary Data Criteria and Limitations Table

All secondary data and information that will be used for the project and their originating sources are identified. Analytical data obtained prior to this QAPP is presented.

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Ongoing monitoring data	Barr Engineering	VOC – Groundwater 1981-2013	Develop soil gas sampling area	Data quality evaluated based on standard laboratory report (MPCA required QC data, no raw data validation).
Monitoring data	Barr Engineering	TCE – soil gas 2011-2013	Develop study area	Data quality evaluated based on standard laboratory report (MPCA required QC data, no raw data validation).

QAPP Worksheet #14 – Summary of Project Tasks

Below is a brief overview of the listed project activities.

Summary of Project Tasks

Activity	Responsible party
Contact homeowners	MPCA/Barr Engineering
Mobilization/demobilization for sampling	Barr Engineering
Perform interior building inspections	Barr Engineering- Field Manager
Sample collection - Soil Gas	Barr Engineering- Field Manager
Analysis	Pace Analytical Services
Validation	Barr Engineering-QA Manager
Summarize data-Report to homeowners	Barr Engineering- PM
Mitigation Installation	Barr Engineering , Home Safety Solutions, and McGough Construction
Reporting	Barr Engineering

QAPP Worksheet #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

15.1 Reference Limits and Evaluation Tables for Soil Gas Samples

Matrix: Air

Analytical Group: VOCs/TO-15 MN List

Analyte	Project Action Limit (PAL)	PAL Reference	Laboratory-specific quantitation limit (RL)[1]	Laboratory-specific detection limit (MDL)[1]
Trichloroethylene (TCE)	20 μg/m^3	MPCA's 10x Residential Interim Intrusion Screening Value (ISV)	0.55 μg/m^3	0.273 μg/m^3
	2 μg/m^3	MPCA's ISV		
Acetone	310,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.48 μg/m^3	0.241 μg/m^3
Benzene	45 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.33 μg/m^3	0.163 μg/m^3
Benzyl chloride	10 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.05 μg/m^3	0.525 μg/m^3
Bromodichloromethane	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.36 μg/m^3	0.177 μg/m^3
Bromoform	90 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	2.10 μg/m^3	1.051 μg/m^3
Bromomethane (Methyl Bromide)	50 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.79 μg/m^3	0.181 μg/m^3
1,3-Butadiene	3 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.45 μg/m^3	0.225 μg/m^3
2-Butanone (Methyl ethyl ketone, MEK)	50,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.6 μg/m^3	0.156 μg/m^3

Analyte	Project Action Limit (PAL)	PAL Reference	Laboratory-specific quantitation limit (RL)[1]	Laboratory-specific detection limit (MDL)[1]
Carbon disulfide	7,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.63 μg/m^3	0.317 μg/m^3
Carbon tetrachloride	7 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.64 μg/m^3	0.320 μg/m^3
Chlorobenzene	500 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.94 μg/m^3	0.468 μg/m^3
Chloroethane (Ethyl chloride)	100,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.54 μg/m^3	0.268 μg/m^3
Chloroform	1,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.99 μg/m^3	0.497 μg/m^3
Chloromethane (Methyl chloride)	900 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.42 μg/m^3	0.210 μg/m^3
Cyclohexane	60,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.70 μg/m^3	0.350 μg/m^3
Dibromochloromethane	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.73 μg/m^3	0.866 μg/m^3
1,2-Dibromoethane (Ethylene dibromide)	0.2 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.56 μg/m^3	0.780 μg/m^3
1,2-Dichlorobenzene	2,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.22 μg/m^3	0.610 μg/m^3
1,3-Dichlorobenzene	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.22 μg/m^3	0.610 μg/m^3
1,4-Dichlorobenzene	600 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.22 μg/m^3	0.610 μg/m^3
1,1-Dichloroethane	5,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.82 μg/m^3	0.412 μg/m^3
1,2-Dichloroethane	4 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.41 μg/m^3	0.206 μg/m^3

Analyte	Project Action Limit (PAL)	PAL Reference	Laboratory-specific quantitation limit (RL)[1]	Laboratory-specific detection limit (MDL)[1]
1,1-Dichloroethene (DCE)	2,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.81 μg/m^3	0.403 μg/m^3
cis-1,2-Dichloroethene	600 μg/m^3	MPCA's 10x Residential Interim Intrusion Screening Value (ISV)	0.81 μg/m^3	0.153 μg/m^3
trans-1,2-Dichloroethene	600 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.81 μg/m^3	0.403 μg/m^3
1,2-Dichloropropane	40 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.94 μg/m^3	0.470 μg/m^3
Dichlorodifluoromethane (Freon 12)	2,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.01 μg/m^3	0.503 μg/m^3
cis-1,3-Dichloropropene	200 μg/m^3 *	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.92 μg/m^3	0.111 μg/m^3
trans-1,3-Dichloropropene	200 μg/ m^3 *	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.92 μg/m^3	0.460 μg/m^3
Dichlorotetrafluoroethane (Freon 114)	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.42 μg/m^3	0.213 μg/m^3
Ethanol	150,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.38 μg/m^3	0.192 μg/m^3
Ethyl Acetate	30,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.73 μg/m^3	0.359 μg/m^3
Ethylbenzene	10,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.88 μg/m^3	0.119 μg/m^3
4-Ethyltoluene	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.00 μg/m^3	0.500 μg/m^3
n-Heptane	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.83 μg/m^3	0.415 μg/m^3
Hexachloro-1,3-butadiene	5 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	2.20 μg/m^3	1.100 μg/m^3

Analyte	Project Action Limit (PAL)	PAL Reference	Laboratory-specific quantitation limit (RL)[1]	Laboratory-specific detection limit (MDL)[1]
n-Hexane	20,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.72 μg/m^3	0.360 μg/m^3
2-Hexanone (Methyl Butyl Ketone)	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.83 μg/m^3	0.415 μg/m^3
4-Methyl-2-pentanone (Methyl isobutyl ketone)	30,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.83 μg/m^3	0.415 μg/m^3
Methylene Chloride (Dichloromethane)	200 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.71 μg/m^3	0.353 μg/m^3
Methyl-tert-butyl ether (MTBE)	30,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.73 μg/m^3	0.088 μg/m^3
Naphthalene	90 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.07 μg/m^3	0.533 μg/m^3
2-Propanol (isopropyl alcohol)	70,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.50 μg/m^3	0.092 μg/m^3
Propylene (Propene)	30,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.35 μg/m^3	0.175 μg/m^3
Styrene	10,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.87 μg/m^3	0.433 μg/m^3
1,1,2,2-Tetrachloroethane	2 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.70 μg/m^3	0.188 μg/m^3
Tetrachloroethylene (PCE)	200 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.69 μg/m^3	0.345 μg/m^3
Tetrahydrofuran	NA	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.60 μg/m^3	0.300 μg/m^3
Toluene (Methylbenzene)	50,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.77 μg/m^3	0.383 μg/m^3
1,2,4-Trichlorobenzene	40 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.51 μg/m^3	0.755 μg/m^3

Analyte	Project Action Limit (PAL)	PAL Reference	Laboratory-specific quantitation limit (RL)[1]	Laboratory-specific detection limit (MDL)[1]
1,1,1-Trichloroethane (Methyl chloroform)	50,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.11 μg/m^3	0.555 μg/m^3
1,1,2-Trichloroethane	6 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.55 μg/m^3	0.277 μg/m^3
Trichlorofluoromethane (Freon 11)	7,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.14 μg/m^3	0.222 μg/m^3
1,2,4-Trimethylbenzene	70 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.00 μg/m^3	0.500 μg/m^3
1,3,5-Trimethylbenzene	60 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.00 μg/m^3	0.130 μg/m^3
1,1,2-Trichlorotrifluoroethane (Freon-113)	300,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.60 μg/m^3	0.800 μg/m^3
Vinyl acetate	2,000 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.72 μg/m^3	0.358 μg/m^3
Vinyl chloride	10 μg/m^3	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.26 μg/m^3	0.130 μg/m^3
m&p-Xylene	1,000 μg/m^3 **	MPCA's 10x Residential Intrusion Screening Value (ISV)	1.77 μg/m^3	0.883 μg/m^3
o-Xylene	1,000 μg/m^3 **	MPCA's 10x Residential Intrusion Screening Value (ISV)	0.88 μg/m^3	0.128 μg/m^3

[1] The laboratory RL and MDL are affected by the canister size and pressure remaining in the canister after sampling.

[*] Based on 1,3-Dichloropropene cas # 542-75-6

[**] Based on total xylenes cas # 1330-20-7

QAPP Worksheet #16 – Project Schedule / Timeline Table

Listed are all project activities as well as the QA assessments that will be performed during the course of the project. Include the anticipated start and completion dates.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Contact homeowners	Minnesota Pollution Control Agency/Barr	11/7/2013	June 2014	Mailer (MPCA) Call Center (Barr, MPCA, MDH) Public Meetings (Barr) Door to Door (Barr)	June 2014
Perform interior building inspections and soil gas sample collection	Barr Engineering- Field Manager	Week of 11/18/13 through June 2014	June 2014	Indoor Building Survey Form and Sub-Slab Sample(s)	June 2014
Analysis	Pace Analytical Services, Inc.	Week of 11/11/13 through June 2014	June 2014	Laboratory report	June 2014
Validation	Barr Engineering- QA Manager	After receipt of data reports	June 2014	Summary Report	June 2014
Summarize data- Report to homeowners	Barr Engineering- PM	Week of 11/18/13 through June 2014	June 2014	Telephone, Email, Mailer	June 2014
Mitigation Installation	Barr Engineering, Home Safety Solutions, and McGough Construction	Week of 11/25/13 through June 2014	June 2014	Mitigation system	June 2014
Reporting	Barr Engineering	Week of 11/18/13 through June 2014	June 2014	Notification to MPCA	June 2014

QAPP Worksheet #17 – Sampling Design and Rationale

17.1 Sampling Approach

The design of the sampling program is outlined in Worksheet 10 and in the Work Plan.

QAPP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Listed below are all site locations that will be sampled.

Sample ID	Matrix	Type	Analyte/ Analytical Group	Sampling SOP	Comments
0000-9999 - Randomly generated property locations (multiple sampling points at one address will be designated a,b,c etc.).	Air	Summa Canister	TCE/VOCs TO-15	Barr SOP Air Sample Collection from a Sub-slab Soil Vapor Monitoring Point	1 sample/1000 square fee at each location

QAPP Worksheet #19 – Analytical SOP Requirements Table

For each matrix, analytical group, and concentration level, the analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding time are listed.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method / SOP Reference	Sample Size	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Air	VOCs	Standard	S-MN-A-013-Rev.13	1 L	Summa canister	None	14 days (MPCA, 2010)

QAPP Worksheet #20 – Field Quality Control Sample Summary Table

Field QC will be maintained by conformance to the Work Plan and Barr Field SOPs (Barr, 2013c).

QAPP Worksheet #21 – Project Sampling SOP References Table

Field SOP Reference Summary Table				
Title, Revision Date and / or Number	**Originating Organization**	**Equipment Type**	**Modified for Project Work? (Y/N)**	**Comments**
Vapor Pin Installation	Barr Engineering	Drill, dead-blow hammer, silicone tubing	N	Sub-Slab Sampling and Mitigation Work Plan, Appendices
Sampling	Barr Engineering	Teflon tubing	Y	Sub-Slab Sampling and Mitigation Work Plan, Appendices
Mitigation System	Barr Engineering	Micromanometer	Y	Sub-Slab Sampling and Mitigation Work Plan, Appendices

QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment Calibration, Maintenance, Testing and Inspection Summary Table						
Field Equipment	**Calibration Activity**	**Frequency**	**Acceptance Criteria**	**Corrective Action**	**Resp. Person**	**SOP Reference**
Photo-Ionization Detector (PID)	Calibration / Verification	Daily	Manufacturers guidance	Operator Adjustments or replacement	Barr Field Staff	Barr SOP Air Sample Collection from a Sub-slab Soil Vapor Monitoring Point
4-Gas Meter	Calibration / Verification	Daily	Manufacturers guidance	Operator Adjustments or replacement	Barr Field Staff	Barr PHASP (Barr 2013)

QAPP Worksheet #23 – Analytical SOP References Table

Listed are all SOPs that will be used to perform on-site or off-site analysis.

Reference Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
S-MN-A-013-Rev.13	Analysis of Whole Air Samples for VOC's by GC/MS, Method TO-15/TO-14, Revision 13, MN Soil Gas List MPCA (2010)	Definitive	Air: VOCs	GC/MS	PASI-MN	N

(1) Laboratory SOPs provided in Attachment B.

QAPP Worksheet #24 – Analytical Instrument Calibration Table

Identified below are all analytical instrumentation that requires calibration, the SOP reference number for each and the person responsible.

Instrument	Activity	SOP Reference	Title or position of responsible person
GC/MS	Calibration	S-MN-A-013-Rev.13	Analyst, Supervisor
GC/MS	Maintenance	S-MN-A-013-Rev.13/ Operators Manual	Analyst, Supervisor
Pre-concentrator	Maintenance	S-MN-A-013-Rev.13/ Operators Manual	Analyst, Supervisor

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Identified below are all analytical instrumentation that requires maintenance, testing, or inspection and the SOP reference number for each is provided.

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/Position responsible for corrective action	Reference
GC/MS	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner	VOCs	Monitor Instrument performance via CCV	As needed, no maintenance is required as long as instrument QC meets internal laboratory requirements	Per instrument manufacturer's documentation	Replace connections, check pressure on canister, clean source, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port	Analyst, Supervisor	SOP: S-MN-A-013-Rev.13, QAM Rev 16 copy52

QAPP Worksheet #26 – Sample Handling System

This worksheet identifies components of the project-specific sample handling system.

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Barr Engineering Field Staff
Sample Packaging (Personnel/Organization): Barr Engineering Field Staff
Coordination of Shipment (Personnel/Organization): Barr Engineering Field Staff
Type of Shipment/Carrier: Hand deliver
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Pace Sample Custodian(s)
Sample Custody and Storage (Personnel/Organization): Pace Sample Custodian(s)
Sample Preparation (Personnel/Organization): Pace Laboratory Analysts
Sample Determinative Analysis (Personnel/Organization): Pace Laboratory Analysts
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Pace Sample Custodian(s)
Number of Days from Analysis: NA
SAMPLE CONTAINER (SUMMA® PASSIVATED CANISTERS) CLEANING, CERTIFICATION, LEAK CHECKING AND PREPARATION FOR SHIPMENT
Personnel/Organization: Pace Sample Custodian(s) – See SOP in Attachment B

QAPP Worksheet #27 – Sample Custody Requirements Table

The procedures that will be used to maintain sample custody and integrity are outlined below. These include examples of chain-of-custody (COC) forms, sample identification, laboratory sample receipt forms, and laboratory sample transfer forms that are described below.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Sampling personnel are responsible for the care and custody of the samples until they are delivered to the lab. Specific sample collection and storage and COC procedures and example forms are provided in field SOP Air Sample Collection from a Sub-Slab Soil Vapor Monitoring Point (Barr, 2013c).

Each COC record form must be appropriately signed and dated by the sampling personnel. The person who relinquishes custody of the samples must also sign this form. The COC should not be signed until the information has been checked for inaccuracies by the lead sampler. All changes should be made by drawing a single line through the incorrect entry, initialing and dating it. Revised entries should be made in the space below the entries.

Samples will not be sent by a commercial courier.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal, cleaning, certification): The laboratory Quality Assurance Manual (QAM) and/or specific SOPs detail the sample receipt and handling procedures in place at the laboratory. In summary, once samples are delivered, a Sample Condition Upon Receipt Form (SCURF) is completed for each sample. Sample integrity is verified by the following activities: COC documentation/completeness, sample canister integrity (broken or leaking canisters), sample label completeness; sample label agreement with COC, sample canister and items included in agreement with requested tests and canister certification as noted on COC. Once this information is verified and resolved, if incomplete or inadequate, samples are logged into the laboratory information management system (LIMS), bar-coded and properly stored until analysis. All laboratory staff are required to document the custody transfer within this system for removal or returning samples. Pace laboratory staff follow the procedures in their Sample Management SOP (Attachment B).

Laboratory facilities are secure with all exterior doors locked with coded entry requirements or are continuously monitored by Pace staff. Keyless door lock combinations and computer access codes/logins are changed periodically (QAM, Attachment B).

Specific laboratory policy and practices for sample cleaning and re-use are provided in the Pace laboratory Procedure for Cleaning, Certification, Leak Checking and Preparation for Shipment of Summa® Passivated Canisters SOP (Attachment B).

QAPP Worksheet #28 – QC Samples Table

Matrix	**Air**
Analytical Group	**VOCs**
Concentration Level	**Standard Level**
Analytical Method / SOP Reference	**TO-15/S-MN-A-013-Rev.13/MPCA, 2010**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparatory batch of 20 samples or once/ 24-hour period, whichever is more frequent.	No compounds detected > MRL. The internal standard must be within ± 50% of the mean area response of the IS in the most recent calibration. The retention time of each of the internal standards must be within ± 0.33 minutes between the method blank and the most recent calibration standard.	MB fails acceptance limit, the source of contamination must be identified and eliminated. Another MB must be prepared and analyzed to verify. If not, samples are flagged and documented in report narrative.	Analyst, Supervisor	Bias Contamination	No compounds detected > MRL
Laboratory Control Sample (LCS)	One per preparatory batch of 20 samples or once/ 24-hour	The percent recovery for each analyte in the LCS	Reanalyze all samples in the batch	Analyst, Supervisor	Accuracy Bias	See Table 2-Method Detection Limits and Reporting Limits

Matrix	**Air**
Analytical Group	**VOCs**
Concentration Level	**Standard Level**
Analytical Method / SOP Reference	**TO-15/S-MN-A-013-Rev.13/MPCA, 2010**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
	period, whichever is more frequent.	must be within the internally generated recovery limits and can be found in the LIMS system and Table 2- Method Detection Limits and Reporting Limits				for EPA TO15
Laboratory Duplicate	One per preparatory batch of 10 samples as noted in Attachment VII of SOP (Attachment B)	The RPD between the sample and the sample duplicate must be < 25%.	Contact the client for further instructions. The client can choose to have the lab qualify the data and narrate as appropriate and/or re-submit the sample.	Analyst, Supervisor	Precision	The RPD between the sample and the sample duplicate must be < 25%.

QAPP Worksheet #29 – Project Documents and Records Table

The documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment are noted below.

Sample Collection Documents and Records	Where Maintained
Field Documents Field Logbook Field Sample Forms Chain-of-Custody Records Field Instrument Calibration Logs Sampling Notes Photographs Health and Safety Plan	Field documents will be maintained in the project file located at Barr Engineering offices which are kept following Barr's Records Management Protocols, indefinitely.
Project Report Documents Project sign-off forms Project report submittals	Report documents will be maintained in the project file located at Barr Engineering Offices which are kept following Barr's Records Management Protocols, indefinitely.
Laboratory Documents Sample receipt, custody, and tracking record Equipment calibration logs (electronically stored) Sample preparation logs (electronically stored) Analysis Run Logs (electronically stored) Raw data	As detailed in the laboratory QAM(s), data is typically retained for a period of 5 years from the report date. As per the MPCA Guidance (MPCA 2010), the data shall be retained for 10 years from the report date.
Reporting Schedule As detailed on Worksheet # 6 – modifications to the Work Plan, QAPP and schedule will be submitted to the MPCA.	All project communications regarding the Work Plan, QAPP and schedule will be kept at Barr Engineering offices, following Barr's Records Management protocols indefinitely.

QAPP Worksheet #30 – Analytical Services Table

Matrix	Analytical Group	Analytical SOP	Data Package Turnaround Time (TAT)	Laboratory / Organization (name and address, contact person and telephone number)
Air	VOCs	S-MN-A-013-Rev.13	2 Business Days	Pace Analytical Services 1700 SE Elm St, Minneapolis, MN 55414 – Chris Bremer - (612)607-6390

QAPP Worksheet #31 – Planned Project Assessments Table

Identified below are the type, frequency, and responsible parties of planned assessment activities that will be performed for the project.

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Review of field procedures	As warranted	Internal	Barr	QA Manager and Field Manager, Barr	PM, QA Manager and Field Manager, Barr	PM, QA Manager and Field Manager, Barr	QA Manager and Field Manager, Barr
Review of field notes/data	Every event/report	Internal	Barr	Field Manager, Barr	QA Manager and Field Manager, Barr	PM, QA Manager and Field Manager, Barr	QA Manager, Barr
Review of COCs	Every event/report	Internal/ External	Barr Laboratory	QA Manager, Pace	QA Manager, Barr	QA Manager, Barr	QA Manager, Barr
Review Validation Analytical Reports	Every event/report	External Internal	Laboratory Barr	QA Manager, Pace	QA Manager, Barr Pace	QA, Manager, Barr PM, Pace	QA Manager, Barr PM, Pace

QAPP Worksheet #32 – Assessment Findings and Corrective Action Responses

For each type of assessment, the procedures for handling QAPP and project deviations encountered during the planned project assessments are described below.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Review of field procedures	Field Audit Findings	Field Manager, Barr QA Manager, Barr	Assumes immediate feedback during any field audit	Verbal communication, SOP updating, Project file documentation for Final Report	Field Manager, Barr	Assumes immediate feedback during any field audit
Review of field sheets/reports	QA/QC Review/Verification	Field Manager, Barr QA Manager, Barr PM, Barr	Within 1 week from receipt of field reporting	Verbal or electronic communication	Field Manager, Barr	Within 2 weeks from initial PM contact
Review of COCs	Email or verbal notification of discrepancies	QA Manager Barr	Upon receipt and before sample login	Verbal or electronic communications	Field Manager, Barr QA Manager, Barr	Immediate feedback for laboratories to check in samples and analyze within holding time/expected TAT.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Review Analytical Reports	Data quality review, verification/validation forms (see Attachment C)	QA Manager, Barr PM, Barr	Initial data evaluation: Within 1 day of data receipt Full data validation: Within 4 weeks of data report receipt.	Data Assessment reports – data qualifiers / footnotes	QA Manager, Barr	Prior to final reporting

QAPP Worksheet #33 – QA Management Reports Table

Identified below are the frequencies and type of planned reports, including the project delivery dates, the personnel responsible for report preparation, and the report recipients.

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Progress Reports	Weekly	Every Tuesday, for prior week while monitoring	QA Manager, Barr PM, Barr	MPCA
Final Report	Once	Summer 2014	PM, Barr	MPCA

QAPP Worksheet #34 – Verification (Step I) Process Table

The following worksheets define the data verification and validation process. Worksheet #34 describes how each item will be verified. Worksheets #35 and #36 describe when specific activities will occur, what documentation is necessary and identifies the person(s) responsible for field and analytical data respectively.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
Field Records			
5	Field logbooks	X	X
6	Equipment calibration records	X	X
7	Chain-of-Custody Forms	X	X
8	Sampling diagrams/surveys	X	X
9	Relevant Correspondence	X	X
10	Change orders/deviations	X	X
11	Field audit reports	X	X
12	Field corrective action reports	X	X
Analytical Data Package			
13	Cover sheet (laboratory identifying information)	X	X
14	Case narrative	X	X
15	Internal laboratory chain-of-custody	X	X
16	Sample receipt records	X	X

Item	Description	Verification (completeness)	Validation (conformance to specifications)
17	Sample chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
18	Definition of laboratory qualifiers	X	X
19	Results reporting forms	X	X
20	QC sample results	X	X
21	Compound(s) identified and reported in proper units	X	X
22	Labeled sample chromatograms	X	X
23	Electronic data deliverable	X	X
24	Tentatively Identified Compounds (TICs) – Reported with full TO-15 MN List	X	X
25	Communication records		X
26	MDL/RL establishment and verification		X
27	Standards Traceability		X
28	Instrument calibration records		X
29	Corrective action reports		X
30	Raw data		X

QAPP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

Describe below are the processes that will be followed to validate project field data.

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field logbook and Forms	QAPP, Barr SOP Air Sample Collection from a Sub-slab Soil Vapor Monitoring Point	Verify that records are present and complete for each day of field activities. Verify that all planned samples were collected and that sample collection locations are documented. Verify that building survey was provided for each sampling location. Verify that changes/exceptions are documented and reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily - Field Manager Weekly - QA Manager, Barr
Chain-of-custody forms	QAPP, Barr SOP Air Sample Collection from a Sub-slab Soil Vapor Monitoring Point	Verify the completeness of chain-of-custody records. Examine entries for consistency with the field logbook. Verify that the required volume of sample has been collected. Verify that all required signatures and dates are present. Check for transcription errors.	Daily - Field Manager QA Manager, Barr

QAPP Worksheet #36 – Validation (Steps IIa and IIb) Summary Table

Describe below are the processes that will be followed to validate project field data.

Data Validator: Barr Engineering – QA Manager

Analytical Group/Method:	Volatile Organics – TO-15
Data deliverable requirements:	Initial data evaluation: MPCA Guidance (MPCA, 2010) – 100% Full data validation: All raw data, full data package (PDF) – 100%
Analytical specifications:	See Worksheet #28
Measurement performance criteria:	See Worksheet #12
Percent of data packages to be validated:	100% initial data evaluation; 10% full data validation
Percent of raw data reviewed:	10% full data validation
Percent of results to be recalculated:	10% full data validation
Validation procedure:	Based on EPA Contract Laboratory Program data procedure and MPCA guidance (MPCA, 2010)

QAPP Worksheet #37 – Usability Assessment

Described below are the procedures / methods / activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Also noted are how data quality issues will be addressed and how limitations on the use of the data will be handled.

Personnel (organization and position/title) responsible for participating in the data usability assessment:

Barr Field Manager, Pace QC Officer, Barr QA Manager, Barr Project Manager

The usability of the data will be assessed based on a review of the field measurements and laboratory results. The laboratory results will be reviewed by the laboratory prior to submittal and by the Barr QA Manager upon receipt.

Step 1	**Review the project's objectives and sampling design** The objective of the sub-slab soil vapor sampling is to determine the nature and extent of a potential vapor intrusion pathway for occupied buildings located within the Study Area and mitigate individual buildings if corresponding sub-slab soil vapor samples exceed the threshold criteria (i.e., 10 x ISV).
Step 2	**Review the data verification and data validation outputs** The laboratory reports will be reviewed based on Barr's SOP for Data Evaluation. The Data Evaluation will be communicated to the project team and the Barr QA Manager will determine its usability and assess whether further action is needed, i.e. data reported with qualification or resampling and reanalysis is warranted.
Step 3	**Verify the assumptions of the selected statistical method** Not applicable. No statistical method employed.
Step 4	**Implement the statistical method** Not applicable. No statistical method employed.
Step 5	**Document data usability and draw conclusions** The goal is to have 100% usable data. The data evaluation for each sample will be summarized and will follow Barr's SOP for Data Evaluation. The Barr Project Manager will assess the data usability based on all relevant information.

References

Barr Engineering Co. (Barr), 1985. *Project Health and Safety Plan.* August 1985.

Barr, 2013a. *Project Health and Safety Plan.* June 2013.

Barr, 2013b. *Form 8 – Project Health and Safety Plan Amendment*. October 2013.

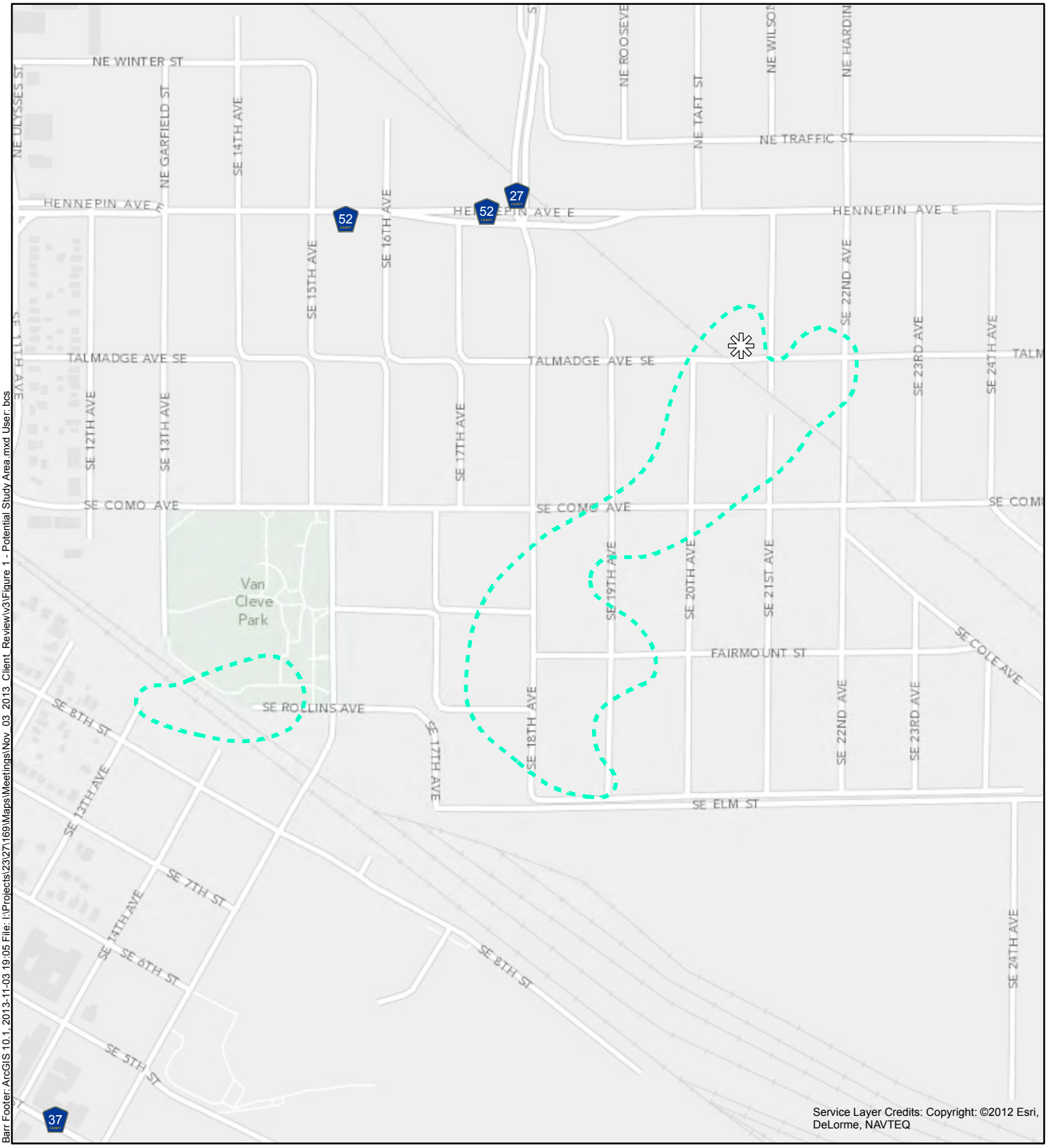
Barr, 2013c. *Sub-Slab Sampling and Building Mitigation Work Plan, East Hennepin Avenue Study Area*. November 2013.

Intergovernmental Data Quality Task Force Uniform Federal Policy (UFP), 2012. *Uniform Federal Policy for Quality Assurance Project Plans – Part 2A (Revised).* EPA-505-B-04-900C. March 2012.

Minnesota Pollution Control Agency (MPCA), 2008. *Risk-Based Guidance for the Vapor Intrusion Pathway.* September 2008.

Minnesota Pollution Control Agency (MPCA), 2010. *Vapor Intrusion Assessments Performed During Site Investigations.* October 2010.

United States Environmental Protection Agency (USEPA), 2006. *EPA Requirements for Quality Assurance Project Plans.* EPA QA/R-5. 2006



Barr Footer: ArcGIS 10.1, 2013-11-03 19:05 File: I:\Projects\23\27\169\Maps\Meetings\Nov_03_2013_Client_Review\v3\Figure 1 - Potential Study Area.mxd User: bcs

Former Disposal Site

Potential Study Area

600 0 600

Feet

Figure 1

POTENTIAL STUDY AREA
East Hennepin Avenue Site
Minneapolis, Minnesota

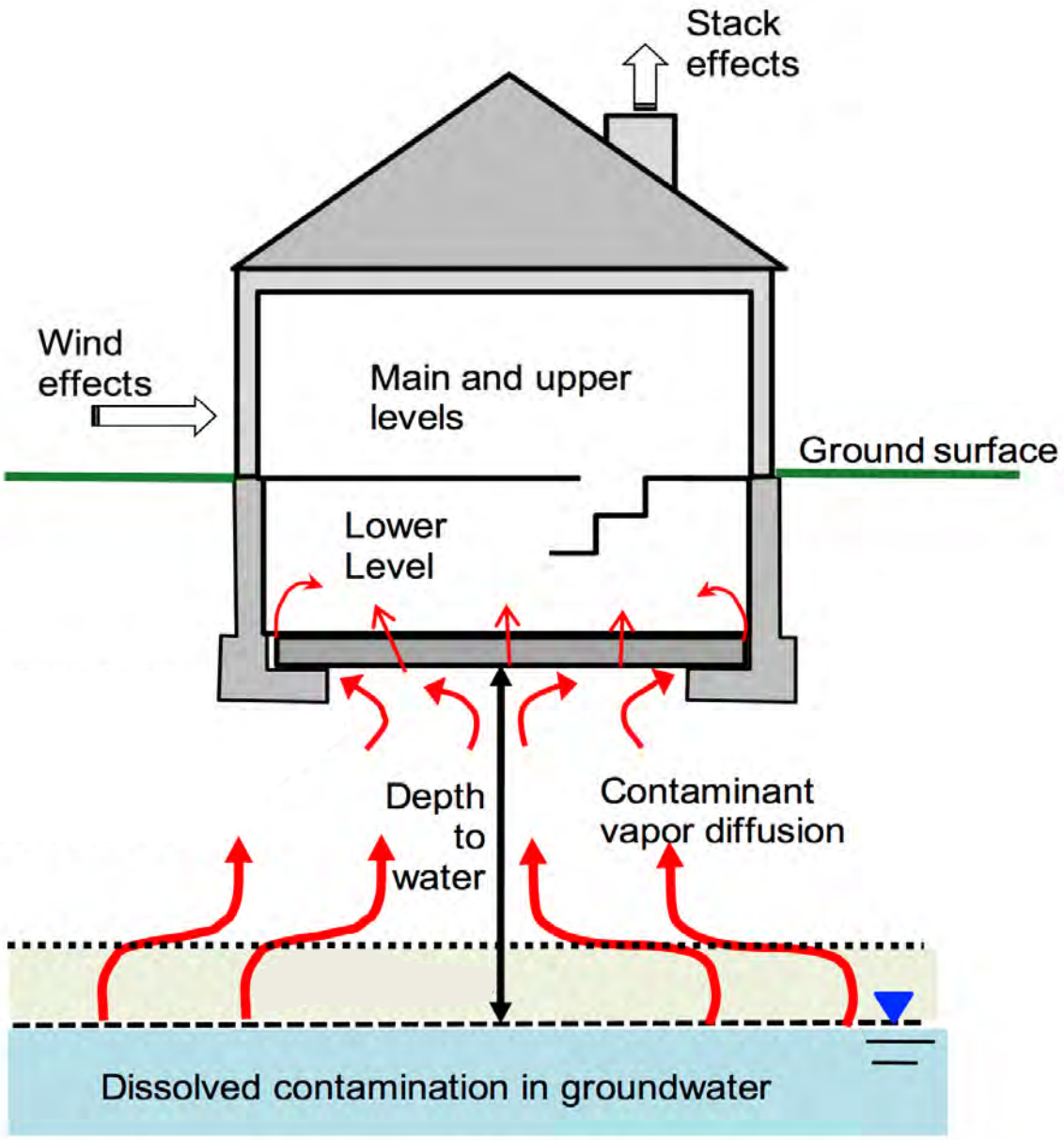


Figure 2

SIMPLIFIED MODEL of VAPOR INTRUSION
East Hennepin Avenue Site
Minneapolis, Minnesota

Table 1

CROSSWALK: UFP-QAPP Workbook To 2106-G-05 QAPP

Required QAPP Element(s) and Corresponding QAPP Section(s)	QAPP Worksheet # in QAPP Workbook	Required Information
Project Management and Objectives		
2.1 Title and Approval Page	1	- Title and Approval Page
2.2 Document Format and Table of Contents		- Table of Contents
2.2.1 Document Control Format	2	- QAPP Identifying Information
2.2.2 Document Control Numbering System		
2.2.3 Table of Contents		
2.2.4 QAPP Identifying Information		
2.3 Distribution List and Project Personnel Sign-Off Sheet		
2.3.1 Distribution List	3	- Distribution List
2.3.2 Project Personnel Sign-Off Sheet	4	- Project Personnel Sign-Off Sheet
2.4 Project Organization		
2.4.1 Project Organizational Chart	5	- Project Organizational Chart
2.4.2 Communication Pathways	6	- Communication Pathways
2.4.3 Personnel Responsibilities and Qualifications	7	- Personnel Responsibilities and Qualifications Table
2.4.4 Special Training Requirements and Certification	8	- Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition		
2.5.1 Project Planning (Scoping)	9	- Project Planning Session Documentation
2.5.2 Problem Definition, Site History, and Background	10	- Problem Definition, Site History, and Background - Site Maps (historical and present)
2.6 Project Quality Objectives and Measurement Performance Criteria	11	- Site-Specific PQOs
2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process		
2.6.2 Measurement Performance Criteria	12	- Measurement Performance Criteria Table

Required QAPP Element(s) and Corresponding QAPP Section(s)	QAPP Worksheet # in QAPP Workbook	Required Information
2.7 Secondary Data Evaluation	13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table
2.8 Project Overview and Schedule	14	- Summary of Project Tasks
2.8.1 Project Overview	15	- Reference Limits and Evaluation Table
2.8.2 Project Schedule	16	- Project Schedule/Timeline Table
Measurement/Data Acquisition		
3.1 Sampling Tasks		
3.1.1 Sampling Process Design and Rationale	17	- Sampling Design and Rationale
3.1.2 Sampling Procedures and Requirements	18	- Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table
3.1.2.1 Sampling Collection Procedures	19	
3.1.2.2 Sample Containers, Volume, and Preservation	20	- Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	21	- Sampling SOPs - Project Sampling SOP References Table
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	22	- Field Equipment Calibration, Maintenance, Testing, and Inspection Table
3.1.2.5 Supply Inspection and Acceptance Procedures		
3.1.2.6 Field Documentation Procedures		
3.2 Analytical Tasks		
3.2.1 Analytical SOPs	23	Analytical SOPs - Analytical SOP References Table
3.2.2 Analytical Instrument Calibration Procedures	24	- Analytical Instrument Calibration Table
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	25	- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
3.2.4 Analytical Supply Inspection and Acceptance Procedures		

Required QAPP Element(s) and Corresponding QAPP Section(s)	QAPP Worksheet # in QAPP Workbook	Required Information
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures	26	- Sample Collection Documentation Handling, Tracking, and Custody SOPs
3.3.1 Sample Collection Documentation		- Sample Container Identification
3.3.2 Sample Handling and Tracking System		- Sample Handling Flow Diagram
3.3.3 Sample Custody		- Example Chain-of-Custody Form and Seal
3.4 Quality Control Samples		
3.4.1 Sampling Quality Control Samples	27	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree
3.4.2 Analytical Quality Control Samples		
3.5 Data Management Tasks		
3.5.1 Project Documentation and Records	28	- Project Documents and Records Table
3.5.2 Data Package Deliverables	29	- Analytical Services Table - Data Management SOPs
3.5.3 Data Reporting Formats		
3.5.4 Data Handling and Management		
3.5.5 Data Tracking and Control		
Assessment/Oversight		
4.1 Assessments and Response Actions		- Assessments and Response Actions
4.1.1 Planned Assessments	30	- Planned Project Assessments Table - Audit Checklists
4.1.2 Assessment Findings and Corrective Action Responses	31	- Assessment Findings and Corrective Action Responses Table
4.2 QA Management Reports	32	- QA Management Reports Table
4.3 Final Project Report		
Data Review		
5.1 Overview		
5.2 Data Review Steps		
5.2.1 Step I: Verification	33	- Verification (Step I) Process Table

Required QAPP Element(s) and Corresponding QAPP Section(s)	QAPP Worksheet # in QAPP Workbook	Required Information
5.2.2 Step II: Validation	34	- Validation (Steps IIa and IIb) Process Table
5.2.2.1 Step IIa Validation Activities	35	- Validation (Steps IIa and IIb) Summary Table
5.2.2.2 Step IIb Validation Activities	36	- Usability Assessment
5.2.3 Step III: Usability Assessment		
5.2.3.1 Data Limitations and Actions from Assessment		
5.2.3.2 Activities		
5.3 Streamlining Data Review		
5.3.1 Data Review Steps To Be Streamlined		
5.3.2 Criteria for Streamlining Data Review		
5.3.3 Amounts and Types of Data Appropriate for Streamlining		

Table 2
Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA TO15 ALL

						LCS		DUP
Analyte	CAS #	MDL (ppbv)	PRL (ppbv)	MDL (ug/m^3)	PRL (ug/m^3)	Lower	Upper	RPD
1,1,1-Trichloroethane	71-55-6	0.100	0.2	0.555	1.11	69	131	25
1,1,2,2-Tetrachloroethane	79-34-5	0.027	0.1	0.188	0.70	66	135	25
1,1,2-Trichloroethane	79-00-5	0.100	0.1	0.277	0.55	68	132	25
1,1,2-Trichlorotrifluoroethane	76-13-1	0.100	0.2	0.800	1.60	65	130	25
1,1-Dichloroethane	75-34-3	0.100	0.2	0.412	0.82	66	131	25
1,1-Dichloroethene	75-35-4	0.100	0.2	0.403	0.81	64	136	25
1,2,4-Trichlorobenzene	120-82-1	0.100	0.2	0.755	1.51	30	150	25
1,2,4-Trimethylbenzene	95-63-6	0.100	0.2	0.500	1.00	71	135	25
1,2-Dibromoethane	106-93-4	0.100	0.2	0.780	1.56	72	132	25
1,2-Dichlorobenzene	95-50-1	0.100	0.2	0.610	1.22	68	148	25
1,2-Dichloroethane	107-06-2	0.050	0.1	0.206	0.41	66	136	25
1,2-Dichloropropane	78-87-5	0.100	0.2	0.470	0.94	68	133	25
1,3,5-Trimethylbenzene	108-67-8	0.026	0.2	0.130	1.00	69	136	25
1,3-Butadiene	106-99-0	0.100	0.2	0.225	0.45	69	134	25
1,3-Dichlorobenzene	541-73-1	0.100	0.2	0.610	1.22	70	134	25
1,4-Dichlorobenzene	106-46-7	0.100	0.2	0.610	1.22	66	134	25
2-Butanone (MEK)	78-93-3	0.052	0.2	0.156	0.6	69	141	25
2-Hexanone	591-78-6	0.100	0.2	0.415	0.83	74	132	25
2-Propanol	67-63-0	0.037	0.2	0.092	0.50	64	139	25
4-Ethyltoluene	622-96-8	0.100	0.2	0.500	1.00	71	134	25
4-Methyl-2-pentanone (MIBK)	108-10-1	0.100	0.2	0.415	0.83	74	131	25
Acetone	67-64-1	0.100	0.2	0.241	0.48	62	142	25
Benzene	71-43-2	0.050	0.1	0.163	0.33	72	136	25
Benzyl Chloride	100-44-7	0.100	0.2	0.525	1.05	70	134	25
Bromodichloromethane	75-27-4	0.026	0.2	0.177	1.36	69	135	25
Bromoform	75-25-2	0.100	0.2	1.051	2.10	72	133	25
Bromomethane	74-83-9	0.046	0.2	0.181	0.79	65	125	25
Carbon Disulfide	75-15-0	0.100	0.2	0.317	0.63	68	127	25
Carbon tetrachloride	56-23-5	0.050	0.1	0.320	0.64	64	133	25

Chlorobenzene	108-90-7	0.100	0.2	0.468	0.94	65	135	25
Chloroethane	75-00-3	0.100	0.2	0.268	0.54	63	129	25
Chloroform	67-66-3	0.100	0.2	0.497	0.99	66	129	25
Chloromethane	74-87-3	0.100	0.2	0.210	0.42	57	135	25
cis-1,2-Dichloroethene	156-59-2	0.038	0.2	0.153	0.81	73	135	25
cis-1,3-Dichloropropene	10061-01-5	0.024	0.2	0.111	0.92	75	137	25
Cyclohexane	110-82-7	0.100	0.2	0.350	0.70	73	139	25
Dibromochloromethane	124-48-1	0.100	0.2	0.866	1.73	73	130	25
Dichlorodifluoromethane	75-71-8	0.100	0.2	0.503	1.01	64	131	25
Dichlorotetrafluoroethane	76-14-2	0.030	0.2	0.213	1.42	64	131	25
Ethanol	64-17-5	0.100	0.2	0.192	0.38	62	134	25
Ethyl Acetate	141-78-6	0.098	0.2	0.359	0.73	73	136	25
Ethyl Benzene	100-41-4	0.027	0.2	0.119	0.88	74	136	25
Hexachlorobutadiene	87-68-3	0.100	0.2	1.100	2.20	30	150	25
m&p-Xylene	106-42-3	0.200	0.4	0.883	1.77	72	135	25
Methyl Tert Butyl Ether	1634-04-4	0.024	0.2	0.088	0.73	71	134	25
Methylene chloride	75-0902	0.100	0.2	0.353	0.71	59	140	25
Naphthalene	91-20-3	0.100	0.2	0.533	1.07	30	150	25
n-Heptane	142-82-5	0.100	0.2	0.415	0.83	73	136	25
n-Hexane	110-54-3	0.100	0.2	0.360	0.72	67	136	25
o-Xylene	95-47-6	0.029	0.2	0.128	0.88	74	135	25
Propylene	115-07-1	0.100	0.2	0.175	0.35	66	138	25
Styrene	100-42-5	0.100	0.2	0.433	0.87	73	135	25
Tetrachloroethene	127-18-4	0.050	0.1	0.345	0.69	66	135	25
Tetrahydrofuran	109-99-9	0.100	0.2	0.300	0.60	73	130	25
Toluene	108-88-3	0.100	0.2	0.383	0.77	71	134	25
trans-1,2-dichloroethene	156-60-5	0.100	0.2	0.403	0.81	68	129	25
trans-1,3-Dichloropropene	10061-02-6	0.100	0.2	0.460	0.92	75	129	25
Trichloroethene	79-01-6	0.050	0.1	0.273	0.55	68	134	25
Trichlorofluoromethane	75-69-4	0.039	0.2	0.222	1.14	61	134	25
Vinyl Acetate	108-05-4	0.100	0.2	0.358	0.72	70	139	25
Vinyl chloride	75-01-4	0.050	0.1	0.130	0.26	64	134	25

Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA TO15 ALL

EXTRA ANALYTES (available upon request at an additional cost)

						LCS		DUP
Analyte	CAS #	MDL (ppbv)	PRL (ppbv)	MDL (ug/m^3)	PRL (ug/m^3)	Lower	Upper	RPD
1,4-Dioxane	123-91-1	0.050	0.1	0.183	0.37	70	130	25
2,2,4-Trimethylpentane	540-84-1	0.021	0.5	0.100	2.37	70	130	25
Acrolein	107-02-8	0.100	0.2	0.233	0.47	70	130	25
Acrylonitrile	107-13-1	0.100	0.2	0.221	0.44	70	130	25
Allyl Chloride	107-05-1	0.250	0.5	0.795	1.59	70	130	25
N-Butylbenzene	104-51-8	0.250	0.5	1.400	2.79	70	130	25
N-Propylbenzene	103-65-1	0.250	0.5	1.250	2.50	70	130	25
Sec- Butylbenzene	135-98-8	0.250	0.5	1.400	2.79	70	130	25
Tert Butyl Alcohol (TBA)	75-65-0	0.029	0.5	0.089	1.54	70	130	25
Vinyl Bromide	593-60-2	0.250	0.5	1.110	2.22	70	130	25
Isopropylbenzene	98-82-8	0.250	0.5	1.25	2.50	70	130	25
THC as gas		7.000	14	30.4	60.80	63	141	25
Xylene (Total)	1330-20-7	0.300	0.6	1.32	2.65	70	130	25

Surrogates							
1,4-Dichlorobenzene-d4 (S)	3855-82-1					62	129
Hexane-d14 (S)	21666-38-6					72	131
Toluene-d8 (S)	2037-26-5					75	125

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