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December 20, 2013

BY ELECTRONIC MAIL

Mr. Ronnie Lee, P.E.
NYSDEC
Division of Environmental Remediation
Remedial Bureau B
625 Broadway
Albany, New York 12233-7017

Subject:
Soil Vapor Intrusion Assessment Work Plan
Krasdale Foods, Inc. Leasehold
Hunts Point former Manufactured Gas Plant
Bronx, New York
NYSDEC Site #V00554

Dear Mr. Lee:

This *Soil Vapor Intrusion Assessment Work Plan* (work plan) presents the soil vapor intrusion (SVI) activities to be conducted at the Krasdale Foods, Inc. Leasehold (Krasdale property) at the Hunts Point former Manufactured Gas Plant (MGP) (site). In an approval letter for the *Site Characterization Report* (ARCADIS 2013), the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) requested an investigation of soil vapors to evaluate current concentrations of volatile organic compounds (VOCs) in soil vapor at the site. This work plan presents the rationale for the sampling strategy and describes the sampling methodology and protocols to be followed for conducting a site-wide SVI assessment, as well as identifies the sampling locations.

The overall objectives of the SVI assessment are to:

1. Evaluate the current concentrations of subsurface VOCs near/adjacent to the building slab.

2. Evaluate VOC concentrations in indoor air within the lowest portions of the building.

3. Evaluate the current concentrations of VOCs in ambient air.

This work plan was prepared in substantial conformance with the *Division of Environmental Remediation-10 Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC 2010) and the *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH 2006).

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Site/Building Setting

Hunts Point is located in the Borough of Bronx, New York City, Bronx County, New York. The former MGP occupied an approximately 160-acre tract of land on Hunts Point, a peninsula at the confluence of the Bronx and East Rivers. The site (the Krasdale property) is an approximately 11-acre tract of land located on the northeastern portion of the former MGP. The site is currently used as a warehouse for shipping and receiving food products. One warehouse building and one office building are currently located on the site. Surrounding the warehouse building to the north, south, and east are parking lots for employees and commercial trucks. To the west, the warehouse building abuts a fence at the property line.

An initial site inspection and survey of the buildings was conducted on November 8, 2013. The objectives of the initial inspection were to obtain building layout and construction information to develop a sampling approach, and to collect preliminary information to complete the NYSDOH Indoor Air Quality Questionnaire and Building Inventory forms (Appendix B of the NYSDOH final guidance document). During the site inspection and survey, relevant information was provided by Mr. Charles Sepulveda, from Krasdale Foods, Inc. Photographs taken during the inspection are presented in Attachment A.

The buildings consist of one two-story office building and one open warehouse building with two two-story office areas within the warehouse. The two buildings are connected by four doorways. The lowest lying area of the warehouse building is a fire escape tunnel, which runs east to west through the middle of the warehouse from the hazard room to the east side of the site. The tunnel is sealed at both ends by a door and consists of concrete walls and floor, which is approximately 6 to 8 inches thick.

The office building is located to the northeast of the warehouse building. The two other office areas are found within the warehouse building. All offices are equipped with heating, ventilation, and air conditioning units on the roof, which, according to Mr. Sepulveda, create positive pressure within the offices. The office areas within the warehouse building sit on an additional foot of concrete above the warehouse floor.

The warehouse building occupies the majority of the site. The concrete floor of the warehouse area is approximately 2 feet thick. Two drains, one within the sanitation room in the middle of the building on the east side, and one within the battery charging room below a shower station south of the office building, were observed within the warehouse area. Both drains feed into the sanitary sewer system. An 8- to 10-foot-deep sump was observed within the sanitation room, which also feeds into the sanitary sewer system. There are no floor drains located in the warehouse. No cracks or pooling water was observed on the floor of the warehouse area. The ventilation system within the warehouse area consists of ceiling fans and radiant tubes installed on the ceiling that provide heating. The eastern side of the warehouse area, where the truck loading dock is located, is open, creating constant additional natural ventilation within the warehouse area.

Previous Results

Various investigations and remediation activities completed to date have documented petroleum and MGP-related residuals—including coal tars, oils, and purifier wastes—as well as constituents associated with these residuals, such as benzene, toluene, ethylbenzene, and xylenes compounds; polycyclic aromatic hydrocarbons; and inorganic constituents, such as cyanides, on the former MGP property. On-

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site portions of the former MGP have been divided into parcels (A through F) for purposes of site cleanup, and have or will be investigated and remediated separately by others.
Various investigations and/or remediation of Parcels A through F have been completed and are documented in several reports. A detailed description of previous and current investigations in the vicinity of the site can be found in the *Site Characterization Work Plan – Krasdale Foods Inc., Leasehold* (SC Work Plan; ARCADIS 2011). Additional details regarding the history and operations of the former MGP can be found in the *Site Characterization Report* (ARCADIS 2013).

Parcel F of the former MGP property is located immediately south of the warehouse building and within the site (Figure 1). Remedial investigations of Parcel F have been completed by HDR, Inc. (HDR) including the collection of soil gas samples (HDR 2007). Previous soil gas sampling locations on Parcel F are shown on Figure 1. The sampling program consisted of the installation of eight soil gas points. Of the eight sampling locations, four were successfully sampled for VOCs using 6-liter SUMMA® canisters. Each canister was sent to Mitkem Laboratories for VOC analysis via United States Environmental Protection Agency (USEPA) Method TO-15. Additional samples were collected for hydrogen cyanide (HCN) analysis from five of the eight locations using soda lime sorbent tubes. Results were screened against USEPA Region 3 risk-based concentrations (RBCs). Benzene was detected above the USEPA Region 3 RBC in all four samples. 1,3,5-Trimethylbenzene and 1,2,4-trimethylbenzene were detected above the USEPA Region 3 RBC in two samples (SG-3 and SG-8). Xylene (m,p), xylene (total), and 1,3-butadiene were detected above the USEPA Region 3 RBC in one sample (SG-3). HCN was not detected in any of the samples.

PRE-SAMPLING WALK-THROUGH INSPECTION AND SURVEY

An additional walk-through inspection and survey of the areas proposed for sampling will be completed just prior to conducting soil vapor and indoor air sampling. Due to site-specific logistics and ongoing building operations, inspection, survey, and sampling will most likely need to occur between 10:30 PM Friday to 12 PM Sunday, and the removal of potential interferences is not feasible prior to collection of indoor air samples. The inspection and survey will be conducted to:

- Evaluate changes to the structure and physical condition/uses of the buildings since the initial site reconnaissance.
- Identify and minimize conditions that may affect or interfere with the proposed testing.
- Confirm sampling locations.

This inspection and survey is required because, according to the USEPA, there are typically dozens of detectable chemicals in indoor air, even in the absence of subsurface contributions (October 2001). The inspection will include the buildings and the fire escape tunnel. The NYSDOH's Indoor Air Quality Questionnaire and Building Inventory form (Appendix B of the NYSDOH final guidance document) will be completed during the walk-through. An inventory of the types of chemicals that are currently used or stored on the premises and the specific types of activities that occur at each proposed sample location that could affect the results of the air sampling program will be recorded (if product labels are legible, chemical components of each product will be recorded).

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Portable organic vapor monitoring equipment capable of measuring VOCs at the parts per billion concentration level will be used to help evaluate potential interferences to the testing that may be present. Examples of the contemporary chemicals that may act as interferences include, but are not limited to, cleaning fluids, solvents, paint and paint thinners, fuel oils for heating, and petroleum products for small motors. Contemporary chemicals identified that could liberate volatile compounds, or chemicals that could potentially impact the air testing, and that indicate a response on the vapor monitoring equipment at the container, will need to be removed, if feasible, and the area allowed to adequately purge prior to conducting the sampling (assuming owner concurrence). The inability to eliminate potential interferences will be noted as part of the evaluation of sampling results. Once these interferences are corrected, ventilation may be required prior to testing (i.e., opening windows and/or doors for at least 10 to 15 minutes). Ventilation will be conducted no later than 24 hours prior to testing.

Floor plan/site sketches will be drawn of the sample locations with tape measurements as appropriate, and locations of any chemical storage areas, doorways, stairways, sumps, and any other pertinent information will be recorded. The portable organic vapor monitoring equipment will be used to evaluate the presence of VOCs near floor cracks, drains, and other observed slab penetrations. The plan sketch will include a compass orientation (north). Outdoor plot sketches will be drawn and will include the building site, area streets, outdoor (i.e., ambient air) sample locations, the location of potential interferences, wind direction, and compass orientation (north).

FIELD ACTIVITES

A total of six near-slab, one indoor air, and two ambient air samples will be collected (nine total). Approximate sampling locations are shown on Figure 2. Standard Operating Procedures (SOPs) are provided as Attachment B. To confirm that air is representative of the locations sampled and to avoid undue influence from sampling personnel, personnel will avoid lingering in the immediate area of the sampling device while samples are being collected and the sampling team members will avoid actions that cause sample interference, such as pumping gas prior to testing, wearing aftershave or cologne, or using permanent marking pens.

Sample Collection and Analysis

Near-Slab

Six near-slab samples will be collected around the warehouse building at the site. Three samples will be collected on the north side of the building. During the site characterization activities, the only area where tars or non-aqueous phase liquid was observed was at the northwestern corner of the site (Figure 1). Three near-slab samples will be collected on the eastern side of the building. Samples cannot be collected along the western side of the building, as there is no space between the property line and fence line of the building and an easement for a railroad lies directly to the west of the fence line.

Based on existing gauging data, temporary near-slab soil vapor sampling points will be installed in the unsaturated zone from approximately 3 to 5 feet below ground surface. Actual depths will be determined based on groundwater gauging data from nearby existing monitoring wells collected prior to installation; all sampling points will be installed a minimum of 1 foot above the top of groundwater. Soil borings will be advanced by first coring through the concrete or asphalt cover, as needed, and then using a hammer drill to install the temporary sampling point to the required depth. Porous, inert backfill material will be used to create a sampling zone 1 to 2 feet in length. Soil vapor probes will be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet. Laboratory or food-grade polyethylene or Teflon® tubing will be used to connect the sample point to the SUMMA® canister for collection of samples for VOC analysis. HCN samples will be collected using soda lime sorbent tubes. Samples for analysis of VOCs and HCN will be collected over an 8-hour period. Procedures for sample collection using SUMMA® canisters and soda lime sorbent tubes are described below (see indoor air section, below). The near-slab samples will be collected in general accordance with the NYSDOH final guidance document and in accordance with the ARCADIS SOPs (see Attachment B).

Indoor Air

One indoor air sample will be collected from the fire escape tunnel, which is located in the middle of the warehouse building. This location represents the lowest lying area within the warehouse and is the only area of the building without either complete ventilation to the outside or positive pressure. As noted above, the positive pressure is maintained within the office areas of the warehouse building and the office building and air exchanges freely between the warehouse area and outside of the building.

The indoor air samples will be collected in general accordance with the NYSDOH final guidance document and in accordance with the ARCADIS SOPs (see Attachment B). The tunnel will be sealed during sample collection by a door at each end. Each sample for VOC analysis will be collected using a 6-liter SUMMA® canister equipped with an attached pre-set flow regulator. The laboratory will provide batch-certified clean canisters with an initial vacuum of approximately 26 inches of mercury for sample collection. Flow regulators will be pre-set by the laboratory to provide uniform sample collection over an 8-hour sampling period. The flow controller/regulator on the SUMMA® canister, as well as with the vacuum in the canister, will be used to collect the air samples directly from the subsurface sampling point. The valve on the SUMMA® canister will be closed when a minimum of 2 inches of mercury vacuum remains in the canister, leaving a vacuum in the canister as a means for the laboratory to verify the canister did not leak while in transit. HCN samples will be collected using soda lime sorbent tubes. Sampling procedures will follow the manufacturer's instructions supplied with the sampling tubes and equipment. Samples for analysis of VOCs and HCN will be collected over an 8-hour period. The indoor air samples will be collected in general accordance with the NYSDOH final guidance document and in accordance with the ARCADIS SOPs (see Attachment B).

Ambient Air

Due to the proximity of the site to the Bronx and East Rivers, the wind direction is variable. To account for this, two outdoor ambient air samples (one to the north and one to the south of the building) will be collected. The samples will be collected at a height above the ground to represent breathing zones (approximately 3 to 5 feet above ground surface) and away from wind obstructions (e.g., trees, bushes). The samples will be collected using similar methods as the indoor air sample.

Analytical Methods

The SUMMA® canisters will be picked up by a laboratory courier within 3 days of sample collection. Samples will be submitted for laboratory analysis in accordance with the USEPA Compendium Method TO-15, entitled *Determination of VOCs in Air Collected in Specially-Prepared Canisters And Analyzed By*

Gas Chromatography/Mass Spectrometry (GC/MS). In addition, project-specific TO-15 Target Analyte List will also include analysis for:

- n-alkanes (n-butane, n-pentane, n-hexane, n-heptane, n-octane, n-nonane, n-decane, n-undecane, and n-dodecane)
- isopropyl benzene
- naphthalene
- branched alkanes (isopentane, 2,3-dimethylpentane, 2,2,4-trimethylpentane, butylcyclohexane, isooctane, and 2,3-dimethylheptane) (to be reported by the laboratory as tentatively identified compounds [TICs])
- other indicator compounds (indene, indane, 1,2,3-trimethylbenzene, and thiopene) (to be reported by the laboratory as TICs)

Soda lime sorbent tubes will be sent to an NYSDOH-approved laboratory for HCN analysis. Samples will be submitted for laboratory analysis in accordance with the modified National Institute for Occupational Safety and Health Method 6010.

The laboratory will provide Category B-equivalent data packages.

Quality Assurance/Quality Control

One quality assurance/quality control (QA/QC) blind duplicate sample will be collected and submitted for laboratory analysis.

The analytical data packages and associated QA/QC information will be reviewed to determine if they meet the project-specific criteria for data quality and data use. Data will be assessed in accordance with the applicable portion of the NYSDEC's *Analytical Services Protocol* (NYSDEC 2000) and DER-10 (NYSDEC 2010), the USEPA's *National Functional Guidelines for Organic Data Review* (USEPA 1999), and the USEPA Region 2 document *CLP Organics Data Review and Preliminary Review* (USEPA 2001), where applicable. The data usability summary review will include the use of dated entries, signed by analysts and supervisors on worksheets and logbooks used for all samples; the use of sample tracking and numbering systems to logically follow the progress of samples through the laboratory; and the use of QC criteria to reject, accept, or qualify specific data. Upon completion of the data usability summary review, a Data Usability Summary Report (DUSR) will be prepared.

Field Documentation

Detailed information will be gathered at the time of sampling to document conditions during sampling to aid in interpretation of the test results. Field personnel will document the following information in the project field notebook:

- weather conditions (precipitation, temperature, and wind direction) prior to and during the sampling activities

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- date and time (start and end time) each sample was collected
- sample identification
- identification of laboratory samplers/regulators/devices
- purge volumes
- volume of air/vapor extracted
- vacuum pressure of canister (before and after sample is collected)
- chain of custody identification

SUPPORT ACTIVITIES

Support activities that will be completed prior to implementing the field program includes health and safety planning and underground utility clearance. Con Edison will also obtain all rights-of-entry and access agreements to the building to be sampled from the property owner.

Health and Safety Planning

The existing site-specific *Health and Safety Plan* (HASP) will be revised to include the vapor sampling activities, as applicable. The site-specific HASP will be consistent with applicable provisions and requirements included in the Occupational Safety and Health Act, 29 Code of Federal Regulations (CFR) 1910, and 29 CFR 1926. The site-specific HASP will describe procedures and controls to protect the health and safety of persons performing the work at the site and will be maintained on site for the duration of field activities. Emergency contact information, a Job Safety Analysis form that summarizes potential hazards and control measures for specific work tasks and tools and techniques that focus on behavior to improve safety will be included. Each member of the project team conducting work at the site will be required to read the site-specific HASP and endorse the signature page, indicating they understand and agree to abide by the health and safety requirements for the site. Work conducted will also be consistent with Con Edison's Corporate Environmental Health and Safety Procedure Rules We Live By Program, Con Edison's Environmental Health and Safety Hazard Analysis for Contractor Work, and Con Edison's Work Area Protection and Traffic Control Field Manual.

Underground Utility Clearance

Based on the highly developed nature of the site, it is anticipated that there will be subsurface utilities in the vicinity of the proposed sample locations (including natural gas and electric lines, telephone lines, as well as fiber optic cables, water lines, and sewers). Prior to conducting intrusive activities, Con Edison's Utility Clearance Process for Intrusive Activities guidance documentation will be reviewed and the appropriate actions identified and completed. Further safety measures associated with working near utilities and procedures for proper underground overhead utility clearance are included in the HASP (Appendix C of the SC Work Plan [ARCADIS 2011]).

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REPORTING

After the completion of the field activities, laboratory analysis, and upon completion of the DUSR, the results will be documented in an addendum to the *Site Characterization Report* (ARCADIS 2013). The report addendum will include:

- A summary of work activities performed and analytical results obtained for the near-slab soil vapor, indoor air, and ambient air samples.
- The final, completed Indoor Air Quality Questionnaire and Building Inventory forms.
- Data tables presenting the validated laboratory analytical results.
- A figure showing sampling locations.
- Copies of the laboratory analytical data reports.
- A copy of the DUSR.
- Photographs showing the sampling locations.
- Conclusions and recommendations, as appropriate.

New York State does not have any standards, criteria, or guidance values for concentrations of volatile compounds in subsurface vapors; therefore, the validated results will be presented and a general description of the results obtained will be included. For comparison purposes, the data tables for indoor air will include the NYSDOH Upper Fence criterion values for indoor air background data for fuel oil heated homes (NYSDOH 2006) and the USEPA's Building Assessment Survey and Evaluation guidance values for the 90th percentile to provide typical concentrations of volatile compounds in indoor air.

In addition, as requested in the NYSDEC approval letter for the *Site Characterization Report*, the report addendum will also include a site-wide Human Health Exposure Assessment. The Site Characterization Report Addendum will be submitted in draft format to the NYSDEC/NYSDOH for review and comment. NYSDEC/NYSDOH comments and edits will be incorporated into the draft document, as appropriate, and a final report will then be generated.

SCHEDULE

Anticipated time periods for performing the main work tasks are as follows:

- Prepare for field work – 30 days
- Mobilize and perform field work – 14 days
- Conduct laboratory analyses and reporting – 30 days
- Perform data validation and reduction – 30 days

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- Prepare Site Characterization Report Addendum – 60 days

A detailed schedule will be provided to the NYSDEC pending approval of this work plan and site access. Estimated durations provided above are contingent upon site access, weather-related considerations, permits, and changes in the scope of this work plan.

If you have any questions or require any further information concerning the site, please do not hesitate to contact me at (718) 204-4205 or via e-mail at skorobogatovy@coned.com.

Sincerely yours,

Y. Skorobogatov

Yelena Skorobogatov
Technical Specialist
MGP Remediation
Environment, Health and Safety

cc: S. Selmer, NYSDOH – 1 hard copy
Dena Putnick , Esq., NYSDEC – 1 electronic copy (via e-mail)
T. Bell, EDC – 1 hard copy
K. Kasier, Con Edison– 1 electronic copy (via e-mail)
M. Hayes, ARCADIS -1 electronic copy (via e-mail)

Enclosures:
Figure 1 – Historical Investigation Locations
Figure 2 – Proposed Investigation Locations
Attachment A – Pre-Sampling Walk-Through Inspection and Survey Photo Log
Attachment B – Standard Operating Procedures

Figures

LEGEND:

- SOIL GAS LOCATION (HDR 2005)

SOIL BORING LOCATION (ARCADIS 2012)

VISUAL OBSERVATION:

- NO OBSERVED IMPACTS
- SHEEN
- STAINING AND ODOR
- PURIFIER WASTE AND ODOR
- TAR SATURATED
- CURRENT/FORMER OUTFALL LOCATION
- FILLED LAND (1947-1975)
- PETROLEUM IMPACTS
- PURIFIER WASTE AREA
- SHEEN
- COAL TAR
- TAR BOILS
- MIXTURE OF COAL TAR AND PURIFIER WASTE AREA
- PARCEL BOUNDARY
- SITE BOUNDARY (KRASDALE PROPERTY)

0 200 400 Feet

GRAPHIC SCALE

SAMPLE LOCATION ID DEPTHS OF IMPACTS OBSERVED IN FEET	SB-25 3.5 - 5'

NOTES:

1. FEBRUARY 26, 2012 IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.
2. PARCEL BOUNDARIES ADOPTED FROM CADD FILE PREPARED BY LAWLER, MATUSKY, AND SKELLY ENGINEERS, LLP.
3. HISTORIC SITE FEATURES ADOPTED FROM CADD FILE PREPARED BY PARSONS ENGINEERING SCIENCE.
4. SITE CHARACTERIZATION DETAILS FOR PARCEL F ADOPTED FROM SITE INVESTIGATIVE REPORT FOR PARCEL F, HDR/LMS, NOVEMBER 2007.
5. SOIL BORING OBSERVATIONS ON THE KRASDALE PROPERTY ARE SUMMARIZED IN THE SITE CHARACTERIZATION REPORT (ARCADIS 2013).

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HUNTS POINT FORMER MANUFACTURED GAS PLANT

SOIL VAPOR INTRUSION ASSESSMENT WORK PLAN

HISTORICAL INVESTIGATION LOCATIONS

ARCADIS

FIGURE
1

City:SYR Div/Group: SWG Created By:J.Rapp Last Saved By: jrapp
CON ED HUNTS POINT (B0043027.0008. 01000)
Q:\ConEd\HuntsPoint\SoilVaporIntrusionAssessmentWP\mxd\PreviousInvestigationLocations.mxd 11/20/2013 2:16:12 PM

NOTES:

1. IMAGERY OBTAINED FROM DIGITAL GLOBE, SEPTEMBER 19, 2009.
2. ALL LOCATIONS ARE APPROXIMATE.
3. PARCEL BOUNDARIES ADOPTED FROM CADD FILE PREPARED BY LAWLER, MATUSKY, AND SKELLY ENGINEERS, LLP.
4. SITE CHARACTERIZATION DETAILS FOR PARCEL D AND ADJACENT PERIMETER PARCEL ADOPTED FROM INVESTIGATIVE REPORT FOR PARCEL D, LAWLER, MATUSKY, AND SKELLY ENGINEERS, LLP, REVISED OCTOBER 2005.
5. SITE CHARACTERIZATION DETAILS FOR PARCEL F ADOPTED FROM SITE INVESTIGATIVE REPORT FOR PARCEL F, HDR/LMS, NOVEMBER 2007.
6. COAL TAR AND PURIFIER WASTE ON PERIMETER PARCEL EXCAVATED DURING THE CONSTRUCTION OF THE IROQUOIS PIPELINE.

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HUNTS POINT FORMER MANUFACTURED GAS PLANT

SOIL VAPOR INTRUSION ASSESSMENT WORK PLAN

PROPOSED INVESTIGATION LOCATIONS

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FIGURE
2

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Attachment A

Photographs

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Warehouse

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Photograph #:

1

Consolidated Edison Company of New York, Inc. Hunts Point Former Manufactured Gas Plant Bronx, New York Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13	
Ceiling Fan and Radiant Heating	
ARCADIS Infrastructure · Water · Environment · Buildings	Photograph #: 2

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Truck Loading Dock

ARCADIS Infrastructure · Water · Environment · Buildings	**Photograph #:** 3

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Two Story Office Area #1

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Photograph #:

4

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Two Story Office Area #2

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Photograph #:

5

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Entrance to Fire Escape Tunnel

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Photograph #:

6

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Fire Escape Tunnel

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Photograph #:

7

Consolidated Edison Company of New York, Inc. Hunts Point Former Manufactured Gas Plant Bronx, New York Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13	
Sump	
ARCADIS Infrastructure · Water · Environment · Buildings	Photograph #: 8

Consolidated Edison Company of New York, Inc. Hunts Point Former Manufactured Gas Plant Bronx, New York Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13	
Sump	
ARCADIS Infrastructure · Water · Environment · Buildings	Photograph #: 9

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

Drain

ARCADIS
Infrastructure · Water · Environment · Buildings

Photograph #:

10

Consolidated Edison Company of New York, Inc.
Hunts Point Former Manufactured Gas Plant
Bronx, New York
Pre-Sampling Walk-Through Inspection and Survey Photo Log – 11/8/13

East Side of Krasdale Warehouse

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Photograph #:

11

ARCADIS

Attachment B

Standard Operating Procedures

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Indoor Air or Ambient Air Sampling and Analysis Using USEPA Method TO-15

SOP # 765199

Rev. #: 2

Rev Date: July 7, 2010

Approval Signatures

Prepared by: ______________________ Date: 07/07/2010
Mitch Wacksman and Andrew Gutherz

Approved by: ______________________ Date: 07/07/2010
Christopher Lutes and Nadine Weinberg

I. Scope and Application

This standard operating procedure (SOP) describes the procedures to collect indoor air or ambient air samples for the analysis of volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method TO-15 (TO-15). The TO-15 method uses a 6-liter SUMMA® passivated stainless steel canister. An evacuated SUMMA® canister (<28 inches of mercury [Hg]) will provide a recoverable whole-gas sample of approximately 5 liters when allowed to fill to a vacuum of 6 inches of Hg. The whole-air sample is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GS/MS) system to provide compound detection limits of 0.5 parts per billion volume (ppbv).

The following sections list the necessary equipment and provide detailed instructions for placing the sampling device and collecting indoor air samples for VOC analysis.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and cardiopulmonary resuscitation (CPR), as needed. ARCADIS field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS personnel responsible for leading indoor air sample collection activities must have previous indoor air sampling experience.

III. Health and Safety Considerations

All sampling personnel should review the appropriate health and safety plan (HASP) and job safety analysis (JSA) prior to beginning work to be aware of all potential hazards associated with the job site and the specific task. The following are examples of hazards that are often encountered in conducting indoor air sampling:

- In crawl spaces, hazards often include low head room, limited light, poisonous insects, venomous snakes, and sharp debris.
- In residential buildings and neighborhoods unfamiliar dogs can pose a hazard. Even though proper permission for sampling may have been secured, it is still possible to encounter persons suspicious of or hostile to the sampling team.
- In occupied industrial buildings be aware of the physical hazards of ongoing industrial processes. Examples include moving forklifts and equipment pits.

IV. Equipment List

The equipment required for indoor air sample collection is presented below:

- 6-liter, stainless steel SUMMA® canisters (order at least one extra, if feasible);
- Flow controllers with in-line particulate filters and vacuum gauges (flow controllers are pre-calibrated by the laboratory to a specified sample duration [e.g., 8-hour]). Confirm with lab that flow controller is equipped with an in-line particulate filter and pressure gauge (order an extra set for each extra SUMMA® canister, if feasible);
- Appropriate-sized open-end wrenches (typically 9/16-inch);
- Chain-of-custody (COC) form;
- Building survey and product inventory form (example attached);
- Portable photoionization detector (PID) (for use identifying potential background sources during building survey described below);
- Sample collection log (attached);
- Camera if photography is permitted at sampling locations;
- Portable weather meter, if appropriate;
- Box, chair, tripod, or similar to hold canister above the ground surface; and
- Teflon sample tubing may be used to sample abnormal situations (i.e., sumps, where canisters must be hidden, etc.). In these situations ¼-inch Swagelok fittings or other methods may be appropriate to affix tubing to canister. Staff should check this before heading out into field.

V. Cautions

Care must be taken to minimize the potential for introducing interferences during the sampling event. As such, keep ambient air canisters away from heavy pedestrian traffic areas (e.g., main entranceways, walkways) if possible. If the canisters are not to be overseen for the entire sample duration, precautions should be taken to maintain the security of the sample (e.g., do not place in areas regularly accessed by the public, fasten the sampling device to a secure object using lock and chain, label the canister to indicate it is part of a scientific project, notify local authorities, place the canister in secure housing that does not disrupt the integrity/validity of the sampling event). Sampling personnel should not handle hazardous substances (such as gasoline), permanent marking pens (sharpies), wear/apply fragrances, or smoke cigarettes before and/or during the sampling event.

Ensure that the flow controller is pre-calibrated to the proper sample collection duration (confirm with laboratory). Sample integrity can be compromised if sample collection is extended to the point that the canister reaches atmospheric pressure. Sample integrity is maintained if sample collection is terminated prior to the target duration and a measurable vacuum (e.g., 5–inches Hg) remains in the canister when sample collection is terminated.

VI. Procedure

Initial Building Survey for Indoor Air Samples (if applicable to project)

1. Complete the appropriate building survey form and product inventory form (e.g., state-specific form, USEPA form, or ARCADIS form, [Attachment A]) as necessary in advance of sample collection.

2. Survey the area for the apparent presence of items or materials that may potentially produce or emit constituents of concern and interfere with analytical laboratory analysis of the collected sample. Record relevant information on survey form and document with photographs.

3. Record date, time, location, and other relevant notes on the sampling form.

4. Items or materials that contain constituents of concern and/or exhibit elevated PID readings shall be considered probable sources of VOCs. Request approval of the owner or occupant to have these items removed to a structure not attached to the target structure at least 48 hours prior to sampling if possible.

5. Set a date and time with the owner or occupant to return for placement of SUMMA® canisters.

Preparation of SUMMA®-Type Canister and Collection of Sample

1. Record the following information on the sampling form (use a hand-held weather meter, contact the local airport or other suitable information source [e.g., weatherunderground.com] to obtain the following information):

   - ambient temperature;

- barometric pressure;
- wind speed; and
- relative humidity.

2. Choose the sample location in accordance with the sampling plan. If a breathing zone sample is required, place the canister on a ladder, tripod, box, or other similar stand to locate the canister orifice 3 to 5 feet above ground or floor surface. If the canister will not be overseen for the entire sampling period, secure the canisters as appropriate (e.g., lock and chain). Canister may be affixed to wall/ceiling support with nylon rope or placed on a stable surface. In general, areas near windows, doors, air supply vents, and/or other potential sources of “drafts” shall be avoided.

3. Record SUMMA® canister serial number and flow controller number on the sampling log and chain of custody (COC) form. Assign sample identification on canister ID tag, and record on the sample collection log (Attachment B), and COC form.

4. Remove the brass dust cap from the SUMMA® canister. Attach the flow controller with in-line particulate filter and vacuum gauge to the SUMMA® canister with the appropriate-sized wrench. Tighten with fingers first, then gently with the wrench. Use caution not to over tighten fittings.

5. Open the SUMMA® canister valve to initiate sample collection. Record the date and local time (24-hour basis) of valve opening on the sample collection log, and COC form. Collection of duplicate samples will include collecting two samples side by side at the same time.

6. Record the initial vacuum pressure in the SUMMA® canister on the sample log and COC form. If the initial vacuum pressure registers less than -25 inches of Hg, then the SUMMA® canister is not appropriate for use and another canister should be used.

7. Take a photograph of the SUMMA® canister and surrounding area, if possible.

8. Check the SUMMA canister approximately half way through the sample duration and note progress on sample logs.

Termination of Sample Collection

1. Arrive at the SUMMA® canister location at least 1-2 hours prior to the end of the sampling interval (e.g., 8-hour, 24-hour).

2. Stop collecting the sample when the canister vacuum reaches approximately 7 inches of Hg (leaving some vacuum in the canister provides a way to verify if the canister leaks before it reaches the laboratory) or when the desired sample time has elapsed.

3. Record the final vacuum pressure. Stop collecting the sample by closing the SUMMA® canister valve. Record the date, local time (24-hour basis) of valve closing on the sample collection log, and COC form.

4. Remove the particulate filter and flow controller from the SUMMA® canister, re-install brass cap on canister fitting, and tighten with wrench.

5. Package the canister and flow controller in the shipping container supplied by the laboratory for return shipment to the laboratory. The SUMMA® canister does not require preservation with ice or refrigeration during shipment.

6. Complete the appropriate forms and sample labels as directed by the laboratory (e.g., affix card with string).

7. Complete COC form and place requisite copies in shipping container. Close shipping container and affix custody seal to container closure. Ship to laboratory via overnight carrier (e.g., Federal Express) for analysis.

VII. Waste Management

No specific waste management procedures are required.

VIII. Data Recording and Management

Notes taken during the initial building survey will be recorded on the sample log, with notations of project name, sample date, sample time, and sample location (e.g., description and GPS coordinates if available) sample start and finish times, canister serial number, flow controller number, initial vacuum reading, and final vacuum reading. Sample logs and COC records will be transmitted to the Task Manager or Project Manager. A building survey form and product inventory form (Attachment A) may also be completed for each building within the facility being sampled during each sampling event as applicable.

IX. Quality Assurance

Indoor air or ambient air sample analysis will be performed using USEPA Method TO-15. This method uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits. The GC/MS system requires a 1-liter gas sample (which can easily be recovered from a 6-liter canister) to provide a 0.5 ppbv detection limit. The 6-liter canister also provides several additional 1-liter samples in case subsequent re-analyses or dilutions are required. This system also offers the advantage of the GC/MS detector, which confirms the identity of detected compounds by evaluating their mass spectra in either the SCAN or SIM mode.

Duplicate samples should be collected in the field as a quality assurance step. Generally, duplicates are taken of 10% of samples, but project specific requirements should take precedence.

Building Survey and Product Inventory Form

Directions: This form must be completed for each residence or area involved in indoor air testing.

Preparer's Name: ___________________________________

Date/Time Prepared: ________________________________

Preparer's Affiliation: _______________________________

Phone No.: ____

Purpose of Investigation: ____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _________________________ First Name: _________________________

Address: ____

County: __________________________________

Home Phone: _______________________ Office Phone: ________________________

Number of Occupants/Persons at this Location: _________________

Age of Occupants: ______________________

2. OWNER OR LANDLORD: (Check if Same as Occupant ___)

Interviewed: Y / N

Last Name: _________________________ First Name: _________________________

Address: ____

County: _________________________________

Home Phone: ____________________ Office Phone: ____________________

3. BUILDING CHARACTERISTICS:

Type of Building: (circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _________________

If the Property is Residential, Type? (circle appropriate response)

Ranch		2-Family 3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_______________

If Multiple Units, How Many? ___________

If the Property is Commercial, Type?

Business Type(s) _____________________________________

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _________

Other Characteristics:

Number of Floors______ Building Age______

Is the Building Insulated? Y / N How Air-Tight? Tight / Average / Not Tight

4. AIRFLOW:

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow Between Floors

____

____

____

Airflow Near Source

____

____

____

Outdoor Air Infiltration

____

____

____

Infiltration Into Air Ducts

____

____

____

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS: (circle all that apply)

a.	**Above grade construction:**	wood frame	concrete	stone brick
b.	**Basement type:**	full	crawlspace	slab other ________
c.	**Basement floor:**	concrete	dirt	stone other ________
d.	**Basement floor:**	uncovered	covered	covered with ______________
e.	**Concrete floor:**	unsealed	sealed	sealed with ______________
f.	**Foundation walls:**	poured	block stone	other ____________________
g.	**Foundation walls:**	unsealed	sealed	sealed with ______________
h.	**The basement is:**	wet	damp	dry moldy
i.	**The basement is:**	finished	unfinished	partially finished

j. Sump present? Y / N

k. Water in sump? Y / N / NA

Basement/lowest level depth below grade: ________(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

____

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? Y / N

6. HEATING, VENTILATING, AND AIR CONDITIONING: (circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard
Space heaters	Stream radiation	Radiant floor
Electric baseboard	Wood stove	Outdoor wood boiler
Other _________		

The primary type of fuel used is:

Natural base	Fuel oil	Kerosene
Electric	Propane	Solar
Wood coal		

Domestic hot water tank fueled by: ___________________________

Boiler/furnace located in: Basement Outdoors Main Floor Other___________

Air conditioning: Central Air Window Units Open Windows None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____

____

____

7. OCCUPANCY:

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage):

Basement ____

1st Floor ____

2nd Floor ____

3rd Floor ____

4th Floor ____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY:

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, car)?

Y / N / NA Please specify: ____

d. Has the building ever had a fire? Y / N When? ________________________

e. Is a kerosene or unvented gas space heater present? Y / N Where? ________________

f. Is there a workshop or hobby/craft area? Y / N Where & Type? ______________

g. Is there smoking in the building? Y / N How frequently? ______________________

h. Have cleaning products been used recently? Y / N When & Type? _______________

i. Have cosmetic products been used recently? Y / N When & Type? _______________

j. Has painting/staining been done in the last 6 months? Y / N Where & When? __________

k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____________

l. Have air fresheners been used recently? Y / N When & Type? __________________

m. Is there a kitchen exhaust fan? Y / N If yes, where _____________________

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?____________________

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type?______________________

q. Are there odors in the building? Y / N

If yes, please describe: ____

Do any of the building occupants use solvents (e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist) at work? Y / N

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No

Yes, use dry-cleaning infrequently (monthly or less) Unknown

Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N

Date of Installation: ______________________

Is the system active or passive? Active/Passive

Are there any Outside Contaminant Sources? (circle appropriate responses)

Contaminated site with 1000-foot radius? Y / N Specify ________________________________

Other stationary sources nearby (e.g., gas stations, emission stacks, etc.): ___________________

____

Heavy vehicle traffic nearby (or other mobile sources): __________________________________

9. WATER AND SEWAGE:

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _______
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _______

10. RELOCATION INFORMATION: (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: ______________________________

____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

11. FLOOR PLANS:

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:

First Floor:

12. OUTDOOR PLOT:

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s), and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.

13. PRODUCT INVENTORY FORM:

Make and Model of field instrument used: ____

List specific products found in the residence or area that have the potential to affect indoor air quality (e.g., gasoline or kerosene storage cans, glues, paints, cleaning solvents/products, polishes/waxes, new furniture/ carpet, nail polish/hairspray/cologne).

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo** Y/N

ARCADIS

Indoor Air/Ambient Air Sample Collection Log

		Sample ID:	
Client:		**Outdoor/Indoor:**	
Project:		**Sample Intake Height:**	
Location:		**Tubing Information:**	
Project #:		**Miscellaneous Equipment:**	
Samplers:		**Time On/Off:**	
Sample Point Location:		**Subcontractor:**	

Instrument Readings:

Date	Time	Canister Vacuum (a) (inches of Hg)	Temperature (°F)	Relative Humidity (%)	Air Speed (mph)	Barometric Pressure (inches of Hg)	PID (ppb)

(a) Record canister information at a minimum at the beginning and end of sampling

SUMMA Canister Information:

Size (circle one):	**1 L** **6 L**
Canister ID:	
Flow Controller ID:	
Notes:	

General Observations/Notes:

ARCADIS
Infrastructure, environment, buildings

Imagine the result

Sub-Slab Soil-Gas Sampling Using Method TO-15 – Temporary Probe Approach

SOP # 427199

Rev. #: 4

Rev Date: July 8, 2010

Approval Signatures

Prepared by: ______________________________ Date: 07/08/2010
Mitch Wacksman and Andrew Gutherz

Approved by: ______________________________ Date: 07/08/2010
Christopher Lutes and Nadine Weinberg

I. Scope and Application

This document describes the procedures for installing temporary sub-slab sampling probes and collect sub-slab soil gas samples for the analysis of volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method TO-15. Method TO-15 uses a 1-liter, 3-liter, or 6-liter SUMMA® passivated stainless steel canister. An evacuated 6-liter SUMMA canister (less than 28 inches of mercury [Hg]) will provide a recoverable whole-gas sample of approximately 5 liters when allowed to fill to a vacuum of 5 inches of Hg. The whole-air sample is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GC/MS) system to provide compound detection limits of 0.5 parts per billion volume (ppbv).

These procedures are not recommended if the probe is to be sampled more than once. Under those conditions refer to ARCADIS SOP for permanent sub-slab soil gas installations. The following sections list the necessary equipment and detailed instructions for installing temporary sub-slab soil gas probes and collecting soil-gas samples for VOC analysis.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training. Site supervisor training, site-specific training, first-aid, and cardiopulmonary resuscitation (CPR) may be appropriate at some sites. ARCADIS field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS personnel responsible for leading sub-slab soil-gas sample collection activities must have previous sub-slab soil-gas sampling experience.

III. Health and Safety Considerations

All sampling personnel should review the appropriate health and safety plan (HASP) and job loss analysis (JLA) prior to beginning work to be aware of all potential hazards associated with the job site and the specific task. Field sampling must be carefully conducted to minimize the potential for injury and the spread of hazardous substances. For sub-slab vapor probe installation, drilling with an electric concrete impact drill should be done only by personnel with prior experience using such a piece of equipment and with the appropriate health and safety measures in place as presented in the JLA. It is possible to encounter high concentrations of VOCs in sub-slab soil gas, so the amount of time the borehole remains open should be minimized. For the same reason, when installing sub-slab probes in spaces with minimal dilution potential, such as closets, it is advisable to provide local ventilation. Finally, sub-slab probe installation should be completed 24 hours in advance or after any indoor air sampling to avoid cross contamination of the indoor air samples.

IV. Equipment List

The equipment required to install a temporary sub-slab vapor probe is presented below. Modifications to account for project- or regulatory-specific requirements should be noted in the accompanying work plan:

- Appropriate personal protective equipment (PPE; as required by the HASP and the JLA);
- Hammer drill (Hilti, Bosch Hammer, or equilivant);
- 1/2 inch-diameter concrete drill bit (drill bit length contingent on slab thickness);
- Hand tools including open-end wrench (typically 9/16-inch), pliers, channel lock pliers, etc;
- 1/4-inch OD tubing (Teflon, nylon, or Teflon-lined); Note that Nylaflow tubing has a somewhat higher background level of BTEX and much poorer recovery of tirchlorobenzene and naphthalene then Teflon, so should not be used on sites where these compounds are a concern (Hayes, 2006).
- Teflon® tape;
- Work gloves;
- Nitrle gloves;
- Hydrated bentonite, VOC-free modeling clay that complies with ASTM D4236 (McMaster Carr 6102T11 recommended) or wax to seal drill hole (see cautions section);
- Whisk broom and dust pan;
- Bottle brush;
- Ground fault circuit interrupter (GFCI);
- Extension cords rated for amperage required for hammer drill;
- Plastic sheeting; and

- Shop vacuum with clean fine-particle filter.

The equipment required for sub-slab soil gas sample collection is presented below:

- 1, 3, or 6-liter stainless steel SUMMA® canisters (order at least one extra, if feasible) (batch certified canisters or individual certified canisters as required by the project) ;

- Flow controllers with in-line particulate filters and vacuum gauges; flow controllers are pre-calibrated to specified sample duration (e.g., 30 minutes, 8 hours, 24 hours) or flow rate (e.g., 200 milliliters per minute [mL/min]); confirm with the laboratory that the flow controller comes with an in-line particulate filter and pressure gauge (order at least one extra, if feasible);

- Extra 1/4-inch Swagelok front and back compression sleeves;

- Swage-Lok fittings;

- Decontaminated stainless steel Swagelok or comparable “T” fitting and needle valve for isolation of purge pump;

- Two 3-inch lengths of 1/4-inch OD Teflon tubing;

- Stainless steel duplicate “T” fitting provided by the laboratory (if collecting duplicate [i.e., split] samples);

- Portable vacuum pump capable of producing very low flow rates (e.g., 100 to 200 milliliters per minute [mL/min]); vacuum pump should also be equipped with a vacuum gauge;

- Rotameter or an electric flow sensor if vacuum pump does not have and accurate flow gauge;

- Tracer gas testing supplies if applicable (refer to SOP ”Adminstering Tracer Gas” #416199);

- Appropriate-sized open-end wrench (typically 9/16-inch and1/2”);

- Photo Ionization Detector (PID) with a lamp of 11.7 eV; detectable to ppb range (optional);
- Tedlar bag to collect purge air;
- Portable weather meter, if appropriate (temperature, barometric pressure, humidity, etc);
- Quick setting grout or sika flex to seal abandoned holes;
- Chain-of-custody (COC) form;
- Sample collection log (attached); and
- Field notebook.

V. Cautions

The following cautions and field tips should be reviewed and considered prior to installing or collecting a sub-slab soil gas sample.

- When drilling sample collection holes be mindful of utilities that may be in the area. Always complete utility location, identification and marking before installing subslab ports as required by the ARCADIS Utility Location Policy and Procedure. Be aware that public utility locator organizations frequently do not provide location information within buildings so alternative lines of evidence must be used. If the driller is concerned about a particular location, consult the project manager about moving it to another location. Don't be hesitant to use your Stop Work Authority, if something doesn't seem right stop and remedy the situation.
- Sampling personnel should not handle hazardous substances (such as gasoline), permanent marking pens, wear/apply fragrances, or smoke cigarettes/cigars before and/or during the sampling event.
- Ensure that the flow controller is pre-calibrated to the proper sample collection duration (confirm with laboratory). Sample integrity can be compromised if sample collection is extended to the point that the canister reaches atmospheric pressure. Sample integrity is maintained if sample collection is terminated prior to the target duration and a measurable vacuum (e.g., 3–7 inches Hg) remains in the canister when sample collection is terminated. Do not let sample canister reach atmospheric pressure (e.g., 0-inches Hg).

- Field personnel will properly seal the vapor probe at the slab surface to prevent leaks of atmosphere into the soil vapor probe during purging and sampling. Temporary points should be fit snug into the pre-drilled hole using Teflon® tape or modeling clay and sealed with hydrated bentonite, clay or wax at the surface. If this is not done properly, the integrity of the sample port may be compromised.

- Modeling clay or other materials used to seal the hole should only be obtained from an approved ARCADIS source and should not be purchased off the shelf from an unapproved retail source. Data indicate that some modeling clays may contain VOCs that can affect sample results.

- It is important to record the canister pressure, start and stop times and sample identification on a proper field sampling form. Often Summa canisters are collected over a 24 hour period. The time/pressure should be recorded at the start of sampling, and then again one or two hours later. It is a good practice to lightly tap the pressure gauge with your finger before reading it to make sure it isn't stuck. If the canister is running correctly for a 24 hour period then the vacuum will have decreased slightly after an hour or two (for example from 29" to 27"). Consult your project manager (PM), risk assessor or air sampling expert by phone if the Summa canister does not appear to be working properly.

- Ensure that there is still measureable vacuum in the Summa after sampling. Sometimes the gauges sent from the lab have offset errors, or they stick.

- When sampling carefully consider elevation. If your site is over 2,000' above sea level or the difference in elevation between your site and your lab is more than 2,000' then pressure effects will be significant. If you take your samples at a high elevation they will contain less air for a given ending pressure reading. High elevation samples analyzed at low elevation will result in more dilution at the lab, which could affect reporting limits. Conversely low elevation samples when received at high elevation may appear to not have much vacuum left in them http://www.uigi.com/Atmos_pressure.html.

- If possible, have equipment shipped two to three days before the scheduled start of the sampling event so that all materials can be checked. Order replacements if needed.

- Requesting extra canisters from the laboratory should also be considered to ensure that you have enough equipment on site in case of an equipment failure.

- Check the seal around the soil-gas sampling port by using a tracer gas (e.g., helium) or other method established in the appropriate guidance document.

VI. Procedure

Temporary sub-slab soil vapor probes are installed using equipment and procedures that allows the point to be installed quickly and abandoned after an initial sample is collected. These procedures are not recommended if the probe is to be sampled more than once. Under those conditions refer to ARCADIS SOP for permanent sub-slab soil gas installations.

Sub-slab Soil Gas Point Installation

1. Complete the ARCADIS Utility Locate SOP prior to drilling activities.

2. Remove, only to the extent necessary, any covering on top of the slab (e.g., carpet).

3. Lay down plastic sheeting to keep the work area clean. Check to make sure shop vacuum is working properly and fine concrete particles will not pass through filter

4. Drill a 1/2-inch-diameter hole into the concrete slab using the electric drill. Do not fully penetrate the slab at this time. Stop drilling approximately 1 inch short of penetrating the slab.

5. Use the shop vacuum, bottle brush and dust broom to clean up the work area and material that may have fallen into and around the drill hole..

6. Advance the 1/2-inch drill bit the remaining thickness of the slab and approximately 3 inches into the sub-slab material to create an open cavity. Note (if possible) from the drill cuttings any evidence for the types of materials in the immediate sub-slab – i.e. moisture barriers, sand, gravel, shrinkage gap?

7. Use the bottle brush, whisk broom, and dust pan to quickly clean material around and within the hole. The hole should not be left open for any extended length of time to ensure that VOCs below the slab do not migrate into indoor air. Do not use the shop vacuum to clean up the drill hole after the full thickness of the slab has been penetrated.

8. Re-drill the 1/2 – inch hole to ensure it remains clear. This can also be accomplished using a piece of steel rod, sample tubing, or even a piece of heavy wire (coat hanger).

9. Wrap the tubing with Teflon® tape or modeling clay, to the extent necessary, for a snug fit of tubing and hole.

10. Insert the tubing approximately 2 to 3 inches into the slab; tubing should not contact material beneath the slab. Tubing should be capped with clay or other fitting so it does not provide a pathway for vapor movement.

11. Prepare a hydrated bentonite mixture and apply bentonite at slab surface around the tubing. Instead of hydrated bentonite, either VOC free modeling clay (McMaster-Carr #6102T11) or wax may be used for the temporary seal around the tubing where it enters the slab.

12. Proceed to soil gas sample collection after waiting a minimum of 1 hour for equilibration following probe installation.

Sub-Slab Soil Gas Sample Collection

Once the temporary sample probe is installed, the following procedure should be used to collect the sample in the Summa canister.

1. Record the following information on the sample log, if appropriate (contact the local airport or other suitable information source [e.g., site-specific measurements, weatherunderground.com] to obtain the information):

    a. wind speed and direction;

    b. ambient temperature;

    c. barometric pressure; and

    d. relative humidity.

2. Assemble the sample train by removing the cap from the SUMMA canister and connecting the Swagelok T-fitting to the can using a short length of 1/4-inch OD Teflon tubing. The flow controller with in-line particulate filter and vacuum gauge is then attached to the T-fitting. The Swagelok (or similar) two-way valve is connected to the free end of the T-fitting using a short length of ¼-inch OD Teflon tubing.

3. When collecting duplicate or other quality assurance/quality control (QA/QC) samples as required by applicable regulations and guidance, couple two SUMMA canisters using stainless steel Swagelok duplicate sample T-fitting supplied by the laboratory. Attach flow controller with in-line particulate filter and vacuum gauge to duplicate sample T-fitting provided by the laboratory.

4. Perform a leak-down-test by replacing the nut which secures sample tubing with the cap from the canister. This will create a closed system. Open the canister valve and quickly close it; the vacuum should increase approaching 30" Hg. If there are no leaks in the system this vacuum should be held. If vacuum holds proceed with sample collection; if not attempt to rectify the situation by tightening fittings.

5. Attach Teflon sample tubing from the temporary probe to the flow controller using Swagelok fittings.

6. Connect the two-way valve and the portable purge pump using a length of Teflon sample tubing.

7. Record on the sample log and COC form the flow controller number with the appropriate SUMMA® canister number.

8. If appropriate, the seal around the soil-gas sampling port and the numerous connections comprising the sampling train will be evaluated for leaks using helium as a tracer gas. The helium tracer gas will be administered according to the methods established in the appropriate guidance documents and SOP: Administering Helium Tracer Gas.

9. Open the two-way valve and purge the soil-gas sampling port and tubing with the portable sampling pump. Purge approximately three volumes of air from the soil-gas sampling port and sampling line using a flow rate of 200 mL/min or less. Purge volume is calculated by the following equation "purge volume = 3 x Pi x inner radius of tubing^2 x length of tubing. Purge air will be collected into a Tedlar bag to provide that VOCs are not released into interior spaces. Measure organic vapor levels and tracer gas within the Tedlar bag, as appropriate.

10. Close the two-way valve to isolate the purge pump.

11. Open the SUMMA® canister valve to initiate sample collection. Record on the sample log (attached) the time sampling began and the canister pressure.

If the initial vacuum pressure registers less than -25 inches of Hg, then the SUMMA® canister is not appropriate for use and another canister should be used.

Sampling flow rate should be 200 mL/min or less.

12. Take a photograph of the SUMMA® canister and surrounding area unless prohibited by the building owner.

13. Check the SUMMA canister approximately half way through the sample duration and note progress on sample logs.

Termination of Sample Collection

1. Arrive at the SUMMA® canister location at least 10 to 15 minutes prior to the end of the required sampling interval in order to have sufficient time to terminate the sample collection.

2. Record the final vacuum pressure. Stop collecting the sample by closing the SUMMA® canister valves. The canister should have a minimum amount of vacuum (ideally 3-7 inches of Hg or slightly greater).

3. Record the date and local time (24-hour basis) of valve closing on the sample collection log and COC form.

4. Remove the particulate filter and flow controller from the SUMMA® canister, re-install the brass plug on the canister fitting, and tighten with the appropriate wrench.

5. Package the canister and flow controller in the shipping container supplied by the laboratory for return shipment to the laboratory. The SUMMA® canister does not require preservation with ice or refrigeration during shipment.

6. Complete the appropriate forms and sample labels as directed by the laboratory (e.g., affix card with a string).

7. Complete the COC form and place the requisite copies in a shipping container. Close the shipping container and affix a custody seal to the container closure. Ship the container to the laboratory via overnight carrier (e.g., Federal Express) for analysis.

8. A Shipping Determination must be performed, by DOT-trained personnel, for all environmental and geotechnical samples that are to be shipped, as well as some types of environmental equipment/supplies that are to be shipped.

9. Remove the tubing and grout the hole in the slab with quick-setting hydraulic cement powder, Sika-Flex, or other material similar to the slab. This step must be done carefully to ensure that the abandoned sampling point does not become a preferential flow pathway.

10. Replace the surface covering (e.g., carpet) to the extent practicable. Sample collection location should be returned to pre-sampling conditions/

VII. Waste Management

The volume of waste materials generated by these activities should be minimal. Personal protective equipment, such as gloves and other disposable equipment (i.e., tubing) should be collected by field personnel for proper disposal.

VIII. Data Recording and Management

Information collected in the field should be recorded in the field notebook as well as written on the field sampling log and COC, as appropriate. The field notebook and sampling log must include the project name, sample date, sample start and finish time, sample location (e.g., global positioning system [GPS] coordinates, distance from permanent structure [e.g., two walls, corner of room]), canister serial number, flow controller serial number, initial vacuum reading, and final pressure reading. Field sampling logs and COC records will be transmitted to the PM.

IX. Quality Assurance

Duplicate samples should be collected in the field as a quality assurance step. Generally, duplicates are taken of 10% of samples, but project specific requirements should take precedence.

Soil-gas sample analysis will generally be performed using USEPA TO-15 methodology or a project specific constituent list. Method TO-15 uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits (typically 0.5-ppbv for most VOCs).

X. References

ASTM – “Standard Guide for Soil Gas Monitoring in the Vadose Zone”, D5314-92.

Hayes, H. C., D.J. Benton and N. Khan "Impact of Sampling media on Soil Gas Measurements" Presented with short paper at AWMA Vapor Intrusion Conference January 2006, Philadelphia PA.

ITRC "Vapor Intrusion Pathway: A Practical Guide", January 2007, Appendix F: "regulators Checklist for Reviewing Soil Gas Data"

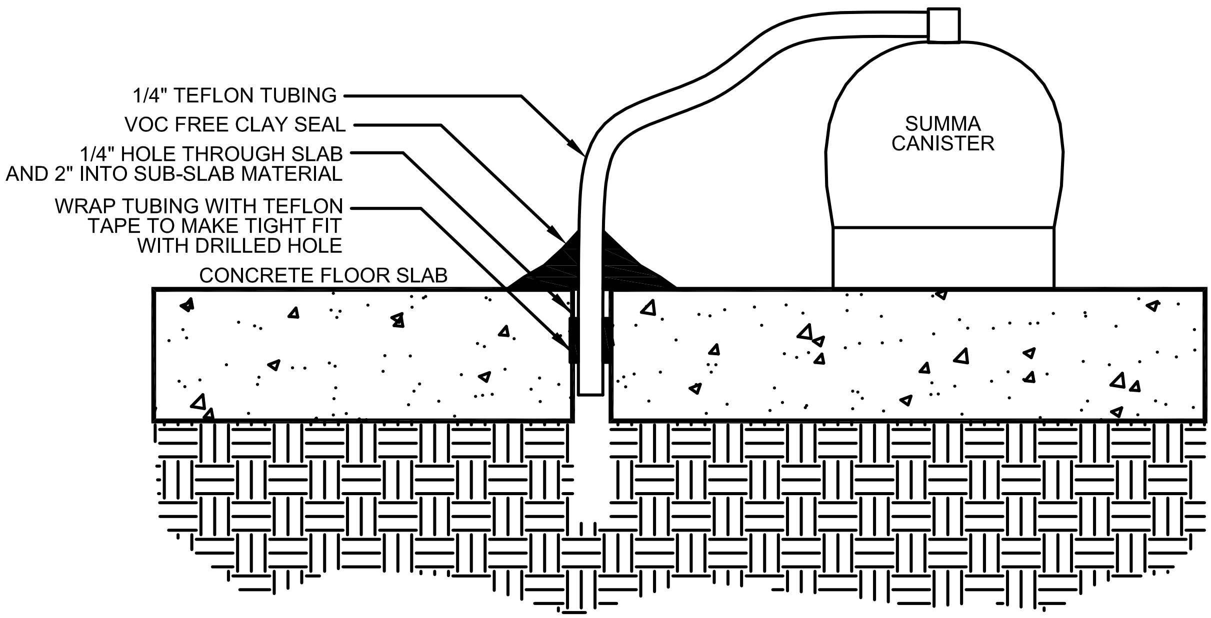

DIAGRAM OF TEMPORARY SUB-SLAB SAMPLE POINT

ARCADIS

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Administering Helium Tracer Gas for Leak Checks of Soil Gas or Sub-slab Sampling Points

SOP #416199

Rev. #: 3

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Approval Signatures

Prepared by: ______________________ Date: 07/07/2010
Mitch Wacksman and Andrew Gutherz

Approved by: ______________________ Date: 07/07/2010
Christopher Lutes and Nadine Weinberg

I. Scope and Application

When collecting subsurface vapor samples as part of a vapor intrusion evaluation, a tracer gas serves as a quality assurance/quality control method to verify the integrity of the vapor port seal and the numerous connections comprising the sample train. Without the use of a tracer, verification that a soil vapor sample has not been diluted by ambient or indoor air is difficult.

This standard operating procedure (SOP) focuses on using helium as a tracer gas. However, depending on the nature of the contaminants of concern, other compounds can be used as a tracer including sulfur hexafluoride (SF6), butane and propane (or other gases). In all cases, the protocol for using a tracer gas is consistent and includes the following basic steps: (1) enrich the atmosphere in the immediate vicinity of the sample port where ambient air could enter the sampling train during sampling with the tracer gas; and (2) measure a vapor sample from the sample tubing for the presence of elevated concentrations (> 10%) of the tracer. A plastic pail, bucket, garbage can or even a plastic bag can serve to keep the tracer gas in contact with the port during the testing.

There are two basic approaches to testing for the tracer gas:

1. Include the tracer gas in the list of target analytes reported by the laboratory; and/or

2. Use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to sampling for the compounds of concern. (Note that tracer gas samples can be collected via syringe, Tedlar bag, etc. They need not be collected in SUMMA® canisters or minicans.)

This SOP focuses on monitoring helium using a portable sampling device, although helium can also be analyzed by the laboratory along with other volatile organic compounds (VOCs). Real-time tracer sampling is generally preferred as the results can be used to confirm the integrity of the port seals prior to formal sample collection.

During the initial stages of a subsurface vapor sampling program, tracer gas samples should be collected at each of the sampling points. If the results of the initial samples indicate that the port seals are adequate, the Project Manager can consider reducing the number of locations at which tracer gas samples are used in future monitoring rounds. At a minimum, at least 5% of the subsequent samples should be supported with tracer gas analyses. When using permanent soil vapor points as part of a long-term monitoring program, the port should be tested prior to the first sampling event. Tracer gas testing of subsequent sampling events may often be reduced or eliminated unless conditions have changed at the site. Soil gas port integrity should certainly be rechecked with Tracer gas if land clearing/grading activities, freeze thaw cycles, or soil dessication may have occurred. Points should also be rechecked if more than 2 years have elapsed since the last check of that port.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, site-specific training, first-aid, and cardiopulmonary resuscitation (CPR), as needed. ARCADIS field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS personnel responsible for leading the tracer gas testing must have previous experience conducting similar tests.

III. Health and Safety Considerations

Field sampling equipment must be carefully handled to minimize the potential for injury and the spread of hazardous substances. All sampling personnel should review the appropriate health and safety plan (HASP) and job safety analysis (JSA) prior to beginning work to be aware of all potential hazards associated with the job site and the specific task. Field staff should review the attachment on safely handling compressed gas cylinders prior to commencing field work.

IV. Equipment List

The equipment required to conduct a helium tracer gas test is presented below:

- Appropriate PPE for site (as required by the Health and Safety Plan)
- Helium (laboratory grade)
- Regulator for helium tank
- Shroud (plastic bucket, garbage can, etc)
    - The size of the shroud should be sufficient to fit over the sample port. It is worth noting that using the smallest shroud possible will miminze the volume of helium needed; this may be important when projects require a large number of helium tracer tests.
    - The shroud will need to have three small holes in it. These holes will include one on the top (to accommodate the sample tubing), and two

on the side (one for the helium detector probe, and one for the helium line).

- The shroud should ideally enclose the sample port and as much as possible of the sampling train.

- Helium detector capable of measuring from 1 - 100% (Dielectric MGD-2002, Mark Model 9522, or equivalent)
- Tedlar bags
- Seal material for shroud (rubber gasket, modeling clay, bentonite, etc) to keep helium levels in shroud high in windy conditions. Although the sealing material is not in direct contact with the sample if leakage does not occur, sealing materials with high levels of VOC emissions should be avoided, since they could contaminate a sample if a leak occurs.
- Sample logs
- Field notebook

V. Cautions

Helium is an asphyxiant! Be cautious with its use indoors! Never release large volumes of helium within a closed room!

Compressed gas cylinders should be handled with caution; see attachment on the use and storage of compressed gasses before beginning field work.

Care should be taken not to pressurize the shroud while introducing helium. If the shroud is completely air tight and the helium is introduced quickly, the shroud can be over-pressurized and helium can be pushed into the ground. Provide a relief valve or small gap where the helium can escape.

Because minor leakage around the port seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations (> 10%) of tracer gas are observed in a sample, the port seal should be enhanced and fittings within the sampling train should be should be checked and/or tightened to reduce the infiltration of ambient air and the tracer test readministered. If the problem cannot be rectified, a new sample point should be installed or an alternate sampling train used.

VI. Procedure

The procedure used to conduct the helium tracer test should be specific to the shroud being used and the methods of vapor point installation. The helium tracer test can be conducted when using temporary or permanent sampling points and inside or outside a facility. When using the tracer gas within indoor areas you must provide adequate ventilation as helium is an asphyxiant.

1. Attach Teflon or nylon (Nylaflow) sample tubing to the sample point. This can be accomplished utilizing a number of different methods depending on the sample install (i.e., most typically Swage-Lok brand compression fittings, but some quick release fittings could also be used etc.).

2. Place the shroud over the sample point and tubing.

3. Pull the tubing through hole in top of shroud. Seal opening at top of shroud with modeling clay.

4. Place weight on top of shroud to help maintain a good seal with the ground.

5. Insert helium tubing and helium detector probe into side of shroud. Seal both with modeling clay to prevent leaks.

6. Fill shroud with helium. Fill shroud slowly, allowing atmospheric air to escape either by leaving a gap where the shroud meets the ground surface or by providing a release value on the side of the shroud.

7. Use the helium detector to monitor helium concentration within the shroud from the lowest hole drilled in the shroud (bottom of the shroud nearest where the sample tubing intersects the ground). Helium should be added until the environment inside the shroud has > 60% helium.

8. Purge the sample point through the sample tubing into a Tedlar bag using a hand held sampling pump. The purge rate should at least match the sample collection rate but not exceed 100 ml/min. Test the air in the Tedlar bag for helium using portable helium detector. If the point is free of leaks there should be very low helium in the purge air from the soil. The natural concentration of helium in the atmosphere is 0.00052% by volume and there are few if any natural sources of helium to soil gas.

9. If > 10% helium is noted in purge air, add more clay or other material to the seal the sample port and repeat the testing procedure. If the seal cannot be fixed, re-install sample point.

10. Monitor and record helium level in shroud before, during and after tracer test.

11. Monitor and record helium level in purge exhaust.

12. At successful completion of tracer test and sample point purging, the soil vapor sample can be collected (if the helium shroud must be removed prior to sample collection be mindful not disturb the sample tubing and any established seals).

VII. Data Recording and Management

Measurements will be recorded on the sample logs at the time of measurement with notations of the project name, sample date, sample start and finish time, sample location, and the helium concentrations in both the shroud and the purge air before, during, and after tracer testing. Any problems encountered should also be recorded in the field notes.

ATTACHMENT: Compressed Gases—Use and Storage

In general, a compressed gas is any material contained under pressure that is dissolved or liquefied by compression or refrigeration. Compressed gas cylinders should be handled as high-energy sources and therefore as potential explosives and projectiles. Prudent safety practices should be followed when handling compressed gases since they expose workers to both chemical and physical hazards.

Handling

- Safety glasses with side shields (or safety goggles) and other appropriate personal protective equipment should be worn when working with compressed gases.
- Cylinders should be marked with a label that clearly identifies the contents.
- All cylinders should be checked for damage prior to use. Do not repair damaged cylinders or valves. Damaged or defective cylinders, valves, etc., should be taken out of use immediately and returned to the manufacturer/distributor for repair.
- All gas cylinders (full or empty) should be rigidly secured to a substantial structure at 2/3 height. Only two cylinders per restraint are allowed in the laboratory and only soldered link chains or belts with buckles are acceptable. Cylinder stands are also acceptable but not preferred.
- Handcarts shall be used when moving gas cylinders. Cylinders must be chained to the carts.
- All cylinders must be fitted with safety valve covers before they are moved.
- Only three-wheeled or four-wheeled carts should be used to move cylinders.
- A pressure-regulating device shall be used at all times to control the flow of gas from the cylinder.
- The main cylinder valve shall be the only means by which gas flow is to be shut off. The correct position for the main valve is all the way on or all the way off.
- Cylinder valves should never be lubricated, modified, forced, or tampered with.
- After connecting a cylinder, check for leaks at connections. Periodically check for leaks while the cylinder is in use.
- Regulators and valves should be tightened firmly with the proper size wrench. Do not use adjustable wrenches or pliers because they may damage the nuts.
- Cylinders should not be placed near heat or where they can become part of an electrical circuit.
- Cylinders should not be exposed to temperatures above 50 °C (122 °F). Some rupture devices on cylinders will release at about 65 °C (149 °F). Some small cylinders, such as lecture bottles, are not fitted with rupture devices and may explode if exposed to high temperatures.

- Rapid release of a compressed gas should be avoided because it will cause an unsecured gas hose to whip dangerously and also may build up enough static charge to ignite a flammable gas.
- Appropriate regulators should be used on each gas cylinder. Threads and the configuration of valve outlets are different for each family of gases to avoid improper use. Adaptors and homemade modifications are prohibited.
- Cylinders should never be bled completely empty. Leave a slight pressure to keep contaminants out.

Storage

- When not in use, cylinders should be stored with their main valve closed and the valve safety cap in place.
- Cylinders must be stored upright and not on their side. All cylinders should be secured.
- Cylinders awaiting use should be stored according to their hazard classes.
- Cylinders should not be located where objects may strike or fall on them.
- Cylinders should not be stored in damp areas or near salt, corrosive chemicals, chemical vapors, heat, or direct sunlight. Cylinders stored outside should be protected from the weather.

Special Precautions

Flammable Gases

- No more than two cylinders should be manifolded together; however several instruments or outlets are permitted for a single cylinder.
- Valves on flammable gas cylinders should be shut off when the laboratory is unattended and no experimental process is in progress.
- Flames involving a highly flammable gas should not be extinguished until the source of the gas has been safely shut off; otherwise it can reignite causing an explosion.

Acetylene Gas Cylinders

- Acetylene cylinders must always be stored upright. They contain acetone, which can discharge instead of or along with acetylene. Do not use an acetylene cylinder that has been stored or handled in a nonupright position until it has remained in an upright position for at least 30 minutes.
- A flame arrestor must protect the outlet line of an acetylene cylinder.
- Compatible tubing should be used to transport gaseous acetylene. Some tubing like copper forms explosive acetylides.

Lecture Bottles

- All lecture bottles should be marked with a label that clearly identifies the contents.
- Lecture bottles should be stored according to their hazard classes.
- Lecture bottles that contain toxic gases should be stored in a ventilated cabinet.
- Lecture bottles should be stored in a secure place to eliminate them from rolling or falling.
- Lecture bottles should not be stored near corrosives, heat, direct sunlight, or in damp areas.
- To avoid costly disposal fees, lecture bottles should only be purchased from suppliers that will accept returned bottles (full or empty). Contact the supplier before purchasing lecture bottles to ensure that they have a return policy.
- Lecture bottles should be dated upon initial use. It is advised that bottles be sent back to the supplier after one year to avoid accumulation of old bottles.