INVESTIGATION

- Key aspects of the process
  (see NYSDOH's guidance for additional details)
- Examples
- Community outreach

Overall objective

To answer the following questions

- Subsurface vapors contaminated?
  - If so, nature and extent? Source(s)?
- Current and potential exposures?
- Actions needed to prevent or mitigate exposures and to remediate the source?

NOTE

Soil vapor is an environmental medium.
Vapor intrusion must be addressed at all sites.

Where is investigation necessary?

Generally, sites with...

- volatile chemical contamination — YES
- non-volatile metals contamination (e.g., arsenic site) — NO

Level of investigation will depend on site conditions

When to begin the investigation?

New site — many unknowns

- option: characterize other media first
- option: begin simultaneously

Undeveloped parcel

- may delay until development phase if information is not needed to address exposures or remediation in the area

NOTE

If exposures are likely, sampling should not be delayed

What types of samples are collected?

Soil vapor samples

Structure sampling

- Sub-slab vapor samples
- Indoor air samples
- Outdoor air samples

NOTE

The types of samples collected will be based on specific sampling objectives.

Where do I sample?

General approach is similar to any site investigation

- consider conceptual site model
- scope the investigation: background information and site visit
- select locations that meet stated objectives
- start at source and work outward

Specific approach depends on site conditions

- refer to objectives of sampling

Examples: Sampling objectives, sample type and location

Scope out area for structure sampling

- soil vapor samples near on-site and off-site buildings

Evaluate exposures related to vapor intrusion

- structure sampling: on-site and/or off-site

Examples: Sampling objectives, sample type and location

Investigate the potential for off-site vapor contamination

- soil vapor samples along the site's perimeter

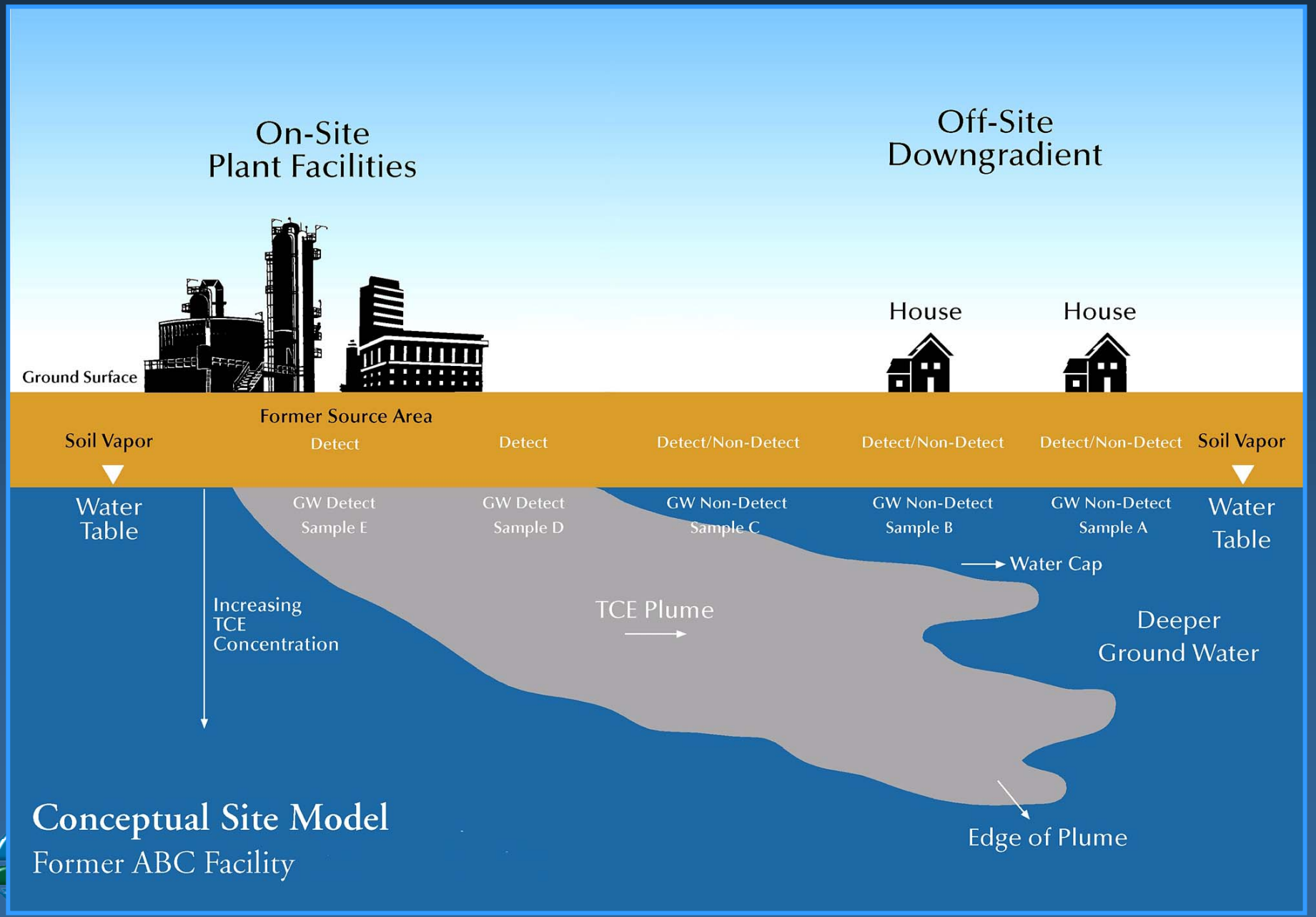
Evaluate preferential migration pathways

- soil vapor samples along suspected preferential flow paths

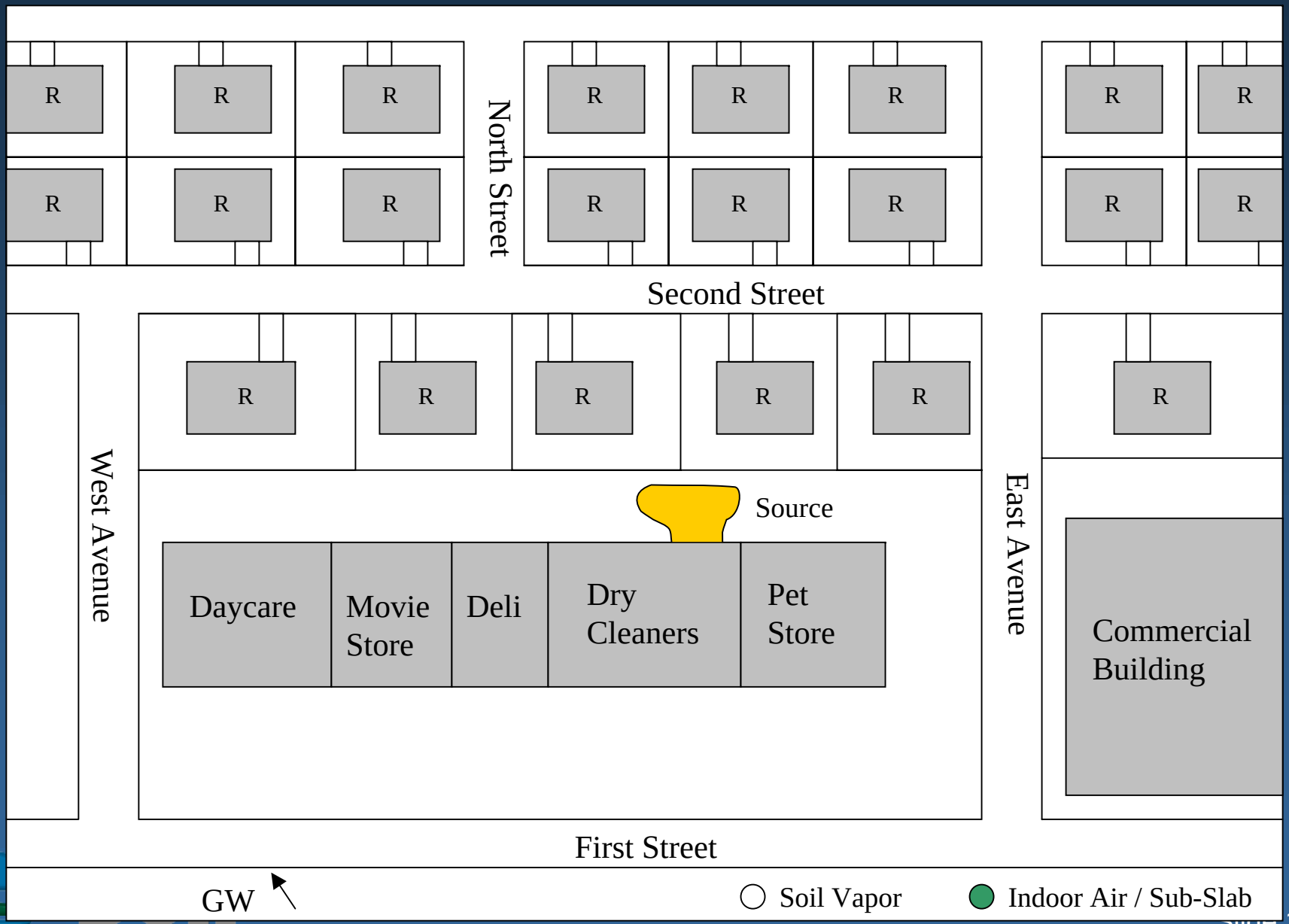
Demonstrate biodegradation is occurring

- soil vapor samples at multiple depths along with biodegradation parameters

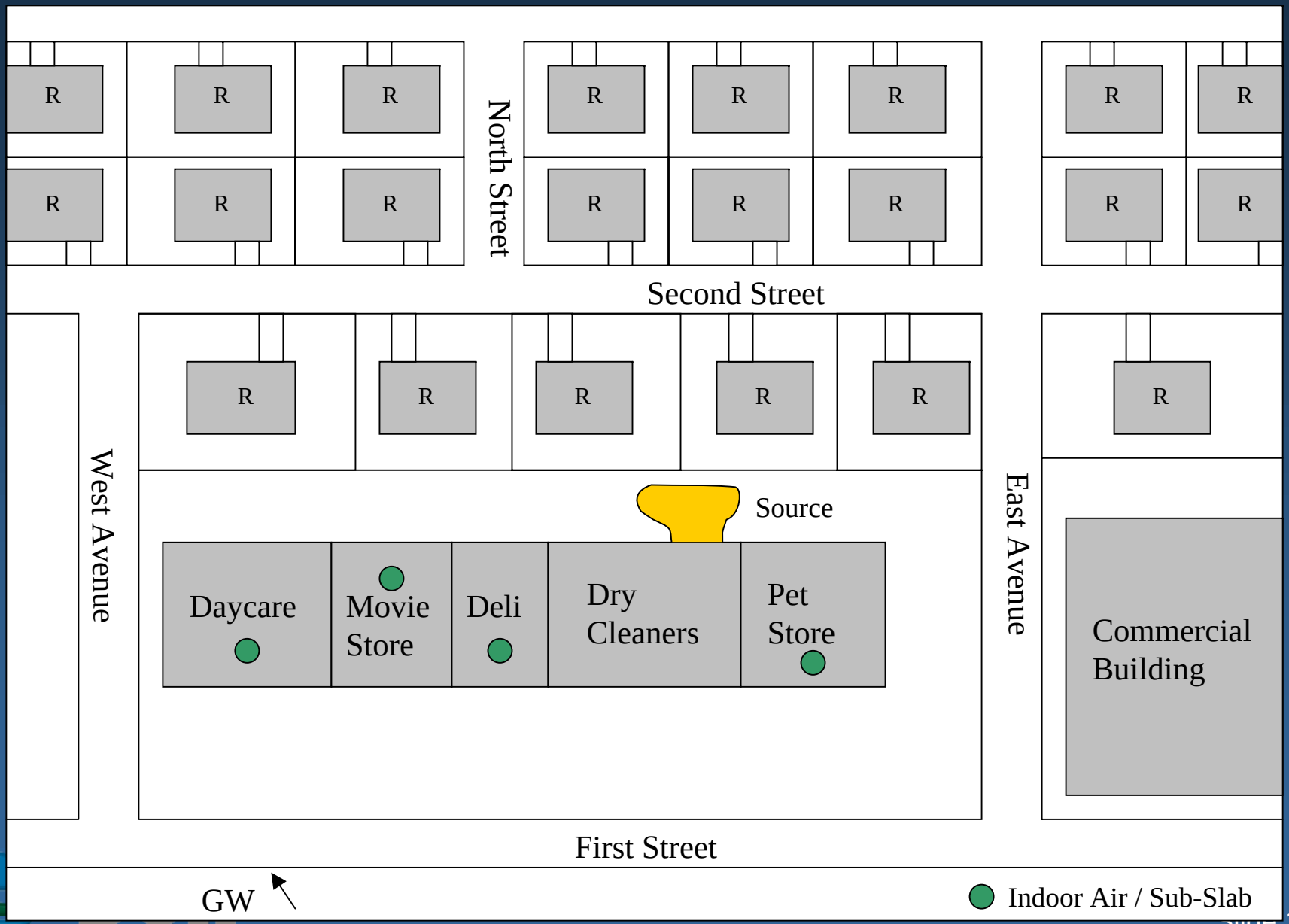
Example: Conceptual site model



Example: Sample type and location **SITE A**



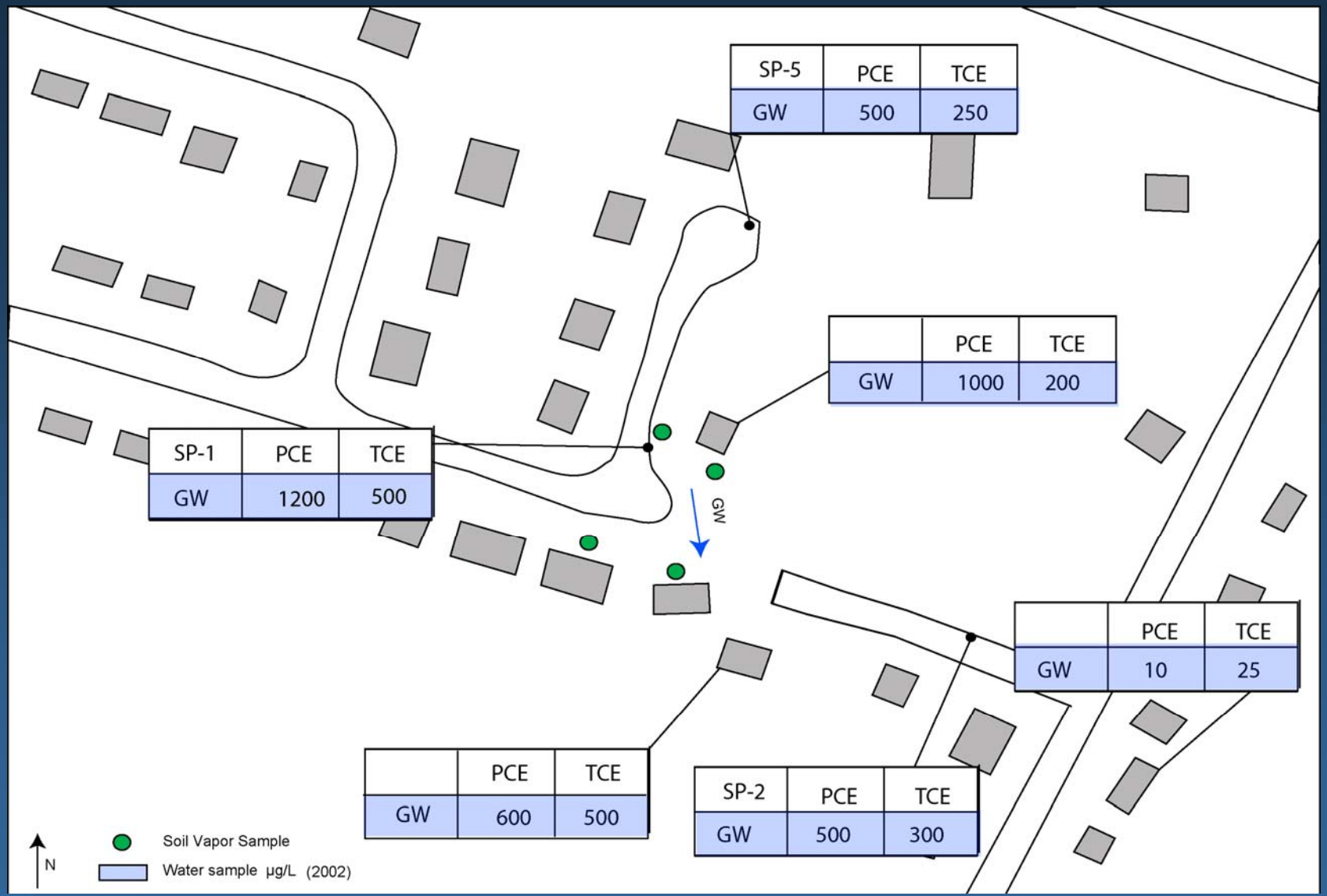
Example: Sample type and location **SITE A**



Example: Sample type and location **SITE A**

Example: Sample type and location **SITE B**

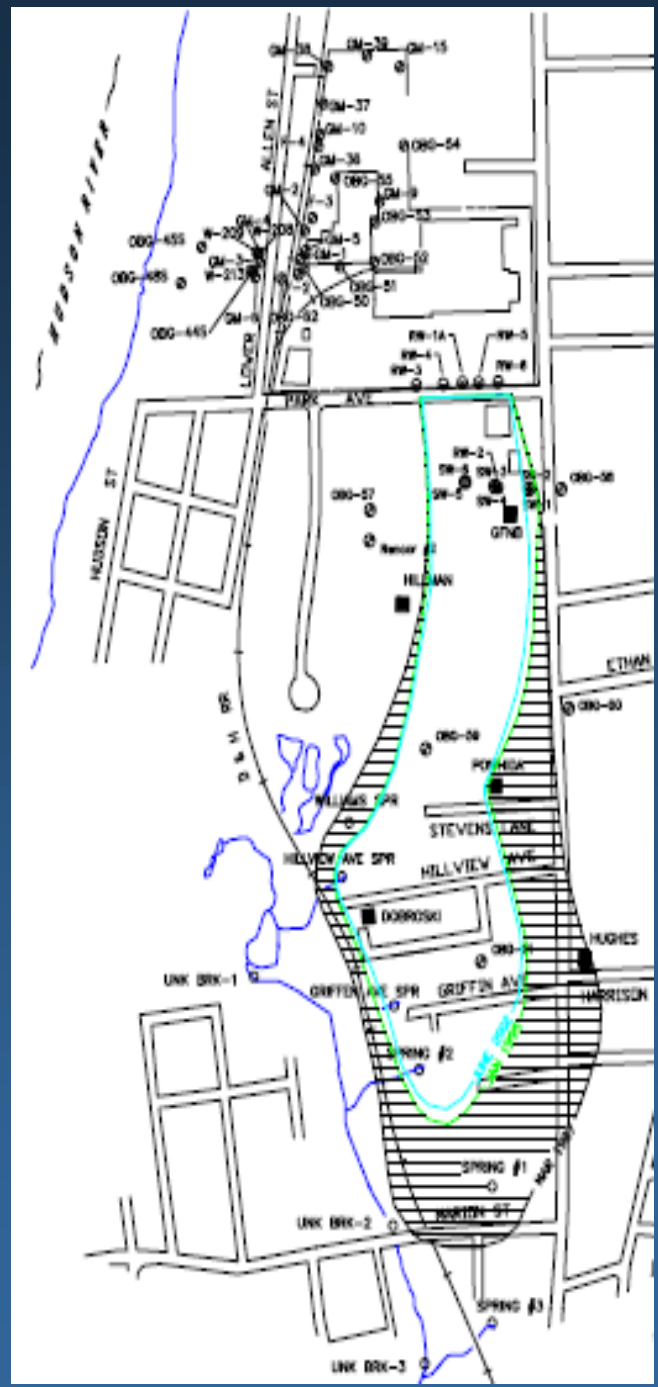
Example: Sample type and location **SITE B**



Example:

Sample type and location

GW

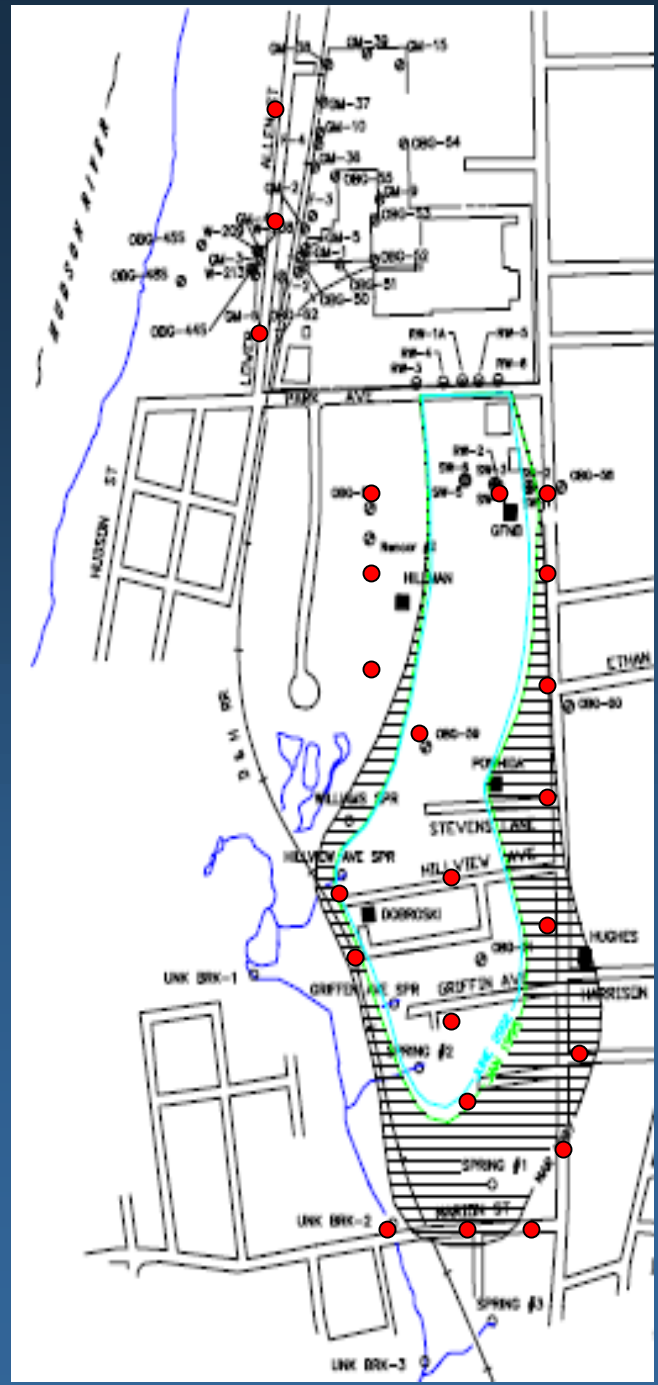


SITE C

Example:

Sample type and location

GW



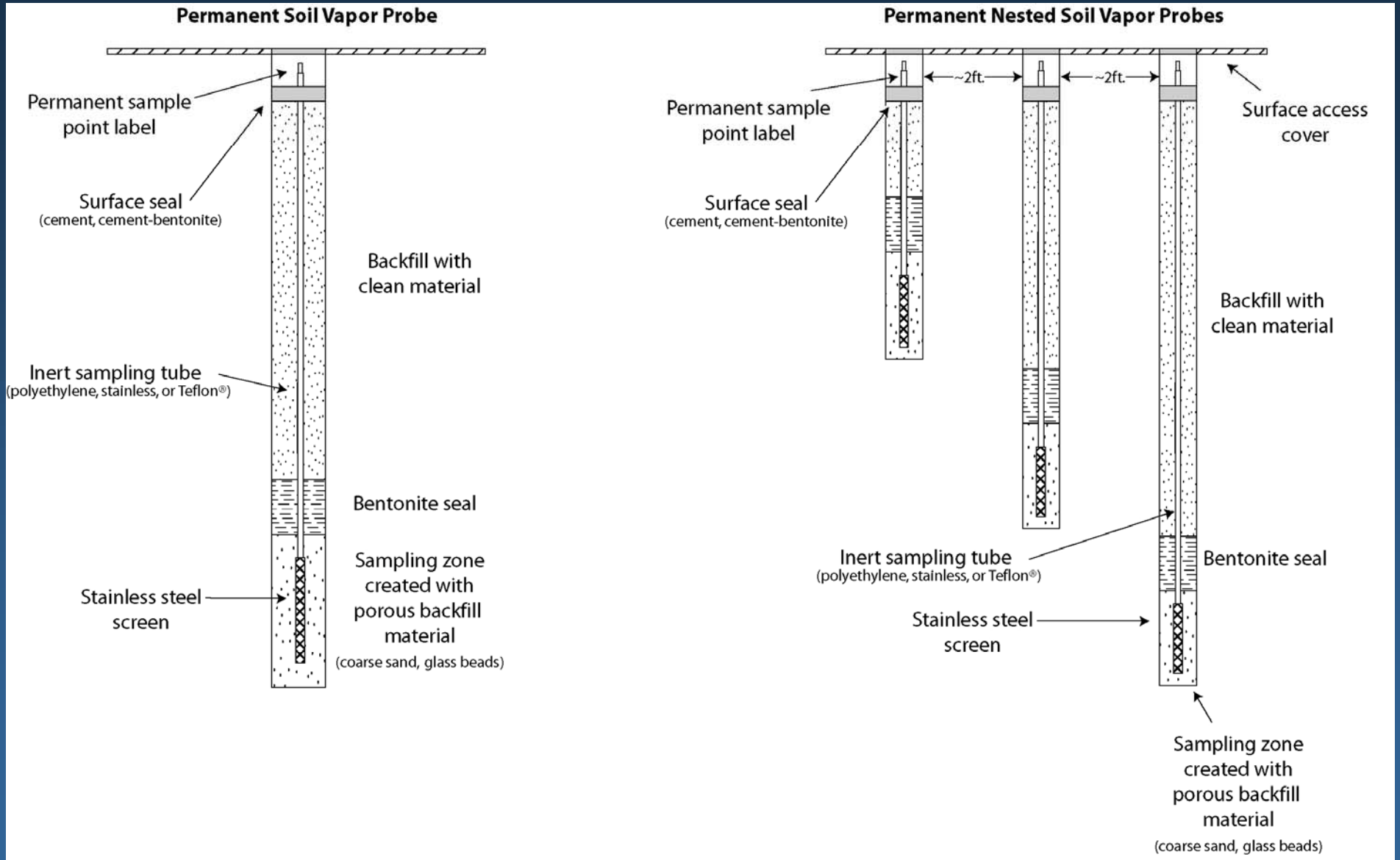
SITE C

Soil Vapor Sampling

NOTE

Use of other sampling methods will be considered if implemented, at least initially, in conjunction with these recommended methods.

Probes


Permanent Soil Vapor Probe
Permanent sample point label
Surface seal
(cement, cement-bentonite)
Backfill with clean material
Inert sampling tube
(polyethylene, stainless, or Teflon®)
Bentonite seal
Stainless steel screen
Sampling zone created with porous backfill material
(coarse sand, glass beads)
Permanent Nested Soil Vapor Probes
~2ft.
~2ft.
Permanent sample point label
Surface access cover
Surface seal
(cement, cement-bentonite)
Backfill with clean material
Inert sampling tube
(polyethylene, stainless, or Teflon®)
Bentonite seal
Stainless steel screen
Sampling zone created with porous backfill material
(coarse sand, glass beads)

Soil vapor sampling: Depth

- if possible, avoid
  - < 5 ft below grade
  - fill material surrounding buildings if no surrounding surface confining layer
- will depend on objective
  - approximate foundation depth: 8 ft dbg
  - evaluate groundwater as a source: 1 ft above water table
  - demonstrate biodegradation: multiple depths from source toward surface

Soil vapor sampling: Collection

- purge 1 to 3 implant volumes
- purging and sampling flow rates < 0.2 L/min
- conventional sampling methods in an appropriate container
    - meets sampling objectives
    - meets requirements of sampling and analytical methods
    - certified clean
- volume needed to achieve reporting limits
- tracer gas is needed

Example: Soil Vapor Probe Installation and Tracer Gas Setup

Example: Direct push tracked vehicle

Example: Soil vapor point installation with direct-push

Example: Typical geoprobe installation

Example: Slide hammer, drive rods, extraction jack, tubing

Example: Slotted drive tips

Example: Cutting tubing for slide hammer

Example: Installing tubing and implant

Example: Approaching completion

Example: Top of drive with tubing installed

Example: Installing using a slide hammer

Example: Extracting the drive rod

Example: Annular space has yet to be sealed

Example: Annular space is sealed

Example: Purging implant tubing

Example: Caps placed over tubing pre-canister

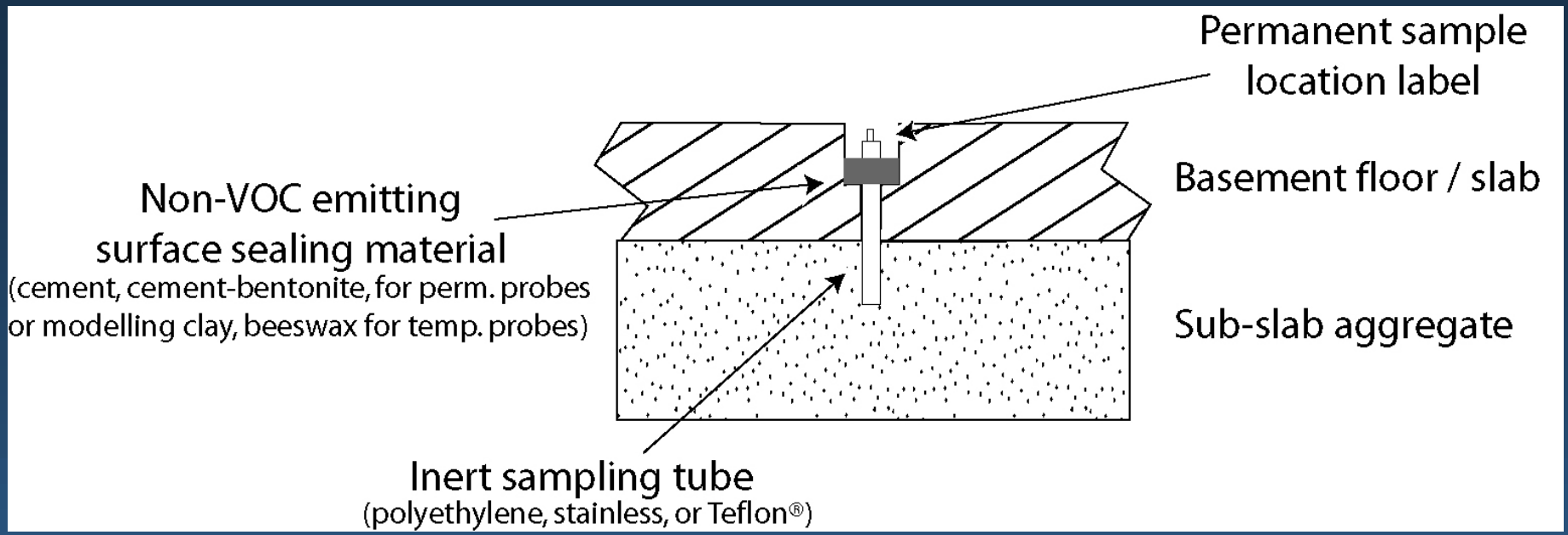
Example: Tracer gas shroud with helium detector

Investigation Recap

Structure Sampling

- Sub-slab vapor
- Indoor air
- Outdoor air

Sub-slab vapor sampling



- Central location away from foundation footings
- Similar collection protocol as soil vapor
- Ideally, collected over same time as indoor and outdoor air

Time of year in which to sample

Sub-slab vapor and indoor air samples may be collected year-round

Only samples collected when building conditions represent the strongest likelihood for vapor intrusion can be used to rule out exposures

- typically the heating season for residential buildings
- may differ for commercial buildings

Example: Sub-slab Vapor Probe Installation

Example: Hammer drill

Example: Geoprobe

Example: Sealing the annular space

Example: Pouring melted beeswax to seal

Example: Probe sample

Example: Tracer gas / probe sample

Example: Sampling

Indoor air sampling

- Sample height = representative breathing zone
- Crawlspace and/or basement
- Lowest level living space
  (finished basement, first floor)
- Multi-tenant spaces
- Appropriate container
- Typically 24 hour sample for residential setting
- Concurrent with outdoor air and sub-slab vapor

Outdoor air sampling

- Sample height = representative breathing zone
- Representative upwind location
- Concurrent with indoor air and sub-slab vapor

Building questionnaire and product inventory

Essential to the data evaluation process — failure to fill out properly may result in the need for additional sampling ($$$)

Building questionnaire and product inventory

- Building features and conditions
- Preferential pathways for vapor intrusion
- Background sources of volatile chemicals
- Only record of volatile chemical-containing products present at the time of sampling
- Real-time instrumentation readings
- Example of a correctly completed form — included in your handouts


UNDER COATING
SADDLE SOAP
TOP SHINE
Velvet Wall Flat
Lacquer Spray
STOP LEAK

Example: Indoor air background sources

Example: Indoor air background sources

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CAN F

MODIFIED TO-15 GC/MS

File Name:	3123016	Date of Collection:	12/14/04
Dil. Factor:	1000	Date of Analysis:	12/30/04 02:18 PM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 113	5000	Not Detected	38000	Not Detected
1,1,1-Trichloroethane	5000	5000	27000	27000
Trichloroethene	5000	460000	27000	2500000
Tetrachloroethene	5000	Not Detected	34000	Not Detected
1,1-Dichloroethene	5000	Not Detected	20000	Not Detected
trans-1,2-Dichloroethene	5000	Not Detected	20000	Not Detected
cis-1,2-Dichloroethene	5000	Not Detected	20000	Not Detected
Vinyl Chloride	5000	Not Detected	13000	Not Detected
Chloroethane	5000	Not Detected	13000	Not Detected
Methylene Chloride	5000	Not Detected	17000	Not Detected
1,1-Dichloroethane	5000	Not Detected	20000	Not Detected

Container Type: 1 Liter Tedlar Bag

Surrogates	%Recovery	Method Limits
Toluene-d8	104	70-130

Example: Indoor air background sources

Example: Indoor air background sources

AIR TOXICS LTD.

CAN E

MODIFIED TO-15 GC/MS

File Name:	**3123017**	**Date of Collection:**	**12/14/04**
Dil. Factor:	**4000**	**Date of Analysis:**	**12/30/04 02:45 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 113	20000	Not Detected	150000	Not Detected
1,1,1-Trichloroethane	20000	16000000	110000	90000000
Trichloroethene	20000	Not Detected	110000	Not Detected
Tetrachloroethene	20000	Not Detected	140000	Not Detected
1,1-Dichloroethene	20000	1300000	79000	5100000
trans-1,2-Dichloroethene	20000	Not Detected	79000	Not Detected
cis-1,2-Dichloroethene	20000	Not Detected	79000	Not Detected
Vinyl Chloride	20000	Not Detected	51000	Not Detected
Chloroethane	20000	Not Detected	53000	Not Detected
Methylene Chloride	20000	Not Detected	69000	Not Detected
1,1-Dichloroethane	20000	Not Detected	81000	Not Detected

Container Type: 1 Liter Tedlar Bag

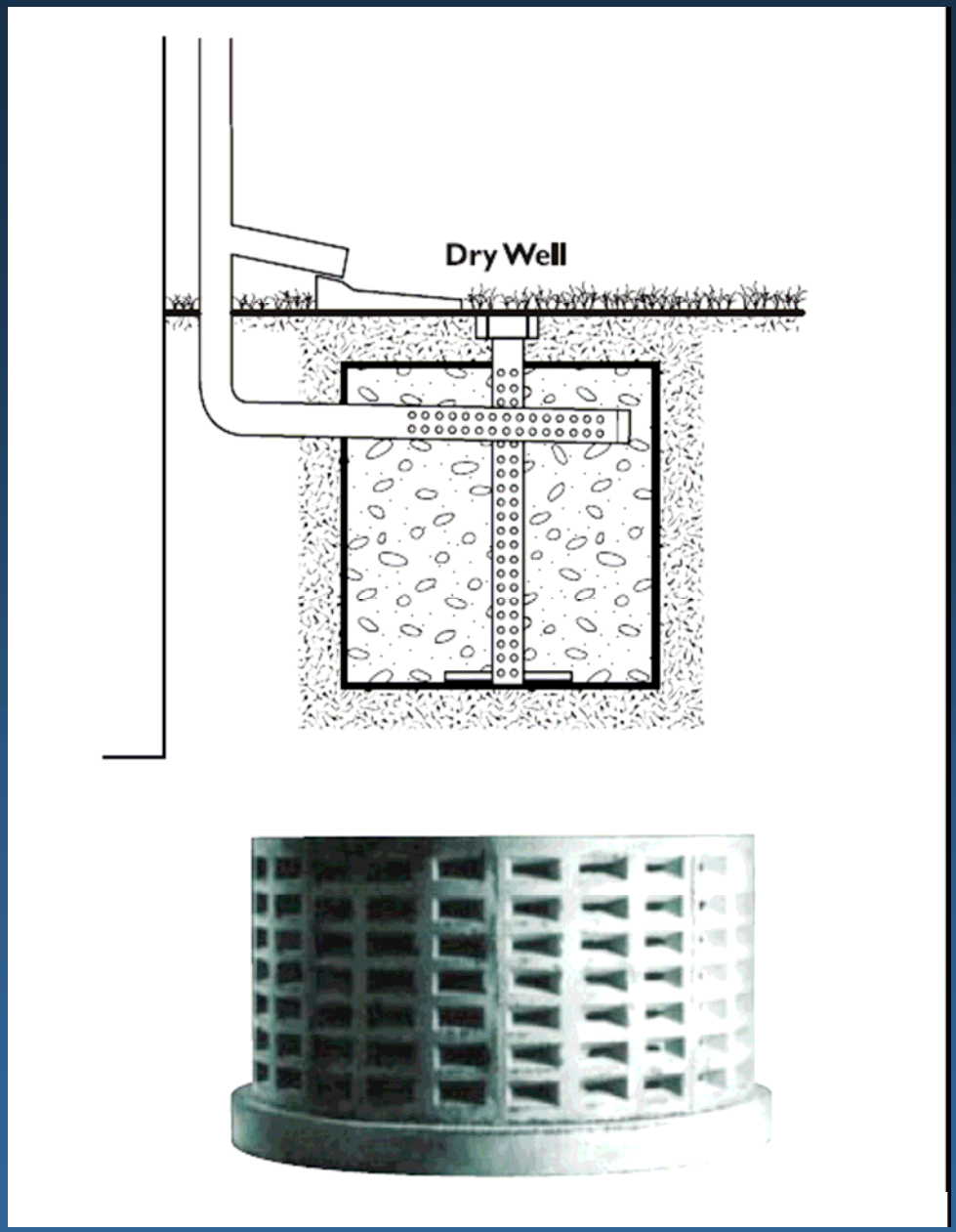
Surrogates	%Recovery	Method Limits
Toluene-d8	102	70-130

Example: Preferential pathways

Example: Preferential pathways

Example:

Preferential pathways



Conducting surveys

- Initial contact: door-to-door approach, phone calls
- Scheduling: questionnaire, inventory, and sampling

Questionnaire

- Performed in teams
- Age of occupants: adults reluctant to give ages, children's ages easily obtained
- Place I.D. number on each document (for example, H-002)
- Partial slab in basement: note percentage slab to earthen floor
- Questionnaire: 1 hour to 1+ days

Inventories

- Full explanation of how inventory will be conducted
- List background levels of indoor air levels from ppbRAE. Have a backup ppbRAE meter.
- Any products containing contaminants of concern should be removed and noted
- Common products containing contaminants of concern: Scott's Liquid gold (TCA), Scotch Guard (TCA), Brake Cleaner (PCE), Water/stain removers (TCA), Gun cleaner (TCA), Engine cleaner (TCE,PCE,TCA)

Sampling

- 2 visits — 24 hours apart
- Sub-slab samples — clean area around hole. Do not use vacuum.
- Earth Floor - Use partial slab if present.
- Earth Floor - NO partial slab, probe sample can be installed

Analyses

Analyte list will primarily depend on the status of site investigations and sampling objectives

- conceptual site model

Minimum reporting limits will depend on the compound, sample type and sampling objectives

- SIMs is not always needed

Turnaround times for preliminary and validated results should be considered

Method Detection Limit (MDL)

The lowest concentration of an analyte that is statistically different from background instrument "noise"

- lowest concentration that can be detected
- determined from numerous replicate samples
- MDL is a lab-specific number

Reporting Limit (RL)

The lowest concentration at which an analyte can be detected and which can be reported with a reasonable degree of accuracy

- lowest concentration that can be measured
- RL is a lab-specific number
- developed from MDLs
- often referred to as Practical Quantitation Limit (PQL)

Analysis

- Analyte list, MDLs & RLs vary from lab to lab
- Communication is key
    - specify what is required
    - verify what the lab can achieve
    - work plans should provide this information

NOTE

Obtaining quality and representative data requires upfront planning and communication

Analysis

Units of measure and conversion

- All units are not created equal
- ppbV not equivalent to mcg/m3

Example: TCE 1 ppbV = 5.37 mcg/m3

NOTE

Avoid unit conversion madness — report analytical data in mcg/m3

QA / QC

- Requirements outlined in DOH Guidance & DER-10
- Take extreme care
- Avoid actions that can cause interferences (e.g., fueling vehicles, using markers)
- Use Environmental Laboratory Approval Program (ELAP)-certified labs
- Follow QA/QC protocols for sample collection and laboratory analysis
- For certain regulatory programs, submit a Data Usability Summary Report (DUSR)

How many sampling rounds?

- Iterative process
- Typically requires more than one round
- Continues until the overall objective is met — answer the questions presented previously

Community outreach

Updating community on environmental investigations

- fact sheets, public meetings

Going into people's homes or businesses

- access and scheduling
- building questionnaires and product surveys
- health issues
- when to expect results

Community outreach

Fact sheets available…

- *What Is Exposure?*
- *Soil Vapor Intrusion: Frequently Asked Questions*
- *Tetrachloroethene (PERC) in Indoor and Outdoor Air*
- *Trichloroethene (TCE) in Indoor and Outdoor Air*

Fact sheets coming soon…

- soil vapor intrusion sampling
- household products and indoor air