STANDARD OPERATING PROCEDURE – BER-33

PROCEDURES FOR SAMPLING AND ANALYSIS OF INDOOR AIR SAMPLES

Effective Date: August 14, 2000
Revised Date: January 1, 2011

TABLE OF CONTENTS

DISCLAIMER:

This Standard Operating Procedure (SOP) was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to KDHE staff in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

KDHE has made every attempt to present the information in a clear and concise manner for a variety of users. However, KDHE is not responsible for the misuse or misinterpretation of the information presented herein. Under no circumstances shall KDHE be liable for any actions taken or omissions made by non-KDHE users of this document.

In general, this document should be used as a reference. Differences may exist between the procedures referenced in this document and what is appropriate under site-specific conditions. This document does not represent an endorsement of practitioners or products mentioned in the document.

1.0 INTRODUCTION

The objective of this Standard Operating Procedure (SOP) is to describe the equipment and techniques for the collection of time-integrated air samples in Summa canisters with the ultimate goal of ensuring that similar methods and protocols are used when collecting such samples for analysis of volatile organic compounds (VOCs) to evaluate vapor intrusion.

2.0 SAMPLING EQUIPMENT

Time-integrated indoor air samples will be collected in specially prepared six-liter Summa canisters. Air flow into the canister is regulated by a sampling valve or a pneumatic flow controller attached to an in-line particulate filter. The sampling valve is typically used for short duration grab samples; however, the valve can be set for longer duration sampling. Flow controllers are generally precalibrated to regulate flow for sample collection times of 1-hour, 3-hours, 8-hours, 12-hours or 24-hours. Larger canisters are available for sampling periods in excess of 24-hours. The desired sampling rate is pre-set either by the canister manufacturer or the laboratory. Canisters will be cleaned and certified by the laboratory as per EPA Method TO-14A or TO-15 guidelines. During the planning stage for the sampling event, the laboratory will need information on the contaminants of interest, the analytical method and reporting limits required for the project so that appropriately cleaned canisters can be selected. Also, the sampling team should consider requesting extra canisters and flow controllers from the laboratory due to the potential for equipment failure.

A vacuum gauge is utilized to measure and record the initial canister vacuum. A post sampling vacuum reading is also taken to ensure that a sufficient sample has been collected and that some residual vacuum remains in the canister. The initial canister vacuum should be at least -26 inches of mercury (" Hg). If the initial vacuum is less than -26" Hg (i.e., between 0" Hg and -25" Hg), the canister should be rejected and returned to the laboratory.

Stainless-steel, Teflon or Nylon tubing can be attached to the inline filter to obtain samples from the breathing zone or a remote location. The inlet manifold is placed in the breathing zone at approximately three to six feet above grade. The laboratory will supply this material upon request.

3.0 BACKGROUND REVIEW AND BUILDING ASSESSMENT

An adequate background review must be conducted before sampling to obtain information on each structure from which a sample is collected. The background review should include a visual survey of each structure to ascertain basement, crawl space or slab on-grade building configuration; determine if sumps, wells, or cisterns are associated with each structure; evaluate the condition of the floors and walls; and describe the heating and ventilation system within each structure. These features may act as conduits that will facilitate the migration of VOCs vapors from the subsurface. An attached garage, basement or workshop may store products that can contribute to indoor air impacts.

Interviews should be conducted with the owner/occupant of the building(s) to assess the use of potential contaminants, frequency of use, storage, as well as methods of handling and disposal. Additional information that is vital to adequately evaluate potential health risks includes, but is not limited to: the length of occupant residency; ages of adults and children living in the structure; if occupants smoke and how often; and, any hobbies using paints, solvents, and/or other potential contaminants. The Indoor Air Sampling Form, provided as Attachment 1, includes a questionnaire to be completed with the occupant and also includes a list of potential VOC containing product(s)/source(s). The occupant should remove and/or refrain from using these potential VOC containing product(s)/source(s) at least 48 hours prior to air sampling, if possible.

4.0 PRELIMINARY SCREENING

Preliminary screening of the sampling area may be conducted through use of a photoionization detector (PID), combustible gas indicator (CGI), and/or colorimetric tubes. Screening will be conducted in the center of the room away from obstructions in the breathing zone, near potential sources, basements and crawl spaces. Screening equipment will be checked and calibrated according to manufacturers' specifications. Additional factors to be documented during the preliminary screening include indoor and outdoor temperature, wind speed/direction, and barometric pressure.

Preliminary screening can also be conducted in buildings or residences outside the area of concern to evaluate background levels of various constituents that may impact data interpretation. It is also important to collect ambient air data to evaluate outdoor concentrations that may affect indoor air quality. The data referenced in this section should also be entered on the Indoor Air Sampling Form.

5.0 INDOOR AIR SAMPLING LOCATIONS

Indoor air samples should be collected in the breathing zone (approximately 3 to 6 feet above grade) in the center of the room. Primary sampling areas will be frequently used areas on the lowest livable level. In addition, air samples from unfinished basement space, crawl spaces, and/or other floors of the structure may also be warranted on a case by case basis. Canisters should not be placed in the kitchen, in areas of high humidity (bathroom/laundry room), near windows, or heat registers. An outdoor ambient air sample should be collected from upwind of the building(s) and away from obvious VOC sources (parked cars, lawn mowers, garages, etc.) to account for potential background influences. The sample locations should be depicted on the Indoor Air Sampling Form. The frequency of duplicate sample collection should be specified in project planning documentation.

6.0 SAMPLING PROCEDURES

Laboratory prepared sampling apparatus configurations may vary. Specific instructions and/or diagrams for system assembly, if any, should be obtained from the laboratory supplying the canister(s). An example of such is provided as Attachment 2. Record the local outdoor temperature, relative humidity and barometric pressure on the Indoor Air Sampling Form (Attachment 1).

In general, assembly of the sampling apparatus, sample collection, and documentation should be performed as follows:

- Connect the flow controller, with attached in-line filter and vacuum gauge, to the canister utilizing a compression fitting;
- Connect a sampling tube (if used) to the sample inlet on the filter;
- Place the canister in the predetermined location and begin sampling by turning the canister valve counter-clockwise one full turn or as specified by the manufacturer and/or laboratory;
- Record the sample number, location, date, flow controller and canister serial numbers, initial vacuum reading, and start time on the identification tag attached to the canister and the Indoor Air Sampling Form (Attachment 1);
- After sampling is complete, close the canister valve and record the end time and final canister vacuum on the canister identification tag and

Indoor Air Sampling Form. Do not over-tighten the valves or compression fittings; and,

- Package the canisters and flow controllers in the laboratory-provided shipping container or box and transport to the laboratory under chain-of-custody protocol.

The final canister vacuum should be less than atmospheric pressure to ensure that a relatively constant flow rate has been maintained for the entire sampling period. The canisters will be shipped under proper chain-of-custody protocol to the laboratory from which the canisters were rented for analysis.

7.0 SAMPLE ANALYSIS

A number of analytical methods are available for analyzing indoor air samples for VOCs. In general, the preferred laboratory analytical method is EPA Method TO-15 which uses gas chromatography/mass spectrometry (GC/MS) to identify and quantify target VOCs. The GC/MS utilized for EPA Method TO-15 is a more scientifically defensible detector scheme and is more desirable than the use of single or multiple specific detectors utilized in EPA Method TO-14A. In some cases it may be necessary to analyze samples using EPA Method TO-15 Selective Ion Monitoring (SIM) to obtain lower detection limits for some contaminants of concern. The laboratory should be consulted prior to sampling to determine which analytical method is most appropriate to satisfy project data needs.

8.0 REFERENCES

EPA, 1999a, *Compendium Method TO-14A – Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters With Subsequent Analysis By Gas Chromatography*, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air – Second Edition, EPA/625/R-96/010b, Center for Environmental Research Information, Office of Research and Development, United States Environmental Protection Agency, Cincinnati, OH, January 1999.

EPA, 1999b, *Compendium Method TO-15 - Determination of Volatile Organic Compounds (VOCs) in Ambient Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry*, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air – Second Edition, EPA/625/R-96/010b, Center for Environmental Research Information, Office of Research and Development, United States Environmental Protection Agency, Cincinnati,

OH, January 1999.

EPA, 2002, OSWER *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*, EPA 530-D-02-004, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., November 2002.

ITRC, 2007, *Vapor Intrusion Pathway: A Practical Guide*, Interstate Technology and Regulatory Council, Washington D.C., January 2007.

KDHE, 2007, *Kansas Vapor Intrusion Guidance*, Bureau of Environmental Remediation, Division of Environment, Kansas Department of Health and Environment, Topeka, KS, June 2007.

MDH, 2009, *Indoor Air Sampling at Vapor Intrusion Sites: Introduction, Methods, and Interpretation of Results*, Minnesota Department of Health, St. Paul, MN, February 2009.

NYSDH, 2006, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, New York State Department of Health, Albany, NY, October 2006.

ATTACHMENT 1

INDOOR AIR SAMPLING FORM

Kansas Department of Health and Environment

Bureau of Environmental Remediation
Indoor Air Sampling Form

Project Name:	Sample Date:
Property ID:	Sampler:

Sample Information

	Sample Location:	Sample ID:	Canister Number:
(1)			
(2)			
(3)			
(4)			

Environmental Conditions

Outdoor Temperature:	Barometric Pressure:	Relative Humidity:
Wind Speed:	Wind Direction:	

Preliminary Screening

Instrumentation:	Calibration Date:	Calibration Time:
Location 1:	Reading 1:	
Location 2:	Reading 2:	
Location 3:	Reading 3:	
Location 4:	Reading 4:	

Air Sample Detail

	Start Time:	Initial Vacuum:	End Time:	Final Vacuum:	Flow Controller Number:
(1)					
(2)					
(3)					
(4)					

Note: This form is to be completed for each residence involved in indoor air sampling activities. Page 3 of the form provides space for additional notes or comments.

Indoor Air Sampling Form – Page 2

Resident/Owner Information

Occupant Name:		Age:	Length of Occupancy:
(1)			
(2)			
(3)			
(4)			
(5)			

Mailing Address:	Phone Number:
Smokers: ❑ Yes ❑ No	If yes, type and frequency:
Do occupants use dry cleaning service? ❑ Weekly ❑ Monthly ❑ Not at All	
Property Owner (if different):	
Owner's Mailing Address:	Owner's Phone Number:

Chemicals Used or Stored In the Residence

Chemical Type:	Used or Stored:	If yes, What type, when and where:
Paint, Paint Thinners, or Varnishes	❑ Yes ❑ No	
Gas-Powered Equipment	❑ Yes ❑ No	
Gasoline	❑ Yes ❑ No	
Pesticides	❑ Yes ❑ No	
Cleaning Solvents	❑ Yes ❑ No	
Cleaning Products	❑ Yes ❑ No	
Carpet/Upholstery Cleaners	❑ Yes ❑ No	
Moth Balls	❑ Yes ❑ No	
Air Fresheners	❑ Yes ❑ No	
Hobby Supplies	❑ Yes ❑ No	
Cosmetic Products	❑ Yes ❑ No	
Other: _____		

Note: To the extent possible, the products listed above should not be used in the residence for at least 48 hours before sampling to avoid background interferences.

Indoor Air Sampling Form – Page 3

Building Information

Building Type:	Year Constructed:	Foundation Type:
Foundation Walls:	Foundation Cracks:	Basement Moisture:
Basement Flooring:	Floor Drains:	Basement (% Finished):
Basement Occupancy: ❑ Full-time ❑ Occasionally ❑ Seldom ❑ Almost Never		
Private Well: ❑ Yes ❑ No	Well Use:	Sump: ❑ Yes ❑ No
Cistern: ❑ Yes ❑ No	Attached Garage: ❑ Yes ❑ No	
Radon Mitigation System Installed: ❑ Yes ❑ No	If yes, what type:	
Recent Remodeling: ❑ Yes ❑ No	If yes, what activities:	

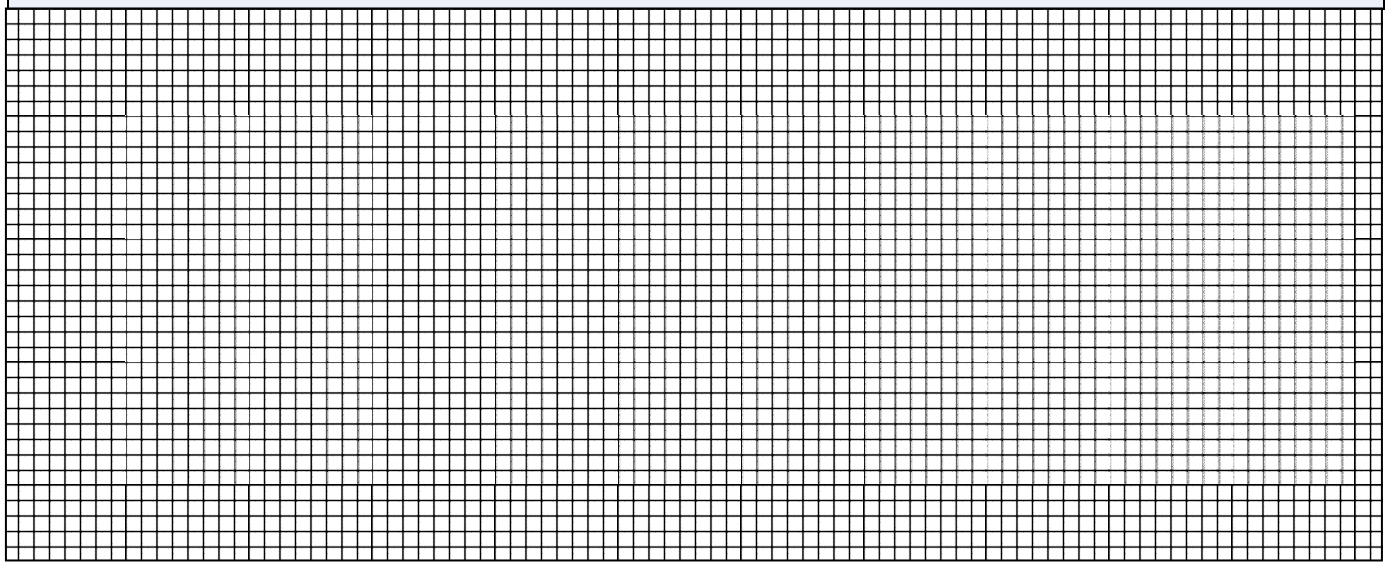
Primary Water Supply:	❑ Public Water ❑ Private Well	❑ Other:_____
Sewage Disposal:	❑ Public Sewer ❑ Septic Tank	❑ Leach Field ❑ Other:_____
Type of Heating System(s): (check all that apply)	❑ Hot Air Circulation ❑ Heat Pump ❑ Hot Air Radiation ❑ Steam Radiation	❑ Wood Stove/Fireplace ❑ Gas Fireplace ❑ Kerosene Space Heater ❑ Electric Baseboard Heat
Fuel Type(s): (Check all that apply)	❑ Natural Gas ❑ Propane ❑ Electric ❑ Fuel Oil	❑ Solar ❑ Coal ❑ Other: _____
Type of Cooling and Ventilation System(s): (Check all that apply)	❑ Central Air Conditioning ❑ Window Air Conditioning ❑ Mechanical Fans ❑ Bathroom Exhaust Fan ❑ Kitchen Exhaust Fan	❑ Air to Air Exchanger ❑ Attic Fan ❑ Whole House Fan ❑ Open Windows ❑ Other: _____

Other Comments

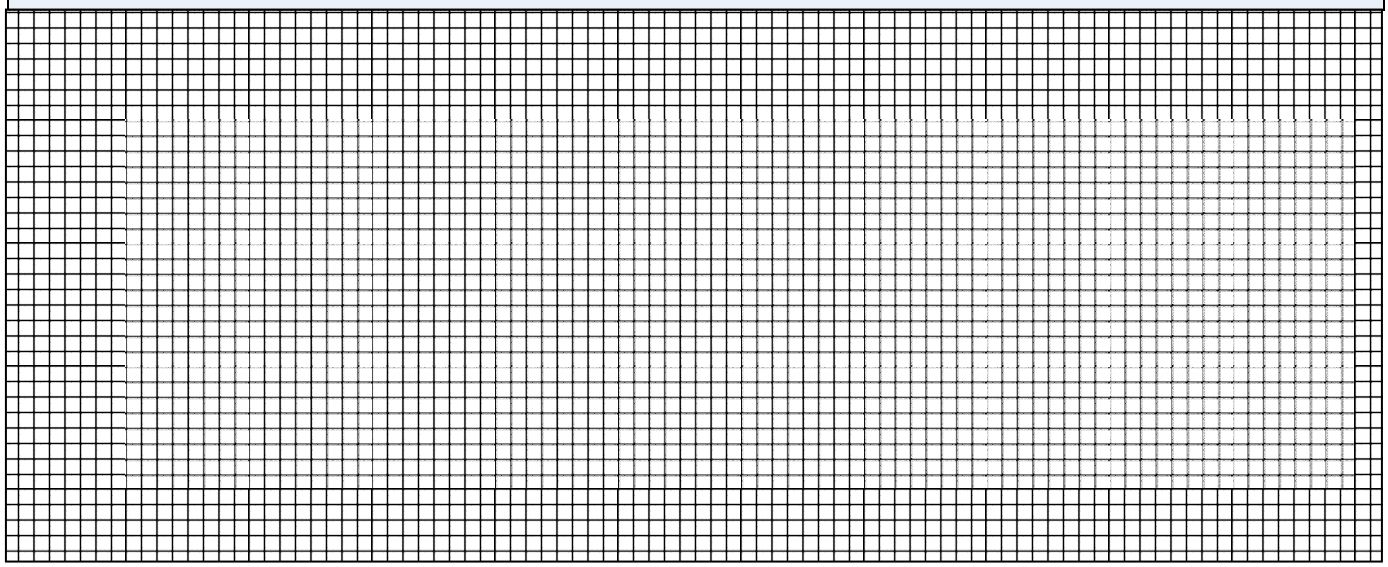
Indoor Air Sampling Form – Page 4

Floor Plans

Basement Layout: Identify furnace and water heater, chemical storage, indoor air pollution sources, preliminary screening locations, and sample locations. Also identify which direction is north.



First Floor Layout: Identify furnace and water heater, chemical storage, indoor air pollution sources, preliminary screening locations, and sample locations. Also identify which direction is north.



ATTACHMENT 2

SAMPLING INSTRUCTIONS FOR CANISTERS WITH PNEUMATIC FLOW CONTROLLERS