

**NEW YORK STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH ASSESSMENT
CENTER FOR ENVIRONMENTAL HEALTH**

**INDOOR AIR SAMPLING & ANALYSIS GUIDANCE
February 1, 2005**

SCOPE

Air testing for specific chemical compounds is an investigative tool used to characterize the nature and extent of contaminants in air and to determine whether contaminant sources affect indoor air quality. The purpose of this document is to outline the recommended procedure for testing indoor air for volatile chemicals.

This document provides guidance for preparing sampling locations and collecting samples for laboratory analysis to ensure the integrity of the test results and allow for meaningful interpretation of the data. The steps discussed include; pre-sampling inspection and preparation of buildings, product inventories, and the collection and analysis of samples.

Forms (attached) - Indoor Air Quality Questionnaire and Building Inventory
 - Product Inventory Form

GUIDANCE

1. Pre-Sampling Inspection:

A pre-sampling inspection should be performed prior to each sampling event to identify conditions that may affect or interfere with the proposed testing. The inspection should evaluate the type of structure, floor layout, physical conditions, and airflows of the building(s) being studied. The inspection information should be identified on the attached Indoor Air Quality Questionnaire and Building Inventory form. In addition, potential sources of chemicals of concern should be evaluated within the building by conducting a product inventory. The primary objective of the product inventory is to identify potential air sampling interference by characterizing the occurrence and use of chemicals and products throughout the building, keeping in mind the goal of the investigation and site specific contaminants of concern. For example, it is not necessary to provide detailed information for each individual container of like items. However it is necessary to indicate that “20 bottles of perfume” or “12 cans of latex paint” were present with containers in good condition. This information is used to help formulate the indoor environment profile.

Each room on the floor of the building being tested and on lower floors, if possible, should be inspected and an inventory provided. This is important because even products stored in another area of a building can affect the air of the room being tested.

For example, when testing for a petroleum spill, all indoor sources of petroleum hydrocarbons should be scrutinized. These can include household and commercial products containing volatile organic compounds (VOCs), petroleum products including fuel from gasoline-operated equipment, unvented space heaters and heating oil tanks, storage and/or recent use of petroleum-based finishes and paints or products containing petroleum distillates. This information should be detailed on the Product Inventory Form.

The presence and description of odors (e.g. solvent, moldy) and portable vapor monitoring equipment readings (e.g., photoionization detectors [PIDs] for VOCs, Jerome Mercury Vapor Analyzer for mercury) should be used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Products in buildings should be inventoried **every time** air is tested to provide an accurate assessment of the potential contribution of volatile chemicals. If available, chemical ingredients of interest should be recorded for each product. If the ingredients are not listed on the label, record the product’s exact and full name, and the manufacturer’s name, address and phone number, if available. In some cases, Material Safety Data Sheets may be useful for identifying confounding sources

of volatile chemicals in air. Adequately documented photographs of the products and their labeled ingredients can supplement the inventory and facilitate recording the information.

2. Preparation of Building

Potential interference from products or activities releasing volatile chemicals may need to be controlled. Removing the source from the indoor environment prior to testing is the most effective means of reducing the interference. Ensuring that containers are tightly sealed may be acceptable. When testing for VOCs, containers should be tested with a PID to determine whether VOCs are leaking. The inability to eliminate potential interference may be justification for not testing, especially when testing for similar compounds at low levels. The investigator should consider the possibility that chemicals may adsorb onto porous materials and may take time to dissipate.

In some cases, the goal of the testing is to evaluate the impact from products used or stored in the building (e.g., pesticide misapplications, school renovation projects). If the goal of testing is to determine whether products are an indoor volatile chemical contaminant source, then removing these sources does not apply.

Once interfering conditions are corrected (if applicable), ventilation may be needed prior to testing to eliminate residual contamination in the indoor air. If ventilation is appropriate, it should be completed 24 hours or more prior to the scheduled sampling time. Where applicable, ventilation can be accomplished by operating the building's heating ventilation and air conditioning (HVAC) system to maximize outside air intake. Opening windows and doors and operating exhaust fans may also help or may be needed if the building has no HVAC system.

Air samples are sometimes designed to represent typical exposure in a mechanically ventilated building, and the operation of HVAC systems during sampling should be noted (see HVAC section on the attached indoor air quality questionnaire). In general, the building's HVAC system should be operating under normal conditions. Unnecessary building ventilation should be avoided within the 24 hours prior to and during testing. During colder months, heating systems should be operating under normal occupied conditions (i.e., 65°-75° F) for at least 24 hours prior to and during the scheduled sampling time.

Depending on the goal of the indoor air sampling, some situations may warrant deviation from the above protocol regarding building ventilation. In such instances, building conditions and sampling efforts should be understood and noted within the framework and scope of the investigation.

FOR 24 HOURS PRIOR TO SAMPLING, ALL REASONABLE MEASURES SHOULD BE TAKEN TO AVOID

- Opening any windows, fireplace dampers, openings, or vents
- Operating ventilation fans unless special arrangements are made
- Smoking in the house
- Painting
- Using wood stoves, fireplaces or other auxiliary heating equipment (e.g., kerosene heaters)
- Operating or storing automobiles in an attached garage
- Allowing containers of gasoline or oil to remain within the house, except for fuel oil tanks
- Cleaning, waxing, or polishing furniture or floors with petroleum- or oil-based products
- Using air fresheners or odor eliminators
- Engaging in any hobbies that use materials containing volatile organic chemicals
- Using cosmetics, including hairspray, nail polish, nail polish removers, perfume/cologne, etc.
- Applying pesticides

3. Collection of Samples

Air samples should be collected from an adequate number of locations to understand likely sources of volatile chemicals and to assess potential exposure to occupants in various locations. In private residences, air samples should be collected from the basement, first floor living space, and from outdoors. In settings with diurnal occupancy patterns such as schools and office buildings, samples should be collected during normally occupied periods to be representative of typical exposure. However, in special circumstances it may be necessary to collect air samples at other times in order to minimize disruptions to normal building activities. Sample collection intakes should be located to approximate the breathing zone for building occupants (i.e., three feet above the floor level where occupants are normally seated or sleep). To ensure that an air sample is representative of the conditions being tested sampled and to avoid undue influence from sampling personnel, samples should be collected for at least a one-hour period, and personnel should avoid lingering in the immediate area of the sampling device while samples are being collected. If the goal of the sampling is to represent average concentrations over longer time periods then longer duration sampling periods may be appropriate. The sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens) that can cause sample interference in the field.

Sample collection techniques vary depending on the analytical method(s) being used, and sample flow rates must conform to the specifications in the sample collection method. Some methods specify collecting samples in duplicate (e.g., Passive Sampling Devices for tetrachloroethene). Sampling personnel should be completely familiar with the sampling protocol for the particular method being used.

a. Quality Assurance/Quality Control

Extreme care should be taken during all aspects of sample collection to ensure that high-quality data are obtained. Appropriate QA/QC measures must be followed for sample collection and laboratory analysis. Items that should be addressed in sampling protocols include sampling techniques, certified-clean sampling apparatus, appropriate sample holding times, temperatures, and pressures. In addition, laboratory accession procedures must be followed including; field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates and laboratory duplicates, as appropriate.

b. Sampling Information

Detailed information must be gathered at the time of sampling to document conditions prior to and during sampling to aid in interpretation of the test results. The information should be recorded on the building inventory form along with the date and the investigator's initials. Floor plan sketches (section 11) should be drawn for each floor and should include the floor layout with sample locations, chemical storage areas, garages, doorways, stairways, location of basement sumps, HVAC systems including air supplies and returns, compass orientation (north) and any other pertinent information. In addition, observations such as odors, PID readings, and airflow patterns should be recorded on the building inventory form. Smoke tubes or other devices are helpful and should be used to confirm pressure relationships and air flow patterns, especially between floor levels and between suspected contaminant sources and other areas. The NYSDOH Wadsworth Laboratories requires that information on odors and PID readings also be recorded on the associated sample accession forms for VOC analyses.

Outdoor plot sketches (section 12) should include the building site, area streets, outdoor sample location, the location of potential interference (e.g., gas stations, factories, lawn mowers), wind direction and compass orientation (north).

c. Sample Analysis

New York State Law requires laboratories analyzing environmental samples from New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte/matrix combinations. Samples must be analyzed by methods that can achieve minimum reporting limits to allow for comparison to background levels (halogenated VOCs are typically 1 microgram per cubic meter ($\mu\text{g}/\text{m}^3$) or less). The laboratory should verify that they are capable of detecting the appropriate target compounds (see below) and can report them at the appropriate reporting limit (typically 1 $\mu\text{g}/\text{m}^3$ or less). Check with an ELAP representative at 518-485-5570 or by e-mail at elap@health.state.ny.us for questions about a laboratory's current certification status.

Indoor air sampling to evaluate potential impacts from chemical contaminant sources (i.e., old spills, soil vapor, groundwater) should generally include the contaminant(s) of concern and potential breakdown products (e.g., 1,1,1-trichloroethane analysis should also include 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, chloroethane and vinyl chloride).

Petroleum products are often a mixture of many individual compounds. Specific aromatic and aliphatic compounds can be good indicators for individual petroleum products (e.g., gasoline, diesel, fuel oil, and kerosene). The primary aromatic compounds benzene, toluene, ethylbenzene, xylenes (BTEX), and trimethylbenzenes should be included in all analyses. Analytical methods using a mass spectrometer detector allow for the identification and quantitation of aromatic and aliphatic hydrocarbons and for oxygenated compounds such as ethanol and methyl tertiary butyl ether (MTBE). Analyzing for specific indicator compounds as suggested below can aid in differentiating potential petroleum sources.

Indicator compounds for gasoline may include BTEX, trimethylbenzene isomers, the appropriate oxygenate additives (MTBE, ethanol, etc.), and the individual C-4 to C-8 aliphatics (e.g., hexane, cyclohexane, dimethylpentane, and 2,2,4-trimethylpentane [iso-octane]).

Indicator compounds for middle distillate fuels (#2 fuel oil, diesel, and kerosene) may include n-nonane, n-decane, n-undecane, n-dodecane, ethylbenzene, xylenes, trimethylbenzene isomers, tetramethylbenzene isomers, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

Indicator compounds for manufactured gas plant (MGP) wastes may include ethylbenzene, xylenes, trimethylbenzene isomers, tetramethylbenzene isomers, thiophenes, indane, indene and naphthalene.

Indicator compounds for natural gas or liquefied petroleum (LP) gas may include propane, propene, butane, iso-butane, iso-pentane and n-pentane. Natural gas and LP gas also contain higher molecular weight aliphatic, olefinic, and some aromatic compounds, but at levels much lower than the listed indicator compounds.

In some cases, a more comprehensive list of compounds may be necessary that includes indicator compounds of different petroleum mixtures to help identify sources and potential interferences. For additional information on sampling and appropriate target compounds, contact the Indoor Health Assessment Section of the Bureau of Toxic Substance Assessment (BTSA) at (518) 402-7810 or the appropriate Bureau of Environmental Exposure (BEEI) project manager (518) 402-7850.