Travelers Laboratory Services

AIR SAMPLING FIELD INSTRUCTIONS

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INTRODUCTION

These instructions are intended to assist you in completing some of the more common types of air sampling surveys. They briefly discuss the basic equipment, procedures, and strategies encountered when performing exposure monitoring. These instructions are not intended to take the place of proper planning and discussion of anticipated field sampling efforts with a Travelers Industrial Hygiene specialist or Loss Control consultant. These instructions should be used in conjunction with the *Travelers Air Sampling Guidelines*

Please feel free to contact the Travelers Industrial Hygiene Laboratory for additional assistance. The laboratory can be reached at 1-800-842-0355.

AIR SAMPLING INSTRUCTIONS

The basic objective of air sampling is to capture a sample of the contaminants present within the air in the workplace. There are three principle types of air sampling methods in use. These methods are, active, grab and passive sampling. Active sampling involves the use of mechanical pumps and other air collection devices. Grab sampling is an active method which is used most often to determine worst case conditions and/or identify emission source locations or “hot spots.” Passive sampling is a method based on the natural tendency of gas or vapor molecules to move from an area of high concentration to one of lower concentration. Active, Passive and Grab sampling methods will be addressed in detail in these instructions.

I. ACTIVE SAMPLING:

Active sampling consists of the collection of a known volume of air and depositing of the contaminant being investigated upon the appropriate collection medium. *The Travelers Air Sampling Guidelines* have been published for your use in determining the appropriate air sampling method for specific contaminants.

Pump with PVC filter

To determine full-shift employee exposure levels to chemicals in the workplace, it is necessary to evaluate the Time-Weighted Average (TWA) contaminant concentration. Integrated sampling methods using rechargeable, battery-powered, personal sampling pumps are used for TWA sampling. Travelers supplies rechargeable, battery powered, personal sampling pumps. The pumps operate over a wide range of flow rates and are suitable for evaluating most airborne chemical exposures encountered in the workplace. The pumps provide a measured air flow for time periods of up to a full work shift, and are of a size and weight to be considered portable.

Attaching the Pump to the Employee:

Integrated sampling involves the attachment of a sampling train to the employee. The sampling train normally consists of the pump, appropriate flexible tubing, the media (tube/filter), and any necessary media holder.

Gilian pumps are equipped with a wide metal clip intended to hold the unit securely on the employee's belt or waist band. The media should be placed on the employee's shoulder or lapel within several inches of his or her chin in an area called the "breathing zone." The breathing zone is defined as an imaginary 9 inch sphere around a person's head. These breathing zone samples are considered to represent the employee's actual exposures. Since placement of the sampling media can be critical, it should be located as close as possible to the employee's face.

Care should be taken to minimize the possibility of the tubing catching on workplace objects or interfering with the employee's work. In general, placing the pump on the employee's left or right hip routing the tubing diagonally across the back (either under the right or left arm or over the right or left shoulder) to the breathing zone seems to be the best arrangement.

MEDIA *Filters:*

Media filters come in a wide variety and are suited for sampling airborne dusts, fumes, and mists. The most common filters have diameters of 37 mm, but other diameters are encountered. An example would be the 25-mm diameter filter used for asbestos monitoring. Filter pore sizes range from 5 microns (dust and mists) to 0.8 micron (fumes).

Assorted Filters

37 mm Filter (bottom view)

Air enters the opposite side of the cassette and tubing connects to the pump on the side of the cassette with the wagon wheel pattern.

A cyclone is a size-selecting device often used with filters to sample for only the respirable sized particles of a contaminant. Cyclones are put into the sampling train before the filter. *The Travelers Air Sampling Guidelines* describe appropriate filters and the use of cyclones for various contaminants encountered in the workplace.

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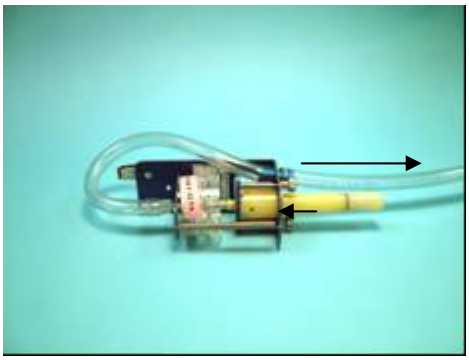
Pump with Bendix cyclone and filter



Bendix cyclone with a preweighed PVC filter
Arrows indicate air flow direction (Notice that the bottom of the filter is at the top of the cyclone and the tubing connects to the pump)

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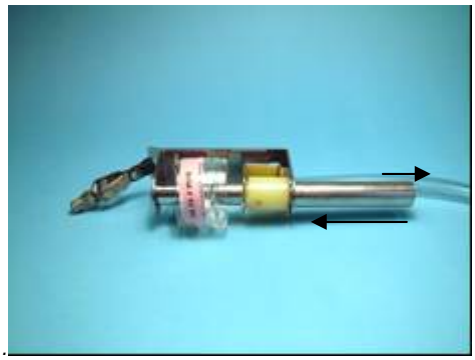


MSA cyclone with a PVC filter
Arrows indicate air flow direction (Tubing is connected to the pump)

Solid Sorbent Tubes:
Solid sorbent tubes are typically used for collecting either gas or vapor. A variety of different sorbent tubes are available. The media within each tube is ***specific*** for a contaminant or class of contaminants. Most sorbent tubes contain two sections of media to allow for evaluation of ***breakthrough*** (an indication as to whether the contaminant was retained by the media or allowed to pass through the tube). The sorbent tube should be oriented so that the air flows through the larger section of the media first.

Assorted Sorbent Tubes

Sorbent tube in a holder. The large section of the media is to the right and the tube connects to the pump. (Arrow indicates air flow direction)

The most common types of tubes used in workplace air sampling contain charcoal or silica gel. Chemical contaminant molecules become trapped within the media and are either adsorbed (in the case of charcoal) or absorbed (in the case of silica gel).

The contaminant molecules are then “desorbed” or washed from the media in the laboratory and the amount of contaminant in the sample is measured.

Flow Adjustment:

Active air sampling methods are developed based upon the known total volume of air collected. Flow rates to be used during air sampling surveys are contaminant specific. *The Travelers Air Sampling Guidelines* describe the flow rate ranges for specific contaminants.

In general, sampling for gases or vapors requires the use of relatively low flow rates (0.05 to 0.2 liters per minute). Sampling for particulate contaminants involves the use of much higher flow rates such as 1.5 liters per minute and above. As previously discussed, published air sampling methods normally specify a specific flow rate or a range of flow rates for the various contaminants.

The sampling pumps furnished by the Travelers are capable of operation at high flow rates or low flow rates. The high flow pump operates between 0.5 - 3.0 liters per minute; while the low flow pump operates between 0.010 - 0.300 liters per minute. The high flow pump is used most frequently when filter sampling is performed with flow rates from 1.5 to 2.0 liters per minute. The low flow pump is used when sorbent tube sampling is performed with flow rates below 0.2 liters per minute.

The pump's flow rate is adjusted using a screw located in the bottom front cover of the high flow pump and the top front cover of the low flow pump. Refer to the instructions for each pump supplied with your equipment order.

The use of an appropriate known flow rate is critical to the air-sampling process. In the case of sorbent-tube sampling, the use of an excessively high flow rate could result in contaminant breakthrough and inadequate capture. In the case of respirable dust sampling using cyclones, the use of an improper flow rate could negate the cyclone's collection effectiveness, resulting in inaccurate results. Contact the Travelers Industrial Hygiene (IH) Help Line at 1-800-842-0355 to speak with an industrial hygienist if you have any questions about air sampling flow adjustment.

Pump Calibration:

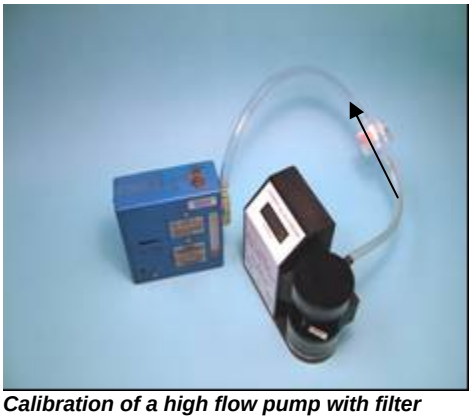
SKC (Buck) Calibrator

Gilian Calibrator (Gilibrator)

Prior to and immediately after air sampling, the pump should be accurately calibrated to the desired flow rate for each individual sample. Since the volume of air depends upon flow rate, calibration of the pump to the appropriate volumetric flow rate and verification of the flow rate during the entire sampling period are essential.

The pump should be visually checked several times during the survey to ensure that it is operating properly. Post-calibration of the pump is important to verify that the actual flow rate was achieved during the sampling period. A primary standard, a Buck Calibrator, is used to measure and set accurate flow rates. The Travelers has supplied you with a Buck Calibrator to be used to set flow rates. The appropriate flow rates can be found in *The Travelers Air Sampling Guidelines.* For additional information refer to the Buck Calibrator instructions supplied with your equipment order.

Calibration of a low flow pump with sorbent tube (Arrow indicates air flow)



Calibration of a high flow pump with filter (Arrow indicates air flow)

Calibration of high flow pump with a cyclone

To calibrate a pump, follow these simple steps:

1. Turn the calibrator on and add bubble solution into the cylinder through the lower port. Add only enough bubble solution so that the bottom of the cylinder is just covered with a thin layer.

2. Attach a length of flexible tubing to the pump and to the collection media as if you were ready to conduct sampling. *The same media to be used for sampling should be used for calibration. Remember to break off both ends of the solid sorbent tubes and remove filter plugs from filters.*

3. Attach another piece of flexible tubing to the inlet port of the medium (filter or tube). Connect this tubing to the top port (outlet) of the calibrator*. Remember, you want to draw a bubble up through the cylinder of the calibrator*. (See note below for open-face and cyclone sampling). The media should now be "in-line" between the sampling train and the calibrator.

4. Turn on the pump and depress the button on the calibrator to release a bubble. Run three or four bubbles through the cylinder to wet the surface. Record the three or four consecutive flowrates and calculate the average. (A flashing "E" means that the flowrate of the bubble was not measured correctly by the unit).

5. Use the adjustment screw on the front of each pump to set the flowrate to the one appropriate for the sampling method.

6. Record the average flowrate on your data sheet. Pumps must be both pre- and post- calibrated.

NOTE: For open-faced or cyclone sampling, OSHA recommends using a bell jar method for calibration (OSHA Field Operations Manual CPL 2-2.20A). However, this method is impractical for use in the field.

Calculating Total Air Volume:

As discussed previously, contaminant-specific sampling procedures and parameters are defined within the *Travelers Air Sampling Guidelines*. In many cases, adherence to specified volume and flow rate criteria is critical to the accuracy of the sampling method. Both maximum and minimum sample volumes are given in *The Travelers Air Sampling Guidelines.*

Total sample volume is simply the flow rate multiplied by the sampling time:

Total Volume (liters) = Sampling Flow Rate (liters/min) X Time (mins.)

Air contaminant quantitation limits are inversely proportional to total air volume collected during sampling. Simply: the higher the air volume collected - the lower the air contaminant quantitation limit. Although many sampling protocols have recommended minimum and maximum air volumes and flow rates, in some cases these items are not as critical, and can be adjusted to achieve the desired air contaminant quantitation limits. Metallic fume and total dust sampling would be examples of such procedures.

In some cases, the maximum recommended air volume and flow rate should be strictly followed. In the case of charcoal-tube sampling for organic vapors, the collection of an excessive air volume or flow rate could result in analyte breakthrough and/or saturation of the sampling media.

Grab Sampling:

Grab sampling is commonly used to determine worst case conditions and/or identify emission source locations of “hot spots.” This method involves the use of a hand-operated bellows, or piston-type pump, and contaminant-specific detector tube. Detector tubes are available for most gas or vapor phase contaminants. Common contaminants sampled using this method include ammonia, carbon dioxide, carbon monoxide, hydrogen chloride, and nitrogen dioxide.

Drager Pumps with detector tubes

This sampling requires 60 to 90 seconds per pump stroke, with several strokes required for each tube. Results are obtained by reading the length of reaction stain on the graduated tubes, and no laboratory analysis is required. Results indicate contaminant concentrations present at the instant of sample collection and may not represent a full-shift time-weighted average (TWA) contaminant concentration. Contaminant detector tube instructions explain how to use each specific type of tube and how to accurately read the reaction stain.

The Travelers Industrial Hygiene Laboratory can supply you with Drager bellows-type pumps and a wide variety of detector tubes. Contact the Travelers IH Help Line at 1-800-842-0355 for more information

II. PASSIVE SAMPLING:

Passive sampling media is available for collection of a wide variety of gases and vapors commonly found in the workplace. This method uses the natural tendency of gas or vapor molecules to move from an area of high concentration to one of lower concentration. Passive monitors are small, badge-like devices which are worn by employees during their workshift. As with active sampling, the collection medium or badge should be placed in the person's breathing zone or as close as possible to his/her chin.

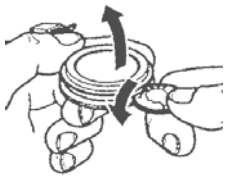
Monitors:

The Travelers can supply you with 3M brand Organic Vapor monitors and Assay Technology monitors. Specific contaminants that can be collected on each type of monitor are detailed in the *Travelers Air Sampling Guidelines* in the passive monitors section. Please read the instructions from 3M and Assay Technology before using the monitors.

3M Organic Vapor Monitor Badge

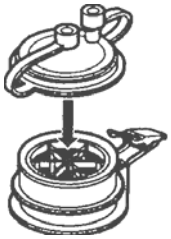
Assay Technology Badge

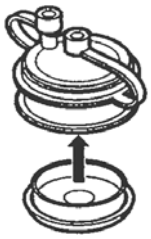
3M Badge Placement for sampling

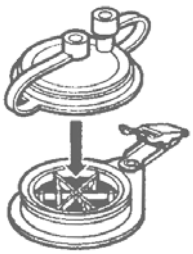


After sampling is completed remove the plastic ring and white film from the 3M monitor

Place the elution cap onto the top of the primary body of the monitor. Separate the front and back sections. Snap the bottom cap (no plugs) into the bottom of the fromt section. Snap the elution cap on the back section of the badge. The badge is ready for shipment. See the illustrations below.







Sampling Time:

The sampling time is critical for collecting accurate sampling data. Instead of using a flowrate as in active sampling, the length of time it takes chemical contaminant molecules to pass into the sampling media of the badge is used. Sampling time is defined as the time the monitor is exposed to the air contaminant in the workplace. Minimum and maximum sampling times are given in *The Travelers Air Sampling Guidelines.* Maximum sampling time should not be exceeded in order to prevent breakthrough of the media. It is important to maintain an accurate record of sampling time in order to ensure valid sampling results.

Long Term Detector Diffusion Tubes:

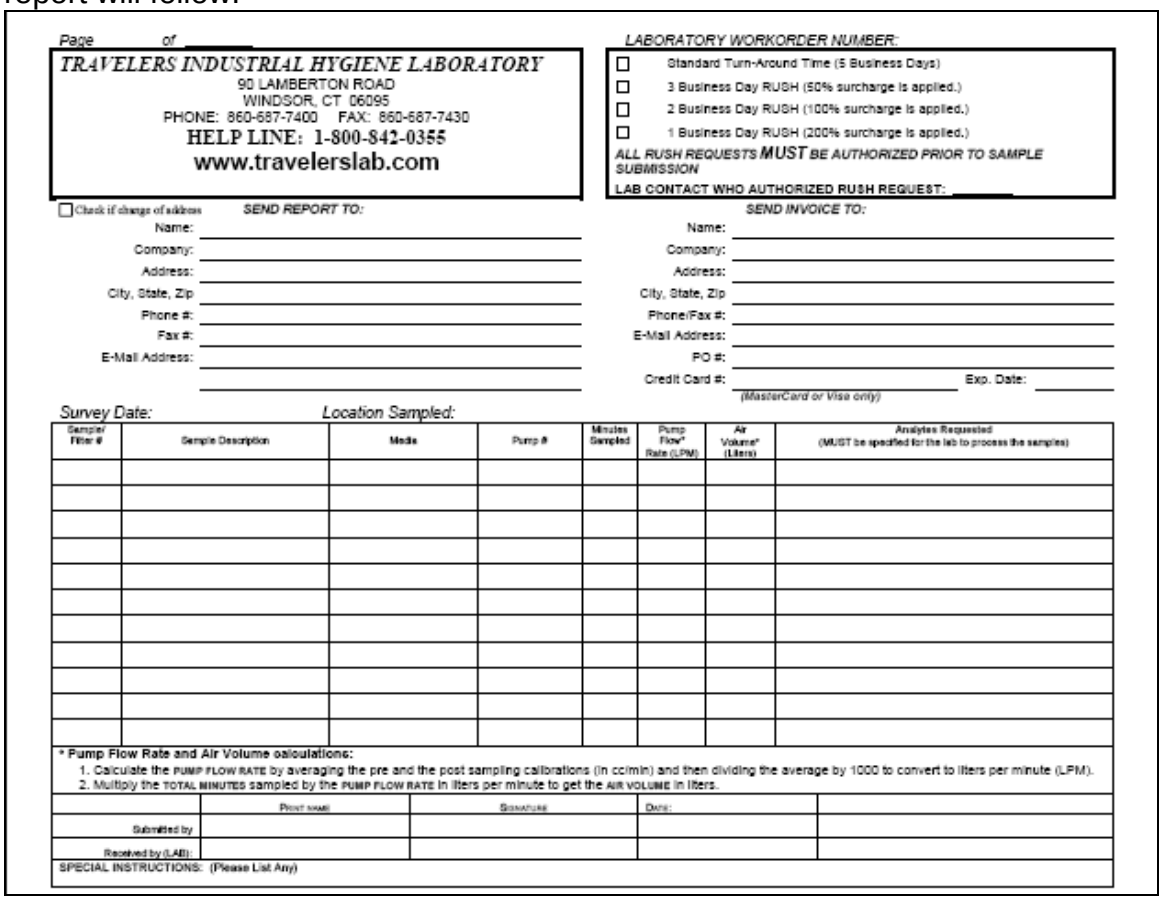
Long term detector tubes or diffusion tubes are available from the Travelers for taking TWA direct readings. Drager diffusion tubes are available for many gases and vapors. Unlike the short term detector tubes used in grab sampling, diffusion tubes are not used with a bellows pump. They are broken at one end allowing the molecules of chemical contaminant to diffuse (move from an area of high concentration to an area of low concentration) into the tube causing a chemical reaction and color change. The time during which the tubes are exposed to the contaminant is noted in hours. At the end of the sampling period, the length of the reaction stain is read and the result divided by the time of sampling (in hours). This result is the measured concentration for that specific contaminant. Refer to the Drager instructions with the tubes or contact the Travelers IH Help Line at 1-800-842-0355

COMPLETION OF THE TRAVELERS IH SURVEY DATA SHEET:

The IH Survey Data Sheet is used to document field air-sampling activities. This data sheet should be completed at the time of sampling. It is important to provide all of the requested information in order to analyze the samples. The columns entitled Sample Number, Sample Description, Total Minutes, Flow Rate and Total Volume should be accurately completed on-site. The samples cannot be processed in the industrial hygiene laboratory unless the data sheet information is complete.

Additional information needed on the data sheet includes the type of collection media used and the lot number of the media. Submit a blank sample from each unique lot number for analysis. Temperature and humidity are important when you are sampling for gases and vapors, especially if the environmental conditions during sampling are not standard (70 degrees and 14.7 mmHg pressure).

If rush analysis is required, notify the lab prior to submitting the samples. Mark the priority box "rush" on the data sheet. If you wish, the lab can fax the results to you. Contact the lab prior to submission of the samples and note on the data sheet that you wish the results to be sent by fax. A written laboratory analysis report will follow.



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HELP LINE: 1-800-842-0355
www.travelerslab.com

LABORATORY WORKORDER NUMBER:

- ☐ Standard Turn-Around Time (5 Business Days)
- ☐ 3 Business Day RUSH (50% surcharge is applied.)
- ☐ 2 Business Day RUSH (100% surcharge is applied.)
- ☐ 1 Business Day RUSH (200% surcharge is applied.)

*ALL RUSH REQUESTS **MUST** BE AUTHORIZED PRIOR TO SAMPLE SUBMISSION*

LAB CONTACT WHO AUTHORIZED RUSH REQUEST: _____

☐ Check if change of address

SEND REPORT TO:
Name:
Company:
Address:
City, State, Zip
Phone #:
Fax #:
E-Mail Address:

SEND INVOICE TO:
Name:
Company:
Address:
City, State, Zip
Phone/Fax #:
E-Mail Address:
P/O #:
Credit Card #: Exp. Date:
(MasterCard or Visa only)

Survey Date: Location Sampled:

Sample/ Filter #	Sample Description	Media	Pump #	Minutes Sampled	Pump Flow* Rate (LPM)	Air Volume* (Liters)	Analytes Requested (MUST be specified for the lab to process the samples)

*** Pump Flow Rate and Air Volume calculations:**
1. Calculate the PUMP FLOW RATE by averaging the pre and the post sampling calibrations (in cc/min) and then dividing the average by 1000 to convert to liters per minute (LPM).
2. Multiply the TOTAL MINUTES sampled by the PUMP FLOW RATE in liters per minute to get the AIR VOLUME in liters.

	Print name	Signature	Date:	
Submitted by				
Received by (LAB):				

SPECIAL INSTRUCTIONS: (Please List Any)

SAMPLE HANDLING, LABELING AND SHIPPING:

Sampling media such as pre-weighted (polyvinyl chloride) PVC filters are assigned unique identification numbers by the laboratory, and these identification numbers serve as a tracking system for such filters. Media such as charcoal tubes, or silica gel tubes however, do not possess laboratory-assigned individual identification numbers. You must assign your own unique identification numbers to these types of media and attach your own label to each tube.

As long as samples can be subsequently identified at critical points within the analysis and reporting process, flexibility in assigning identification numbers can be maintained. For example, charcoal tubes used for xylene sampling on can be labeled CT 11594-1, CT 11594-2, etc., or a system as simple as CT 001, CT 002, CT 003, etc., can be used. If more than one type of sample is being forwarded for a single survey, the various types of samples should be identified with appropriate prefixes as well as numbers. Such prefixes as CT (charcoal tube) and SGT (silica gel tube) are commonly used. The specific format utilized to identify them is not critical as long as individual samples can be identified on the data sheet.

Passive monitors have their own unique identification numbers from the manufacturer. These should be used. Passive monitors should be shipped in their original, individual containers, which are also uniquely numbered.

It is good practice to use a separate individual data sheet for each different type of collection media. For example, all silica gel tubes should be reported on one sheet and all charcoal tubes reported on a separate data sheet.

In some cases, special sample-handling procedures are required, and these should be discussed in advance with an Industrial Hygienist. An example of a special handling procedures is the sampling method for isocyanates as TDI and MDI. This method requires a specially treated glass-fiber filter that must be shipped via overnight courier within an insulated, cooled container. Refer to the *Travelers Air Sampling Guidelines* for contaminant-specific shipping and handling procedures.

Bulk samples should be shipped in a separate container from the media. All samples should be shipped via overnight mail. Do not ship samples to the laboratory on a Saturday or Sunday unless prior arrangements have been made for receipt of the samples. Please use a shipping company with tracking system capabilities whenever possible.

Be sure to put your name, address, and e-mail address on the data sheet for the electronic receipt of the lab report.