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**CHANGE HISTORY (≤ LAST 5 REV-MODS)**

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<th>Release Date</th>
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<tr>
<td>D-7</td>
<td>12/05/2018</td>
<td>Inconsequential Change</td>
<td>Updated obsolete reference to TFC-ESHQ-RP_MON-C-23. This document was replaced by TF-RC-043, &quot;Perform Release Surveys for Material and Equipment.”</td>
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<tr>
<td>D-6</td>
<td>04/12/2018</td>
<td>IH Request</td>
<td>Inserted a note right before step 5.1.7 to clarify labeling for TDU tubes and to avoid issues with analysis process at labs. Modified “Records Section” to current standard.</td>
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<tr>
<td>D-5</td>
<td>02/14/2018</td>
<td>IH Request</td>
<td>Modified Notes before Step 5.1.5 and at the beginning of Section 5.2 within procedure to address the frequency of flow rate checks performed within the same work shift unless approved by an IHT Supervisor, Project IH, or manager to deviate.</td>
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<tr>
<td>D-4</td>
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<td>IH Request</td>
<td>Added Attachment 13 for direction on performing Dimethyl Mercury Sampling to address WRPS-PER-2016-1538.1.</td>
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<td>03/16/2017</td>
<td>IH Request</td>
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## Industrial Hygiene Pump Preparation and Field Use for Conducting Personal/Area Air Sampling

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Attachment 3 - SKC Model Airchek XR5000

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Figure 1 - Types of Low Flow Tube Holders

Figure 2 - Low Flow Tube Holder with Adjustment Screw

Figure 3 - Gilian Model LFS-113 Front, Side, and Top Views

Figure 4 - Gilian Model LFS-113 Back and Side Views
1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for the proper calibration and field use of industrial hygiene (IH) air sampling pumps. Techniques for personal and area air sampling for various gases, vapors, and particulates will also be covered for radiological and non-radiological areas.

1.2 Scope

This procedure includes field calibration procedures using a primary standard for low, medium, and high flow pumps. Personal and area air sampling techniques focus on gas, vapor, and particulate fibrous contaminants such as asbestos, volatile organic compounds, nitrous oxide, respirable fumes, metal dust, etc.

2.0 INFORMATION

2.1 Terms and Definitions

**Breathing zone sampling.** The measurement of gases/vapors taken in an area approximately 5 to 6 feet from the ground or by OSHA’s definition, the area around the employee’s face which consists of a hemisphere forward from the shoulders with a radius of approximately 6 inches.

**Discharge boss.** An accessory which installs into the discharge outlet of the Gilian pump and provides a way of filling gas/vapor sampling bags.

**Field calibration.** Procedure used at the sampling location at the beginning, during and end of the sample collection period to determine the volumetric flow rate of air through the sampling train. Field calibration typically consists of attaching a calibration device to the sampling train and recording the corresponding flow rate.

**Inlet boss.** Air inlet located on top of the filter housing of the Gilian pump that provides a means of attaching tubing.

**Personal/area sampling train.** A sampling train consists of a combination of components (e.g., pumps, flexible tubing, cyclones, and various sampling media such as filter cassettes, charcoal tubes, silica gel tubes, liquid reagents in impingers/bubblers, etc.) designed to collect a specific contaminant from a defined volume of air onto a suitable sampling media, which can then be analyzed.

**Primary standard.** Measures precisely the parameters that govern flow rate, i.e., volume and time.
2.2 General Information

The equipment should be operated within the following parameters:

**BIOS DryCal DC-LITE**
- Temperature range: 32° to 131°F
- Relative Humidity Range: 0 – 70%, non-condensing
- Accuracy: ± 2 % (for a single reading)
- Operating time: 6 - 8 hours
- Charge time: 8 - 12 hours.

**Gilian LFS-113DC Dual Mode Low Flow Air Sampler**
- Temperature range: -4° to 113°F
- Relative Humidity Range: 0 – 85%, non-condensing
- Accuracy: ± 5 % (constant flow)
- Operating time: ~ 8 hours
- Charge time: 16 hours

**SKC Model XR5000 AIRCHEK**
- Temperature range: 32° to 113°F
- Relative Humidity range: 0 – 95%, non-condensing
- Accuracy: ± 5 %
- Range: 1,000 - 5,000 ml/min or 5 – 500 ml/min with low flow adapter kit
- Flow fault auto start: every 15 sec for up to 5 times
- Operating time: 22 hours at 5 and 40 hours at 2 (High Power Li-Ion Battery)
- Charge time: 8 hours
- Intrinsically safe: Class 1 A, B, C, D & Class 2 E, F & G, Class 3, Temperature code T4.
2.2 General Information (Cont.)

Gast Model 1532 High Flow Vacuum Pump
- Flow range: up to 30 Lpm
- Temperature range: 32 to 104°F
- Relative Humidity range: 8 to 100%, non-condensing
- Weight: 8 lbs
- Not intrinsically safe.

Bios Defender 510 DryCal
- Operating Temperature range: 32° to 122°F
- Relative Humidity range: 0 – 70%, non-condensing
- Flow range: 50 to 50,000 ml/min
- Accuracy: ± 1 %
- Battery Life: 6 - 8 hours.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 When breaking open glass sorbent tubes, use a closed tube breaker, wear safety glasses and leather gloves. Ensure others are protected from flying glass and debris.

3.1.2 Take special care in handling opened glass sorbent tubes and be sure its jagged points and body are shielded during placement and use on workers.

3.2 Equipment Safety

CAUTION - Over tightening the inlet assembly on the Gilian could damage the O ring resulting in equipment damage and pump leakage.

CAUTION - Over tightening the rotor on the Gilian may cause equipment damage.

3.2.1 See Attachment 10 for high humidity consideration to protect the pump.
3.3 Radiation and Contamination Control

3.3.1 Planned work in radiological areas must be approved by Radiological Control personnel per the Radiological Risk Screening procedure TFC-ESHQ-RP-RWP-C-01.

3.3.1.1 When performed without a formal work package or approved procedure (i.e., Level 3 or 4 work), this procedure is limited to radiological areas and work activities permitted by a low risk Radiological Work Permit (RWP).

3.3.2 Filtration requirements for air monitoring equipment.

- A radiological particulate pre-filter (1~3 micron pore size, 25 mm diameter) when monitoring in a Contamination Area (CA), High Contamination Area (HCA), or Airborne Radioactivity Area (ARA), if instrument is capable. Not required, but encouraged in posted Radiological Buffer Areas (RBA).

- The “Bacterial Air Vent” filter (manufactured by Pall – Galman Laboratory) ahead of the radiological filter when monitoring from unfiltered tank systems. This is a sealed filter that cannot be opened for radiological survey purposes, in this case, dispose of as low level radioactive material waste if needed.

- The use of parallel, sacrificial sorbent tubes or sample media, or multiple filters may be necessary depending on intended use and equipment parameters. A specific radiological Release Survey Plan (RSP) would need to address this allowance.

3.3.3 Before conducting sampling or monitoring, contact the responsible Radiological Control personnel for the facility or area to determine any specific survey or monitoring requirements.

- Pre, during, and post contamination survey requirements.

- Any applicable RSP’s for your specific equipment or task.

- Alternative survey or monitoring needs to support the radiological release survey process.
3.3 Radiation and Contamination Control (Cont.)

3.3.4 Comply with the requirements set forth by the RWP, HPT coverage, Release Survey Plan (RSP), and any other applicable procedures as determined above.

3.3.5 When exiting radiological areas where no HPT coverage was provided, inform the radiological control personnel of the use/history for the equipment being presented (e.g., only sampled air in the Contamination Area, No known history of contamination based on use, etc.) to aid them in properly evaluating the radiological release criteria needed.

3.3.6 Samples collected in a radiological area shall not be removed from the facility, transported by personnel, or submitted to an analytical laboratory until they have been evaluated by an HPT in accordance with approved procedures.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:
- SKC - dual, tri or quad tube holder, jeweler’s flat head screwdriver
- Gilian - Allen key, dual, tri or quad tube holder, jeweler’s flat head screwdriver.

4.2 Performance Documents

The following documents may be needed to perform this procedure:
- Instruction manuals for the following:
  - Bios DryCal Primary Flow Meter
  - Gilian LFS-113DC Dual Mode Low Flow Air Sampler, and SKC AIRCHEK SAMPLER (model XR5000)
  - Gast Model 1532 High Flow Vacuum Pump.
  - TFC-ESHQ-S_IH-C-46, “Industrial Hygiene Reporting, and Records Management.”
  - TFC-ESHQ-RP_RWP-C-03, “ALARA Work Planning.”
  - TFC-PLN-34, “Industrial Hygiene Exposure Assessment Strategy.”

4.3 Field Preparation

4.3.1 ENSURE a review of applicable industrial hygiene sampling plan has been completed.
5.0 PROCEDURE

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.1 General Requirements for Conducting Personal and Area Air Sampling

NOTE - The Industrial Hygienist selects the sampling method and plans the sampling strategy.

- The sampling plan will include determining what, where, when, how, and types of activities to sample, as well as selecting the instrumentation that will accurately measure and adequately characterize potential exposures.

The sampling strategy should include:

- Personal monitoring wherever possible. Area monitoring shall be conducted only where personal monitoring is not feasible or additional data is desired.

- Performing personal monitoring on a cross-sectional representation of the work force to include worse-case exposure scenarios. TFC-PLN-34 can provide guidance regarding this.

- Sampling conducted for the duration of the work assignment/shift or as specified by the sampling method.

- Collection of a sufficient number of samples to obtain a representative estimate of exposure. Consider that contaminant concentrations vary seasonally with weather, production levels, time of day/shift, and in a single location or job class.

5.1.1 SELECT the sampling method or plan AND

PLAN the sampling strategy.

5.1.2 INFORM the Industrial Hygiene Technician (IHT) of the air sampling to be conducted, including all relevant information such as survey location, areas and employees to be monitored, contaminants to be sampled, sampling methodology, sampling duration, etc.
5.1 General Requirements for Conducting Personal and Area Air Sampling (Cont.)

NOTE - Survey report numbers can be obtained from the Site Wide IH Database (SWIHD) or log book, as necessary.

5.1.3 RECORD survey report number generated by SWIHD.

5.1.4 OBTAIN sampling equipment and media necessary to conduct sampling per the approved sampling plan, including field blanks per Attachment 1.

NOTE - Setting and checking flow rates shall be performed as soon as is practical before and after use, respectively, on the same shift, unless approved by IHT Supervisor, Project IH or Manager to deviate.

- Approval to deviate shall be documented in writing on the applicable IH Sampling Plan, dated & approving authority’s name printed & signed on this form.

5.1.5 PERFORM functional checks of the industrial hygiene sampling equipment (e.g., pump calibration) in accordance with Section 5.2.

5.1.6 PERFORM air sampling with multiple tubes following instructions in, Attachment 2 or Attachment 3 depending upon the industrial hygiene pump selected.
5.1 General Requirements for Conducting Personal and Area Air Sampling (Cont.)

NOTE - SWIHD will generate a unique sample identification number.
- A label should not be attached directly to a metal or glass TDU tube. Instead, the label should be put on the outside of the plastic bag that contains the TDU tube.
- Marking or taping the external Plexiglas covers for the TDU tubes will interfere with the lab analysis process.

5.1.7 OBTAIN a unique sample identification number AND
ATTACH number to each sample media.

5.1.7.1 IF attaching a label to a metal or glass TDU tube, ENSURE the label is be put on the outside of the plastic bag that contains the TDU tube.

5.1.8 PERFORM the following steps at the monitoring site to place the sampling instrumentation in the appropriate area or on the employee whose exposure is being assessed.

Personal Monitoring:

5.1.8.1 SELECT the employee to be sampled AND
DISCUSS the purpose and procedure for sampling with the employee and work area supervisor.
5.1 General Requirements for Conducting Personal and Area Air Sampling (Cont.)

5.1.8.2 STRESS the importance of not removing or tampering with the sampling equipment.

5.1.8.3 IF sampling equipment cannot be placed in the breathing zone, INDICATE on the sampling form the location of the sampling media and explain why it was placed in that location.

5.1.8.4 POSITION the sampling equipment on the employee(s) such that it does not interfere with work performance.

a. IF sampling equipment cannot be placed in the breathing zone, INDICATE on the sampling form the location of the sampling media and explain why it was placed in that location.

5.1.8.5 ATTACH the collection device (e.g., filter cassette, sorbent tube, etc.) to the shirt collar or as close as practical to the breathing zone of the employee.

NOTE - Sorbent tubes may be positioned vertically down or up depending upon, particulate contamination in the air, the specific sampling procedure, etc.

5.1.8.6 ENSURE the inlet of the collection device for particulates is in a downward vertical position to avoid gross contamination during the collection period.

5.1.8.7 POSITION and secure any excess tubing from the sampling train so it will not interfere with the employee’s work.

a. IF available, ATTACH the pump to the employee’s belt or place in a pocket.

5.1.8.8 CONFIRM the employee sampled by checking the name on their badge with the “Worn By” entry in the “IH Sampling Field Log”.

NOTE - Additional information may be obtained by using the employee’s HID number.

a. IF the “IH Sampling Field Log” is not used, CONFIRM the employee sampled by checking the name on their badge with the corresponding sample pump ID.
5.1 General Requirements for Conducting Personal and Area Air Sampling (Cont.)

5.1.8.9 INFORM the employee/work area supervisor (if new to this type of sampling) of the following general information:

- What is being sampled
- How the equipment works
- What will happen at the lab with the media
- When and where the sampling equipment will be installed and removed.

5.1.8.10 IF the sampling equipment needs to be removed prior to the end of the work activity,

OR

IF the pump stops or alarms during the sampling operation,
REQUEST the employee perform the following:

a. NOTIFY the IHT

b. IF pump stops and/or alarms occur, NOTE the time pump stopped and alarms were activated

5.1.8.11 IF the employee needs to leave the work area for a break or lunch, the IHT should, PLACE the pump on hold or turn the pump off, as applicable, immediately prior to the employee leaving contaminated area.

Area Monitoring:

5.1.8.12 IF conducting area monitoring, PLACE the sampling train in the area to be sampled AND

ENSURE that the inlet of the air contaminant collection device for particulates is positioned in a downward vertical position to avoid gross contamination.

5.1.8.13 POSITION the collection media at approximately a height above the floor or work surface to best characterize the breathing zone level at which employees may be exposed.
5.1 General Requirements for Conducting Personal and Area Air Sampling  
(Cont.)

NOTE - The correct flow rate can be checked using a calibrated flow meter in the correct flow range.

5.1.9 CHECK the pump’s operation periodically, e.g., every one to two hours to ensure it is running properly.

5.1.9.1 ENSURE the sampler is still assembled correctly, and the hose has not become pinched or detached from the sampling media or the pump, etc.

5.1.9.2 IF checking for the correct flow rate, USE a calibrated flow meter in the correct flow range.

5.1.9.3 RECORD any relevant observations.

5.1.9.4 IF a sampling problem arises that prevents obtaining a valid sample (e.g., pump fails, tubing disconnects, sorbent tube/cassette breaks, etc.), TERMINATE sampling AND DOCUMENT the problem.

5.1.9.5 IF appropriate and if time permits, INITIATE a new sample.

5.1.9.6 HANDLE the invalid sample in exactly the same manner as any other sample AND CONSULT with the Project Industrial Hygienist before disposition.
5.1 General Requirements for Conducting Personal and Area Air Sampling (Cont.)

NOTE - For any given analysis and job, field blank quantities are based on total samples collected, total days and media as described in Attachment 1.

- Passive samples (e.g., nitrous oxide badges), the field blank badge should only be opened briefly (i.e., a few seconds) to reduce the risk of field blank contamination.

5.1.10 PREPARE blank(s) for the survey for each type of media being used for sampling.

5.1.10.1 ENSURE blanks are handled and delivered to the analytical laboratory in exactly the same manner as the field samples, including the following:

a. ENSURE the blank(s) is/are taken to the field, with the exception that no air is drawn through the blank sample.

b. ASSIGN a unique sample identifier to the blank that will be included in the documentation and on the Industrial Hygiene Chain of Custody (COC) and Laboratory Request form.

5.1.11 WHEN preparing samples for delivery to the analytical lab, PLACE the field and blank samples in a re-sealable plastic bag unless otherwise indicated (e.g., asbestos cassettes).

5.1.12 COMPLY with the appropriate sample storage duration, temperature limits and shipping instructions as required by the analytical method or sampling plan (i.e., some samples may require storage in a cooler or other special handling) to ensure sample validity.

5.1.13 ENSURE that all pertinent sampling data is recorded including any visible airborne contaminants, work practices, potential interferences, and other relevant conditions in accordance with TFC-ESHQ-S_IH-C-46, “Industrial Hygiene Reporting and Records Management.”

5.1.14 COMPLETE the Industrial Hygiene Chain of Custody and Laboratory Request form to verify custody of the sample(s) until receipt by the analytical laboratory. (Refer to TFC-ESHQ-S_IH-C-46.)

5.1.15 DELIVER the samples, field blanks, and the Chain of Custody and Laboratory Request form to the analytical laboratory for the appropriate analysis.
5.2 Field Calibrating and Using Industrial Hygiene Pumps

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

- Setting and checking flow rates shall be performed as soon as is practical before and after use, respectively, on the same shift, unless approved by IHT Supervisor, Project IH or Manager to deviate.

- Approval to deviate shall be documented in writing on the applicable IH Sampling Plan, dated & approving authority’s name printed & signed on this form.

5.2.1 **OBTAIN** the proper air sampling pump for the survey.

5.2.2 **CHECK** that the maintenance calibration date on the sticker is current for the pump.

5.2.3 **IF** calibration is past due, **RETURN** pump to equipment custodian with a completed green tag, i.e., “IH Instrument Service Tag” (BT-6004-019) checking the box next to “Scheduled Maintenance Calibration”.

NOTE - See Attachment 3 for operating the SKC AIRCHEK SAMPLERs (model 224-PCXR8 and XR5000) and Attachment 2 contains information for operating the Gilian LFS-113DC Dual Mode Low Flow Air Sampler pump.

5.2.4 **START** the pump AND **RUN** for five minutes before calibrating.

5.2.5 **CHECK** that the pump is fully charged.

NOTE - Flow rate ranges are 2 - 500 ml/min (model DC-L500), 10 ml/min - 12 Lpm (model DC-L12K) and 20 ml/min - 20 Lpm (model DC-L20K).

5.2.6 **OBTAIN** a Bios DryCal electronic flow calibrator for the flow range needed.

5.2.7 **IF** use of the Bios Defender 510 DryCal is preferred, **REFER** to instructions listed in Attachment 11 - Use of the Bios Defender 510 DryCal.

5.2.8 **CHECK** that the maintenance calibration date on the sticker is current.

5.2.9 **IF** calibration is past due, **RETURN** the flow calibrator to equipment custodian with a completed green tag, i.e., “IH Instrument Service Tag” (BT-6004-019) checking the box next to “Scheduled Maintenance Calibration”.

5.2.10 **INSPECT** tubing to be used for holes or tears.

5.2.11 **STOP** the pump.
5.2 Field Calibrating and Using Industrial Hygiene Pumps (Cont.)

NOTE - The inlet and outlet ports of the primary flow calibrator are located on the right side of the unit. The lower port is for suction (labeled “OUTLET”) and the upper port is for pressure (labeled “INLET”).

- If a cassette adaptor is used, care should be taken to ensure that it does not come in contact with the back-up pad.

- With sorbent tubes, place them into the tube holder ports with the arrow (printed on sorbent tube) pointing toward the pump (direction of air flow), or if there is no arrow, insert the end of the tube with the smallest sorbent section (i.e., backup section) into tube holder port. If using thermal desorption unit (TDU) sorbent tubes or individually hand-packed tubes, consult the manufacturer or the lab for information regarding the orientation of the tube.

5.2.12 IF a cassette adaptor is used, USE care to ensure that it does not come in contact with the back-up pad in the cassette.

5.2.13 CONNECT the sampling media, tubing, and pump to the suction port of the calibrator.

5.2.13.1 IF using sorbent tubes, PLACE them into the tube holder ports with the arrow (printed on sorbent tube) pointing toward the pump (direction of air flow),

    OR

    IF there is no arrow on the sorbent tube, INSERT the end of the tube with the smallest sorbent section (i.e., backup section) into tube holder port,

    OR

    IF using thermal desorption unit (TDU) sorbent tubes or individually hand-packed tubes, CONSULT the manufacturer or the lab for information regarding the orientation of the tube.

5.2.13.2 LABEL each calibration sorbent tube with the media type, e.g., Hydrar, etc., the date the tube was first opened, and the specific lot # for that tube.

5.2.13.3 SAVE the labeled calibration tube for use during the post-function flow check.
5.2 Field Calibrating and Using Industrial Hygiene Pumps (Cont.)

5.2.14 START the pump.

NOTE - The calibrator will show the current flow, the average flow, and the number of readings in the average.

5.2.15 START the calibrator by pressing the “ON” button.

5.2.15.1 PRESS the “READ” button once for a single measurement of flow.

5.2.15.2 PRESS and hold it for a few seconds for continuous readings.

5.2.15.3 PRESS the “STOP” button once, to stop the readings.

5.2.16 ADJUST the pump to the appropriate flow rate required for the specific sampling method used.

5.2.16.1 IF the desired flow rate is not achieved, ADJUST the pump flow rate AND

REPEAT the calibration process until two consecutive average readings as noted above are within 2% of the appropriate flow rate.

5.2.17 CALCULATE the average flow rate of the above two consecutive readings.

NOTE - Unless otherwise stated by the specific sampling method, the same filter cassette and “individually packed” sorbent tube can be used both for the calibration (pre and post) and the survey. With other sorbent tube sampling, new sampling media from the same lot should be used to replace the calibration sorbent tube at the start of the survey.

5.2.18 UNLESS otherwise stated by the specific sampling method, USE the same filter cassette and “individually packed” sorbent tube for the calibration (pre and post) and the survey. (With other sorbent tube sampling, new sampling media from the same lot should be used to replace the calibration sorbent tube at the start of the survey.)

5.2.19 REPEAT Steps 5.2.13 to 5.2.17 for pumps that need calibration.

5.2.20 USE a currently calibrated rotameter to record flow rates approximately once every one to 2 hours, recording the time and flow rate and adjusting it to within ± 5% of the appropriate flow rate.
5.2 Field Calibrating and Using Industrial Hygiene Pumps (Cont.)

NOTE - It is recommended that 10 readings be taken before recording the average flow rate.

5.2.21 AFTER the survey is completed, PERFORM a field calibration check to determine the current flow rate through the pump AND RECORD the average of ten consecutive readings for each pump used in the field.

5.2.21.1 IF the ending flow rate is within ±10% of the initial flow rate, RECORD the ending flow rate.

5.2.21.2 IF the ending flow rate is not within the required tolerance levels, CONSULT the Project Industrial Hygienist to determine further actions to be taken.

5.2.22 CALCULATE an overall average using the flow rates recorded from the pre, post, and during the survey.

5.2.23 RECORD pre, post- and average flow rates as well as the start and stop pump times.

5.2.24 PROVIDE the completed sampling forms and associated field records to the Project Industrial Hygienist within 2 working days.
5.3 Using an Industrial Hygiene Pump to Fill a Tedlar Bag

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.3.1 OBTAIN an air sampling pump.

5.3.2 START and allow the pump to run for a few minutes to warm up.

5.3.3 STOP the pump.

5.3.4 ATTACH tubing from the outlet port (see manufacturer’s instructions for the SKC pump and for the Gilian to activate the port) of the pump to the Tedlar bag.

5.3.4.1 For the SKC pump, UNSCREW the large cap screw on top of the pump near the front and screw in the pressure port fitting.

5.3.4.2 For the Gilian pump, UNSCREW the outlet port/cap on top of the pump and attach a bag sampling boss.

5.3.5 OPEN the cock valve on the Tedlar bag.

5.3.6 START the pump and allow the bag to fill with air that is to be sampled.

NOTE - Filling to 80% capacity allows a safety factor for the bag such that environmental conditions like high temperatures will allow for further expansion without rupturing it.

5.3.7 WHEN the bag is sufficiently full (approximately 80% of capacity), STOP the pump AND CLOSE the cock valve on the Tedlar bag.

5.3.8 DISCONNECT the tubing from the exit port and the Tedlar bag.
5.4 Polypropylene Bag Sampling for HAPSITE Analysis

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

5.4.1 PRIOR to proceeding, ASK the Industrial Hygienist for any additional instructions.

NOTE - These pumps are labeled either “STACK/SOURCE ONLY” or “AREA ONLY”.

5.4.2 USE the sampling pumps designated for one of the following:

- A “source” sample
- General “work area” sample.

5.4.3 USE new sampling tubing that is made of Teflon or is Teflon-lined, AND

IF transition tubing is needed, USE new MASTERFLEX in as short a length as possible,

OR

USE new Tygon tubing in as short a length as possible.

5.4.4 BEFORE using, FLUSH the 1 liter polypropylene bag with clean air three (3) times,

OR

BEFORE using, FLUSH the 1 liter polypropylene bag with nitrogen three (3) times.

5.4.5 COLLECT a bag blank that has been flushed three (3) times at the same location where this was performed.

5.4.5.1 TREAT it as a field blank.

5.4.6 WHEN at the site, USE tubing AND

ATTACH the outlet port of the pump to the inlet of the sample bag.

5.4.7 WITH the inlet port of the pump at the desired sampling location (or by using sample tubing), OPEN the sample bag valve one turn counterclockwise AND

TURN the pump on.
5.4 Polypropylene Bag Sampling for HAPSITE Analysis (Cont.)

5.4.8 WHEN the bag is about 80% full, TURN the pump off AND SHUT OFF the valve.

5.4.9 COMPLETE the pre-printed bag label that indicates the following AND

- DRI number
- Date
- Sampling location, etc.

PLACE on the bag.

5.4.10 STORE the sample bag in the refrigerator AND NOTIFY the Industrial Hygienist that it is ready for analysis and interpretation.

5.4.11 DISCARD used tubing and sample bags.
5.5 Sampling Techniques

NOTE - Steps in this section can be performed in any logical order. Sections may be performed sequentially, concurrently or any logical order.

NOTE - Air sampling methods using filters, passive diffusion monitors, midget impingers/bubblers, sorbent tubes, and thermal desorption units (TDU) tubes are detailed in Attachment 4 through Attachment 9.

- The specific analytical method and calculation of the air volume will determine the analytical sensitivity (i.e., parts per million or parts per billion) for the individual contaminants being monitored.

5.5.1 ENSURE the tube used in the functional test is from the same lot as the tubes that will be used to sample in the field.

5.5.1.1 UNIQUELY LABEL this tube AND RETAIN tube for use in the post-sample function test.

5.5.2 SELECT the appropriate sampling media for the specific chemical contaminants to be sampled.

5.5.3 PERFORM the sampling in accordance with the industrial hygiene sampling plan or an approved analytical method. For more information, refer to the NIOSH, OSHA or EPA analytical methods manual or the Project Industrial Hygienist.

5.5.4 ENSURE that a radiological release is performed in accordance with Section 3.3 of this procedure, if applicable.

5.5.5 ENSURE each sample and blank is labeled with a unique sample identification number.

5.5.6 PROVIDE the completed sampling forms and associated field records to the Project Industrial Hygienist within 2 working days.

5.5.7 Project Industrial Hygienist will REVIEW AND APPROVE all industrial hygiene sampling forms that were completed by the IHT as specified in TFC-ESHQ-S_IH-C-46.
5.6 Records

Data and attachments are entered into the Site-Wide Industrial Hygiene Database and when reviewed and completed by the Industrial Hygienist, are uploaded to IDMS via an automated interface. The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Attachment 1 - Field Blank Criteria

For any given analysis and job, field blank quantities are based on total samples collected, total days, and sample media as follows:

- One set of field blanks per media will suffice for up to 10 active samples collected.
- For multiple days on the same job, at least 2 field blanks per media are required.
- For passive samples, at least 1 blank per media is the minimum requirement.

Example 1: One job of 9 active samples over 3 days will require a total minimum of 2 blanks per media because up to 10 samples requires only one field blank but the multiple days require 2 field blanks.

Example 2: One job of 9 passive samples over 3 days will also require a total minimum of 2 blanks per media because passive sampling always requires a minimum of 2 field blanks, and the multiple days also requires a minimum of 2 field blanks.

Changes to this field blank quantity determination shall be identified by the Project IH in the industrial hygiene sampling plan (e.g., asbestos personal sampling). These blanks may include opened but unused sorbent tubes, cassettes, etc.
Attachment 2 - Using the Gilian Low Flow Pump

NOTE - The Gilian LFS-113DC sample pump is used for air sampling systems with sorbent tubes and for filling gas sampling bags. See Figure 3 and Figure 4 and numbers in parentheses referenced in this section refer to the corresponding number of the sampler features depicted in these figures.

1. **CHECK** the maintenance calibration dates on the stickers are current for the Gilian LFS-113DC.
   a. **IF** calibration is past due, **RETURN** the pump to the equipment custodian with a completed green tag, i.e., “IH Instrument Service Tag” (BT-6004-019) indicating “Scheduled Maintenance Calibration” is due.

2. **ENSURE** the inlet filter assembly [2] is secured into the pump inlet (see Figure 3).

   **CAUTION**

   Over tightening the inlet assembly could damage the O-ring resulting in equipment damage and pump leakage.

3. **IF** the inlet filter assembly is loose, **TIGHTEN** it by rotating the knurled grip clockwise.

4. **PLACE** the recessed switch [5] (see Figure 3) (located on the front panel) in the up position, i.e.; “ON” to turn the pump on.

   **NOTE** - A green light indicates the battery will run for a minimum of 8 hours under maximum load conditions.

5. **CONFIRM** the battery check LED indicator light [6] is green AND **TURN** “OFF” the pump.

   **NOTE** - If the inlet is not blocked, a red LED light indicates insufficient battery voltage to maintain the present flow.

6. **IF** the fault indicator LED [7] is red, **ENSURE** the inlet is not blocked.

7. **IF** the inlet is not blocked, **RECHARGE** the battery.
Attachment 2 - Using the Gilian Low Flow Pump (Cont.)

Pump Mode Selection

NOTE - Constant flow mode is shown by a BLACK indicator; constant pressure or multi-flow sampling is shown by a WHITE indicator.
- The pump should be set in the constant pressure mode for sampling with multiple tubes. In this mode, two, three or four tubes can be used to collect samples with each tube set at a specific flow rate.
- The mode selector switch unlocks, indexes, and re-locks the mode selector valve into constant flow or constant pressure mode.

1. LOOK through the hole in the side of the case at the mode position indicator [3] (see Figure 4) AND CONFIRM that the pump is in the desired sampling mode.

2. IF the pump is not in the constant pressure mode, LOCATE the mode selector switch [4] on the back of the pump, adjacent to the top of belt clip AND PERFORM the following:
   a. INSERT the Allen key into the mode selector switch [4].
   b. ROTATE the Allen key counterclockwise approximately one full turn to unlock the rotor.
   c. ROTATE the Allen key approximately another turn counterclockwise until the switch clicks in AND ENSURE that the mode indicator switch turns WHITE.

   **CAUTION**
   Over tightening the rotor may cause equipment damage.

3. AFTER the constant pressure mode is confirmed WHITE, ROTATE the Allen key gently clockwise approximately one-half full turn until it stops, AND TIGHTEN it gently into the desired position.

Multiple Flow and Constant Pressure Calibration

NOTE - In the constant flow mode (black indicator), the unit is set from 5 to 200 ml/min by adjusting the flow control valve on the front of the pump.
- In the constant pressure mode (white indicator), the unit is set from 1 to 350 ml/min by means of a screw on the tube holder assembly.

1. ENSURE that the pump is in the constant pressure mode as indicated by the WHITE indicator.
2. IF the mode indicator is BLACK, CHANGE it as indicated earlier.
Attachment 2 - Using the Gilian Low Flow Pump (Cont.)

3. **OBTAIN** the flow rates (refer to sampling plan) for each sorbent tube **AND**
   **CALCULATE** the sum of all flow rates as follows:
   a. **ENSURE** the total of all flow rates does not exceed 350 ml/min.
   b. **IF** the total of all the flow rates exceeds 350 ml/min, **OBTAIN** another pump.

4. **PERFORM** set up for a dual, tri, or quad adjustable low flow tube holder for a sampling train as follows:
   a. **CONNECT** the tube holder to the inlet boss [10] with flexible tubing.
   b. **ENSURE** that the calibration tubes are from the same lot # as the tubes that will be used for sampling.
   c. **LABEL** each calibration sorbent tube with a unique identifier.
   
   **NOTE** - Do not remove sorbent tubes from the tube holder ports during calibration. All ports must be filled during calibration to represent a sampling train. Failure to comply may result in inaccurate flow rates.
   d. **USE** a tube breaker, and break off both ends of each calibration tube (or remove the cap) **AND PLACE** them into the tube holder with the arrow (printed on the tube) pointing toward the pump (direction of flow).
   
   **NOTE** - A low flow range calibrator (DryCal DC-Lite Meter model DC-L500) should be used when calibrating pumps that will be operated at low flow rates.

5. **OBTAIN** an electronic primary flow calibrator.

6. **CALIBRATE** the flow rate through each tube as follows:
   
   **NOTE** - Each tube holder port should have an opened calibration tube in it when verifying flow rates.
   a. **USE** flexible tubing **AND**
      **CONNECT** the open end of one calibration tube to the suction port labeled “Outlet” of the calibrator.
   b. **ENERGIZE** the pump, i.e., “ON” **AND**
      **ALLOW** it to warm up for at least five minutes prior to proceeding.
   c. **ENERGIZE** the calibrator, i.e., “On”.
   d. **PRESS** the “Read” button on top of the calibrator **AND**
      **OBSERVE** the flow rate through the sorbent tube.
Attachment 2 - Using the Gilian Low Flow Pump (Cont.)

NOTE - Turning the screw in a clockwise direction decreases the flow.

e. IF using a tri or quad tube holder, **ROTATE** the anti-tamper cover to expose the flow adjustment screws.

OR

IF using a dual tube holder, **ADJUST** the screw near the sorbent tube outlet.

NOTE - Do not adjust the flow control on the Gilian using the “FLOW ADJ” opening.

f. **ADJUST** the flow adjustment screw on the corresponding tube holder until the desired flow rate is achieved.

g. **PRESS** the “Stop” button on the calibrator.

h. **DISCONNECT** the flexible tubing attached to the calibrator from the sorbent tube **AND** **REATTACH** it to the next one.

NOTE - When using multiple tubes in a sampling assembly, flow rates should be verified twice at a minimum to ensure the proper flow rate was set for each tube.

i. **REPEAT** the above steps until all flow rate readings are maintained within 2% of target flow rates.

7. **RECORD** the calibration information in accordance with TFC-ESHQ-S_IH-C-46, “Industrial Hygiene Reporting and Records Management.”

8. **REMOVE** the calibration tubes from the tube holders **AND RETAIN** for post sampling calibration unless otherwise indicated.

9. **UNLESS** “individually packed” tubes were used for initial calibration, **INSTALL** new sorbent tubes into the tube holder for the survey.

10. **AFTER** use, **RETURN** the pump to the charger to recharge the batteries.

**Charging the Gilian LFS-113DC Pump**

1. **PLUG** Gilian dual rate charger into a properly grounded AC outlet.

NOTE - Upon insertion, the “NORMAL” rate red LED on the charger will light indicating active charging of the battery pack. Charger will operate in the normal mode for 15 hours and then automatically switch to the “TRICKLE” mode. This prevents the battery from being overcharged. Overcharging the battery pack will eventually lead to deterioration in the performance level of the battery pack.

2. **INSERT** charging jack into the pump’s charging receptacle [1] on Figure 3 located on the side of pump.
Attachment 2 - Using the Gilian Low Flow Pump (Cont.)

NOTE - Red “TRICKLE” LED is lit and discharging the pump’s battery pack by running the pump fully till it stalls each time which helps to erase the “memory” stored in it.

3. **CONFIRM** the “NORMAL” rate LED on charger is lit.

4. **IF** pumps are used for a short duration of time (an hour or less) **AND**
   
   **AFTER** inserting the charging plug into the charging jack, **PRESS** the white button to place to place charger into “TRICKLE” mode.

5. **IF** pump is stored for long periods without use (i.e., > 2 months),
   
   **OR**

   **IF** pump is only used for short periods of time (one hour or less),

   **PERFORM** the monthly discharge of pump’s battery pack as follows:

   a. **ENERGIZE** pump **AND**
      
      **ALLOW** to run until pump stalls.

   b. **INSERT** charging jack into pump’s charging receptacle.

   c. **ALLOW** pump to charge for at least 16 hours.

   d. **REMOVE** pump from charging jack.
Attachment 3 - SKC Model Airchek XR5000

1. **TURN ON** pump using any key, i.e., ▲, *, or ▼, until “On” is displayed.

2. **CHECK** the battery life to ensure 3 bars are showing inside the battery icon.

3. **WITH** the sampling train assembled and attached to the pump inlet, **USE** the DryCal to set the flow rate.

4. **ACCESS** the flow rate adjust menu by pressing *, ▲, ▼, *, while the pump is in the HOLD mode, i.e., blue light not flashing on top of the pump and/or flashing HOLD.

5. **PRESS** the * key until “ADJ FLOW” appears

6. **PRESS** ▲ or ▼ arrow until the desired air flow rate is set on the DryCal.

7. **LOCK** this flow rate by simultaneously pressing the ▲ and ▼ arrows.

8. **CLEAR** the run time as follows:
   a. **WHILE** in the “HOLD” mode, **ACCESS** the flow rate adjust menu by pressing *, ▲, ▼, *.
   b. **AT** the “CLr” display, **PRESS** the ▲ and ▼ arrows simultaneously, “0 min” will appear.
   c. **START** the pump by pressing the ▲ and ▼ keys simultaneously.

9. **PRIOR** to sampling in the field, **CHECK** the flow rate of the pump.
Attachment 4 - Collecting Filter Samples

NOTE - Filter cassettes are used to sample for particulates such as asbestos, metal fumes, total dust, lead, beryllium, and synthetic vitreous fibers. Common filter types include polyvinyl chloride (PVC) and mixed cellulose ester (MCE).

1. REFER to the sampling plan or the appropriate analytical method to determine the proper filter size and type to sample for the contaminant of concern.

2. OBTAIN the proper sampling pump and filter cassettes AND REMOVE the end caps from the cassettes.

3. ENSURE each cassette is labeled with a unique sample identification number.

4. ATTACH tubing to the outlet side of the cassette and to the inlet port of the sampling pump.

5. ENSURE air flows through the cassette are in the direction indicated on the cassette, OR as described in the sampling method.

6. PERFORM a pre-use function test for the sampling pump in accordance with Section 5.2.

7. ENSURE the sampling pump is set to the proper flow rate as indicated in the sampling method AND RECORD the initial flow rate.

NOTE - The cassette should be placed as close as possible to the employee’s breathing zone and is positioned downward to avoid loose particulates from entering the cassette.

- The cassette should be positioned downward and perpendicular to the wind when collecting asbestos area air samples to avoid loose particulates from entering the cassette.

8. USE a clip AND

ATTACH the filter cassette to the breathing zone of the employee to be monitored.

a. PLACE the pump in a pocket or clip it to a belt.

9. EXERCISE care during the sampling period to avoid any overloading of the filter, as indicated by loose particulates.
Attachment 4 - Collecting Filter Samples (Cont.)

10. IF overloading is observed, PERFORM the following:
   a. RECORD the stop time.
   b. RECORD the final flow rate.
   c. STOP the pump.
   d. REPLACE the filter cassette with a new one.
   e. START the pump.
   f. RECORD the start time.
   g. RECORD flow rate.
   h. CONTINUE sampling.

10. PLACE the pump on hold, OR turn the pump off, as applicable, at the end of sampling period.

11. IF the ending flow rate is within $\pm 10\%$ of the initial flow rate, RECORD the ending flow rate.

12. IF the ending flow rate is not within $\pm 10\%$ of the initial flow rate, CONSULT with the Project Industrial Hygienist to determine further actions to be taken.

13. PERFORM the post-use function test of the sampling pump as described in Section 5.2.

14. TURN off the pump.

15. DISCONNECT the filter cassette from the pump AND
    IMMEDIATELY seal the ends of the cassette with the caps provided.

16. ENSURE that a radiological release is performed, if applicable.

NOTE - The filter type and size should be included on the form as well as the location of the filter cassette during the sampling period (i.e., breathing zone or area sample).

17. COMPLETE the documentation.

18. PREPARE the appropriate number of blanks for the sampling activity AND ENSURE they are labeled with a unique identification number.
Attachment 5 - Respirable Dust Sampling Using Cyclones

1. **OBTAIN** the following to collect respirable dust samples as required per the sampling plan or as directed by the Project Industrial Hygienist:
   - Dorr-Oliver nylon cyclone sampling device
   - Plastic tubing
   - One liter calibration jar
   - Pre-weighed 37 mm, 2 or 3-piece 5 um PVC filter cassettes
   - Electronic primary calibration device
   - Sampling pump.

2. **VERIFY** the cyclone is clean by performing the following steps:
   - **NOTE** - The “grit pot” collects the particles that are not respirable.
   a. **UNSCREW** the end cap called the “grit pot”.
   - **NOTE** - Do not use an abrasive cleaner to clean the inside of the cyclone’s tube.
   b. **USE** a warm, mild, soapy solution **AND**
      **CLEAN** all the parts and let dry.
   c. **CHECK** that the O-ring is on the end of the tube prior to replacing the end cap.
   d. **REPLACE** the end cap **AND**
      **MAKE** sure the cap is tightened until snug.

3. **ENSURE** a unique sample identification number is attached to each filter cassette.
   - **NOTE** - The filter cassette used for function testing the pumps should be from the same lot number as the cassettes to be used for sampling.

4. **REMOVE** the lid of the calibration jar **AND**
   - **INSTALL** a 37 mm, 2 or 3-piece 5 um PVC filter cassette on the filter holder of the cyclone device placed in the calibration jar, **THEN**
   - **CONNECT** it to one of the tubes protruding through the bottom of the lid.
Attachment 5 - Respirable Dust Sampling Using Cyclones (Cont.)

5. REPLACE the lid of the jar AND CONNECT the plastic tubing extending from the jar (that’s connected to the cyclone) to the sampling pump and the other tubing to the electronic primary calibrator.

6. TURN on the sampling pump AND ALLOW it to warm up for five minutes.

NOTE - If a different type of cyclone is used, refer to the sampling plan or approved analytical method to determine the proper flow rate.

7. WHEN using this type of nylon cyclone, ADJUST the flow rate of the sampling pump to 1.7 liters per minute as required AND RECORD the flow rate.

8. TURN off the calibrator and the sampling pump.

9. DISCONNECT the sampling pump from the calibration jar.

10. REPEAT Steps 5 through 9 for all pumps to be used for sampling.

11. USING plastic tubing, ATTACH a new cyclone sampling train with filter cassette to the air pump.

NOTE - Make sure that the inlet port of the cyclone is facing outward away from the employee to ensure proper air flow into the cyclone. Ensure that it cannot be blocked by clothing or other barriers such as a collar or hood.

12. ATTACH the clip of the cyclone device in the breathing zone of the employee to be monitored AND PLACE the pump in a pocket or clip it to a belt.

13. AFTER the survey, RECONNECT the air pump and cyclone sampling train to the calibration jar.

14. TURN on the calibrator and the sampling pump.

15. CHECK the ending flow rate of the sampling pump.

   a. IF the ending flow rate is within +/- 10% of the initial flow rate, RECORD the ending flow rate.

   b. IF the ending flow rate is not within the required tolerance levels, CONSULT with the Project Industrial Hygienist to determine further actions to be taken.
Attachment 6 - Organic Vapor and Gas Sampling Using Solid Sorbent Tubes

1. **BREAK** or cut off both ends of the sorbent tube before sampling to provide an opening approximately one half the internal diameter of the tube.

2. **OBTAIN** the proper sampling pump as directed by the Project IH AND **PERFORM** functional checks in accordance with Section 5.2.

**NOTE** - Sorbent tube holders may be used to protect the tubes from breakage and minimize the exposure to sharp edges for the wearer. The sampled air should not pass through any tubing before entering the sorbent tube unless allowed by the sampling method. Some analytical methods require a filter cassette in the sampling train before the sorbent tube.

  - In most solid sorbent tubes, the smaller sorbent section is a backup for any breakthrough of gases or vapors from the front section.

  - To minimize gas channeling, the sorbent tube should be placed in a vertical position in the breathing zone with the inlet facing up or down.

3. **POSITION** a sorbent tube in the sampling train so that airflow through the tube is in the direction indicated by the arrow on the tube AND **ENSURE** that the backup section is positioned nearest the sampling pump.

4. **REFER** to the sampling plan or the approved sampling method to determine the correct flow rate.

5. **SET** the pump to the designated flow rate for each type of sorbent tube being used.

6. **RECORD** initial flow rate.

7. **USE** a clip AND **ATTACH** a new sorbent tube in the breathing zone of the employee to be monitored AND **PLACE** the pump in a pocket or clip it to a belt that is placed around the waist of the employee.

8. **WHEN** sampling is completed, **REMOVE** the solid sorbent tube AND **IMMEDIATELY** cap both ends of the tube with the supplied plastic caps.

9. **RECORD** the stop time.

10. **PERFORM** a post-calibration test.

11. **RECORD** the flow rate, and turn the pump off.
Attachment 7 - Organic Vapor and Gas Sampling Using Passive Diffusion Badges

NOTE - Passive diffusion badges are useful for screening and monitoring exposures to organic and other toxic vapors and gases. Badges are available to detect exposures to airborne contaminants such as mercury, nitrous oxide, organic vapors, formaldehyde, etc.

1. **OBTAIN** the proper passive badge to monitor for the chemical of concern.

2. **FOLLOW** the manufacturer’s instructions very carefully during storage, use, and analysis.

3. **ENSURE** the shelf life for the passive badge has not expired.

NOTE - Some passive badges, such as a nitrous badge are pre-labeled with an identification number. This number should be incorporated as part of the Site-Wide Industrial Hygiene Database sample ID number.

4. **LABEL** the passive badge with the unique identification number generated by the Site-Wide Industrial Hygiene Database.

NOTE - When attaching the sample to the employee, it should be attached in the breathing zone.

5. **IMMEDIATELY BEGIN** sampling by attaching the monitor to the employee OR by placing it in the sampling area.

6. **CONFIRM** the minimum sampling period so the analytical detection levels are approximately 50% of the TLV (e.g., mercury should be sampled for a minimum of four hours).

7. **IF** possible, **SAMPLE** for 8 hours OR **SAMPLE** to whatever exposure time that is desired that is within the capability of the monitor.

8. **IMMEDIATELY AFTER** sampling, **SEAL** the badge with the provided container or material as directed by the manufacturer’s instructions.
Attachment 8 - Organic Vapor and Gas Sampling Using Thermal Desorption Unit Tubes

NOTE - TDU tubes are useful for screening and monitoring exposures to organic vapors and gases.

1. **OBTAIN** the following:
   - Appropriate number and type of TDU tubes:
     - CarboTrap 300 tubes
     - Perkin-Elmer
     - TDS3 tubes
   - Low flow sampling pumps.

NOTE - Be sure NOT to apply tape or labels directly to the sampling tubes. Attach the label to the plastic bag that the TDU tube and container was shipped in.

2. **ENSURE** each TDU tube is labeled with a unique sample identification number.

3. **REMOVE** the tube from the shipping container.

4. **REMOVE** the end caps from the tube that is to be used to perform the calibration for the sampling pump.
   a. **IF** using the metal TDU tubes, **USE** a 9/16” and ½” wrench, taking care to avoid touching the tube body with a bare hand or fingers **AND**
      **LOosen AND REMOVE** the end swage fittings.
   b. **IF** using the TDS3 tubes, **REMOVE** the storage end caps **AND**
      **USE** a gloved hand **AND**
      **INSTALL** the sampling caps.

NOTE - The OUTLET sampling cap is the cap with the hose barb. The sampling tube should protrude from the container body by 1/8” (3 mm) on the INLET end of the tube.

1) **IF** the inlet end of the tube protrudes more or less than this, **SLIGHTLY** tighten or loosen the OUTLET cap until the proper distance is achieved.

2) **INSTALL** the INLET cap (the female luer fitting with a clip attached).

3) **IF** using the TDS3 tube for calibrating the flow rate through it, **USE** a male luer fitting to the hose barb fitting to attach plastic tubing to the TDS3 system.

4) **TIGHTEN** both sampling caps simultaneously until they are snug **AND**
   **DO NOT** over-tighten.
Attachment 8 - Organic Vapor and Gas Sampling Using Thermal Desorption Unit Tubes (Cont.)

NOTE - The ringed end of the metal TDU tube is the inlet end. If using Perkin-Elmer tubes, the inlet is located nearest the “P” on the “Perkin-Elmer” label.

5. **ATTACH** the TDU tube to the sampling pump using flexible tubing AND **ENSURE** sure air flow is moving in the correct direction through the tube.

NOTE - If appropriate, the TDU tube used for the pre-use function test should be retained for performing the post-use function test.

6. **PERFORM** the pre-use function test of the sampling pump in accordance with Section 5.2.

7. **ENSURE** the sampling pump is set at the proper flow rate as indicated in the sampling method AND **RECORD** the flow rate.

NOTE - It is recommended to remove the end caps immediately prior to sampling. Once the fittings have been removed, the tube will be passively sampling the ambient environment.

8. **OBTAIN** a new TDU tube and remove the end caps.

9. **INSTALL** the new TDU tube into the sampling train.

10. **REPLACE** the end caps on the TDU tube(s) immediately after sampling is completed AND **PLACE** the tube(s) into the original shipping container.

11. **RECORD** stop time.

12. **OBTAIN** the TDU tube used for the pre-sampling function test AND **PERFORM** a post-use function test of the sampling pumps.

13. **IF** flow rate is within 10% of the initial flow rate, **RECORD** the flow rate.
Attachment 9 - Sampling With Midget Impingers/Bubblers

NOTE - Midget impingers/bubblers are used for sampling certain gases, vapors, mists or dust particles. Impingers are Pyrex® glass or plastic tubes that can be filled with a method-specific liquid medium to collect airborne hazards. An air sample pump is used to pull a known volume of air through the impinger. After the air is “bubbled” through the impinger, airborne concentrations are determined by analyzing the liquid.

- An impinger may be mounted on the side of an air sample pump or put into a holster and placed near a worker's breathing zone.

- Care must be taken in preparing impingers/bubblers to ensure that their tips are not damaged and that their joints can be securely tightened. Use a trap with impingers to prevent impinger liquids from being drawn into the sample pump. Solid sorbents may be added downstream of the trap to protect the pump chamber from exposure to vapors when using a volatile liquid. Refer to the manufacturer’s instructions for more information about the care and use of the impinger.

1. **ASSEMBLE** a sampling train consisting of the following:
   - Sampling pump
   - Trap
   - Impinger.

NOTE - SKC impingers have printed serial numbers on both sections to assist with sample identification and to ensure proper part matching.

2. **ENSURE** the impinger is labeled with a unique sample identification number.

3. **RINSE** the impinger/bubbler with the appropriate reagent for the contaminant being sampled.
   a. **ADD** the specified amount of this reagent (as defined by the substance-specific sampling method) to the impinger flask.
   b. **DO NOT** add over 10-15 milliliters (ml) of reagent to prevent overflowing.

4. **PERFORM** pre-use functional checks of the sampling pump.

5. **RECORD** flow rate and start time.

NOTE - Excessive tilting during sampling may cause the reagent to flow out of the impinger and into the secondary impinger, trap, or sampling pump.

- In some instances, it may be necessary to add reagent during the sampling period to prevent the level of reagent from dropping below one-half of the original amount.

6. **IF** performing personal sampling, **CAUTION** the worker to avoid movements that would tilt the impinger during the sampling period.

7. **PERFORM** a post-use function test of the sampling pump.

8. **RECORD** flow rate and stop time.

9. **CONFIRM** pre and post flow rates are within 10 % of each other.
Attachment 9 - Sampling With Midget Impingers/Bubblers (Cont.)

10. **REMOVE** the stopper and stem from the impinger/bubbler flask.
11. **RINSE** the inside and outside of the stem directly into the impinger/bubbler flask with a small amount (1 or 2 ml) of the sampling reagent.
12. **POUR** the contents of the flask into a sample bottle,
13. **RINSE** the flask with a small amount of reagent,
14. **POUR** the rinse solution into the bottle **AND**
    **SECURELY CAP** the bottle.
Attachment 10 – Considerations for High Relative Humidity

Manufacturer specifications for temperature and humidity ranges are listed in Section 2.2. The concern with high humidity is water condensation may shorten pump life or result in pump failure by damage to the internal electronics. These conditions are readily apparent if the flow or function of the pump begins to fail.

When humidity ranges approach the recommended maximum humidity range or condensing conditions are likely, one or more of the following precautions should be taken:

- Provide external heat to the pump to increase the dew point temperature. This can be accomplished by using methods such as insulated enclosure or simply taking the pump to a location where it can be warmed up. The goal should be to keep the temperature about 10°F higher than the air being sampled.

- Increase monitoring of flow rate indicators, such as by using the internal or an external rotometer more frequently.

- Watch for any indicators of condensate in tubing entering or exiting the pump.

- Have a spare pump available in a relatively warm location in case exchange is needed.
Attachment 11 - Use of the Bios Defender 510 DryCal

1. **CHECK** the maintenance calibration date for expiration.

2. **IF** not expired, **USE** it.
   a. **IF** calibration is past due, **RETURN** the flow calibrator to the equipment custodian with a completed green tag, i.e., "IH Instrument Service Tag" (BT-6004-019) indicating "Scheduled Maintenance Calibration" is needed.

3. **TURN** on the instrument by pressing the On/Off button.

4. **CHECK** the battery level using the icon in the display.

   **NOTE** - A fully charged battery will power the unit for about 6 to 8 hrs with the backlight off. Battery icon will empty in 20% increments.

5. **USE** ¼ inch inner diameter tubing to connect the pump to the Bios suction fitting (upper port).

6. **SET** the configuration menu using the following key strokes:
   a. **CHOOSE** the "SETUP" command using the cursor controls **AND PRESS** "Enter".

   **NOTE** – "Readings" is the number of measurements calculated for the average with a range of 1 to 100. Default value is 10.

   b. **SELECT** "Readings" **AND PRESS** "Enter".

   c. **CHOOSE** the number of readings preferred using the left and right arrows.

   **NOTE** – The "Time Between" parameter will place a time delay between consecutive measurements with a range of 0 to 60 minutes. The default value is 0.

   d. **PRESS** the down arrow to select "Time Between".

   e. **CHOOSE** the value preferred.

   f. **SCROLL** to "Confirm" **AND PRESS** "Enter" to save the changes.
Attachment 11 - Use of the Bios Defender 510 DryCal (Cont.)

g. **IF changes are not wanted, CHOOSE "EXIT" AND PRESS "Enter".**

h. **CHOOSE "Units" to select the flow rate units AND PRESS "Enter".**

i. **SELECT the unit using the left and right arrows AND PRESS "Enter".**

j. **IF needed, SET the "Time", "Date" and their formats.**

k. **SCROLL to "Preferences" AND PRESS "Enter", THEN CHOOSE "Read Default" AND PRESS "Enter".**

NOTE – Step (l) will allow the DryCal to save power by shutting down after 5 minutes of inactivity.

l. **SELECT "Power" AND PRESS "Enter", THEN CHOOSE "On" under "Power Save" AND PRESS "Enter".**

m. **UNDER "Backlight", PICK "On" to be able to illuminate the display.**

NOTE - In the "MEASURE" mode, the options of “SINGLE”, “BURST” and “CONT.” (Continuous) measurement are available.

- In “SINGLE” measurement, when the "Enter" key is pressed, one measurement will be made.
- In “BURST” measurement, readings will continue automatically until the preset number of measurements has been made.
- In “CONT.” (Continuous) measurement, readings will continue automatically until manually stopped.

n. **WHEN setting the configuration menu has been completed, SCROLL to "MEASURE" AND PRESS "Enter".**

NOTE – Other commands include:

"PAUSE" – This ends the current flow measurement but leaves the average flow and previous flow measurement on the screen.

"RESET" – Terminates the flow measurement and clears the screen.
Attachment 12 - Operation of the Gast Model 1532 High Flow Pump

**EQUIPMENT SAFETY**

**CAUTION**  Pump is not intrinsically safe.

**CAUTION**  Pump is heavy and weighs about 8 lbs.

**CAUTION**  Wear safety glasses while operating the pump.

**CAUTION**  Let a cold pump come to ambient temperature before starting it.

**CAUTION**  Protect all surrounding items from the potentially hot exhaust air.

**CAUTION**  Do not pump or evacuate any other gases, fluids, particles, solids or substances mixed with air, particularly combustible substances that are likely to cause explosion.

**CAUTION**  Water vapor, oil-based contaminants, and other liquids should be filtered out.

**CAUTION**  Corrosive gases and particulate material will damage the pump.

**CAUTION**  Install and use in protected environments only. Pump is not weather proof. Protect pump from dirt and moisture.

**CAUTION**  To avoid the risk of electrocution, do not install or operate the pump in areas where it can come into contact with water or other liquids.

**CAUTION**  To prevent overheating, do not block the flow of cooling air over the pump. Pump ventilation grills should be kept clear of debris and obstruction. Do not place fingers, metal tools, or any other object through the grill holes.

**GAST MODEL 1532 HIGH FLOW PUMP OPERATION**

1. **CHECK** the maintenance calibration date for expiration.

2. **ATTACH** tubing from the pump inlet to the calibration cassette outlet.

3. **CONNECT** the calibration cassette inlet to the suction side of a calibrated rotameter, eg “SKC Field Rotameter”.

4. **WITH** the power cord plugged into an A/C outlet, **TURN** on the pump using the On/Off switch located on the power cord.

5. **USE** the rotameter **AND**

   **ADJUST** the flow rate to the desired setting by turning the flow adjust clockwise or counterclockwise.

6. **TURN OFF** the pump **AND**

   **REPLACE** the calibration cassette with a sample cassette.
7. **AT** the location of interest, **SET** the sample cassette at breathing zone height and turn the pump on.

8. **SAMPLE** for the exposure time indicated by the industrial hygiene sampling plan.

9. **TURN** the pump off **AND**.

   **CONDUCT** a post – function test using the sample cassette.

10. **INSERT** plugs to the open ports to prevent dirt and other contaminants from entering the pump.
Attachment 13 – Sampling Guidance for Dimethyl Mercury

REFERENCES
- INSP-IHSP–CMHZ-10 Source sampling for DMHg
- IHSP-RETRY-AY-35 Environmental Sampling Requirements During Retrieval at 702AZ and AP Exhauster
- Eurofins Guidelines for Measuring Dimethyl Mercury In Air
- DOE/RL-96-68 HASQARD requirements 6/1/07 rev 3.

PRECAUTIONS and BEST PRACTICES

Dimethyl Mercury (DMHg) sample media becomes light & moisture sensitive after sampling. This requires that it be wrapped with aluminum foil prior to sampling and undergo a specific drying process at 222-S Labs the same day of sampling. Samples CANNOT be refrigerated and sent over the next day.

Prior arrangements MUST be made with Sample Management Office (SMO) (J.M. McKinney (née Johnson), manager) at 509-372-9474 to:
- Retrieve media from storage and wrap with aluminum foil for light sensitivity.
- Coordinate technician support for the drying process.

CONTACT SMO at least three business days prior to planned sampling, to order media.

CONTACT SMO again when sampling has begun with an estimate of arrival time

Samples must be received no later than 1500 (3 pm) of the day sampled. Plan accordingly.

1 day prior to the sampling event:
- ENSURE sufficient Blue Ice (or equivalent) is available.
  - Samples must be cooled to ~39°F immediately (stage cooler in change trailer)
  - Water/ice not acceptable.

- OBTAIN sample media and PREPARE the sampling train
  - Media is supplied from Eurofins as two traps connected in series.
  - Keep sample media tubes horizontal and handle gently to avoid separating media.
  - Sample traps have individual identifiers, but not lot numbers
  - Request an extra set of media for use as a field spare.
    -- If not needed as a spare, it can be separated into its individuals and utilized as the field blanks if not otherwise provided for.
    -- The media can get jostled and may not be able to yield the correct flow range.
    -- Having a back-up set can avoid wasting a sample event.
    -- If not utilized at all, it can be returned to 222-S labs.
    -- The field blank can also be used as a spare, however, send for another while still in the field

- Sampling in high moisture environments may require use of three traps in series.
  -- As of yet, WRPS has not seen breakthrough into a third trap.
  -- It would be necessary to contact Eurofins to have these prepared and sent to WRPS.

Label each sample tube from inlet end toward pump as A, B, etc., following the flow arrow.
(1 day prior continued)

Leak testing of ALL components is critical. Minimization of leakage in any part of the flowpath is critical due to the extremely low sample masses. Eurofins requires leak rates less than 4% of the sample flow. i.e. less than 2 mL/min of all components summed, or when tested as a whole.
--Care must be taken to slowly pressure/vacuum and equalization so as not to “blow out” the sample media within the trap.
--Flow adjusters are prone to leaks around the adjustment screw.

Sample Pumps: One XR-5000 required for each train, combining trains with a tee at the pump end will not work. However, a tee at the inlet end can be utilized.

One field blank per sampling evolution is sufficient.

During the sampling evolution, DOCUMENTATION and FIELD NOTES are critical to success.

DOCUMENT the following in the survey:
1. The survey title must describe the location and nature of sample
2. That Teflon-lined tubing was used for the inlet to the train (if used to connect to a source)
3. That a leak check on the train was performed
4. Whether Teflon lined or solid Teflon sample line was used, record the length and note it was purged at least 3 volumes (record time and flow rate of purging)
5. Identify local prevailing wind direction whether different or identical to the Meteorological Station.
6. Include flow rate data in the COC for Eurofins/222S lab.
7. Note any changes or unusual conditions that occurred during sampling.
8. Note if weather conditions were stable, or if not, during the sampling period.
9. State where the field blank was opened.
10. Note the time from end of sampling, until the sample tubes were put on Blue Ice for transport
11. Note the time of delivery to the laboratory on the COC.
12. Require to have the temperature received at the 222S lab written on the IH COC.

They have a separate form where they usually record this, but we need it on our COC form.

SAMPLING STEPS

1. Walkdown the proposed sampling location. IDENTIFY sample location with the IH if using Multi-Function Tree (MIT), or vapor probes in the Double Shelled Tanks (DSTs). Sample tube location, diameter, and length of run need to be evaluated.
   DOCUMENT location of sample port and above information in the survey.

2. OBTAIN:
   • Appropriate number of Al foil wrapped DMHg sample media A and B sets with flow indication arrow marked on foil.
Request an extra set for use as a spare.

**Attachment 13 – Sampling Guidance for Dimethyl Mercury (Cont.)**

- Aluminum foil for sample line covering to prevent light deterioration of DMHg.
- Sampling Pumps  SKC XR5000 preferred.  1 pump for each sample train.
- DMHg labeled constant pressure adapter. These have been adjusted to maintain 38-40 inches of water column vacuum. Normal (CPC) units will flow fault due to the high back pressure of DMHg media.
- BIOS DryCal/Defender Series devices.  Milliliter (mL) range required. One for each sample set inline, and one for calibration of total flow on the inlet side. i.e. 3 DryCal/Defender Series for one pair of samples, 5 for two pairs.
- Appropriate number of RadCon approved <3µm inline particulate filters. All filters MUST be Fluoropore (mfg by Millipore) or Zefluor (mfg by Pall) teflon-based products.  MCE or PVC will retain DMHg and invalidate the sample. Two filters must be in-line with the sample sets. Eurofins may supply one filter per set. Eurofins CANNOT accept radioactive samples.
- Sample cooler with sufficient Blue Ice (or equivalent non-water ice packs) to maintain <39°F during the sampling evolution and transport to 222-S (typically 3-4 hours). Temperature does not need to be recorded, as 222-S will measure & record upon receipt.
- Sufficient Teflon-lined or solid Teflon tubing.  All sample connections and tubing MUST be Teflon-based, as any non-fluoropolymer will absorb DMHg.  This includes inlet tees and filter surrounds.  No metal connector adapters are permitted due to potential decomposition.
- Table and support structure (sunshade tent) for the long sample train. Protect sample train from direct sun, wind, vibration, etc. In strong sunlight, sample tubing must be covered with aluminum foil to reduce any deterioration of DMHg in transit between sample port and sample train. Use of duct tape to fasten down sample trains and traffic barrier tape to keep people away from sampling equipment is recommended.

**NOTE**  All flowmeters, valves, connections, etc. MUST be leak tested prior to sampling. Best practice has been found to put the component being tested directly in circuit with a DryCal/Defender Series connected to an XR-5000 without a CPC.  Cap the end of the component, and observe the flow thru the DryCal.  Flow-faulting of the XR-5000 is insufficient.

3. Calibration in the Field.  (both pre- and -post calibration checks) See diagram in section 6 ENSURE that all RadCon filtration, and the actual length of Teflon tubing necessary from sampling table to the sample port are utilized for calibration. REMOVAL of the tee on the inlet side of the two sample sets required to set flows. CONNECT DryCal #1 at the sample port connection end of the required Teflon sample tubing run.
   a. SET the flow through DryCal/Defender Series at 50-55 mL/min.
   b. RECORD flow rate of DryCal/Defender Series as the “Pre-Flow” in your survey.
Attachment 13 – Sampling Guidance for Dimethyl Mercury (Cont.)

NOTE  The reading of DryCal/Defender will not be equivalent to DryCal/Defender Series. Differences are typically ~5-10 mL/min due to the flow restrictions imposed by the filters, media, & flow adjuster.

c. RECORD flow rate of DryCal/Defender Series  This will be your baseline for adjustment if necessary during sampling period.

d. REPEAT with the second sample trap set-up.

e. RECONNECT the sample tee prior to sampling.

4. Preparation for sampling in the field
a. REMOVE Dry Cal/Defender Series and CONNECT to source.
b. CALCULATE purge time/volume of the required length of sample tubing
c. PURGE sample thru tubing for a minimum of 3 times the calculation above. RECORD purge time/volume in field notes.
d. Form a “U” in the sample line prior to the RadCon filter at the split “tee” to collect any moisture. Glass condensation traps are suitable, but must be oriented and drained regularly such that the sample does not bubble thru any collected moisture. Previous experience indicated difficulty attaching Teflon tubing to glass traps.

5. Sampling Train Layout:  Sampling MUST always performed in duplicate.
(See also Photo 1 at end of attachment)
Attachment 13 – Sampling Guidance for Dimethyl Mercury (Cont.)

NOTE If a sample set is inadvertently connected and sampled backwards, the sample can be salvaged by:

a. **LABEL** the sample train as to actual sample flow direction
b. **DOCUMENT** the reversal of flow direction in field notes
c. **CONTACT** 222-S SMO to inform them about discrepancy. **PRIOR** to delivery, they will correctly flush dry the sample set in the corrected direction and inform Eurofins of the error in sampling direction

6. **RECORD** flow rate of DryCal/ #2 (Both A and B) every 30 minutes of sampling. **IF** flow has changed by more than 10%, **ADJUST** flow to appropriate pre-sampling flow --media backpressure is a function of humidity

7. At conclusion of sampling period, **DISCONNECT** sample line from sample port. **PERFORM** post sampling calibration check as in section 3 above. **RECORD** total time of sampling to nearest half minute.

8. **IF** this sample is subject to the HASQARD process, it is performed subject to a Data Quality Objectives Document. HASQARD has a special Chain of Custody and seals that must be used. Sign the COC when you turn the tubes over for transport to 222-S lab and record the ‘as received’ temperature on the form. The transporter must sign when turning it over to the lab. HASQARD has its own requirements for recording of sample period, flow, etc.

Photo 1, Sampling Train Assembly
Figure 1 - Types of Low Flow Tube Holders

Dual Tube Holder

Tri Tube Holder

Quad Tube Holder
Figure 2 - Low Flow Tube Holder with Adjustment Screw
Figure 3 - Gilian Model LFS-113 Front, Side, and Top Views

1. Charging Jack
2. Inlet Filter Assy.
3. On/Off Switch
4. Battery Check Indicator
5. Fault Indicator
6. Clock Display
7. Flow Control Valve
8. Inlet Boss
9. Outlet Port/Cap
10. Belt Clip
Figure 4 - Gilian Model LFS-113 Back and Side Views

3. Mode Position Indicator
4. Mode Selector Switch
12. Bag Sampling Boss
14. Case Screws (4)
15. Battery Pack