

## Chapter 8

### Sampling for Mercury Vapors

#### Overview

The purpose of personal air monitoring is to determine an individual's exposure to airborne metallic mercury vapor. A sampling device is placed on the employee within his/her breathing zone, which usually involves clipping the monitor to the shirt collar. The sampling time is dependent on the objectives of the survey. The sampling results are compared to either predetermined values established by the company or to regulatory standards to ascertain whether corrective action is needed to ensure the health of the employee. MSHA's full-shift exposure limit is  $0.050 \text{ mg/m}^3$ . Exceeding this limit requires corrective action.

#### Personal Air Monitoring

There are two sampling methods that can be used to obtain an individual's exposure to airborne mercury vapor:

1. Passive diffusion monitors can be used to collect full-shift samples. The primary benefit of using this sampling protocol is the ease of use.
2. The other method is active-integrated sampling, which entails using a calibrated sampling pump and a sorbent tube. The pump draws air, at a predetermined flow rate, through a sorbent tube where the contaminant is captured. The sorbent tube is sent to a laboratory to determine the amount of the contaminant collected on the sampling media. The results for both air monitoring methods are presented in either  $\mu\text{g/m}^3$  or  $\text{mg/m}^3$  of mercury.

#### *Passive Diffusion Monitoring*

Sampling using a passive diffusion monitor is very easy. You should identify the employee that you would like to sample and meet with them to explain the sampling goals and procedures. Choose your sampler (either the gold film or Sorbent Capsule) and clip the monitor in their breathing area, most likely on the lapel or shirt pocket. Open the cover and start monitoring. An activity log should be kept by the employee during the test to help identify problematic areas or activities in the event the sample exceeds the allowable limits (MSHA's full-shift exposure limit is  $0.050 \text{ mg/m}^3$ , the ACGIH TLV is  $0.025 \text{ mg/m}^3$ ).

Direct the employee that is being sampled not to cover or handle the passive diffusion monitor. The monitor should be worn throughout the entire shift. You should check on the monitoring every few hours to verify that it is being worn correctly and not being tampered with. At the end of the sample period, remove the sample and follow the manufacturer's recommendation for processing the sample. Sorbent capsule typically will require removing the sorbent capsule and cleaning the holder. Gold film badges typically require removing a perforated cloth that is used to keep particulate out of the monitor. Seal the sample and send it to the lab for analysis. During sampling it is

important to log the serial number of the passive monitor, the date and time the sample started and ended in addition to maintaining a complete record of chain of custody.



The SKC Sorbent Capsule  
Passive Monitor



The CHEMDISK II  
Gold Film Badge Passive  
Monitor

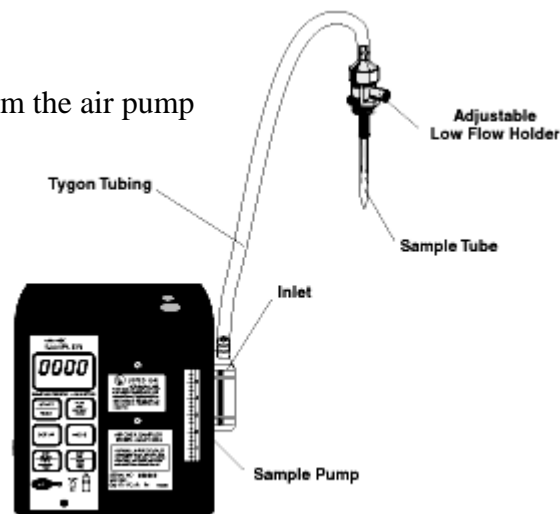
### ***Active-Integrated Sampling***

Active Integrated Sampling for mercury utilizes a sampling pump, Tygon tubing, an adjustable low flow tube holder and the sorbent tube. The sampling pump should be calibrated to .2 LPM before sampling (please see the Calibration Procedures Chapter). (Use NIOSH Manual of Analytical Methods 6009)

### **Sampling Train**

The sampling train (see picture 1) will consist of:

- Air sampling pump
- Tygon tubing, the tubing must be long enough to reach from the air pump (at person's waist) to the cassette (at the person's collar)
- Adjustable Low Flow Holder. The tube holder will hold the sorbent tube and have a clip that will clip to the person's collar.



### **Sampling Procedures**

- Select employees to be sampled. Explain that the purpose of the sampling is to monitor the employee's exposure to lead or arsenic dust and/or fume over his shift.
- Instruct the employee to wear the sample the entire shift.
- Attach the pump to the employee. This can be done several ways:
  - Attach the pump to the employee's belt
  - Use the carrying case & straps that usually come with a sampling pump
  - Use a vest, such as a fishing vest to carry the pump.
- Attach the tube assembly to the employee's collar. This should be within the employee's breathing zone (within 12-inches around the employee's head).

- Check on the sample every couple of hours to ensure:
  - Pump is still running
  - Sample is still in correct position
  - Employee is still performing same task
  - Etc.
- A task log could be given to the person to fill out every half-hour. This helps in identifying tasks that may have contributed to elevated exposures.



**Collect Samples When Sampling is Complete:**

- Collect sample train
- Record sample run time in minutes
- Perform post calibration as described in the Pump Calibration Procedures chapter
- Remove sorbent tube and insert plugs into inlet & outlet
- Charge pump for next sampling
- Send samples to IH-Accredited lab for analysis.

**Area Airborne Monitoring**

The purpose of obtaining area airborne samples is to determine specific sources of mercury vapor within the plant and to ascertain the effectiveness of clean-up and equipment decontamination procedures. Area samples should not be used as a substitute for personal exposure sampling. This type of monitoring should be used only to approximate employees' personal exposures to mercury vapor or to determine contamination of an area or objects.

Area airborne monitoring can be done using the same sampling techniques described above for personal exposure monitoring. In addition, there are two types of hand-held instruments that can be used to obtain instantaneous airborne concentrations of metallic mercury vapor:

1. Bacharach Instrument Company makes a mercury vapor analyzer that is based on ultra-violet (UV) absorption principle. It has a sensitivity of 0.01 mg/m<sup>3</sup> and is accurate within +/- 5 percent. Since the mercury vapor detector depends on the absorption of UV radiation by the sample, it will be affected to some extent by any substances that have a greater absorption of UV light than does normal air. Commonly encountered substances are vapors of various hydrocarbons, water vapor, sulfur compounds, and particulate, such as smoke. The advantage of the UV instrument is that it can be used continuously in relatively high concentrations of mercury vapor (less than 1.0 mg/m<sup>3</sup>) whereas the gold film instrument requires periodic regeneration of the gold film. The disadvantages of the UV instrument are that the instrument must be zeroed between samples and its sensitivity.
2. Arizona Instruments Inc. makes a gold film mercury vapor monitor that is based on mercury's ability to alter the resistance of a gold film. The instrument's

sensitivity is 0.003 mg/m<sup>3</sup> and the accuracy is +/- 5 percent at 0.100 mg/m<sup>3</sup>. Ammonia and acid gases are the principle chemicals that interfere with the operation of the instrument. Filters can be purchased from AZI in ammonia & acid environments to eliminate the interference. The instrument is also temperature sensitive. The advantage of the gold film instrument is its sensitivity and its ability to automatically zero itself between each sample.

To perform area sampling, conduct a walkthrough of potential expose area and identify thermal areas. Potential sources would include carbon kilns, strip solution storage tanks, retorts, refineries, electro-winning cells and melting furnaces. Take area readings in these locations and document the results. If the readings are well below the exposure limits, no addition action is necessary. If readings are near or above the exposure limits, the source of the mercury vapor should be identified and either engineering or administrative controls should be put in place to control the exposure to the employees.

Readings should be taken periodically to establish trends and identify exposure levels above the TLV. Monitoring would be more frequent if higher exposures are encountered. Appropriate PPE such as respiratory protection may be necessary if exposure levels can not be lowered.

### **Surface Sampling**

Wipe samples are used to determine the effectiveness of equipment decontamination procedures and clean-up protocols used for the hygiene facility and lunch room. This type of sampling involves swiping a 100cm<sup>2</sup> area with moist filter paper. The wipe sample is placed in a plastic bag and submitted to a laboratory for analysis. The results are presented in either micrograms or milligrams of mercury. These results should be used only to determine the presence or absence of mercury. A control sample should be taken in an area where mercury should not be present (such as a desk in an administrative area that is not located in a mercury area). This control sample can be used as an 'acceptable' amount of mercury.

Contact your preferred analytical lab and ask for a Ghost Wipe sample kit. The test kits typically come with a template for the wipe area, directions and the required materials. Make sure your hands are free of any mercury before you perform the wipe test.

Also, there are commercially available surface test kits for evaluating surface contamination. They can be used as indicators of the presence or absence of mercury on various surfaces. A Mercury Test Kit is available from SKC to indicate the presence of mercury\*.

\*Please note that this is not an endorsement for SKC.