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IX. APPENDIX I

AIR SAMPLING PRACTICES FOR HYDROGEN FLUORIDE

General Requirements

Concentrations of HF in the air shall be determined within the worker's breathing zone and shall meet the following criteria in order to evaluate conformance with the standard:

(a) Samples collected shall be representative of the individual worker's exposure.

(b) Sample data sheets shall include:

(1) The date and time of sample collection.

(2) Sampling duration.

(3) Volumetric flowrate of sampling.

(4) A description of the sampling location.

(5) Ambient temperature and pressure.

(6) Other pertinent information (eg, worker's name, shift, work process).

(c) Sampling will be in accordance with the provisions of the procedures outlined herein.

Breathing Zone Sampling

In order to assure that a sample is representative of a worker's exposure, collection shall be as near the breathing zone of the worker as practical. Sampling should not hamper the typical movements associated with his work, but care should be taken that the bubbler is maintained in a vertical position during sampling.

A portable, battery-operated, personal sampling pump capable of being calibrated to ±5% at the required flow and a standard glass midget bubbler containing 0.1 N sodium hydroxide solution shall be used to collect the sample (see Figure XII-1). The bubbler solution is prepared by dissolving 4 g of sodium hydroxide in 1 liter of distilled water.

The sampling rate shall be accurately determined and maintained at a value of approximately 1.5 liters/minute; each sample taken to determine a TWA concentration shall be collected for 30 minutes.

The minimum number of TWA exposure determinations for an operation or process shall be based on the number of workers exposed as provided in Table I-2. The TWA may be determined as follows:

$$TWA = \frac{C1t1 + C2t2 + \ldots + Cntn}{T}$$

where: C = HF or HF acid concentration (C1,C2,C3...Cn) during any sampling period t1,t2,t3...tn, respectively.
T = the sum of all sampling periods (t1,2,3...n)

Samples, taken to determine if airborne HF concentrations greater than the ceiling concentration exist, shall be collected at a rate of 1.5 liters/minute for 15 minutes.

A "blank" bubbler should be handled in the same manner as the bubblers containing the samples (fill, seal, and transport) except that no air is sampled through this bubbler.

Calibration of Sampling Trains

Since the accuracy of an analysis can be no better than the accuracy of the volume of air which is measured, the accurate calibration of a sampling pump is essential to the correct interpretation of the volume indicator. The frequency of calibration is dependent on the use, care, and handling to which the pump is subjected. In addition, pumps should be recalibrated if they have been subjected to misuse, or if they have just been repaired or received from a manufacturer. If the pump receives hard usage, more frequent calibration may be necessary. Ordinarily, pumps should be calibrated in the laboratory both before they are used in the field, and after they have been used to collect a large number of field samples.

The accuracy of calibration is dependent on the type of instrument used as a reference. The choice of calibration instrument will depend largely upon where the calibration is to be performed. For laboratory testing, a 1- or 2-liter buret or a wet-test meter is recommended, although other standard calibrating instruments such as a spirometer or dry gas meter can be used.

Instructions for calibration with the soapbubble flow meter follow. However, if an alternative calibration device is selected, equivalent procedures should be used. The calibration setup for personal sampling pumps with a midget bubbler is shown in Figure XII-1.

(a) Check the voltage of the pump battery with a voltmeter both with the pump off and while it is operating to assure adequate voltage for calibration. If necessary, charge the battery to the manufacturer's specifications.

(b) Fill the bubbler with 10 ml of the absorbing solution.

(c) Assemble the sampling train as shown in Figure XII-1.

(d) Turn the pump on and moisten the inside of the soapbubble meter by immersing the buret in the soap solution and drawing bubbles up the inside of the buret until they are able to travel the entire buret length without bursting.

(e) Adjust the pump rotameter to provide a flowrate of 1.5 liters/minute.

(f) Check the water manometer to ensure that the pressure drop across the sampling train does not exceed 13 inches of water (approximately 1 inch of mercury).

(g) Start a soapbubble up the buret and, with a stopwatch, measure the time it takes for the bubble to transit a minimum of 1.0 liter.

(h) Repeat the procedure in (g) above at least three times, average the results, and calculate the flowrate by dividing the volume between the preselected marks by the time required for the soap bubble to travel the distance.

(i) Data for the calibration include the volume measured, elapsed time, pressure drop, air temperature, atmospheric pressure, serial number of the pump, date, and name of the person performing the calibration.

(j) Corrections to the flowrate may be necessary if the pressure or temperature when samples are collected differs significantly from that when calibration was performed. Flow rates may be calculcated by using the following formula:

$$q\ (\text{actual}) = q\ (\text{indicated}) \times \frac{P\ (\text{calibrated})}{P\ (\text{actual})} \times \frac{T\ (\text{actual})}{T\ (\text{calibrated})}$$

where:

q = volumetric flowrate

P = pressure

T = temperature (Kelvin or Rankine)

(k) Use graph paper to record the air flow corrected to 25 C and 760 mmHg as the ordinate and the rotameter readings as the abscissa.