Sampling to Measure Exposure

Potentially toxic compounds can be detected and measured in air, water, soil or on surfaces using a variety of procedures. Written procedures are followed for preparation, use, and follow up/maintenance of instruments and tools used to measure exposure, during routine operations, or as part of an emergency response.

In this exercise you will review a collection protocol and demonstrate an ability to use it for the preparation, use, and after-use check-out for an instrument or tool available at your workplace for exposure monitoring.

Objectives

When complete, participants will better be able to:

- Demonstrate preparation of sampling device for use
- Demonstrate use to collect sample
- Demonstrate required after-use actions
- Identify any personal protective equipment necessary during use

Overall Guidance

Work site management is responsible for selecting equipment appropriate for routine sampling and anticipated emergencies. Manufacturers provide information about equipment used and its limitations.

Real-time monitoring with direct-reading instruments provides an immediate result and can be done with a range of devices depending on the information required. If the exposure of a worker is to be evaluated, personal monitoring is conducted; the sample may be sent to a laboratory and therefore may not be available immediately.

Some general considerations when selecting/using monitoring equipment follow:

- The unit should be intrinsically safe. (It will not produce sparks that could trigger an explosion.) Check the label and the manufacturer's guide.
- Most direct-reading instruments are designed to detect or measure only one contaminant or group of contaminants.
- There are no instruments that can sample all toxic substances.
- Instrument should be easy to observe/operate while wearing PPE.
- Equipment should be easy to transport and operate in the field under changing conditions and be decontaminated after use as needed.
- Instruments should operate properly at the temperatures that are anticipated during site activities.
- Instrument training should be provided through routine "hands-on" practice.
- Tubing should always be used to measure confined spaces before making entry. The use of an appropriate collapsible wand may be warranted also. Never lower the monitor into a confined space. Know how long it will take the sample to travel through the tubing to the monitor per the manufacturer's recommendations.
- Determine whether Tygon or Teflon tubing for sampling is appropriate. Chemicals can bind to the Tygon tubing and leave residue. If using a PID, the unit will detect the residue and not give an accurate reading.

- Follow OSHA's atmospheric testing priorities: (1) test for oxygen first, (2) then combustible gases, and then (3) for toxic gases and vapors.
- Utilize the 2 by 2 rule when monitoring for confined space hazards: monitor in no more than 4-foot intervals, add 2 seconds per foot of tubing, and add 2 minutes to get a good sample. For example, if you have 20 feet of tubing on your monitor, you would multiply 20 feet by 2 seconds and then add 2 minutes for each level you are sampling. This would equate to 2 minutes and 40 seconds per level.
- Many sampling instruments have rechargeable batteries that typically last longer than 8 hours when new and fully charged. Operation may reduce the battery life. Cold temperatures also reduce battery duration of use; never store fully charged equipment in a cold location just prior to use.

- Some equipment can be operated with non-rechargeable batteries that can be an option when working in the field.
- For rechargeable batteries, periodically discharge the battery fully and recharge to prevent 'battery memory'.
- Many instruments do not reach the highest readout instantaneously. For chemical sensors, the time to reach 90% of the actual concentration is referred to as T90 and is typically in the range of 15 seconds to 2 minutes. Sensors also need time to warm up and reach equilibrium and to post accurate results. Refer to the manufacturer's user manual to find these times.

Sampling Plan or Protocol

A sampling plan provides representative and accurate information on exposure.

A sampling plan includes:

- Areas where sampling is required
    - By regulation
    - By Site Safety and Health Plan
    - By Emergency Response Plan
- Equipment needed
- Frequency, duration, and procedures
- Sampling methods
- Analytical method (if needed)
- Benchmarks for comparison of result with accepted values
- Name (and signature)/date of plan developer and any amendments

Documentation for sampling generally includes:

- Pre- and post-calibration (if specified in protocol; initials of person doing it)
- Name/number of sampling analytical method (if used)
- Person conducting the monitoring
- Person monitored (if personal monitoring)
- Equipment ID number
- Drawings showing location of sample collection
- Notes regarding activities conducted during sampling
- Notes regarding work practices and other exposure controls
- Use of any PPE
- Any observed problems with the equipment
- Any deviation from the sampling method
- Result (recorded by sampling personnel or laboratory report)
- Chain of custody
- Record of transmitting result to person sampled (if personal monitoring)

A Calibration and Maintenance Log Book will include the following for each device:

- Description of required calibration and maintenance
- Date of each calibration/maintenance
- Results (often as a letter from an external source)
- Location of Manufacturer Literature for review, as needed

Note: electronic calibrators must be calibrated; see manufacturer's literature.

Before you sample…

For any sample collection, first make sure you have been trained in the methods and the use of the equipment. It is also important to be trained to recognize problems during sample collection and who to alert if you need assistance. Your facilitator will provide guidance for the type of sampling you will be conducting.

Exercises – Use a Specific Instrument

Detailed knowledge of an instrument design, operation, limitations, and recognition of potential malfunction is required for use during many work activities such as confined space entry, rescue or hazard identification. In this exercise you will use equipment available or similar equipment as at your worksite in a simulation of possible use.

Because the instrument and application is specific to your work activities, the program facilitator will provide you with several checklists.

Closing

For the sampler or tool used at your work site, did you:

- Demonstrate preparation for use
- Demonstrate use to collect sample
- Demonstrate required after-use actions
- Identify any personal protective equipment necessary during use

Based on this exercise, what takeaways do you have as you go back to work?

Please ask any remaining questions