

Exposures Measured at Your Workplace

Detecting and measuring hazardous substances at a work site is very important for the safety and health of workers and the community. Potentially toxic compounds can be detected and measured using a variety of different monitoring instruments.

This exercise provides time to review monitoring that has been conducted at your workplace, how these records relate to your exposures and some of the exposure limits that are applicable.

Objectives

When you have completed this review, you will be better able to:

- Identify limits and levels for exposure(s) measured in your workplace
- Review a report of monitoring results
- Identify jobs or tasks where exposures may occur

Monitoring in the Workplace

Monitoring provides important information about the presence and concentration of hazardous substances at a work site. Proper use of sampling equipment can provide information needed to protect life and property.

OSHA has a number of standards that require monitoring, including:

29 CFR 1910.120 requires air monitoring:

- Upon initial site entry;
- When work begins on a different part of the site;
- When you start handling chemicals that weren't found before;
- At the start of a different operation, such as opening drums instead of well drilling;
- When you are handling leaking drums or working with liquid contamination, such as a spill or a lagoon; and
- During various stages of emergency response.

29CFR1910.146 requires air monitoring:

- In permit-required confined spaces.

29CFR1910.1000 and chemical specific standards require air monitoring:

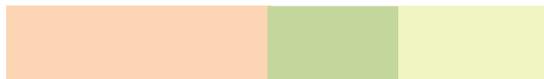
- To evaluate workplace exposure.

EPA and other agencies also have guidelines for sampling air, water, soil and surfaces.

Monitoring is performed when there is a question as to whether employees may be exposed to hazardous substances; the results are used as one factor in selecting PPE. The reasons for monitoring are:

- To **detect** whether potential hazardous condition(s) exist or a hazardous substance is present.
- To **measure** the concentration of hazardous substances.

pH paper – used to DETECT ← pH = 11 (caustic vapor or mist)



solid sorbent tube, personal pump, lab analysis (MEASURE ammonia concentration)



During the past year:

- Was your exposure monitored (wear a device or in your breathing zone)?
- Did you observe monitoring in the work area?
- Did you conduct monitoring?

Exposure Records

Results of any exposure monitoring of your work area conducted by your employer are considered part of your medical record and must be available to you upon request.

See the OSHA Standard “Access to Employee Exposure and Medical Records” (1910.1020). Records which workers can request include either environmental information or personal medical records. When requested, the employer must provide access within fifteen working days after the request is made. The employer can comply by either making a copy of the requested record at no cost to the employee, allowing the employee to use the employer copy machine to copy the requested record, or by allowing the employee an opportunity to inspect the record.

Exposure Limits

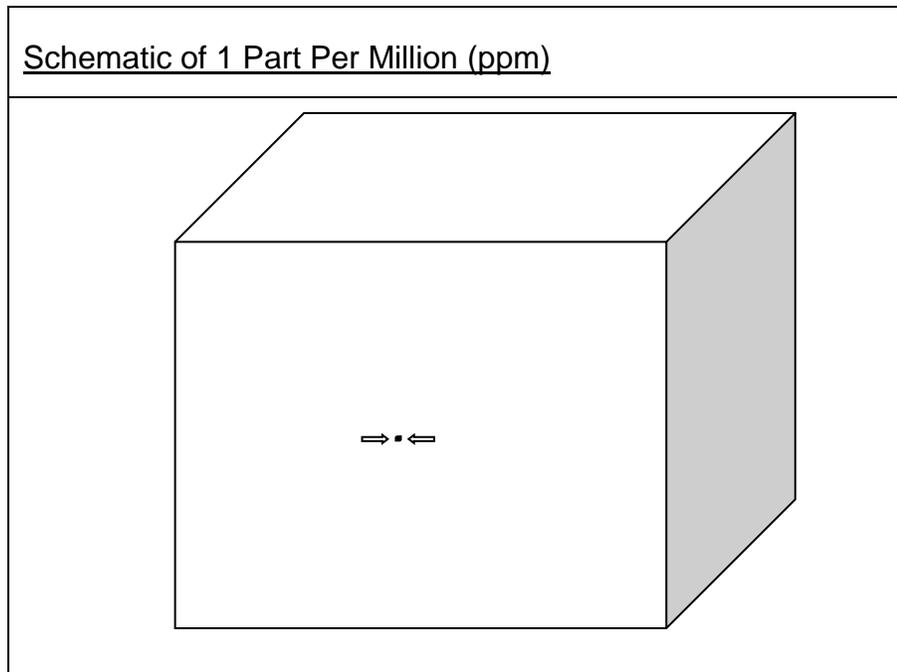
Legally-enforceable airborne exposure limits for the workplace are set by OSHA.

NIOSH and non-governmental agencies (such as the American Conference of Governmental Industrial Hygienists [ACGIH]) have also established levels that are recommended to not be exceeded. These guidelines and recommendations are not legally enforceable. Some exposure limits have a “skin” description, which means that the material is readily absorbed through the skin. Several exposure terms are described below.

Measures of Concentration

Exposure limits and guidelines are expressed as an airborne concentration. Concentration is the amount of a substance contained in a certain volume of something else, in this case - air. Concentrations of gases or vapors in air are usually reported in parts per million (ppm) or percent by volume of air:

- 1 ppm is equivalent to 1 inch in 16.7 miles.
- One percent by volume is equivalent to 10,000 ppm.



Concentrations of particulates, dust, and mists are usually reported in milligrams per cubic meter of air (mg/m^3).

- There are about 455,000 milligrams in one pound.
- There are about 35 cubic feet in one cubic meter. (A meter is about 40 inches.)

Fiber concentrations are reported in fibers per cubic centimeter (f/cc).

- A cc is about the size of a sugar cube.

Immediately Dangerous to Life and Health (IDLH)

IDLH is a concentration or condition that poses an immediate threat to life or health or might prevent someone from escaping such an environment. An IDLH condition may exist where a chemical is present above the IDLH concentration, where oxygen concentrations are too low in the air, or in other dangerous circumstances such as in a structure fire.

Permissible Exposure Limits (PELs)

Permissible exposure limits (PELs) are legal exposure levels set by OSHA. Employers are required by law to keep exposures below the PELs. In most cases, the PELs have not been updated for many years.

Threshold Limit Values (TLVs)

Threshold Limit Values are recommendations for exposure limits which are prepared by the ACGIH, a private, non-governmental agency. TLVs, which are not legally enforceable, do include updates of some levels each year. They are usually more protective (lower) than PELs. TLVs are not listed in the NPG, and the full listing and basis for the concentration are not available for free. The TLV is listed in safety information from chemical suppliers.

Recommended Exposure Limits (RELs)

Recommended exposure limits (RELs) are set by NIOSH. RELs are not legally enforceable. Like TLVs, RELs are generally more protective than the legally-enforceable PELs.

Short-Term Exposure Limits (STELs)

These exposure limits are set by ACGIH, OSHA, and NIOSH. The STEL is a maximum average concentration a person may be exposed to over a short period of time, usually 15 minutes. It is legally enforceable if set by OSHA. STEL is sometimes abbreviated further to ST.

Ceiling Limits (C)

The ceiling limit is an exposure level set by ACGIH, OSHA, and NIOSH which should not be exceeded at any time. It is legally enforceable if set by OSHA.

Time-Weighted Averages (TWAs)

Most PELs, TLVs, and RELs are 8-hour time-weighted average concentrations. The purpose of this type of average exposure is to characterize an 8-hour work shift. An example of how the TWA is calculated as follows:

Time-Weighted Averages Calculated

An employee is exposed to acetone at 60 ppm for 6 hours and 12 ppm for 2 hours. What is the TWA?

$$\text{TWA} = \frac{(\text{Exposure}_1 \times \text{Time}_1) + (\text{Exposure}_2 \times \text{Time}_2) + \dots}{(\text{Time}_1 + \text{Time}_2 + \dots)}$$

$$\text{TWA} = \frac{(60 \text{ ppm} \times 6 \text{ hrs}) + (12 \text{ ppm} \times 2 \text{ hrs})}{(6 \text{ hrs} + 2 \text{ hrs})}$$

$$\text{TWA} = \frac{(360 + 24) \text{ ppm hrs}}{8 \text{ hrs}}$$

$$\text{TWA} = 48 \text{ ppm}$$

Exercise – Exposure Limits and Levels

Use resources to identify the occupational exposure limits and guideline exposure levels for chemicals monitored at your workplace and how to collect samples to evaluate exposure. Complete the Worksheet provided.

Exercise – Exposure Monitoring Information in a Report

The facilitator will provide a monitoring report from a laboratory or from in-house monitoring. Use the report to find information and complete the Worksheet provided.

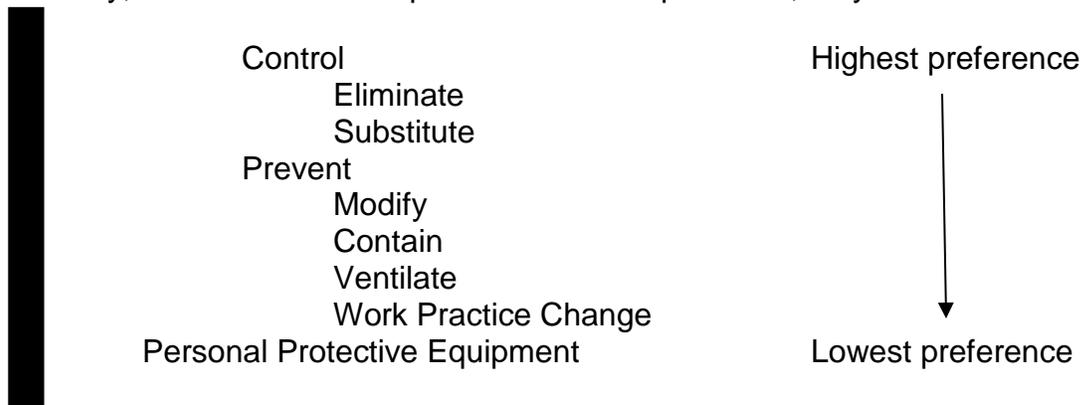
Exercise – Mapping Exposures Measured to Jobs or Tasks

Not all locations where an exposure can occur may have been monitored. In small groups, use your knowledge of the work site activities and discuss

- other locations where the exposure reported in the previous exercise may occur
- what jobs or tasks may result in exposure
- have these jobs/tasks been assessed
- Are control measures (engineering, administrative, PPE) in place to reduce exposure, if needed?

Hierarchy of Controls

The hierarchy of controls refers to the preferred methods of hazard control. Traditionally, in order from most-preferred to least-preferred, they are:



Have one member of the group report back to summarize your discussion.

Closing

Did you:

- Identify limits and levels for exposure(s) measured in your workplace?
- Review a report of monitoring results?
- Identify jobs or tasks where exposures may occur ?

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

Please ask any remaining questions.