24-Hr HAZWOPER Module 7

Air Monitoring

Section 7.1 Air Monitoring Overview

7.1.1 Types of Hazardous Atmospheres

Hazardous atmospheres can manifest in different ways, including:

- Explosive atmospheres, which are characterized by the presence of ignitable or explosive vapors, gases, aerosols, and dust
- Toxic atmospheres, which are characterized by the presence of harmful vapors, gases, particulates, and aerosols
- Oxygen-deficient atmospheres, which result from the displacement of breathable air
- Radioactive atmospheres, which are characterized by the presence of radioactive gases and aerosols

The presence of such hazards may dictate necessary operations to mitigate the likelihood of incidents and ensure the safety of response personnel.

7.1.2 Importance of Air Monitoring

While predictions can be made about airborne hazards based on the substance involved and weather conditions, air monitoring is essential to confirm these predictions, identify or measure contaminants, and detect unknown pollutants. Specific requirements for air monitoring are outlined in 29 CFR 1910.120(h), and effective practices to meet these requirements are further discussed in this module.

7.1.3 Initial Entry and Continuous Monitoring

During initial entry, air monitoring must be conducted wherever there is a possibility of employee exposure to hazardous substances. Representative air monitoring is performed to identify exposures exceeding Permissible Exposure Limits (PELs), IDLH concentrations, potential sources of skin and eye irritation, explosion sensitivity and flammability ranges, and oxygen deficiency. Additionally, air monitoring is necessary to confirm the cleanliness of the designated Support Zone. If there are any concerns of contaminant migration, then air and/or surface soil samples should be collected and compared with on-site and off-site background samples. The results of the initial air monitoring survey, visual characterization of site hazards, properties of on-site contaminants, and potential pathways of dispersion should be evaluated to determine if further monitoring is needed to designate work zones. This evaluation may include the use of direct-reading instruments, visible indicators, other sources of information, and limited air sampling if time permits.

In cases where elevated levels of hazardous substances are detected, continuous monitoring should be undertaken, along with the implementation of additional site control measures, to safeguard employee health and safety. Continuous monitoring is essential to accurately characterize their exposure levels. If these exposures surpass the permissible or published limits, monitoring should be extended to all potentially affected employees. Representative

sampling, based on initial results, can also be employed to assess the average exposure levels in specific areas or around waste piles.

Identifying and quantifying airborne contaminants can be achieved through two primary methods:

1. *On-Site Use of Direct-Reading Instruments (DRIs):* provides real-time data and rapid response.
2. *Laboratory Analysis of Air Samples:* provides compound or class-specific results but requires additional time/money for analysis and may necessitate specialized equipment.

Section 7.2 Air Monitoring Practices and Procedures

7.2.1 Perimeter Monitoring and Personal Monitoring

Fixed-location monitoring at the perimeter or fence line, where PPE is no longer required, enables the measurement of contaminant migration away from the site. Wind speed and direction data are necessary to interpret the sample results as they may reflect exposures either upwind or downwind from the site.

Personal air monitoring is the selective monitoring of high-risk workers (those closest to the source of contaminant generation) and is required by 29 CFR §1910.120(h). Personal air sampling is not necessary until site operations begin. Personal monitoring samples should be collected in the breathing zone and, if workers are wearing respiratory protective equipment, outside the facepiece. Sampling should occur frequently enough to characterize employee exposures. If an employee is exposed to concentrations over PELs, monitoring must continue to ensure the safety of all employees likely to be exposed to concentrations above those limits. Multiple sampling media may be needed for personal monitoring, and alternative methods such as assigning different monitoring devices to team members or placing multiple sampling devices on heavy equipment can provide representative exposure information.

7.2.2 Periodic Monitoring and Long-Term Monitoring

Periodic monitoring should be conducted when there is a possibility of a dangerous condition or when there is reason to believe that exposures may have exceeded PELs since prior monitoring was conducted. Significant changes in site operations, handling of different contaminants, or working in areas with obvious liquid contamination should prompt consideration for periodic monitoring.

Long-term air monitoring programs should be designed to effectively detect a wide range of airborne compounds. Several factors need to be considered, including equipment type, costs, personnel, analytical accuracy, turnaround time for results, and availability of accredited laboratories.

7.2.3 Variables in Hazardous Waste Site Air Monitoring

Accurately assessing airborne contaminants in complex environments like hazardous waste sites requires considering various independent and uncontrollable variables. Important variables include:

- **Temperature:** Higher temperatures increase the vapor pressure of most chemicals.
- **Wind speed**: Increased wind speed affects vapor concentrations near free-standing liquid surfaces and particulate-bound contaminants.
- **Rainfall**: Water and rainfall can reduce airborne emissions by capping or plugging vapor emission routes.
- **Moisture**: Moisture content affects the sensitivity and accuracy of sampling results, particularly for dusts and finely divided hazardous solids.
- **Vapor emissions**: Saturated vapor displacement can lead to short-term, high vapor concentrations, while continuing evaporation and diffusion may result in long-term low vapor concentrations.
- **Work activities:** Mechanical disturbance of contaminated materials during work activities can alter airborne contaminant concentrations.

7.2.4 Using Vapor/Gas Concentrations to Determine PPE Level

Total atmospheric vapor/gas concentrations can be used as a numerical criterion for selecting the appropriate level of PPE such as Level A, B, or C. This approach is useful in situations where the presence of vapors or gases is unknown, or if the individual components are unknown. Total vapor/gas concentration can guide the selection of PPE until more definitive criteria are established based on the constituents and atmospheric concentrations.

It's important to evaluate multiple factors, including potential exposure, the characteristics of materials present, and the limitations of monitoring instruments and PPE when selecting the correct level of protection for on-site activities.