O

Occupational Exposure Limits

Andrew Maier

Occupational exposure limits (OELs) provide health and safety professionals an important tool for protecting worker health. OELs provide health and safety guidance to chemical users, inform workers of potential adverse effects of chemical exposure, and provide a scientific basis for evaluating whether existing environmental exposure controls are adequate.

Many organizations around the world develop OELs using approaches that fit the unique needs of the constituencies involved and the mission of the organization. For example, some organizations set health-based guidelines that reflect best scientific judgment regardless of other considerations, while many regulatory organizations evaluate policy and management issues such as implementation costs and technical feasibility as part of the OEL determination. Nevertheless, the general scientific approach used by most organizations is similar and includes a detailed critical review of the epidemiology and toxicology information to identify potential hazards, selection of sensitive adverse effects, dose-response estimation to determine appropriate thresholds, and an evaluation of tenant uncertainties to ensure the desired margin of safety.

There are several general categories of OELs for airborne chemical exposure, which differ primarily on the duration of exposure considered relevant for preventing the effect of concern. The common OEL duration categories include:

- *Time-weighted average (TWA)*: These limits are generally developed to protect from health effects caused by longer-term or chronic exposures (e.g., chronic target organ damage) and are compared against air concentrations measured over full-shift exposure durations (e.g., 8 or 10 h, depending on the organization). Note that methods to adjust OELs for other durations based on toxicokinetic considerations have been developed for cases involving exposures that occur during nonstandard work schedules.
- *Short-term exposure limit (STEL)*: These limits are generally developed for substances that induce effects of concern following fairly brief periods of exposure. For example, many STELs are based on thresholds for the induction of irritant responses or central nervous system depression, or for preventing chronic or irreversible damage due to brief periods of exposure. Many organizations establish STELs as a 15 min TWA air concentration that should not be exceeded during a work shift. Many compounds do not have sufficient data to serve as the basis for developing a STEL. However, some organizations recommend general excursion limits that are a multiple of the full-shift TWA limit (e.g., three times the TWA), as a measure of protection from peak exposures even when no STEL has been established.
- *Ceiling limit*: These limits are generally developed to protect from effects caused very quickly if a threshold concentration is exceeded. For example, ceiling limits are established for many highly potent irritants. The ceiling limit generally refers to the maximum concentrations in air that should not be exceeded at anytime during the work period.

Most published OELs are derived on the basis of preventing adverse effects arising from occupational exposures due to contaminant concentrations in the air. However, dermal exposures may also contribute to the overall body burden. Most OEL-setting organizations have developed qualitative notations to identify those substances for which dermal exposure may contribute significantly to the total body burden. For substances with a skin notation, caution should be used in interpreting the level of protection afforded by the OEL if skin exposure may occur.

Most OEL-setting organizations also establish qualitative notations to indicate the ability of a compound to induce dermal or respiratory sensitization. This approach is used since dose-response thresholds for the induction of these sensitization responses are generally not well understood, and sensitized individuals may respond to very low exposure