

Selecting Community and Responder Action Levels

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Community Action Levels

- National Advisory Committee
 - Acute Exposure Guideline Levels (AEGl)
- Department of Energy
 - Temporary Emergency Exposure Limits (TEEL)
- American Industrial Hygiene Association
 - Emergency Response Planning Guidelines (ERPG)

National Advisory Committee AEGLs

- Acute Exposure Guideline Levels (AEGLs)
 - Represent threshold exposure limits for the general public and are applicable to emergency exposure periods ranging from 10 minutes to 8 hours.
- Three levels: AEGL-1, AEGL-2 and AEGL-3
 - Developed for each of five exposure periods (10 and 30 minutes, 1 hour, 4 hours, and 8 hours) and are distinguished by varying degrees of severity of toxic effects.

AEGL-1

- **AEGL-1** is the airborne concentration (expressed as parts per million or milligrams per cubic meter (ppm or mg/m³)) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL-2

- **AEGL-2** is the airborne concentration (expressed as ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3

- **AEGL-3** is the airborne concentration (expressed as ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

AEGL Development

1. Draft AEGLs
2. Proposed AEGLs
3. Interim AEGLs
4. Final AEGLs

<http://www.epa.gov/oppt/aegl/>

AEGL Development

- Most comprehensive process ever used for the determination of short-term exposure limits for acutely toxic chemicals.
- Peer-reviewed
- Final AEGLs may be reviewed as new toxicity data arise

American Industrial Hygiene Association ERPGs

- Emergency Response Planning Guidelines (ERPGs)
 - Represent maximum levels for one-hour exposures to the general public for emergency planning and response.
- There are three levels set by the ERPG committee for each chemical.

ERPG-1

- The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

ERPG-2

- The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

ERPG-3

- The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

ERPG Development

- ERPG Committee gathers information on the chemical properties, available animal data, and any human data or experience with exposures to the chemical at issue.
- ERPGs selection is based on review of available and relevant toxicity data.
- Rationales for the specific ERPGs are provided within the ERPG documentation.
- ERPGs are peer reviewed.

Department of Energy TEELs

- Temporary Emergency Exposure Limits (TEEL)
 - Developed for over 1250 chemicals for which ERPGs have not been developed.
- Product of DOE Subcommittee on Consequence and Protective Actions (SCAPA).

TEEL-0

- The threshold concentration (measured as the peak 15-minute TWA) below which most people will experience no appreciable risk of health effects.

TEEL-1

- The maximum concentration in air (measured as the peak 15-minute TWA) below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

TEEL-2

- The maximum concentration in air (measured as the peak 15-minute TWA) below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action

TEEL-3

- The maximum concentration in air (measured as the peak 15-minute TWA) below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

Development of TEELs

- DOE's SCAPA examined the relationships between ERPGs and occupational exposure values for chemicals with ERPGs.
- TEELs are calculated using a mathematical formula based on those relationships.
- TEEL development process is less rigorous than that of ERPGs or AEGLs

How Do We Use Community Action Levels?

- Requires professional judgment.
- Understand the basis for the available guidelines.
- Must take into account occupational guidelines.
- Consider potential duration of exposure.
- Consider feasibility and impact of evacuation decisions.
- If exposure duration will be limited, CTEH typically uses the ERPG-2 to advise on evacuations.
- Evaluate physical/chemical properties, such as odor threshold in consideration of community response to action level.

Worker/Responder Action Levels

- ACGIH
 - Threshold Limit Values (TLVs)
- OSHA
 - Permissible Exposure Limits (PELs)
- NIOSH
 - Immediately Dangerous to Life and Health (IDLH)
- AIHA
 - Workplace Environmental Exposure Levels (WEELs)
- Lower Explosive Limit (LEL)

ACGIH TLVs

- Threshold Limit Values (TLVs)
 - “Threshold limit values (TLVs®) refer to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects. TLVs® are developed to protect workers who are normal, healthy adults.”*
- TLVs are not regulations
- TLVs are evaluated/revised periodically based upon updated research
- Three types of TLVs:
 - TLV-TWA (8-hour time-weighted average)
 - TLV-STEL (Short-term exposure limit-15 min.)
 - TLV-Ceiling (Not to be exceeded)

OSHA PELs

- Permissible Exposure Limits (PELs)
 - Analogous to ACGIH TLVs
- PELs are regulations and enforceable by law
- PELs development/modification requires extensive public comment, therefore PELs are updated infrequently.
- Three types of PELs:
 - PEL-TWA (8-hour time-weighted average)
 - PEL-STEL (Short-term exposure limit-15 min.)
 - PEL-Ceiling (Not to be exceeded)

ACGIH TLVs and OSHA PELs

- TLV-TWA or PEL-TWA
 - The TWA concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, for a working lifetime without adverse effect.

ACGIH TLVs and OSHA PELs

■ TLV-STEL and PEL-STEL

- 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA.
- ACGIH further specifies that:
 - The concentration to which it is believed that workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, 3) dose-rate-dependent toxic effects, or 4) narcosis of sufficient degree to increase the likelihood of accidental injury, impaired self-rescue, or materially reduced work efficiency.
 - Exposures above the TWA up to the STEL should be less than 15 minutes, should occur less than four times per day, and there should be at least 60 minutes between successive exposures in this range.

ACGIH TLVs and OSHA PELs

■ TLV-Ceiling and PEL-Ceiling

- The concentration that should not be exceeded during any part of the working exposure.
- If instantaneous measurements are not available
 - ACGIH: sampling should be conducted for the minimum period of time sufficient to detect exposures at or above the ceiling value.
 - OSHA: If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day.

NIOSH Immediately Dangerous to Life and Health (IDLH)

- The IDLH is the concentration for a given chemical that poses an immediate threat of loss of life or immediate or delayed irreversible adverse effects on health that would prevent escape from a hazardous atmosphere.
- Originally developed to guide the selection of proper respiratory protection.

AIHA WEELS

- Workplace Environment Exposure Limits (WEELS)
 - Normally expressed as 8 hour TWA
 - Developed for selected chemicals that do not have alternative worker exposure guidelines.

Lower Explosive Limit (LEL)

- The lower range of airborne concentrations at which a chemical vapor is capable of exploding or igniting given the appropriate stimulus (i.e. heat, flame)

How Do we Use Worker Action Levels?

- Requires professional judgment (e.g. basis for selection, potential exposure duration).
- Consider respiratory protection for extended exposures $\geq 1/2$ worker action level.
- CTEH generally uses the more conservative action levels for work site recommendations.
- As airborne chemical concentrations reach 10% of the LEL, especially in a confined space, measures should be taken to eliminate the vapors prior to allowing work in the area.

Review of Community and Worker/Responder Action Levels

- Community Action Levels
 - AEGLs
 - ERPGs
 - TEELs
- Worker/Responder Action Levels
 - TLVs and PELs
 - IDLH
 - WEELs
 - LEL

What if There Is No Guideline?

- Structure Activity Relationships (SAR)
 - Based on the known relationship between toxicity and chemical structure.
- Analogy
 - Guidelines for chemicals of similar classes or with otherwise similar characteristics may be used by analogy in the absence of specific guidelines.

Example: 2-Ethylhexanal Release

- No OEVs or community guidelines available
 - Animal tox data were available for 2-ethylhexanal and other aldehydes
 - OEVs were available for other aldehydes

Example: 2-ethylhexanal Release

- Using SAR, CTEH developed a suitable, conservative action level
 - Tox data suggested that as the number of carbons in the aldehyde molecule increased, the toxicity decreased.
 - OEVs of other aldehydes showed the same thing:
 - Propionaldehyde (3 Carbons) = 20 ppm TLV
 - Isobutyraldehyde (4 carbons) = 25 ppm WEEL
 - Pentanal (5 carbons) = 50 ppm TLV
 - 2-ethylhexanal (8 carbons) = ???
 - 2-ethylhexanal was assigned a conservative action level of 20 ppm

Establishing Action Levels: Rules of Thumb

- Obtain as much information as possible regarding physical/chemical properties
- Determine the available exposure guidelines from various sources and the bases for those guidelines.
- Identify site-specific factors (examples)
- Get input from all knowledgeable response personnel
- Consider effects of exposure to multiple contaminants or mixtures

Establishing Action Levels: Rules of Thumb

- Consider community impacts when selecting action levels (evacuation recommendations, odor impact).
- Consider respiratory protection when chemical concentrations are $\geq \frac{1}{2}$ action level.
- Consider work stoppage and evaluate conditions when LEL reaches 10% or higher.
- Site managers should keep in mind that many chemicals have Substance-Specific Standards under OSHA.
- Be prepared to explain and defend the basis for action level decisions.