

## Standards and Guidelines

Occupational Values: Occupational Exposures Levels tend to reflect the normal workday and/or workweek exposures for healthy adults. Table 1 shows the various values used in the United States. Other standards may be adopted overseas, though most countries used the ACGIH TLVs. Occupational values may be averaged over the default period described in the definition, over some other specified periods of time, or a ceiling value never to be exceeded.

**Table 1: Occupational Exposure Levels**

Term	Definition	By Whom	Comment
Permissible Exposure Limit (PEL)	8 hour day/40 hour week	Occupational Safety & Health Administration (OSHA)	Regulatory value enforceable by law.
Recommended Exposure Limit (REL)	10 hour day/40 hour week	National Institute for Occupational Safety & Health (NIOSH)	Peer reviewed recommendation for OSHA.
Threshold Limit Value - Time Weighted Average (TLV-TWA)	8 hour day/40 hour week	American Conference of Governmental Industrial Hygienists (ACGIH)	Industry developed guidance updated annually.
Workplace Environmental Exposure Level (WEEL)	8 hour day/40 hour week usually; may be different depending on basis for value	American Industrial Hygiene Association (AIHA)	Workplace exposure guidelines for agents in common use that have no other exposure guidelines by others

Other occupational concentrations are also used mostly in determining respiratory protection or feasibility of rescue by unprotected personnel. Table 2 shows these.

**Table 2: Other Occupational Exposure Levels**

Term	By Whom	Definition	Target Pop.	Comment
Short Term Exposure Level (STEL)	ACGIH, AIHA, OSHA, NIOSH	Maximum Concentration not to exceed 15 minutes	Healthy adult workers	In response, used mostly to determine rescue feasibility
Immediately Dangerous to Life & Health (IDLH)	NIOSH	Concentration likely to cause death <i>or</i> permanent adverse effects <i>or</i> prevent escape; <i>formerly</i> with exposure of 30 minutes or more	Healthy adult workers	Concentration at which supplied air respirator with an escape device must be worn.

General Population Guidelines: The general population can include sensitive individuals such as children, the elderly, or those with health conditions that may make them more - or rarely less - sensitive to the effects of an exposure to a hazardous substance. While the guidelines listed in Table 3 may be the basis for regulatory standards or adopted in enforcement actions such as administrative orders, they are not by themselves a regulatory value. In most cases, enforceable standards such as the MCLs may also be considered to be protective for the general population as of the date of their adoption. In some cases because they take longer to modify or must meet other practical criteria not necessarily pertinent to these guidelines, regulatory standards may not be as protective of individuals that tend to be unusually sensitive to the effects of a substance as we would like. In those rare instances, the standards should be evaluated before being applied to a specific situation.

**Table 3: Health Guidance Values**

<b>Term</b>	<b>Definition</b>	<b>By Whom</b>	<b>Comments</b>
Minimal Risk Level (MRL)	An estimate of daily human exposure likely to be without appreciable risk of adverse non-cancerous effects over a stated period of time.	HHS/ATSDR	Peer-reviewed value based on peer-reviewed Study. May be developed for acute (< 14 days), intermediate (14-365 days), or chronic (>365 days)
Reference Dose/ Reference Concentration (RfD/RfC)	An estimate of daily human exposure likely to be without risk of deleterious effects over a lifetime of exposure & measured over a 24 hour period	EPA	Interagency consensus value based on peer-reviewed or proprietary studies. Usually developed for 70 years of exposure, but may be for a shorter period of time, usually 90 days.

Emergency Guidance Values: Since the Bhopal incident in 1984 highlighted the dangers of acute release events, various attempts have been made to produce guidance values for use in short term exposure scenarios for the general population. The most common of these are shown in Table 4. In general, these values are provided for 3 and sometimes 4 endpoints. Typically, a Level 1 emergency value (e.g., ERPG-1, AEGL-1, or PAC-1) are based on either a default exposure duration of 1 hour or a specified period of time. Exposure to these concentrations for that period of time should produce no health effects other than transitory irritation or objectionable odors. Exposure to a Level 2 emergency value should produce no irreversible health effects for the general population. Exposure to a concentration not exceeding a Level 3 emergency value should not result in any deaths. When developed, the 4<sup>th</sup> endpoint is referred to as a Level 0 value and should not result in any irritation or objectionable odors for most people. At this time, only DOE is developing what they refer to as TEEL-0s.

Some of these values in Table 4, such as the AEGLs, assume that only one exposure event will occur at that concentration. Use of these values for more than one exposure event before the body has had a chance to metabolize the previous exposures should be considered with caution.

**Table 4: Emergency Guidance Values**

<b>Term</b>	<b>By Whom</b>	<b>Definition</b>	<b>Target Pop.</b>	<b>Comment</b>
Temporary Emergency Evaluation Levels (TEELS)	DOE/SCAPA	Three concentrations per compound for different effects after a 1 hour exposure	General population	Developed by a group of scientists at Brookhaven National Lab following ERPG protocols; no independent review.
Emergency Response Planning Guides (ERPGs)	AIHA	Three concentrations per compound for different effects after a 1 hour exposure	General population	May be incorporated into AEGLs below.
Acute Emergency Guidance Level (AEGL)	EPA, ACGIH, AIHA, ATSDR, ACC, NIOSH	Three concentrations per compound for different effects over 5 different durations of exposure	General population	Consensus values developed by multiple agencies.

Table 5 provides a listing of all the guidance values and standards described in Tables 1-4 for a specific compound, Hydrogen Sulfide. Other regulatory standards, industry consensus standards, and agency internal guidance are available to address specific concerns. The underlying assumptions and reasons for developing the guidance should be considered when applying these values for purposes other than the original intent.

**Table 5: Hydrogen Sulfide Standards and Guidelines**

Standard or Guideline	Value (in ppm)	Source
EPA RfC (UF=300)	0.001	<a href="http://www.epa.gov/iris/">www.epa.gov/iris/</a>
Approximate Odor Threshold	0.01	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
ATSDR Intermediate MRL (UF=30)	0.02	<a href="http://www.atsdr.cdc.gov/mrls/">http://www.atsdr.cdc.gov/mrls/</a>
ATSDR Acute MRL (UF=27)	0.07	<a href="http://www.atsdr.cdc.gov/mrls/">http://www.atsdr.cdc.gov/mrls/</a>
AIHA ERPG-1	0.1	<a href="http://toxnet.nlm.nih.gov/hsdb">toxnet.nlm.nih.gov/hsdb</a>
AEGL-1 8 hr	0.33	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-1 4 hr	0.36	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
TEEL-0	0.51	<a href="http://www.hss.energy.gov/">http://www.hss.energy.gov/</a>
PAC-1	0.51	<a href="http://www.hss.energy.gov/">http://www.hss.energy.gov/</a> AEGL-1 - 1 hour
AEGL-1 60 min	0.51	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-1 30 min	0.6	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-1 10 min	0.75	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
Human NOAEL	2	<a href="http://www.atsdr.cdc.gov/toxprofiles/tp114-c3.pdf">http://www.atsdr.cdc.gov/toxprofiles/tp114-c3.pdf</a>
Asthmatic LOAEL	2	<a href="http://www.atsdr.cdc.gov/toxprofiles/tp114-c3.pdf">http://www.atsdr.cdc.gov/toxprofiles/tp114-c3.pdf</a>
ACGIH TLV-TWA	10	<a href="http://toxnet.nlm.nih.gov/hsdb">toxnet.nlm.nih.gov/hsdb</a>
NIOSH REL	10 C	<a href="http://www.cdc.gov/niosh">www.cdc.gov/niosh</a>
ACGIH TLV-STEL	15	<a href="http://toxnet.nlm.nih.gov/hsdb">toxnet.nlm.nih.gov/hsdb</a>
AEGL-2 8 hr	17	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
OSHA PEL	20 C	<a href="http://www.cdc.gov/niosh">www.cdc.gov/niosh</a>
AEGL-2 4 hr	20	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
PAC-2	27	<a href="http://www.hss.energy.gov/">http://www.hss.energy.gov/</a> AEGL-2 - 1 hour
AEGL-2 60 min	27	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AIHA ERPG-2	30	<a href="http://toxnet.nlm.nih.gov/hsdb">toxnet.nlm.nih.gov/hsdb</a>
AEGL-3 8 hr	31	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-2 30 min	32	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-3 4 hr	37	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-2 10 min	41	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
PAC-3	50	<a href="http://www.hss.energy.gov/">http://www.hss.energy.gov/</a> AEGL-3 - 1 hour
AEGL-3 60 min	50	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
OSHA PEAK per shift	50	<a href="http://toxnet.nlm.nih.gov/hsdb">toxnet.nlm.nih.gov/hsdb</a>
AEGL-3 30 min	59	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
AEGL-3 10 min	76	<a href="http://www.epa.gov/oppt/aegl/pubs/chemlist.htm">www.epa.gov/oppt/aegl/pubs/chemlist.htm</a>
IDLH	100	<a href="http://www.cdc.gov/niosh">www.cdc.gov/niosh</a>
AIHA ERPG-3	100	<a href="http://toxnet.nlm.nih.gov/hsdb">toxnet.nlm.nih.gov/hsdb</a>
Lowest Lethal Concentration	444	<a href="http://www.cdc.gov/niosh/rtecs/mx12b128.html">http://www.cdc.gov/niosh/rtecs/mx12b128.html</a>