

Protective Action Criteria (PAC) Rev 25 based on 60-minute AEGLs, ERPGs, or TEELs for Chemicals of Concern

Introduction

This document provides an introduction to Revision 25 of the Protective Action Criteria (PAC) for chemicals of concern. PAC values, including 60-minute Acute Exposure Guideline Levels (AEGLs) (EPA, 2009) and Emergency Response Planning Guidelines (ERPGs) (AIHA, 2009) through May 2009, and Temporary Emergency Exposure Limits (TEELs), are provided for 3373 chemicals. TEEL values are always subject to change, being replaced by AEGLs or ERPGs when new values are published, and many are updated annually when different concentration-limits [e.g., Permissible Exposure Limits (PELs) or Threshold Level Values (TLVs)] or new toxicity data are published. Additional chemicals for which new PAC values are derived are added at the same time.

The following is a description of each table. There are introductions at the beginning of each of the tables that provide table-specific information.

Table 1 is an alphabetical list of the chemical substances, their Chemical Abstract Services Registry Numbers (CASRN), and some physical constants. Columns have been added to this table that provide the following:

- the date of the original derivation of the PAC values;
- the date of the last technical review of the data used for deriving the PAC values;
- the date of the last revision of the data and/or PAC values;

Columns containing the primary references used for TEEL derivation of each chemical, the lowest value found for the lower explosive limit (LEL) in parts per million (ppm), and the National Fire Protection Agency (NFPA) Health Hazard Rating (HHR) have also been added. Future reviews will update this data.

Table 2 is an alphabetical list of the chemical substances and their corresponding PAC values. For the most part, values are given in parts per million (ppm) for gases and volatile liquids and in milligrams per cubic meter (mg/m^3) for solids, particulates (aerosols) and nonvolatile liquids. A column has been added to this table that lists the TEEL or PAC values that have changed since the last revision. The final column in this table contains technical comments and information provided by the PAC Development Team.

Table 3 is a list of the same PAC values as presented in Table 2, but the chemicals are sorted by CASRN. They are presented in the original units of the request, either ppm or mg/m^3 .

Table 4 is an alphabetical list of the chemical substances and their corresponding PAC values in mass per unit volume (mg/m^3) with the ppm to mg/m^3 conversion carried out assuming standard temperature and pressure, 25 °C and 760 mm Hg. The final column in this table provides "Source of PACs" information.

The SCAPA website features a PAC/TEEL webpage <http://orise.orau.gov/emi/scapa/teels.htm> that provides links to PAC/TEEL products and related technical information. This includes links to:

- PAC data tables in Adobe Acrobat (pdf) and Microsoft Excel formats on the DOE Health, Safety, and Security (HSS) Chemical Safety Program's PAC webpage
- An on-line searchable PAC database
- Links to the most recent AEGL and ERPG data sets
- Links to the published TEEL methodology

Several improvements to the TEEL-derivation methodology have occurred over the past several years and are documented in DOE-HDBK-1046-2008, Temporary Emergency Exposure Limits: Methods and Practice (DOE, 2008). This document is available online at <http://www.hss.doe.gov/nuclearsafety/ns/techstds/standard/hdbk1046/doe-hdbk-1046-2008.pdf>. Suggestions for improvement to this document, for chemicals to be added to the list, for the format of the database, and other comments are welcome.

Anyone desiring PAC values for chemicals not on the "PAC Rev 25" list is asked to send the request to the PAC development team at pacdevelopment@listserv.orau.gov or use the form provided on the SCAPA webpage. A comprehensive set of contact information, including phone numbers, is also available on the SCAPA webpage <http://orise.orau.gov/emi/scapa/teels.htm>.

The definitions of the PACs are found at the end of this introduction.

Further Information

Because of its length, "PAC Rev. 25" is not available as a bound hard copy document. For further information please contact the PAC development team at pacdevelopment@listserv.orau.gov.

Definition of PACs (AEGLs, ERPGs or TEELs):

AEGL's represent threshold exposure limits for the general public and are applicable to emergency exposures ranging from 10 minutes to 8 hours. Three levels—AEGL-1, AEGL-2, AEGL-3—are developed for each of five exposure periods (10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours) and are distinguished by varying degrees of severity of toxic effects. DOE guidance is to use the 1 hour AEGL values, which appear in this database. The three AEGLs are defined as follows:

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

Emergency Response Planning Guidelines (ERPGs) are defined as follows:

- ERPG-1 is the maximum concentration in air 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 perceiving a clearly defined objectionable odor.
- ERPG-2 is the maximum concentration in air 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 their abilities to take protective action.
- ERPG-3 is the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

Temporary Emergency Exposure Limits (TEELs) are defined as follows:

- TEEL-0 is the threshold concentration below which most people will experience no adverse health effects.
- TEEL-1 is the airborne concentration (expressed as ppm [parts per million] or mg/m³ [milligrams per cubic meter]) of a substance above which it is predicted that the general population, including susceptible individuals, could experience discomfort, irritation, or certain asymptomatic, nonsensory effects. However, these effects are not disabling and are transient and reversible upon cessation of exposure.
- TEEL-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.
- TEEL-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.

TEELs are intended for use until AEGLs or ERPGs are adopted for those chemicals.

Key to Abbreviations

abs	absolute	ERPG	Emergency Response Planning Guidelines of the AIHA
ACGIH	American Conference of Governmental Industrial Hygienists	eth	ether
AEGL	Acute Exposure Guideline Level	expls	explodes
af	atomic formula	(F)	Fahrenheit
AIHA	American Industrial Hygiene Association	FCC	Food Chemical Codex
alc	alcohol	FDA	U.S. Food and Drug Administration
alk	alkaline	fibrs	fibers
amorph	amorphous	flam	flammable
anhyd	anhydrous	flash p	flash point
approx	approximately	FP, fp	freezing point
aq	aqueous	g, gm.	gram
atm	atmosphere	glac	glacial
autoign	auto-ignition	gran	granular, granules
aw	atomic weight	hygr	hygroscopic
BEI	ACGIH Biological Exposure Indexes	H, hr	hour(s)
BP, bp	boiling point	HR	Hazard Rating (SAX)
b range	boiling range	htd	heated
CASRN	Chemical Abstracts Service Registry Number	htg	heating
cc	cubic centimeter	IARC	International Agency for Research on Cancer
CC	closed cup	immisc	immiscible
CL	ceiling concentration	incomp	incompatible
COC	Cleveland open cup	insol	insoluble
conc	concentration, concentrated	IU	International Unit
compd(s)	compounds	kg	kilogram (one thousand grams)
contg	containing	L, l	liter
cryst, crys	crystal(s), crystalline	LEL	Lower Explosive Limit
d	density	liq	liquid
D	day(s)	M	minute(s)
decomp, dec	decomposition	m³	cubic meter
deliq	deliquescent	mf	molecular formula
dil	dilute	mg	milligram
DOT	U.S. Department of Transportation	misc	miscible
EPA	U.S. Environmental Protection Agency	μ	micron
		mL, ml	milliliter
		mm	millimeter

mm Hg	pressure in millimeters of mercury	spont	spontaneously
mod	moderately	STEL	short term exposure limit
MP, mp	melting point	subl	sublimes
mppcf	million particles per cubic foot	T	TEEL
MW, mw	molecular weight	TCC	Tag closed cup
ng	nanogram	tech	technical
NIOSH	National Institute for Occupational Safety and Health	TEEL	Temporary Emergency Exposure Limits
nonflam	nonflammable	temp	temperature
NTP	National Toxicology Program	μ, u	micron
OBS	obsolete	TLV	Threshold Limit Value
OC	open cup	TOC	Tag open cup
org	organic	TWA	time weighted average
OSHA	Occupational Safety and Health Administration	U, unk	unknown, unreported
P	PAC	UEL, uel	upper explosive limit
Pa	Pascals	μg, ug	microgram
PEL	permissible exposure level	ULC, ulc	Underwriters Laboratory Classification
petr	petroleum	USDA	U.S. Department of Agriculture
pg	picogram (one trillionth of a gram)	vac	vacuum
Pk	peak concentration	vap	vapor
pmole	picomole	vap d	vapor density
powd	powder	VP, vap press	vapor pressure
ppb	parts per billion (v/v)	Vol	volume
pph	parts per hundred (v/v)(percent)	visc	viscosity
ppm	parts per million (v/v)	vsol	very soluble
ppt	parts per trillion (v/v)	W	week(s)
prep	preparation	Y	year(s)
press	under pressure	%	percent(age)
PROP	properties	>	greater than
Pwdr	powder	<	less than
rhomb	rhombic	< =	equal to or less than
SAX Number	each chemical's identifying code as used in SAX3	> =	equal to or greater than
SCAPA	Subcommittee on Consequence Assessment and Protective Actions	°	degrees
S, sec	second(s)	°C	temperature in Celsius
SAR	Structure Activity Relationships	(F), °F	temperature in Fahrenheit
Si, sit, sitly	slightly		
SG	specific gravity		
sol	soluble		
soln	solution		
solv(s)	solvent(s)		

References

Environmental Protection Agency (EPA). (2009). Acute Exposure Guideline Levels (AEGs), for Chemicals. Available at: <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm>.

American Industrial Hygiene Association (AIHA). (2009). *The AIHA 2008 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook*. Fairfax, VA: AIHA Press.

U.S. Department of Energy (DOE). (2008). *Temporary Emergency Exposure Limits: Methods and Practice*, DOE-HBK-1046-2008. Available as: [DOE-HBK-1046-2008](#).