



Permissible Exposure Limits (PELs) for Airborne Contaminants Advisory Meeting

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Garrett Keating, Ph.D.
Toxicologist
Cal/OSHA
Research and Standards-Health

Welcome and Introduction

- Cal/OSHA
- Health Effects Advisory Committee (HEAC)
- Hazard Evaluation System and Information Service (HESIS)

Policy and Procedure for the Advisory Committee Process for Permissible Exposure Limit (PEL) California Labor Code Section 144.6

- The role of the Health Expert Advisory Committee (HEAC) is to consider the need and scientific basis for recommending to the Division new or revised health-based exposure levels for airborne contaminants.
- In evaluating the scientific literature HEAC will use a “weight-of-evidence” approach rather than attempt to evaluate all existing scientific evidence relevant to a particular substance.
- The Division believes it is most appropriate that the HEAC operate primarily on a consensus-based decision-making model.
- HEAC recommendations are to be consistent with Labor Code 144.6 and will most adequately assure that no employee will suffer material impairment of health or functional capacity even with regular occupational exposure to the substances for the period of a working life.
- The Division will seek experts from other state agencies, academic institutions, professional associations, and other interested groups. HEAC members will be expected to disclose fully any organization they represent or affiliations they have which might be a source of bias. However, they will also be expected to serve on the committee to the best of their ability as neutral technical experts

Rule Making Status:

Finished at HEAC, submitted or drafted documents for formal rulemaking (listed in no particular order)

Trichloroethylene - submitted

2-Butoxyethanol

Cyclohexane

Aluminum

2-Butoxyethyl acetate

n-Propanol

1,1,2,2-Tetrabromoethane

Trimellitic anhydride

Finished at HEAC, in que to commence drafting documents for formal rulemaking (listed in no particular order)

Hydrogen sulfide

Peracetic acid

Manganese

n-, sec-, tert-, and iso-Butyl acetate

Methyl isobutyl ketone

n-, and tert-Butyl alcohol

Under consideration at HEAC

Sulfur dioxide

Benzophenone

Turpentine, and select monoterpenes

Development of the Prioritization List

New or revised occupational exposure limits (OELs) from nationally and internationally recognized professional associations and governmental agencies

Cal/OSHA “Form 9” requests

Petition decisions granted by the Cal/OSHA Standards Board;

Other requests from the public or other governmental agencies such as the Department of Public Health - OHB and Cal/EPA - OEHHA.

Key considerations used for P1 ranking.

1. Evidence of a serious potential hazard not adequately addressed by existing regulations.
2. A substantial change in the value of an OEL that could contribute to increased protection of workers if adhered to by employers.
3. The degree to which a substance is in widespread use in California or to which there are other indications of pervasive and potentially hazardous worker exposure to the substance.
4. The seriousness of the nature of the health hazard presented by the substance. For example, substances with apparent potential for cancer, reproductive, developmental, or sensitizing effects would generally receive a higher priority for consideration than substances where the hazard potential is mild respiratory irritation.

2019 Prioritization

Chemical	ACGIH TLV	Cal/OSHA PEL	ACGIH/NIOSH/EPA/OEHHA	EPA (tons/y)	CERS	Factor
1-Bromopropane	0.1	5	ACGIH: A3, CNS impair, dev/repro, hematological, peripheral neuropathy; OEHHA: cancer	10-50M	61	1
Carbon tetrachloride	5	2	ACGIH: A2, liver damage; OEHHA: cancer	100-250M	129	4
Dicyclopentadiene	0.5	5	ACGIH: URT/LRT/eye irr, CNS; other: kidney lesions	250-500M	12	2
Diethylene glycol monobutyl ether	10	-	ACGIH: IFV, hematologic, liver and kidney effects	100-250M	1830	3
Di(2-ethylhexyl) phthalate (DEHP)	0.5	5	ACGIH: A3, LRT irr (^2019 NIC repro; teratogenicity)	-	6	1,4
Methanol	200	200	ACGIH: Headache, eye dam, dizziness, nausea; EPA: developmental	10-20B	468	5
Monochloroacetic acid	0.5	-	ACGIH: IFV, URT irr	50-100M	103	3
Phthalic anhydride	0.002	6	ACGIH: IFV, DSEN, RSEN, respiratory sen, asthma	500-750M	6	2,4
p-chloro- α,α,α -trifluorotoluene (PCBTF)	-	-	IARC, NTP, OEHHA: cancer	10-50M	681	3
Titanium dioxide, ultrafine (<100 nm)	0.3	5	PEL is particulates not otherwise regulated respirable; *NIOSH REL: cancer, 2.4 mg/m ³ for fine and 0.3 mg/m ³ for ultrafine	10-50M	81	2

MOE = Margin of exceedance; the factor by which Cal/OSHA PEL exceeds the OEL(s).

$$\sum PEL/OEL_n$$

n = number of authoritative bodies (1-4)

Analogous to OSHA Z tables: OSHA, Cal/OSHA, NIOSH, and ACGIH

Not all OELs based on same health-endpoint

MOEs mostly for volatile chemicals; particulates and gases need to be added

Does not compare STEL, CEILING values

Different updating schedules by authoritative bodies

Values not shown for substances for which there is no PEL

3 or 4 authoritative bodies with OEL < PEL

Chemical	Cal/OSHA PEL		Margin of Exceedance (PEL / OEL)					MOE sum	MOE count	MOE avg.
	ppm	mg/m ³	TRGS	ACGIH	EU	OEHHA	NIOSH			
Benzene; see also Section 5218	1	3.19		20	5	1063	10	1098	4	275
2-Methoxyethanol	5	16	5	50	5		50	110	4	28
2-Methoxyethyl acetate	5	24	5	50	5		50	110	4	27
o-Toluidine; o-methylaniline	2	9	20	2000	18		0.4	2038	3	679
2-Butoxyethanol (EGBE)	20	97	2			591	4	598	3	199
Manganese fume, as Mn	--	0.2	10	10		1176		1196	3	399
Arsine	0.05	0.2	10	10			100	120	3	40
Formaldehyde, see Section 5217	0.75	--	2.5	7.5			47	57	3	19
2-Ethoxyethyl acetate	5	27	2.5	1	2		10	16	3	5
2-Ethoxyethanol; Glycol monoethyl ether	5	18	2.5	1	2		10	16	3	5
Acetonitrile	40	70	4	2			2	8	3	3
Dimethylformamide; DMF	10	30	2	2	2		1	7	3	2

2 authoritative bodies with OEL < PEL

Chemical	Cal/OSHA PEL		Margin of Exceedance (PEL / OEL)					MOE sum	MOE count	MOE avg.
	ppm	mg/m ³	TRGS	ACGIH	EU	OEHHA	NIOSH			
1-bromopropane	5	25		50		7353		7403	2	3701
Toluene-2,4-diisocyanate; TDI	0.005	0.04		5		2667	0.25	2672	2	1336
Acrolein	0.1	0.25	5			357	1	363	2	182
Methylene bis(phenylisocyanat	0.005	0.051		1		319	1.02	321	2	160
Phenylhydrazine	5	20		50			36	86	2	43
Maleic anhydride; cis-butenedi	0.1	0.4	5	40			0.4	45.4	2	23
Dicyclopentadiene	5	30	10	10			1	21	2	11
Chloroprene; 2-chloro-1,3-buta	10	36		10			10	20	2	10
Nitrobenzene	1	5	10	1	5		1	17	2	9
Cumene; isopropylbenzene	50	245	5	10			1	16	2	8
Tetrahydrofuran	200	590	10	4			1	15	2	8
1,1,2,2-Tetrachloro-1,2-difluor	500	4170	3	10			1	14	2	7
Triorthocresyl phosphate	--	0.1	7	5			1	13	2	6
Ethylene oxide; see Section 522	1	2		1	1		10	12	2	6
2,4,6-Trinitrotoluene; TNT	--	0.5	5	5			1	11	2	6
Methyl acrylate	10	35	5	5			1	11	2	6
Phenyl mercaptan	0.5	2		5			5	10	2	5
Mesityl oxide; 4-methyl-3-pent	15	60	8	1			2	10	2	5
Styrene (monomer); phenyleth	50	215	3	5			1	9	2	4

1 authoritative body with OEL < PEL or OEL = PEL

Chemical	Cal/OSHA PEL		Margin of Exceedance (PEL / OEL)					MOE sum	MOE count	MOE avg.	
	(ppm)	(mg/m ³)	TRGS	ACGIH	EU	OEHHA	NIOSH				
Phthalic anhydride	1	6		3000				1	3001	1	3001
1,2,3-Trichloropropane	10	60		2000				1	2001	1	2001
Chlorodiphenyl (42% chlorine)	--	1		1			1000		1001	1	1001
Iodoform	0.6	10		600				1	601	1	601
Chlorodiphenyl (54% chlorine)	--	0.5		1			500		501	1	501
1,3-Butadiene (see also section	1	2.2		0.5	1	244		1	246.9	1	247
Isopropyl ether; diisopropyl eth	250	1050	1	1			0.5		2.75	0.0	1.0
Isopropyl acetate	250	950		2.5					2.5	1.0	2.5
Vinyltoluene	50	240	3						3.0	1.0	3.0
Sodium azide	0.1	0.3	2					1	2.0	1.0	2.0
Biphenyl; diphenyl; phenylbenz	0.2	1.5		1			1.5		1.5	1.0	1.5
Propargyl alcohol; 2-propyn-1-	1	2	1	1				1	3.0	3.0	1.0
n-Butyl mercaptan	0.5	1.5	1	1				1	3.0	0.0	0.0
Hydrogen bromide	3	10	1					1	2.0	0.0	0.0
Methyl n-amyl ketone; 2-hepta	50	235	1	1			0.5		2.5	0.0	0.0
Hydrazine	0.01	0.013		1	1		0.333		2.3	0.0	0.0

MOE can also be developed for carcinogens – based on quantitative risk estimates (1/1000) and qualitative cancer determinations (1, 2A, 2B etc.)

HESIS, CDPH: **OCCUPATIONAL HEALTH HAZARD RISK ASSESSMENT PROJECT FOR CALIFORNIA**

<https://www.cdph.ca.gov/Programs/CCDCPHP/DEODC/OHB/HESIS/CDPH%20Document%20Library/riskreport.pdf>

IARC: *IARC Monographs on the Identification of Carcinogenic Hazards to Humans*

Report of the Advisory Group to Recommend Priorities for *IARC Monographs* during 2025–2029

<https://monographs.iarc.who.int/event/advisory-group-to-recommend-priorities-for-the-iarc-monographs-during-2025-2029/>

ACGIH cancer determinations

<https://pmc.ncbi.nlm.nih.gov/articles/PMC1646668/#:~:text=Abstract,classify%20carcinogens%20for%20its%20evaluation. 1986>

EU cancer OEL's and rankings.

Use MOE to:

Identify latest occupational health and risk findings by other authoritative bodies

Review these findings for specific basis: toxicological, epidemiological or medical

Prepare health assessments with consultation of HEAC subject matter experts

Present recommendation at HEAC at least two times.

Questions about Prioritization:

Other authoritative bodies to include in MOE table? AIHA, AEGL Priority List

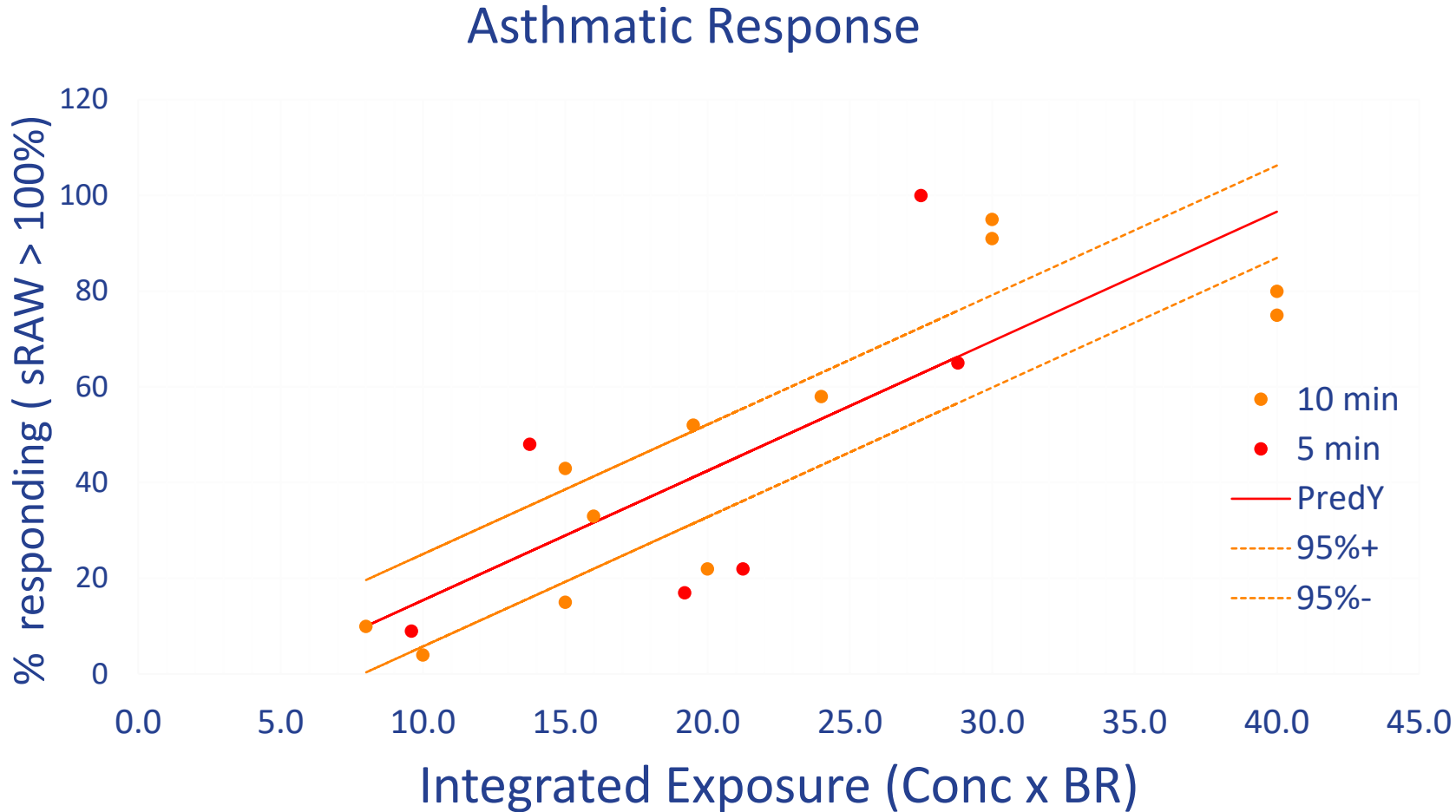
Other sources of worker health impacts – PISP

Coordination with other reviews: IARC priorities, TSCA risk assessments, ACGIH NIC, OEHHA “Hot Spot” program

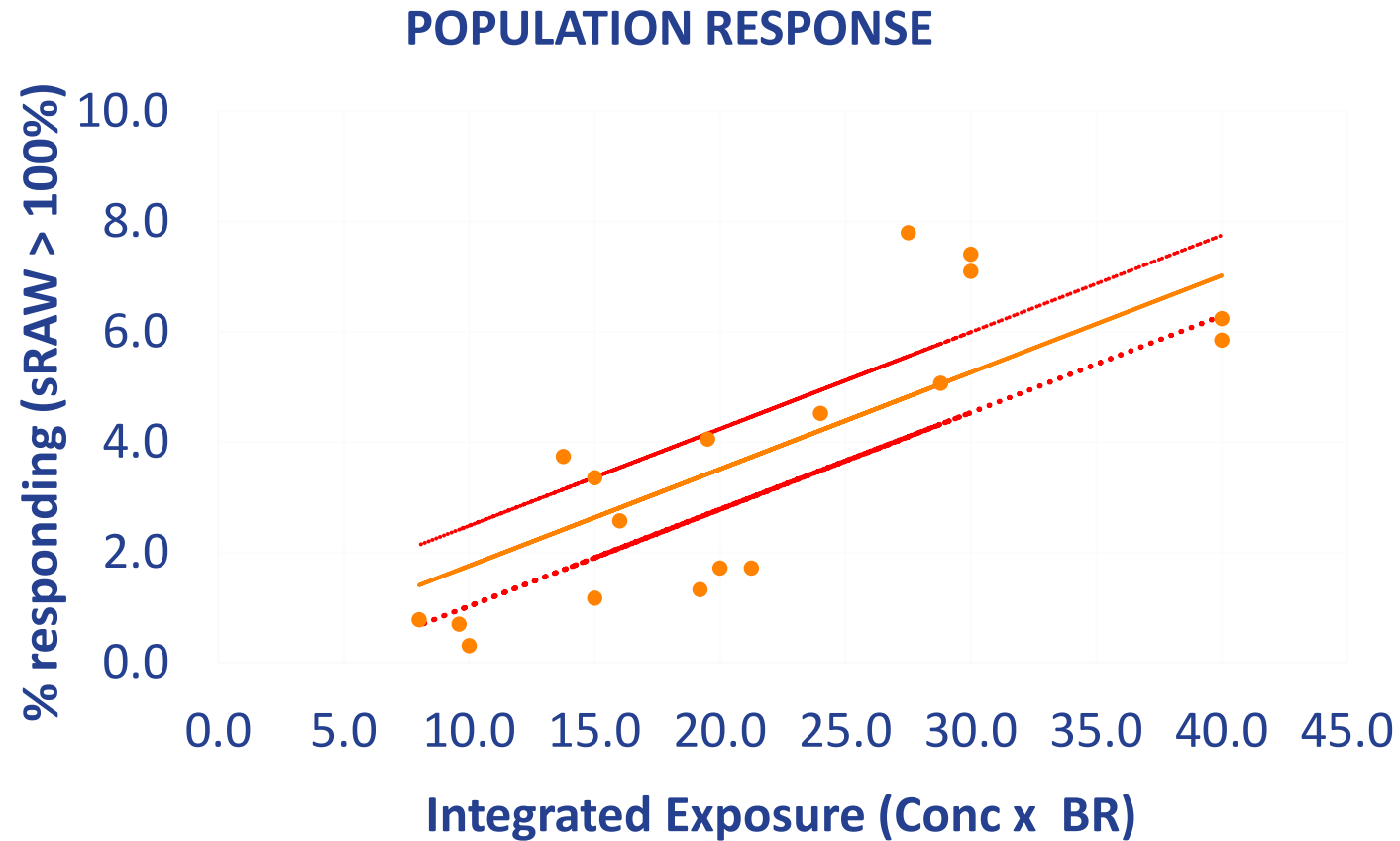
Chemical Reviews

Sulfur Dioxide
Turpentine
Benzophenone
Chemicals from 2019 Prioritization

Sulfur Dioxide –asthmatic response



Sulfur Dioxide – population response



Benzophenone

- Benzophenone has no ACGIH TLV, NIOSH REL, or OSHA PEL. Only one authoritative body has recommended an exposure limit (AIHA). Benzophenone is a solid at room temperature and presents vapor and particulate exposures. Benzophenone is well absorbed through the skin. There is limited toxicological data on benzophenone and no chronic inhalation study in animals with which to assess its health hazard. A metabolite of benzophenone has estrogenic activity and has been weakly linked to such effects in humans.
- A PEL of 0.5 mg/m³ based on kidney effects is recommended for discussion. The key target endpoints for the human hazard assessment of benzophenone are kidney and liver effects. Non-neoplastic and neoplastic effects were observed in both these organs in chronic feeding studies in two species. . Benzophenone has been shown to be non-genotoxic and not or weakly endocrine-active in numerous assays. A skin notation is recommended.

Turpentine and monoterpenes

- An 8-hour PEL for turpentine (CAS number 8006642) and selected monoterpenes (alpha-pinene, beta-pinene, delta-carene and d-limonene, CAS numbers 80568, 127913, 13466789 and 5989-27-5, respectively) of 20 PPM is proposed for discussion. Turpentine contains multiple terpene compounds, the 4 principle being the pinene isomers, carene and limonene. Eye, nose and throat irritation is the health basis for the proposed exposure level. NIOSH methods for turpentine and the monoterpenes indicate that this exposure level is analytically feasible. The proposed exposure level would apply to turpentine or separately to the select monoterpenes.
- NTP to release results of 2-year chronic inhalation study with pinene later this year.



PRIORITIZATION for HEAC 2026

HEAC Priority List, 2019

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MCAA: no PEL; three OELs

- ACGIH: 0.5 ppm
- TRGU: 0.5 ppm
- AIHA: 0.5 ppm

Diethylene glycol monobutyl ether: no PEL; 2 OELs

- ACGIH: 10 ppm
- TRGU: 10 ppm

• **Carbon tetrachloride: PEL, MOE = 2.5 ; 3 OELs**

- ACGIH: 5 ppm
- TRGU: 0.5 ppm
- EU: 1 ppm

Carbon Tetrachloride

“In the last *Monographs* evaluation of carbon tetrachloride in 1998, the evidence for cancer in humans was assessed as *inadequate*. Several new studies of the association between cancer and carbon tetrachloride exposure have been published. For NHL, several studies show consistent associations. Three out of the four cohort studies with results on NHL and carbon tetrachloride exposure showed positive associations. All three new population-based case–control studies in Canada and the USA also found positive associations (McDuffie et al., 2001; Wang et al., 2009; Callahan et al., 2018)”.

Chemical Use Data

	EPA (tons/y)	CERS reports	Gallons on site (median)	Cal SIC codes
Monochloroacetic acid	50-100M	103	0.5	5
Carbon tetrachloride	100-250M	129	0.2	8
Diethylene glycol monobutyl ether	50-100M	1830	50	64

1-bromopropane

OEHHA 1-Bromopropane 8-hr Reference Exposure Level

Study (key study) population: 71 female workers from four 1-BP manufacturing plants (Li et al., 2010b)

Critical effects: Reduction in distal peripheral nerve function

EPA 1-Bromopropane Risk Assessment:

In the 1-BP risk characterization, developmental toxicity (i.e., post-implantation loss) was identified as the most sensitive endpoint for non-cancer adverse effects from acute and chronic inhalation and dermal exposures for all conditions of use. For cancer, the benchmark cancer risk estimate of 1×10^{-4} was exceeded for all of the uses in workers and occupational nonusers.

EPA: In July 2024, EPA announced a proposed rule for 1-BP under the Toxic Substances Control Act (TSCA). A final rule has not yet been published.



Questions

Garrett Keating, Ph.D.

gkeating@dir.ca.gov

Cal/OSHA

Research and Standards Health