

Occupational Exposure Banding: What if there is no Occupational Limit?

AIHA Gulf Coast Local Section PDC

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Occupational Exposure Limits

There's a lot, but not enough

- US EPA Toxic Substances Control Act (TSCA) Chemical Substances Inventory lists more than 86,000 chemicals regulated under TSCA.
- Yet only about 1,000 of them have been assigned government, consensus or peer-reviewed OELs.
- The 86,000 chemicals do NOT include: pesticides, foods and food additives, drugs, cosmetics, tobacco or tobacco products, nuclear materials or munitions.
- The Chemical Abstracts Registry Service of the ACS has assigned CAS Numbers to more than 263 million registered substances, with thousands more added every day.
- Sources:
 - <https://www.epa.gov/tsca-inventory/about-tsca-chemical-substance-inventory>
 - <https://www.cdc.gov/niosh/docs/2019-132/pdfs/2019-132.pdf?id=10.26616/NIOSH PUB2019132>
 - <https://www.cas.org/cas-data>

Limitations on Limits

OELs Not Always Understood

- Time Weighted Average (TWA) $\Sigma (C_i/T_i)/8$
- Short Term Exposure Limit (STEL) 15 minutes - how many/how frequently
- Ceiling Value and Skin notations
- Why are non-enforceable OELs needed?
 - ACGIH Threshold Limit Value (See new ACGIH Data-Hub)
 - NIOSH Recommended Exposure Limit

Limitations on Limits

OELs Not Always Understood

- Mixtures of Chemicals: OSHA reg does not specify similar toxicity or target organs, but should.
- Nuisance Dust ... or not?
- What Jurisdiction applies ... see OSHA Annotated List Z-1,2,3, Note on TLVs
 - <https://www.osha.gov/annotated-pels>
 - <https://www.osha.gov/annotated-pels/table-z-1>
 - <https://www.osha.gov/annotated-pels/table-z-2>
 - <https://www.osha.gov/annotated-pels/table-z-3>
 - <https://www.osha.gov/annotated-pels/note>

Table Z-1: State PELs: California's nice, but what about Michigan, Oregon, etc. ?

Note: the Cal/OSHA, PELs TLVs and RELs are only shown for Federal OSHA regulated chemicals in Table Z-1

Note: This table only includes occupational exposure limits (OELs) for substances listed in the OSHA Z-1 Table. OELs for hundreds of additional substances have been adopted by Cal/OSHA, NIOSH, and ACGIH. These organizations periodically make revisions to their OELs and so they should be consulted directly for their most current values and substances, as well as special notations such as for skin absorption. The TLVs[®] and BEIs[®] are copyrighted by ACGIH[®] and are not publicly available. However, they can be purchased in their entirety on the ACGIH[®] website. Permission must be requested from ACGIH[®] to reproduce the TLVs[®] and BEIs[®]. [Click here](#) for permission request form.

OSHA Annotated Table Z-1^(a)

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Substance	CAS No. (c)	Regulatory Limits			Recommended Limits	
		OSHA PEL ^(b)		Cal/OSHA PEL ^(f) <i>(as of 10/2/2019)</i>	NIOSH REL ^(g) <i>(as of 10/18/2019)</i>	ACGIH [®] 2019 TLV [®] (h)
		ppm ^(d)	mg/m ³ (e)	8-hour TWA (ST) STEL (C) Ceiling	Up to 10-hour TWA (ST) STEL (C) Ceiling	8-hour TWA (ST) STEL (C) Ceiling
Acetaldehyde	75-07-0	200	360	(C) 25 ppm	Ca See Appendix A See Appendix C	(C) 25 ppm
Acetic acid	64-19-7	10	25	10 ppm (ST) 15 ppm (C) 40 ppm	10 ppm (ST) 15 ppm	10 ppm (ST) 15 ppm
Acetic anhydride	108-24-7	5	20	(C) 5 ppm	(C) 5 ppm	1 ppm (ST) 3 ppm

https://www.acgih.org

NIOSH OEB tech....pdf ^

Show All

Table Z-2: Wait, why are Benzene, Beryllium, Cadmium, etc. listed specially here?

Note: This table only includes occupational exposure limits (OELs) for substances listed in the OSHA Z-2 Table. OELs for hundreds of additional substances have been adopted by Cal/OSHA, NIOSH, and ACGIH. These organizations periodically make revisions to their OELs and so they should be consulted directly for their most current values and substances, as well as special notations such as for skin absorption. The TLVs[®] and BEIs[®] are copyrighted by ACGIH[®] and are not publicly available. However, they can be purchased in their entirety on the ACGIH[®] website at <http://www.acgih.org/store/>. Permission must be requested from ACGIH[®] to reproduce the TLVs[®] and BEIs[®]. Click [here](#) for permission request form.

Annotated OSHA Z-2 Table^(a)

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Regulatory Limits					Recommended Limits		
Substance	8-hour Time Weighted Average (TWA)	Acceptable Ceiling Concentration	OSHA PELs ^(b)		Cal/OSHA PEL ^(c) <i>(as of 10/2/2019)</i>	NIOSH REL ^(d) <i>(as of 10/18/2019)</i>	ACGIH [®] 2019 TLV ^{®(e)}
			Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift				
			Concentration	Maximum Duration	8-hour TWA (ST) STEL (C) Ceiling	Up to 10-hour TWA (ST) STEL (C) Ceiling	8-hour TWA (ST) STEL (C) Ceiling
Benzene ^(f) (Z37.40-1969)	10 ppm	25 ppm	50 ppm	10 min	See Annotated Table Z-1		
Beryllium and beryllium compounds ^(f) (Z37.29-1970)	2 µg/m ³	5 µg/m ³	25 µg/m ³	30 min	0.2 µg/m ³ (ST) 2 µg/m ³ (C) 25 µg/m ³	Ca See Appendix A	0.05 µg/m ³ (IHL)
Cadmium fume ^(g) (Z37.5-1970)	0.1 mg/m ³	0.3 mg/m ³			See Annotated Table Z-1		



Table Z-3: Wait, what are these silica limits for?

And the mica Federal OSHA PEL is only in mppcf?

Annotated TABLE Z-3 Mineral Dusts^(a)

[*Go to list of all footnotes](#)

Regulatory Limits			Recommended Limits		
OSHA PEL ^(b)			Cal/OSHA PEL ^(c) 8-hour TWA <i>(as of 10/2/2019)</i>	NIOSH REL ^(d) Up to 10-hour TWA <i>(as of 10/18/2019)</i>	ACGIH [®] 2019 TLV ^{®(e)} 8-hour TWA
Substance	mppcf ^{(f)(g)}	mg/m ³	mg/m ³	mg/m ³	mg/m ³
Silica: Crystalline					
Quartz (Respirable) ^(l)	250 ^(h) (%SiO ₂ +5)	10 mg/m ^{3(k)} (%SiO ₂ +2)	See Annotated Z-1	See Annotated Z-1	See Annotated Z-1
Cristobalite ^(l)	Use ½ the value calculated from the count or mass formulae for quartz.		See Annotated Z-1	See Annotated Z-1	See Annotated Z-1
Tridymite ^(l)	Use ½ the value calculated from the formulae for quartz.		See Annotated Z-1	See Annotated Z-1	See Annotated Z-1
Amorphous, including natural diatomaceous earth	20	80 mg/m ³ (%SiO ₂)	6 (total) 3 (resp.)	6	
Silicates (less than 1% crystalline silica):					
Mica	20		3 (resp.)	3 (resp.)	3 (resp.)



Limitations on Limits

OELs Not Always Used: UK Study on Small Businesses

- Relied on suppliers or personal experience for decisions on control measures
- Only 19% of almost 1200 respondents understood OELs
- Especially true for microbusinesses (< 5 employees)
 - No OSH specialist in house
 - Measurements of workers' exposure expensive, not available, difficult to interpret and apply to micro business
- Source: <https://www.cdc.gov/niosh/docs/2009-152/pdfs/2009-152.pdf>

TSCA Update: OELs from EPA

Existing Chemical Exposure Limits (ECELs)

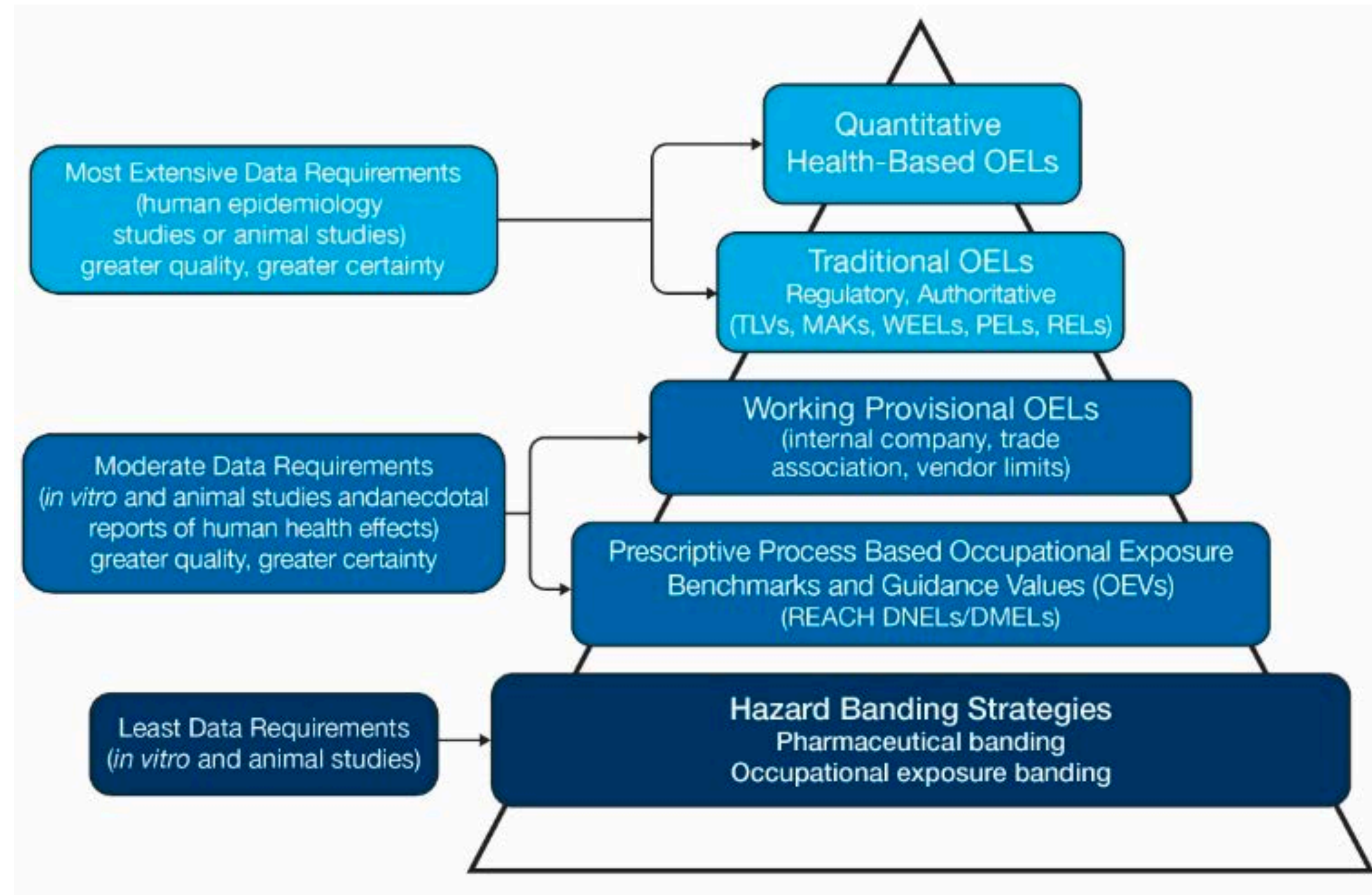
- January 19, 2017 Federal Register (82 FR 7464) Proposed Rule under TSCA Section 6(a) on commercial paint and coating removal was WITHDRAWN on January 15, 2021, but an indicator of possible future actions.
- Methylene Chloride 1 ppm TWA
 - OSHA 25 ppm TWA, 125 ppm STEL
- N-Methyl-Pyrrolidone 5 ppm TWA (20 mg/m³) and Brief-Scala reduction for longer than 8 hour shifts
 - $ECEL_n = ECEL \times (8/n) \times (24-n/16)$

Lack of OELs May Impose Limitations, too

Why monitor if there's no PEL?

- Some organizations have asked, “Why monitor for a chemical if there is no PEL or other OEL to which to compare the results?”
- It's not that the millions of chemicals without a PEL or other OEL are safe.
- What does the Safety Data Sheet (SDS) say?
 - Section 8 of SDS: Exposure Controls/Personal Protection
 - Section 11 of SDS: Toxicological Information
 - Most products are mixtures, but these sections only list OELs and Tox data for individual ingredients, not usually for the mixture as a whole

Hierarchy of OELs



Occupational Exposure Banding Defined

aka Hazard Banding or Health Hazard Banding

- Process of assigning chemicals into categories (“bands”) based on:
 - toxicological potency and
 - risk and type of adverse health effects from exposure
- Resulting in a range of airborne concentrations anticipated to protect worker health
- Related but NOT the same as Control Banding

Applications of Banding Concept

Pharmaceutical and Chemical Industry pioneered banding

- Active Pharmaceutical Ingredients were created, but had no OEL
- Toxicological, Physical and Chemical Properties affecting Health
- Grouped into categories requiring specific levels of controls (PB-ECL)
 - Conventional handling - low potency - PB-ECL category 1...1 mg/m³
 - No open handling for potent or toxic - PB-ECL category 3...10 µg/m³
 - Closed process/robotics - extremely toxic - PB-ECL category 5...0.1µg/m³

Source: Naumann et. al, (1996) Performance- Based Exposure Control Limits for Pharmaceutical Active Ingredients, AIHAJ, 57:1, 33-42.

NIOSH expanded concept to industrial chemicals

<https://www.cdc.gov/niosh/topics/oeb/default.html>

- Intended to apply banding to a broader group of chemicals than previously
- Uses available, but often limited, toxicological information to set exposure levels for workers
- The airborne concentrations set can then be used as a target for exposure controls based on the specific situation
- Technical Guidance Document explains how in detail
 - <https://www.cdc.gov/niosh/docs/2019-132/default.html>
- NIOSH also developed an e-Tool to assist deriving OEBs

AIHA & NIOSH EXPOSURE BANDING

- **Vision Statements:**
 - AIHA in partnership with NIOSH is educating health & safety professionals on the **importance of utilizing Occupational Exposure Banding (OEB) in their exposure risk assessments.**
 - **IH/OEHS and allied professionals**, e.g., Product Stewards, Occupational Health Nurses and Doctors, etc., develop and actively use **practical guidance for application of OEB in their professional practice.**
 - CPAG Champion: John Baker, johnbaker1947@icloud.com

AIHA OEB WEBSITE - WWW.AIHA.ORG/OEB



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Occupational Exposure Banding: What You Need to Know

Occupational exposure banding, also called hazard banding, health hazard banding, or exposure banding, is a process of assigning chemicals into bands or categories based on a chemical's toxicological potency and the risk of adverse health effects associated with exposure. The result of this process is called an occupational exposure band, or OEB, which is a range of exposure concentrations where worker health is anticipated to be protected.

Public Resources **Occupational Exposure Banding**

Public Resources

Vendor Directory for OEHS Professionals

Center for Safety & Health Sustainability

Consultants Listing +

Consumer Resources +

Government Relations & Advocacy



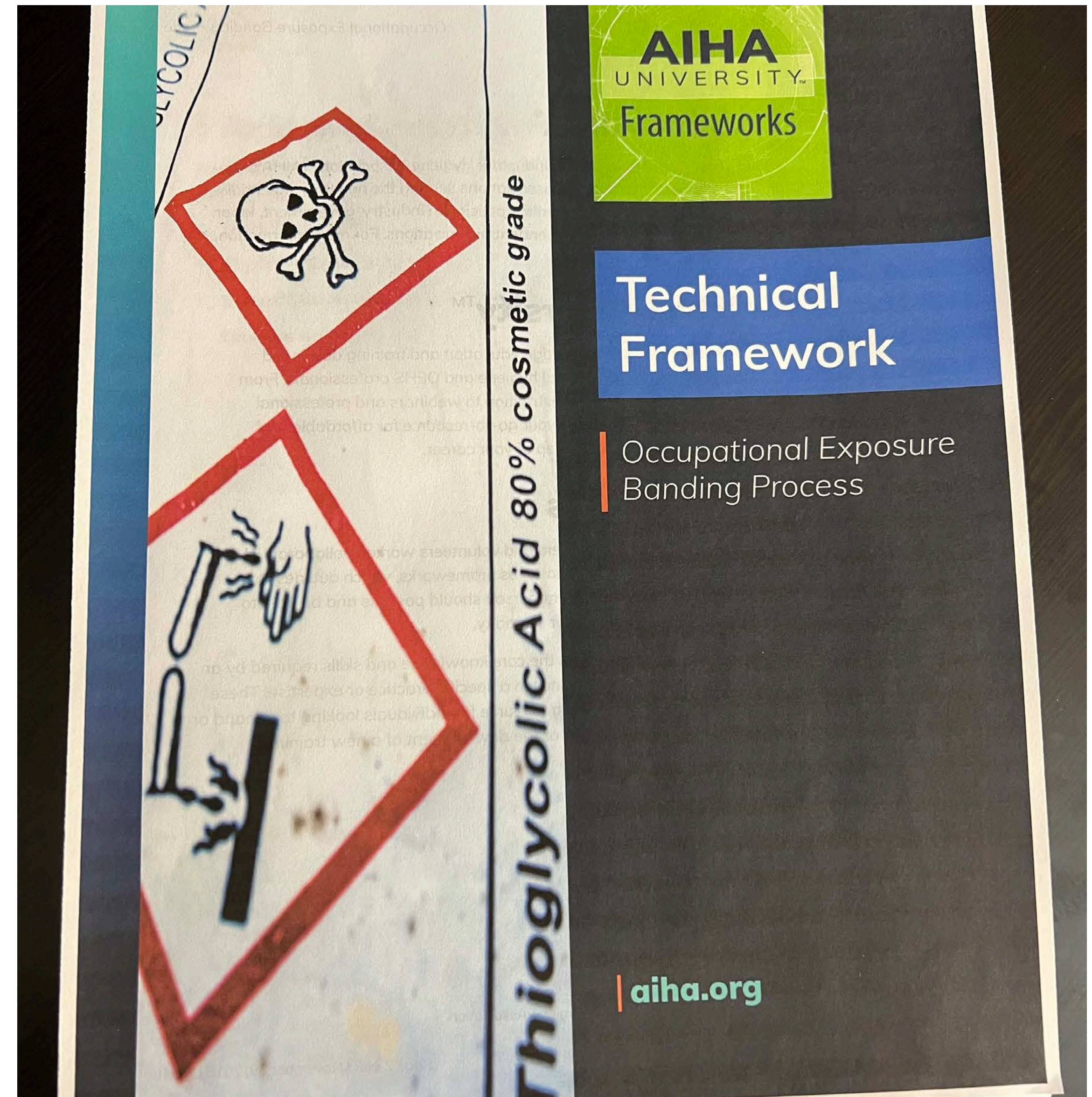
An IH/OEHS professional interact with occupational exposure banding (OEB) in situations where they must make health-based risk management decisions in the absence of occupational exposure limits (OELs). While OEBs are provisional, OELs are official, authoritative standards created by recognized occupational



AIHA OEB resources

Available for your use

- Technical Framework/Body of Knowledge
- Intro to OEB guidance
- Link to NIOSH e-Tool
- Link to CPAG OEB page
- OEB Virtual Conference Recordings
- 2 Microlearning Videos



WWW.AIHA.ORG/OEB



QUESTIONS FOR THE GROUP

- Are you familiar with the principles of OEB?
- Have you personally used OEB in a professional setting?
- Have you seen either of the two OEB instructional videos?
- If you are familiar but have not used OEB what was the barrier?

What are Tier 1, Tier 2, and Tier 3?

Levels of OEBs developed with less to more data

- Tier 1 uses GHS Hazard Codes (“H-codes”) assigned to chemicals under the UNECE Globally Harmonized System for Classification and Labeling of Chemicals to place the chemicals in air concentrations called Bands C, D or E.
 - Typically Gestis, ECHA Annex VI or SDS data is used for Tier 1
- Tier 2 uses specific toxicological data from authoritative databases such as National Toxicology Program (NTP), International Agency for Research on Cancer (IARC), Health Canada, Agency for Toxic Substances and Disease Registry (ATSDR), EPA Integrated Risk Information System (IRIS), etc. to place the chemicals in air concentrations called Bands A, B, C, D or E.
- Tier 3 requires expert judgement to evaluate experimental data

The 5 Bands of NIOSH

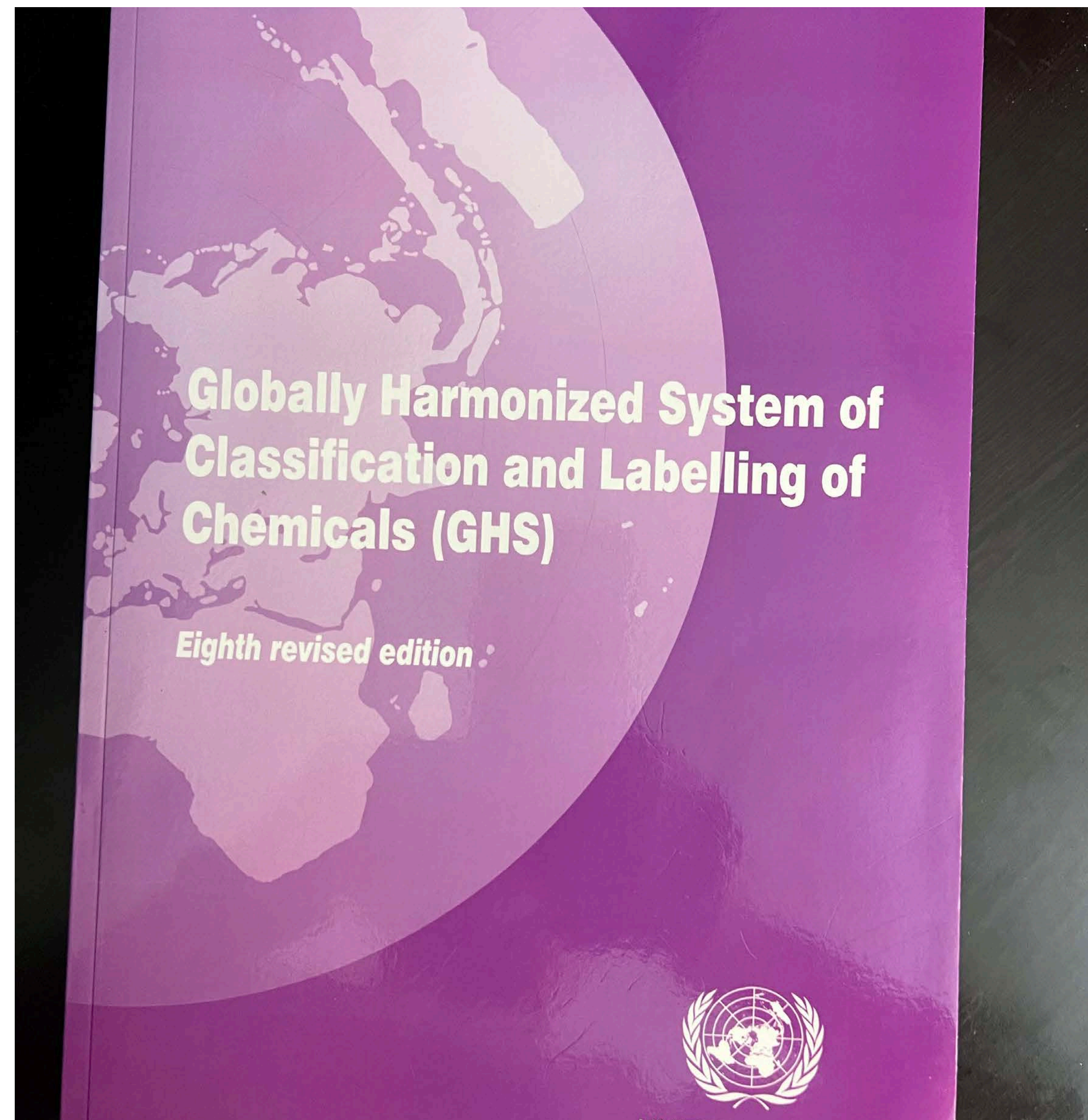


Recommended airborne concentrations decrease from A to E

- Tier 1 C,D,E only
- Tier 2 A,B,C,D,E

OEB	Dust/Particle mg/m ³	Gas/Vapor ppm
A	>10	>100
B	>1 to 10	>10 to 100
C	>0.1 to 1	>1 to 10
D	>0.01 to 0.1	>0.1 to 1
E	≤0.01	≤0.1

GHS H-Codes are used in Tier 1 Hazard Class and Category



Let's start with an SDS...Oh, wait...

OSHA Hazard Communication Standard 29 CFR 1910.1200

- OSHA does not require H-codes on SDSs.
- Hazard statements and pictograms ARE harmonized.
- You need UN GHS “Purple Book” Annex 3 to cross-reference.
- Example:
 - Acute Toxicity, oral, category 1
 - Skull and Crossbones pictogram
 - “Fatal if swallowed” = H 300

Overview of Tier 1 Banding Process

Table 2-2 of NIOSH Guidance Doc. 2019-132

- Step 1. Chemical of Interest has no OEL
- Step 2. Locate GHS Hazard codes and categories in recommended databases
- Step 3. Compare hazard codes/categories for each NIOSH criteria of each health endpoint
- Step 4. Assign band to each relevant health endpoint based on criteria
- Step 5. Assign an OEB for the chemical based on the most protective endpoint band among C, D, E.

Health endpoints used for NIOSH OEB

GHS health hazard classes used (which ones are missing?)

- Carcinogenicity
- Reproductive and Developmental Toxicity
- Specific Target Organ Toxicity
- Repeated Exposure
- Genotoxicity
- Respiratory Sensitization
- Skin Sensitization
- Acute Toxicity/Lethality
- Skin Corrosion/Irritation
- Eye Damage/Corrosion

🏠 OEB e-Tool Home

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Tier One



Tier Two



Additional Resources

Conversion Calculator

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Related Information

[NIOSH Pocket Guide](#)

[NIOSH OEB Topic Page](#)

NIOSH Occupational Exposure Banding e-Tool

Overview

Occupational exposure banding is a process of assigning chemicals into specific categories or bands based on a chemical's potency and the adverse health outcomes associated with exposure. The output of this process is an occupational exposure band (OEB), which corresponds to a range of exposure concentrations that is expected to protect worker health. For more information on occupational exposure banding please refer to the NIOSH occupational exposure banding topic page: [occupational exposure banding](#).

The **occupational exposure banding e-Tool** is a supplementary online application that incorporates the occupational exposure banding process and allows users to apply toxicology and potency information to generate quantitative exposure guidance for chemicals. The Occupational Exposure Banding e-Tool should be used in concert with the Current Intelligence Bulletin (CIB). The CIB contains detailed instructions for searching for and choosing appropriate data for banding. This e-Tool is a supplementary tool meant to assist with Tier 1 and Tier 2 banding. To learn more click here: [e-Tool](#)

Spotlight

[Technical Report: The NIOSH Occupational Exposure Banding Process for Chemical Risk Management](#)

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Occupational Exposure Banding
A conversation with
Lauralynn Taylor McKernan, ScD CIH
Captain, US Public Health Service
NIOSH/CDC

Watch on YouTube

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https://wwwn.cdc.gov/NIOSH-OEB/TierOne/Overview

NIOSH Occupational Exposure Banding e-Tool (version 1.1)

[OEB e-Tool Home](#) > [Tier One](#)



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Promoting productive workplaces through safety and health research **NIOSH**

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Chemical Information

Please note that the following hazard codes will not be used for Tier 1 Banding: H200's (physical hazards), H303, H305, H313, H316, H320, H333, H335, H336, H362, and H400's (environmental hazards). If a chemical has been assigned any of these codes, they will not contribute to the Tier 1 band assignment.

Chemical Information

Chemical Name

CAS Number

Physical State

- Vapor
- Particles
- Vapor & Particles

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Tier One Update

Please note that the following hazard codes will not be used for Tier 1 Banding: H200's (physical hazards), H303, H305, H313, H316, H320, H333, H335, H336, H362, and H400's (environmental hazards). If a chemical has been assigned any of these codes, they will not contribute to the Tier 1 band assignment.

Chemical Information

Chemical Name

CAS Number

Physical State

Carcinogenicity

- Reproductive Tox
- STOT
- Genotoxicity
- Resp/Skin Sensitization
- Acute Tox
- Skin Corr/Irr
- Eye Damage/Irr

Carcinogenicity

Clear Selection

Select	Hazard Category	Hazard Code	Hazard Statement
<input type="radio"/>	1	350	May cause cancer
<input type="radio"/>	1a	350	May cause cancer
<input type="radio"/>	1b	350	May cause cancer
<input type="radio"/>	2	351	Suspected of causing cancer

Update Tier One

Related Information

- [NIOSH Pocket Guide](#)
- [NIOSH OEB Topic Page](#)

Tier 1 Example 1 Chloral Hydrate

Example of eTool Tier 1 Screen Shot summary from NIOSH 2019-132 Guidance Document

- Band of C based on:
 - Acute Toxicity Oral category 3,
 - Skin Irritation, category 2
 - Eye Irritation, category 2

Table 2-2. Tier 1 example.

Chemical Name: Chloral Hydrate

CAS Number: 302-17-0

Endpoint	Hazard code	Hazard category	H-code source	Endpoint band
Carcinogenicity	None	—	—	—
Reproductive toxicity	None	—	—	—
Specific target organ toxicity	None	—	—	—
Genotoxicity	None	—	—	—
Respiratory and skin sensitization	None	—	—	—
Acute Toxicity	—	—	—	—
Inhalation	—	—	—	—
Oral	H301	Category 3	GHS	C
Dermal	None	—	—	—
Skin corrosion/irritation	H315	Category 2	GHS	C
Eye damage/irritation	H319	Category 2	GHS	C
Most stringent band				C

Notes:

Tier 1 Example 2 Perfluorooctane Sulfonic Acid

Example of Tier 1 eTool Screen Shot Summary from NIOSH Guidance Document 2019-132

- Band of E based on:
 - Carcinogenicity category 1B
 - STOT-RE category 1
 - Skin Corrosion category 1B
- Bands of C and D for Acute Toxicity and Reproductive Toxicity were overridden, but useful to see in evaluation
- Tier 2 optional because its Band E

Chemical Name: Perfluorooctane Sulfonic Acid

Chemical Name: Perfluorooctane Sulfonic Acid
CAS number: 1763-23-1

Endpoint	Hazard code	Hazard category	H-code source	Endpoint band
Carcinogenicity	H351	Category 2	GHS	E
Reproductive toxicity	H360D	Category 1B	GHS	D
Specific Target organ toxicity - repeated exposure	H372	Category 1	GHS	E
Genotoxicity				
Respiratory and skin sensitization				
Acute toxicity				
Inhalation	H332	Category 4	GHS	C
Oral	H302	Category 4	GHS	
Dermal				
Skin corrosion/irritation	H314	Category 1B	GHS	E
Eye damage/irritation				
Most stringent band				E

Result: Band E is assigned as a result of the Tier 1 evaluation. A Tier 2 evaluation is optional.
Data Source: GESTIS: <http://www.dguv.de/ifa/gestis-database>

Overview of Tier 2 Banding Process

Figure 3.1 of OEB Guidance 2019-132

- Step 1. Begin Tier 2 process
- Step 2. Search recommended databases for toxicity information
- Step 3. Compare qualitative and quantitative data to NIOSH Tier 2 banding criteria
- Step 4. Assign band and Endpoint Determinant Score (EDS) for each NIOSH Tier 2 banding criteria
- Step 5. Assign a Tier 2 band for the chemical based on most protective endpoint band if the Total Determinant Score (TDS) is above 30 or if the overall band is E

A numerical scheme for data adequacy is used to evaluate chemical substances with different combinations of toxicological outcomes and available data, as shown in Table 3-4.

Table 3-4. Assigned scores for the presence of toxicological endpoints encountered in the Tier 2 evaluation.

Toxicological endpoint	Endpoint determinant score (EDS)
Carcinogenicity	Qualitative = 20 or 30 Quantitative = 30
Reproductive and Developmental Toxicity	30
Specific Target Organ Toxicity-Repeated Exposure	30
Genotoxicity	5
Respiratory Sensitization	10
Skin Sensitization	5
Acute Toxicity/Lethality	5
Skin Corrosion/Irritation	5
Eye Damage/Irritation	5
Data Sufficiency/Total Determinant Score (TDS)*	30/125

*The minimum TDS criteria are waived if any of the endpoint bands are E. In that case, the chemical is assigned an overall band E, regardless of TDS.

Tier 2 Data Entry Example

Bromodichloromethane

STOT-RE Health Endpoint

- Rank 1 (preferred data source)
- Endpoint type
- Duration of exposure (issues?)
- Route of exposure
- Quantitative data entry
- Can add more source of info

Tier Two

Chemical Information

Chemical Name

CAS Number

Physical State

Vapor

Particles

Vapor & Particles

Carcinogenicity Reproductive Tox **STOT** Genotoxicity Sensitization(resp) Sensitization(skin) A

Specific Target Organ Toxicity

Rank 1

Source:

NOAEL/LOAEL: NOAEL LOAEL

Duration: 90 (Days) 28-89 (Days)

Type:

Input:
mg/kg-day

Example of Tier 2 NOAEL data

ATSDR tox profile of bromodichloromethane

- Useful for STOT-RE data entry
- Which data to select?
 - Exposure period
 - Route of entry
 - Endpoint effect
 - Other considerations?

2. HEALTH EFFECTS

2-2. Levels of Significant Exposure to Bromodichloromethane – Inhalation

Exposure Parameters	Doses (ppm)	Parameters monitored	Endpoint	NOAEL (ppm)	Less serious LOAEL (ppm)	Serious LOAEL (ppm)	Effect
/day week	1, 10, 30, 100, 150	LE, BW, OW, HP	Death			30	2/6, 1/6, 3/6 de 30, 100, and 1
			Bd wt	10	30	Decreased bo	
			Hepatic	10	30	Centrilobular h degeneration & hepatocellular	
			Renal	1	10	Tubular degen	
			Ocular	10	30	Mild eye irritati	
			Other noncancer (urinary bladder)	150			
/day week	1, 10, 30, 100, 150	LE, BW, OW, HP	Death			30	2/6, 4/6, 6/6 de 150 ppm, resp
			Bd wt	100			
			Hepatic	1	10	Centrilobular h degeneration & hepatocellular	
			Renal	1	10	Tubular degen	
			Other noncancer	150			

Tier 2 process is time consuming

Need to research available data for 9 health endpoints

- Rank 1 preferred databases may have large amounts of information, but need to be carefully studied
- The eTool requires certain data parameters for input
 - Example: Bromodichloromethane ATSDR tox profile
 - inhalation studies were not more than 29 days long
 - oral chronic studies ran as long as 2 years
 - neither of which is a selection in the eTool

Completed Tier 2 Example 1 Cacodylic Acid Summary pdf from e-tool

- Carcinogenicity Weight of Evidence alone would have resulted in Band E
- Acute Oral Toxicity quantitative data (EDS = 5) would not have resulted in Band B if no other information had been available because need TDS of 30 or more.

Overall Recommended Band
E
Vapor Range: ≤ 0.1 ppm
Particle Range: ≤ 0.01 mg/m³
TDS = 35

Chemical Name: cacodylic acid CAS Number: 75-60-5				
Endpoint	Source	Data	EDS	Endpoint Band
Carcinogenicity Quant				
Carcinogenicity WOE	IARC	Group 2B (possibly carcinogenic to humans)	30	E
Reproductive Toxicity				
Target-Organ Toxicity				
Genotoxicity Toxicity				
Respiratory Sensitization				
Skin Sensitization				
Acute Toxicity	National Library of Medicine ChemID Plus	Rank: 1; Type: Oral LD50; Duration: 4.00 hrs; Input: 644	5	B
Skin Irritation				
Eye Irritation				
Overall Recommended Band			TDS=35	E
Notes				

Completed Tier 2 Example 2 Benzo(k)Fluoranthene Summary pdf from eTool

- Carcinogenicity Quantitative results would be Band D but
- Carcinogenicity Weight of Evidence moved it to Band E
- Genotoxicity resulted in Band E also
- Total Band E TDS of 40 sufficient to score.

Selected Tier Two Entry Recommendation

Overall Recommended Band

E

Vapor Range: ≤ 0.1 ppm
Particle Range: ≤ 0.01 mg/m³
TDS = 40

Chemical Name: Benzo (k) Fluoranthene CAS Number: 207-08-09				
Endpoint	Source	Data	EDS	Endpoint Band
Carcinogenicity Quant	California Slope Factor	1.2 x 1 (mg/kg-day) ⁻¹	30	D
	California Inhalation Unit Risk	1.1 x 0.0001 (µg/m ³) ⁻¹		D
Carcinogenicity WOE	U.S. EPA IRIS	Group B2 (probable human carcinogen)	30	E
Reproductive Toxicity				
Target-Organ Toxicity				
Genotoxicity Toxicity	NTP: Report on Carcinogens	Rank 1; Results: Positive	5	E
Respiratory Sensitization				
Skin Sensitization				
Acute Toxicity				
Skin Irritation	REACH	Rank 1; Results: Irritant with unspecified severity	5	C
Eye Irritation				
Overall Recommended Band			TDS=40	E
Notes				Genotoxicity Toxicity: Salmonella (023963) Completed: Positive

Benefits of e-Tool

Tier 1 and Tier 2

- Tier 1 is quick and easy using the e-Tool
- Tier 2 can be done manually, but the e-Tool provides
 - hyperlinks to Reference databases (kinda)
 - concise summary of endpoints and scores in the “Edit” screen

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Tier One Edit

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List of Existing Tier One Entries

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Chemical Name	CAS Number	Vapor Range	Particles Range	Recommended Band			
2-butyl-1,2-benzisothiazolin-3-one	4299-07-4	≤ 0.1 ppm		E	Edit	Delete	Print PDF
Acetyl chloride	75-36-5	≤ 0.1 ppm	≤ 0.01 mg/m ³	E	Edit	Delete	Print PDF
Cacodylic acid	75-60-5		> 0.1 to 1 mg/m ³	C	Edit	Delete	Print PDF
n-Hexyllithium	21369-64-2	≤ 0.1 ppm	≤ 0.01 mg/m ³	E	Edit	Delete	Print PDF
quercetin	117-39-5	> 1 to 10 ppm		C	Edit	Delete	Print PDF
quercetin	117-39-5	> 1 to 10 ppm		C	Edit	Delete	Print PDF

Related Information

- [NIOSH Pocket Guide](#)
- [NIOSH OEB Topic Page](#)

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Chemical Name	CAS Number	Vapor Range	Particles Range	Recommended Band			
acetyl Chloride	75-36-5			INSUFFICIENT DATA	Edit	Delete	Print PDF
Benzo (k) Fluoranthene	207-08-09	≤ 0.1 ppm	≤ 0.01 mg/m ³	E	Edit	Delete	Print PDF
cacodylic acid	75-60-5		≤ 0.01 mg/m ³	E	Edit	Delete	Print PDF
vincristine sulfate	2068-78-2				Edit	Delete	Print PDF

Related Information

[NIOSH Pocket Guide](#)

NIOSH OEB Tier 3 - not an eTool process

Using Expert Judgment to Evaluate Experimental Data

- Searching the literature
- Selecting relevant studies
- Evaluating the studies
- Selecting a band
- Judging data sufficiency
- Assessing uncertainty

Special Issues in NIOSH OEB

More research needed...

- Special categories of aerosols: nanoparticles and fibers
- Impacts of physical form on OEB selection
- Banding mixtures of chemical substances

Lessons Learned by NIOSH - so far

It's a Process....

- Users want it short and sweet: how to video's not 156 page technical manual
 - But “the devil is in the details...”
- Toxicology terms don't mean the same thing to everyone
- Conducting a Tier 2 requires training
- Transcription errors from using other agencies' classifications
- Therefore the NIOSH OEB e-tool was created
- <https://synergist.aiha.org/201603-the-niosh-decision-logic-for-oeps>

Upcoming activities by NIOSH

Stay tuned...

- eTool update is awaiting a close look at OSHA proposed updates on the Hazard Communication rule and updates from GHS
- So far, none warrant revisions to the banding process guidance as of April 12, 2022.
- A companion document to the NIOSH Technical Report 2019-132 is in the works: Toxicological Endpoints and Banding Criteria Employed in the NIOSH Occupational Exposure Banding Process. (currently undergoing final updates to address peer reviewers' comments)



JOHN MULHAUSEN, PhD, CIH, CSP, FAIHA, retired in 2018 from 3M where he worked for 31 years in a variety of global health and safety risk management roles, most recently as director of corporate safety and industrial hygiene. He can be reached at jmulhausen@gmail.com.

Send feedback to synergist@aiha.org.

Occupational Exposure Banding: No More Excuses

BY JOHN MULHAUSEN, AIHA PRESIDENT

My January *Synergist* article (bit.ly/syn2201care) presented an example of two OEHS practitioners with similar backgrounds but different approaches to IH programs: Practitioner A pursues regulatory compliance by seeking to control exposures below OSHA's permissible exposure limits, while Practitioner B sets a goal of driving exposures below ACGIH threshold limit values. The point of the simplistic example was to illustrate how standards of care—the minimum expected performance of a particular function—influence our interventions and help determine how protective our programs will be on the shop floor.

This month's column concerns what happens when we're dealing with a substance that does not have an OEL. We all know that this situation is quite common: the gap between the number of chemicals in commerce and those that have OELs is vast and getting larger every year. Fortunately, an effective approach exists for these substances, but distressingly few OEHS professionals are taking advantage of it.

is intended for use with substances with established hazard statements in the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). For chemicals without appropriate GHS hazard statements, the e-Tool guides the user through a structured "Tier 2" process of data collection and interpretation to assign an appropriate OEB.

The e-Tool is a remarkable achievement. It provides a freely available

which are decades old. Refusing to use a tool because it isn't required by regulations reflects the mindset of Practitioner A. Do we really want to resign ourselves to practicing our profession with science that was state of the art in the 1960s?

"It's only for the most distinguished experts." This may have been true in the early days of occupational exposure banding, but the e-Tool has been designed for use by OEHS professionals without extensive toxicology knowledge. While a Tier 2 assessment can require several hours, this time is very well spent considering the alternative with substances that have no OELs is to throw up our hands and do nothing.

"I don't see it being done routinely in major organizations." This objection ignores the history of occupational exposure banding, which has been used for decades in the phar-

RESOURCES

AIHA: *A Strategy for Assessing and Managing Occupational Exposures*, Chapter 25, "Occupational Exposure and Control Banding," 4th ed. (2015).

AIHA: "Occupational Exposure Banding: What You Need to Know," bit.ly/aihaoeb.

AIHA: "Top 10 Imperatives for the AIHA Exposure Risk Management Process" bit.ly/aihauimperatives

No more excuses...

February 2022 The Synergist President's Letter

- AIHA President John Mulhausen stated regarding substances without an OEL, “Fortunately an effective approach exists for these substances, but distressingly few OEHS professionals are taking advantage of it.”
- Excuses:
 - OSHA doesn't require it...
 - It's only for the most distinguished experts...
 - I don't see it being done routinely in major organizations...
- Our profession owes workers and communities better protection.
- We are best prepared and ethically obligated to make progress.

Thank you!
Questions?