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# Standards and Guidelines and Ethical Code of Conduct

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# Section A

*Historical Perspective*

# Hatch Curve

- ◆ Hatch, T: Changing Objectives in Occupational Health. *Industrial Hygiene Journal* 3(1):1–7 (1962)
- ◆ Implications:
  - Man-environment interaction is complex
  - Shift in emphasis from overt illness to physiological disturbances that may be precursors of disease



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## Section B

*ACGIH Threshold Limit Values  
and Biological Exposure Indices*

# Threshold Limit Value (TLV)

- ◆ *Threshold limit values (TLVs)* refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects

# Threshold Limit Value (TLV)

- ◆ Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the TLV
- ◆ A smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness

# Threshold Limit Value (TLV)

- ◆ Published by ACGIH
- ◆ Established in 1946 (updated annually)
- ◆ Approximately 750 chemicals covered
- ◆ Guidelines not law
- ◆ Documentation of TLVs and BEIs
- ◆ Method of adoption
- ◆ “Balancing of health considerations and cost to industry” –ACGIH 1948



# Examples of TLVs

Substance (CAS No.)	Adopted Values			Mol Wgt	TLV Basis – Critical Effect(s)
	TWA (ppm/mg/m <sup>3</sup> )	STEL/C (ppm/mg/m <sup>3</sup> )	Notations		
Azinphos-methyl (86-50-0)	0.2 mg/m <sup>3</sup>	—	Skin; A4; BEI	317.34	Cholinergic
Barium (7440-39-3) and soluble compounds, as Ba	0.5 mg/mg <sup>3</sup>	—	A4	137.30	Irritation; GI; burns; muscle toxin
Barium sulfate (7727-43-7)	10 mg/m <sup>3</sup> (E)	—	—	233.43	Pneumoconiosis (baritosis)
Benomyl (17804-35-2)	10 mg/m <sup>3</sup>	—	A4	290.32	Dermatitis; irritation
Benz[a]anthracene (56-55-3)	—	—	A2	228.30	Cancer
Benzene (71-43-2)	0.5 ppm	2.5 ppm	Skin; A1; BEI	78.11	Cancer
Benzidine (92-87-5)	—	—	Skin; A1	184.23	Cancer (bladder)
Benzo[b]fluoranthene (205-99-2)	—	—	A2	252.30	Cancer
Benzo[a]pyrene (50-32-8)	—	—	A2	252.30	Cancer
P-Benzoquinone, see Quinone					
Benzotrichloride (98-07-7)	—	C 0.1 ppm	Skin; A2	195.50	Irritation; cancer
Benzoyl chloride (98-88-4)	—	C 0.5 ppm	A4	140.57	Irritation
Benzoyl peroxide (94-36-0)	5 mg/m <sup>3</sup>	—	A4	242.22	Irritation
Benzyl acetate (140-11-4)	10 ppm	—	A4	150.18	Irritation
Benzyl chloride (100-44-7)	1 ppm	—	A3	126.58	Irritation; lung

# Typical Time Constants

- ◆ *Time-weighted average (TWA)*
  - Contaminant concentration averaged over a period of time; usually over a full work shift—i.e., eight-hour TWA

# Typical Time Constants

- ◆ *Short-term exposure limit (STEL)*
  - Contaminant concentration averaged over a 15-minute period

# Typical Time Constants

- ◆ *Ceiling*
  - Instantaneous concentration; or concentration averaged over a 15 minute period if technology does not exist to measure instantaneous concentrations

# Skin Notation

- ◆ *Skin notation (S)* indicates substances for which there is the potential for substantial contribution to exposure via adsorption through the skin
  - Examples:
    - Diazanone
    - Chlordane
    - Carbon disulfide
    - Benzene

# Sensitizer Notation

- ◆ Listed substances followed by the *sensitizer notation (SEN)* refer to the confirmed potential for worker sensitization as a result of dermal contact and/or inhalation exposure
  - Examples
    - Formaldehyde
    - Flour dust
    - Glutaraldehyde

# Carcinogenicity Classification

- ◆ A1: Confirmed human carcinogen
- ◆ A2: Suspected human carcinogen
- ◆ A3: Confirmed animal carcinogen with unknown relevance to humans
- ◆ A4: Not classifiable as a human carcinogen
- ◆ A5: Not suspected as a human carcinogen

# Excursions

- ◆ *Excursions* are concentrations above the TLV and are permitted as long as they are balanced by concentrations below the TLV such that the eight-hour TWA is less than the TLV
- ◆ Refer to the magnitude of these elevated concentrations and current guidance is that up to 30 minutes at three times the TLV is permitted but five times the TLV is not permitted



# Biological Exposure Indices (BEIs)

- ◆ Measurement of chemical determinant in a biological media
- ◆ Examples
  - Acetone in urine
  - S-Phenylmercapturic acid (metabolite of benzene) in urine
  - n-Hexane in end-exhaled air
  - Lead in blood



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## Section C

*Occupational Safety and Health  
Administration (OSHA) Standards*

# Permissible Exposure Limits (PEL)

- ◆ Set by OSHA
- ◆ Established in 1970 (rarely updated)
- ◆ Antecedents—Walsh Healey, TLV, ANSI
- ◆ Approximately 450 chemicals covered
- ◆ Eight-hour TWA, STEL, and C
- ◆ Z table and complete standards
- ◆ Legally enforceable
- ◆ Method of promulgation

# OSHAct

## *Each employer*

- ◆ “Shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;
- ◆ Shall comply with occupational safety and health standards promulgated under this Act.”

# Criteria for PEL from OSHA Act

- ◆ “The Secretary, in promulgating standards dealing with toxic materials or harmful physical agents under this subsection, shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence,...

# Criteria for PEL from OSHA Act

- ◆ ... that *no employee* will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life”

# Examples of PELs

Substance	CAS No. (c)	ppm (a) (1)	mg/m <sup>3</sup> (b) (1)	Skin designation
Azinphos-methyl.....	86-50-0	.....	0.2	X
Barium, soluble compounds (as Ba)....	7440-39-3	.....	0.5	
Barium sulfate.....	7727-43-7	.....	15	
Total dust.....		.....	5	
Respirable fraction..		.....	5	
Benomyl.....	17804-35-2	.....	15	
Total dust.....		.....	5	
Respirable fraction..		.....	5	
Benzene; See 1910.1028. See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028(d)	71-43-2			
Benzidine; See 1910.1010.....	92-87-5			
p-Benzoquinone; see Quinone.				
Benzo(a)pyrene; see Coal tar pitch volatiles.....				
Benzoyl peroxide.....	94-36-0	.....	5	
Benzyl chloride.....	100-44-7	1	5	
Beryllium and beryllium compounds (as Be).....	7440-41-7		(2)	

# OSHA Standards

*29 CFR*

- ◆ Part 1910: Occupational Safety and Health Standards
- ◆ Part 1915: Occupational Safety and Health Standards for Shipyard Employment
- ◆ Part 1926: Safety and Health Regulations for Construction
- ◆ Part 1928: Occupational Safety and Health Standards for Agriculture



# OSHA Standards

## *29 CFR Part 1910*

- ◆ Subpart Z Authority for 1910 subpart Z
- ◆ 1910.1000 Air Contaminants
- ◆ 1910.1000 Table Z-1 Limits for Air Contaminants
- ◆ 1910.1000 Table Z-2
- ◆ 1910.1000 Table Z-3 Mineral Dusts

# 29 CFR Part 1910

## *Complete Standards*

### *Examples*

- ◆ 1910.1001 Asbestos
- ◆ 1910.1002 Coal tar pitch volatiles
- ◆ 1910.1017 Vinyl Chloride
- ◆ 1910.1018 Inorganic Arsenic
- ◆ 1910.1025 Lead
- ◆ 1910.1028 Benzene
- ◆ 1910.1051 1,3-Butadiene

# OSHA Standards

## *Benzene 1910.1028*

- ◆ Scope and application
- ◆ Definitions
- ◆ PELs
- ◆ Regulated areas
- ◆ Exposure monitoring
- ◆ Methods of compliance
- ◆ Respiratory protection
- ◆ Protective clothing and equipment
- ◆ Med. surveillance
- ◆ Hazard communication
- ◆ Record-keeping

# OSHA Terms

- ◆ *Permissible exposure limit (PEL)* is that concentration expressed as an eight-hour time-weighted average, which shall not be exceeded
- ◆ *Short term exposure limit (STEL)* is that concentration expressed as a 15-minute time-weighted average, which shall not be exceeded

# OSHA Terms

- ◆ *Ceiling (C)* is that concentration which shall never be exceeded, although it is expressed as a 10- or 15-minute TWA
- ◆ *Action level (AL)* is defined as one-half the PEL
  - Concentrations in excess of the AL trigger specified activities in complete standards

# OSHA Terms

- ◆ *Immediately dangerous to life and health (IDLH)* signifies concentrations to substances for which exposure of more than 30 minutes would be expected to be fatal
  - Used in the selection of respirators

# OSHA Terms

- ◆ OSHA does not classify carcinogens, but instead relies on the classifications made by the National Toxicology Program (NTP) and the International Agency for Research on Cancer (IARC)



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## **Section D**

***National Institute for Occupational  
Health and Safety (NIOSH)  
and Other Organizations***



# NIOSH

- ◆ National Institute for Occupational Safety and Health (NIOSH)
  - Part of Centers for Disease Control
  - Research, recommendation, and training duties
  - Recommended Exposure limits (RELs)

# Recommended Exposure Limits (RELs)

- ◆ Recommended by NIOSH
- ◆ Created by the OSHA Act
- ◆ Associated with Criteria Documents
- ◆ Recommendations to OSHA
- ◆ Used as another guideline but not law
- ◆ Based solely on health considerations
- ◆ Usually below corresponding PEL

# Other Relevant Organizations

- ◆ American National Standards Institute (ANSI)
- ◆ International Radiation Protection Association (IRPA)
- ◆ American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- ◆ Institute for Electrical and Electronics Engineers (IEEE)



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# Section E

*Code of Ethics*

# Cannons of Ethical Conduct

1. Practice their profession following recognized scientific principles with the realization that the lives, health, and well-being of people may depend upon their professional judgment and that they are obligated to protect the health and well-being of people

# Cannons of Ethical Conduct

2. Counsel affected parties factually regarding potential health risks and precautions necessary to avoid adverse health effects

# Cannons of Ethical Conduct

3. Keep confidential personal and business information obtained during the exercise of industrial hygiene activities, except when required by law or overriding health and safety considerations

# Cannons of Ethical Conduct

4. Avoid circumstances where a compromise of professional judgment or conflict of interest may arise
5. Perform services only in the areas of their competence
6. Act responsibly to uphold the integrity of the profession