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Maine Worksite Wellness Initiative

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Status of Legal and Recommended Occupational Airborne Exposure Limits: OSHA PELs and ACGIH TLVs, A Quantitative Examination

Topics

- Background
  - Origins & connections between most commonly used air contaminant limits
    - Definitions/terms
  - Difference between air limits and comprehensive health standards
- Examination of substances with carcinogen designations
- Case study

Background

- Dec. 1970 – Congress Passes the OSH-Act
  - gave 2-year window for the new agency to adopt existing standards
- May 1971 – Air Limits Adopted:
  - ACGIH 1968 TLVs ~ 450 (“Z-1 Table”)
  - ANSI Z-standards ~ 21 (“Z-2 Table”)
  - ANSI mineral dusts ~ 9 (“Z-3 Table”)
  - Found in CFR 1910.1000

Definitions/Background

- Newly adopted air contaminant limits termed: Permissible Exposure Limits (PELs)
- Since adoption:
  - Few PEL values have changed (e.g. lowered)
  - Few PELs for other substances created
  - Exception: Comprehensive Health Stds.
- Shortcomings:
  - Adopted limits did not receive adequate (or any?) vetting
  - OSH-act did not provide for change/updating process over time

Background

- American Conference of Governmental Hygienists
  - ACGIH - professional, non-profit scientific association
  - Membership from academic, governmental, military and private sectors
  - Process for TLV updates & changes:
    - Annual report (published early February):
      - NIC list: proposed changes (values, designations, new substances, etc.)
      - Lists substances/changes adopted

Background

- ACGIH
  - "Documentations" provide rational for TLVs & Designations:
    - "A1, A2, A3, A4, or A5" (carcinogens)
    - "Skin" (absorption viable exp. route)
    - Sen" (skin or respiratory sensitizer)
  - BEIs – Biological Exposure Indices
  - TLVs generally regarded as "state of science"

Background

- ACGIH position:
  - Non-profit scientific association
  - Not a standards-setting body
  - TLVs & BEIs expression of scientific opinion
  - TLVs & BEIs based solely on health factors, not technical or economic feasibility
  - Since 2002 lawsuits, state and federal entities advised not to use TLVs as basis for citations

Background

- Occupational Exposure Limit (OEL)
  - Generic term, can apply to:
    - OSHA PELs
    - ACGIH TLVs
    - NIOSH RELs
    - AIHA WEELs
    - Manufacturer limits (DuPont)
    - Other countries (German MAKs)

Air Limit Limitations

- Other routes of entry for substances
- Variability (what's the distribution?)
- Tendency to regard levels as distinguishing between "safe" and "unsafe"
- Focuses on individual substances, mixtures seldom addressed

Background

- What is an Occ. Exposure Limit (OEL)?

The average airborne conc. of a substance required or recommended not to be exceeded.

•Usually over an 8-hr shift;

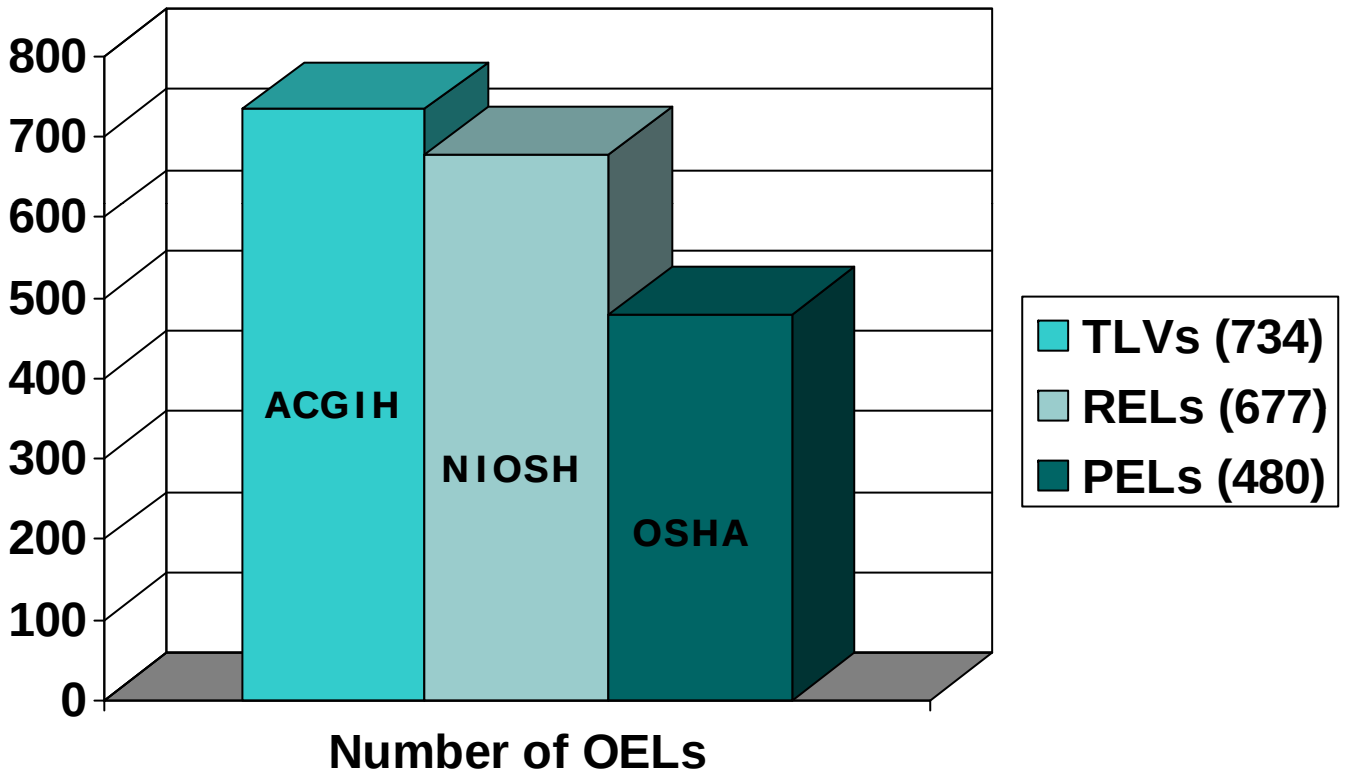
•Exceptions: STELs & Ceiling values

2003: Monitoring Al dust exposure during changing of dust collector cylinder filters.

OSHA PEL: 15mg/m^3(T), 5mg/m^3(R)

ACGIH TLV: 1mg/m^3(R) - 2008

Background: Number of OELs



PEL Background

- 1988 - OSHA Air Contaminant Initiative:
  - Lowered PELs for 212 substances, new limits for 164 - all mostly to ’89 TLVs
  - July, 1992 – 11th circuit court vacated entire rulemaking
  - March, 1993 – OSHA reverts back to enforcing 1971 levels (’68 TLVs)
  - Exception: some states with OSHA plans maintained 1989 changes.

PEL Background

- Lowering of a PEL has been accomplished through promulgating Comprehensive Health Standards
  - 1971-2007 - 29 CHS:
    - 15 substance-specific w/ air limits
    - 1 non-specific with an air limit
    - “13 carcinogens” – no air limits

PEL Background

- Each CHS has similar template:
  - Action Level – usually 50% of (new) PEL
  - Initial & periodic air monitoring (e.g. process changes)
  - Medical surveillance & Training (>AL)
  - Signs and Labels
  - Record Keeping
  - Abatement of exposure (>PEL) via engineering, admin., PPE controls
- Some CHS PELs/ALs lower than TLVs

15 CHS With Air Limit Triggers

Substance	Year Promulgate
Asbestos	1971
Vinyl chloride	1975
Acrylonitrile	1978
1,2-dibromo-3- chloropropane	1978
Inorganic Arsenic	1978
Lead	1979
Cotton Dust	1980
Ethylene oxide	1984
Benzene	1987
Formaldehyde	1988
Cadmium	1992
Methylenedianiline	1992
1,3-Butadiene	1996
Methylene chloride	1997
Hexavalent chromium	2007

Other CHS

- **Coke Oven Emissions – 1977**
  - Non-specific, total particulate matter during the destructive distillation of coal for production of coke.

- **“13 Carcinogens”- No Airborne Limits**

Substance	Year Promulgated
4-Nitrobiphenyl	1974
Alpha-Naphthylamine	1974
Chloromethyl ether	1974
3,-Dichlorobenzidine (and salts)	1974
Bis-Chloromethyl ether	1974
Beta-Naphthylamine	1974
Benzidine	1974
4-Aminodiphenyl	1974
Ethyleneimine	1974
Beta-propiolactone	1974
2-Acetylaminofluorene	1974
4-Dimethylaminoazo-benzene	1974
N-Nitrosodimethylamine	1974

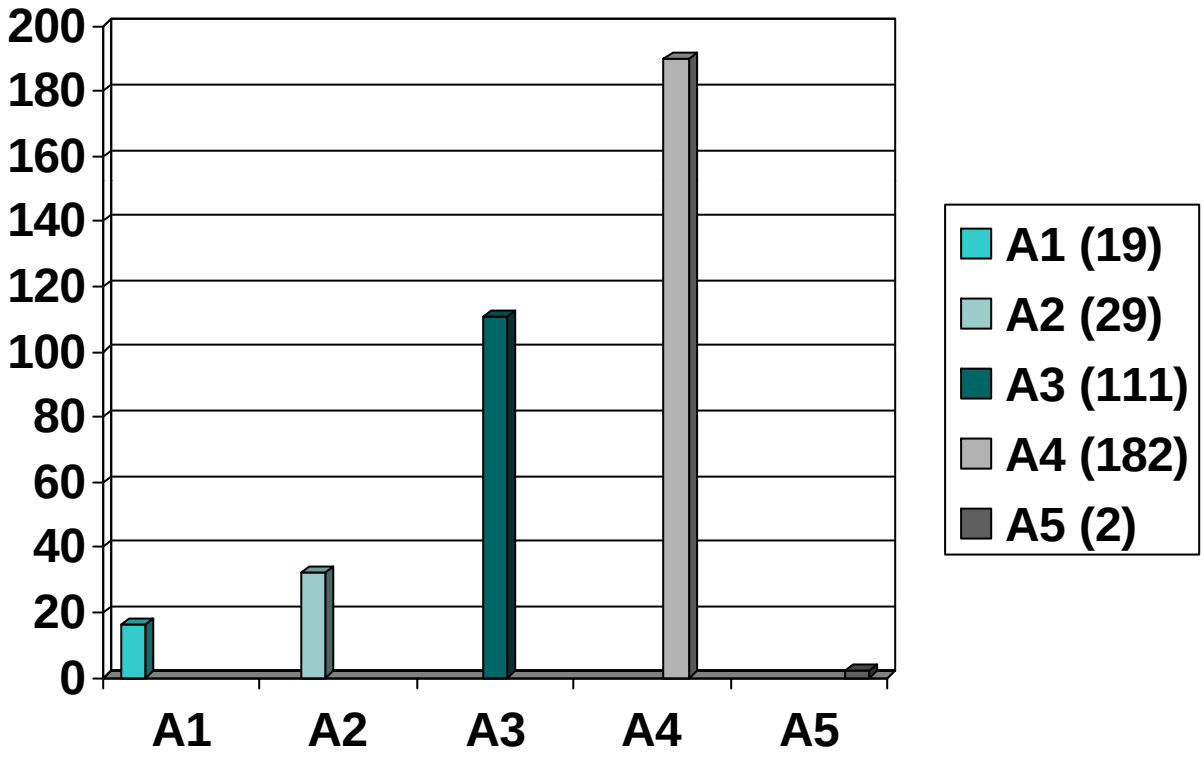
ACGIH Carcinogens

- ACGIH may propose/adopt carcinogen designation to a substance w/ or w/out numerical TLV change:
  - 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

ACGIH Carcinogens

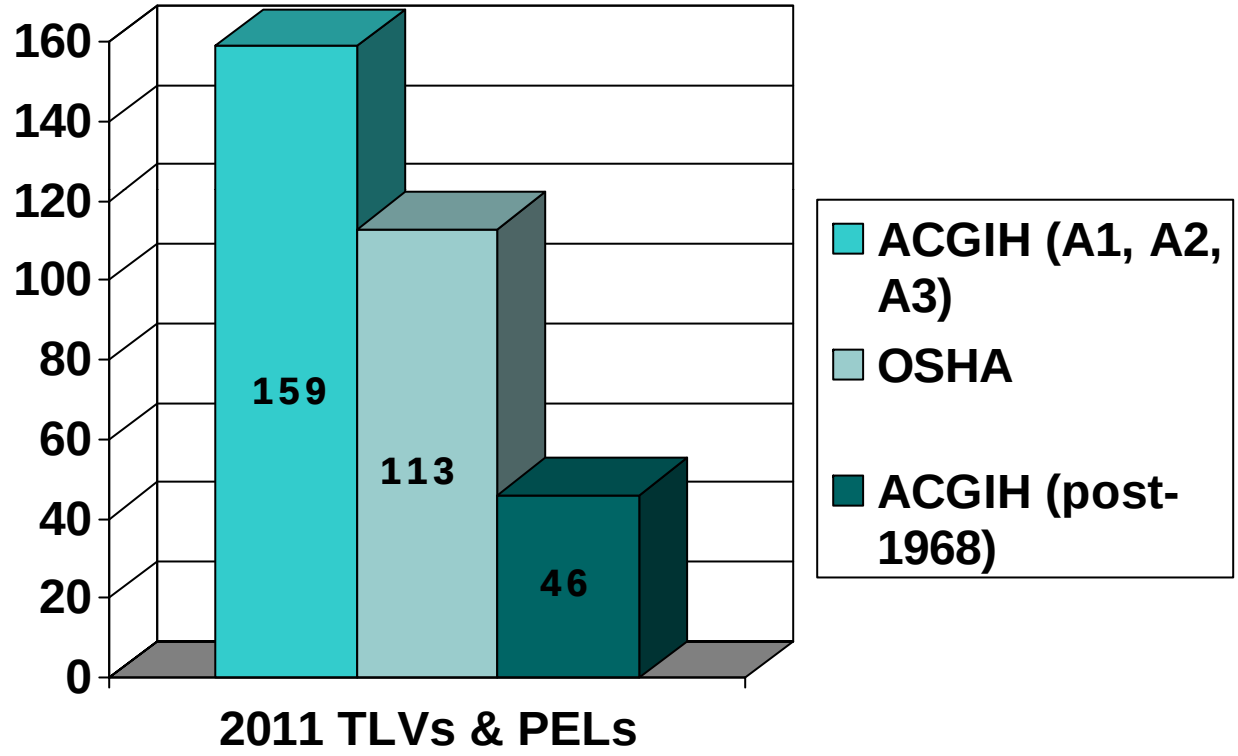
- Current count: 343/734 (~47%) TLVs have a carcinogen designation
- Almost all designations post-1970
  - Cancer latency periods (e.g. post WWII)
  - Health studies/review processes
  - Advances in science/epidemiology
- Substances now known or suspected to be cancer-causing weakly reflected in OSHA numerical PELs
  - Exception - CHS

ACGIH Carcinogens

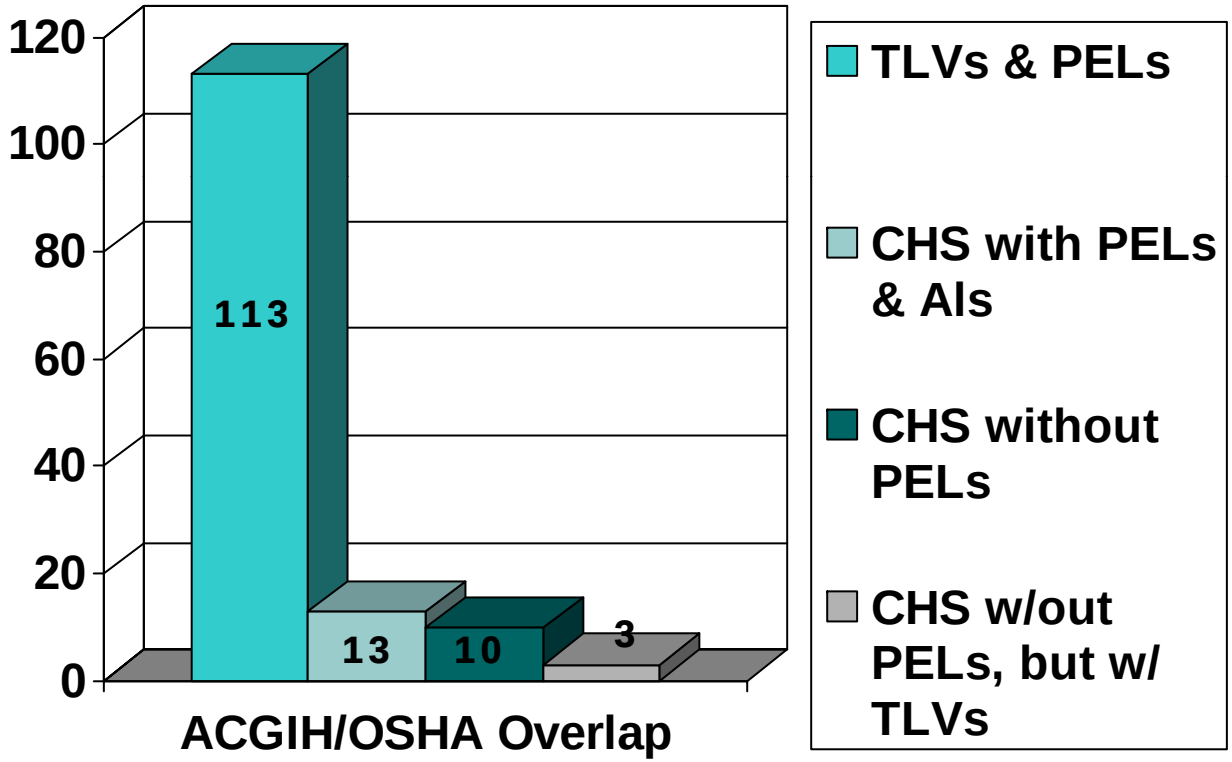


Distribution of Carcinogen Designations (of 734 TLVs)

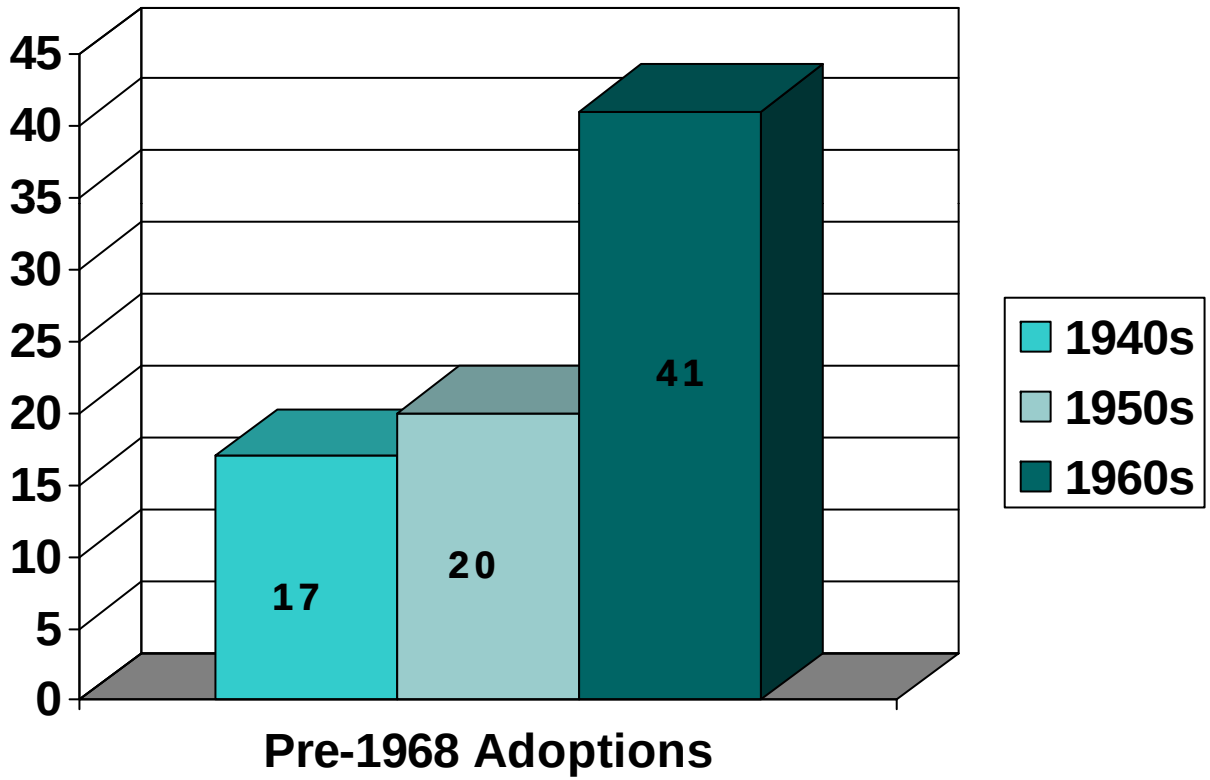
ACGIH Carcinogens: A1, A2, A3



ACGIH Carcinogens: A1, A2, A3

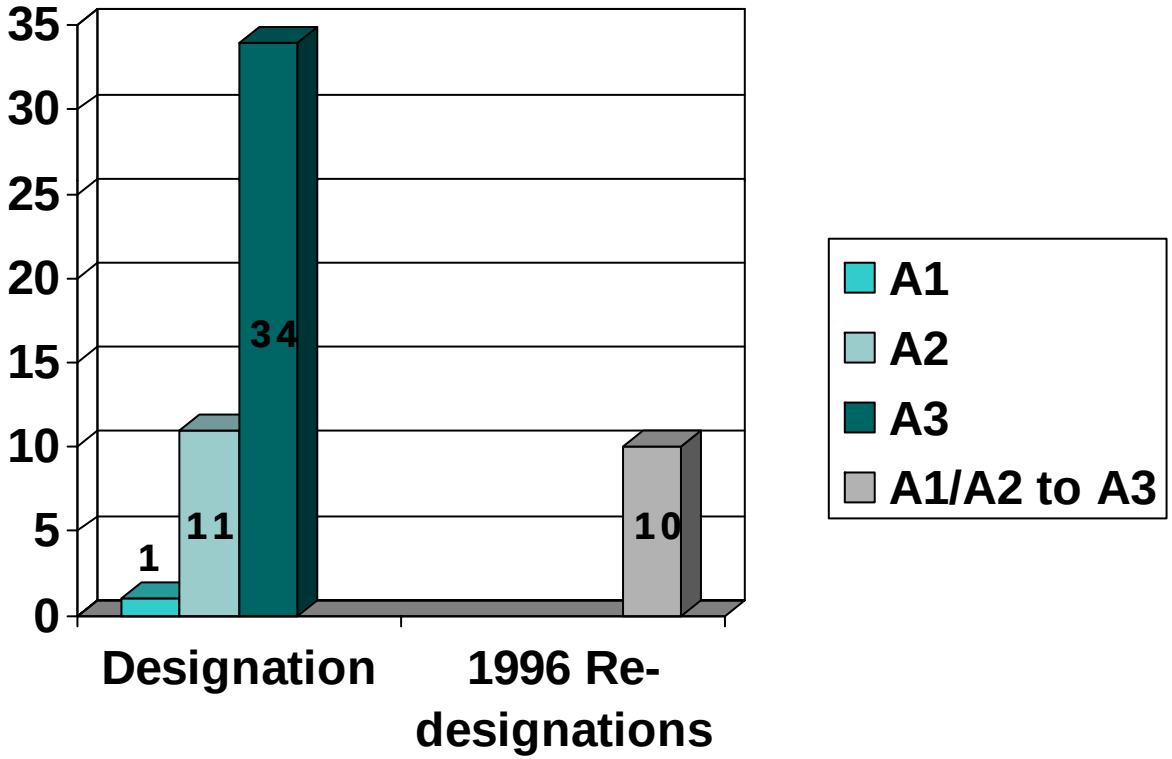


Decade PEL Value Adopted

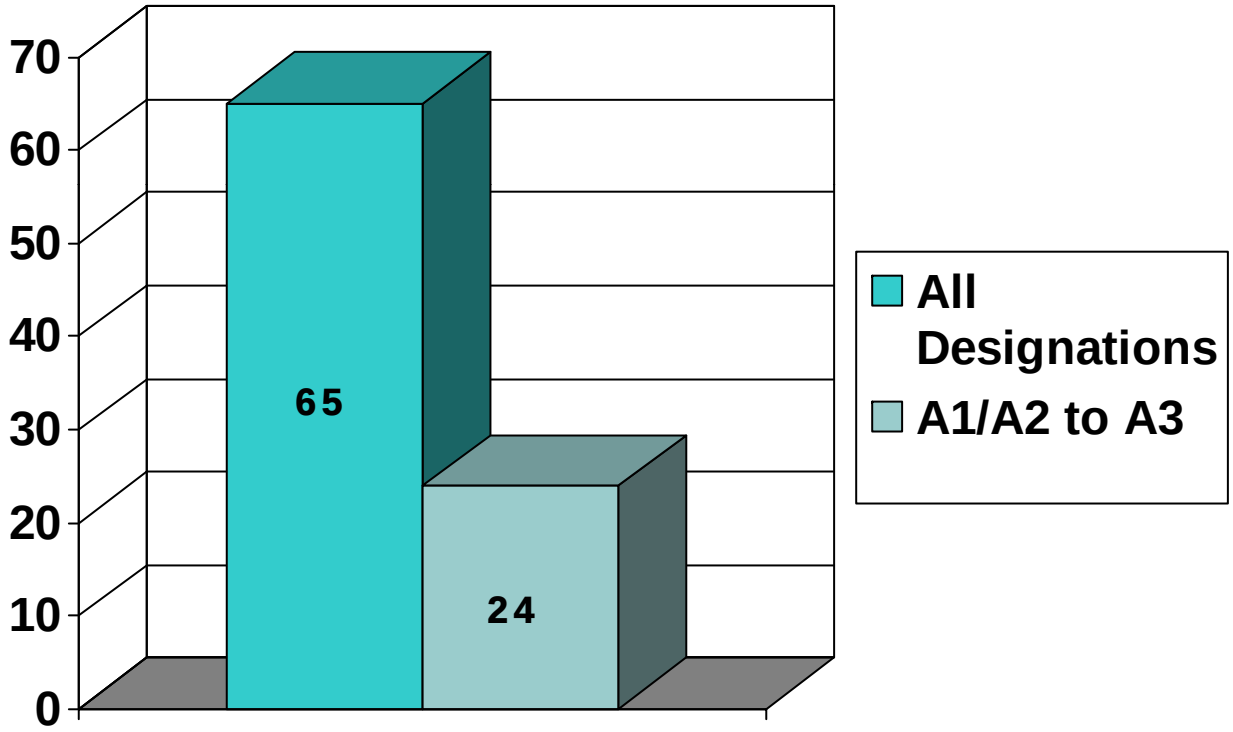


- Represents 78/159
- 12 Substances have same PEL/TLV values

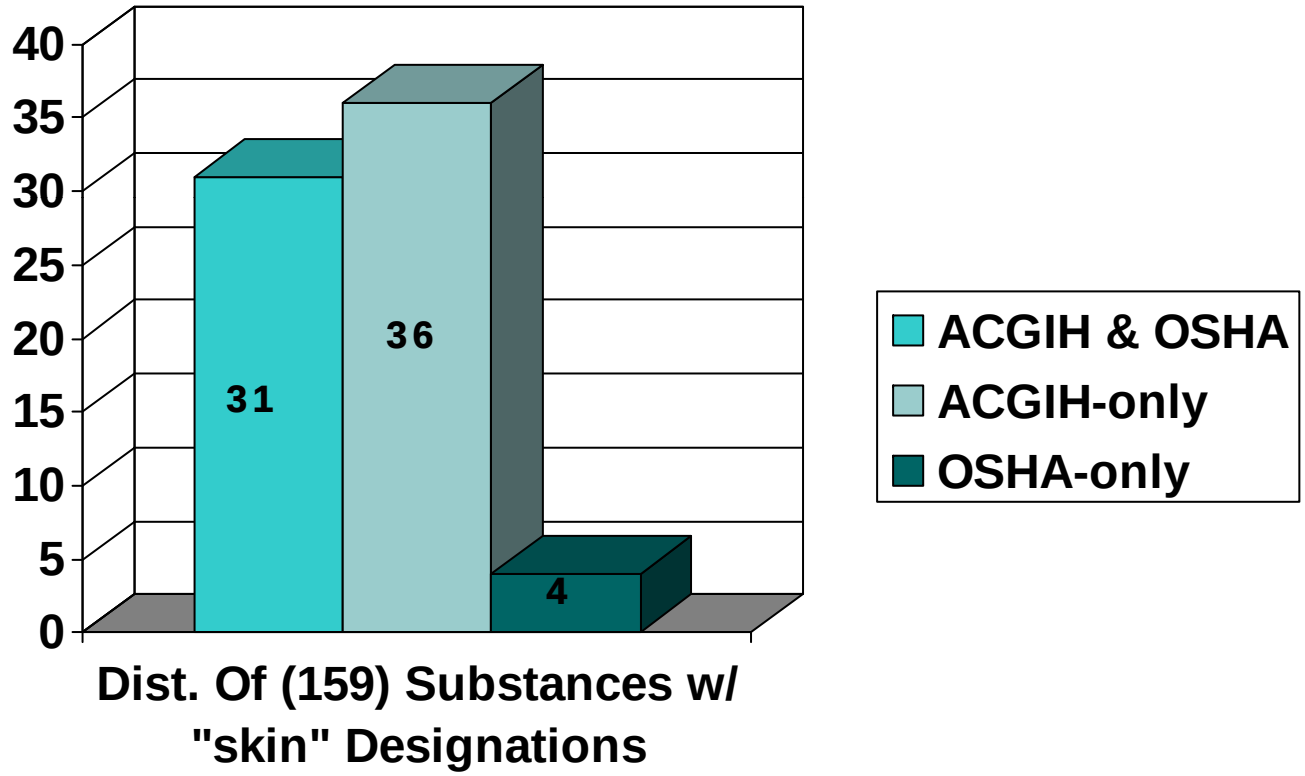
ACGIH 46 Post-1968 Carcinogens



ACGIH 1996 Carcinogen Changes

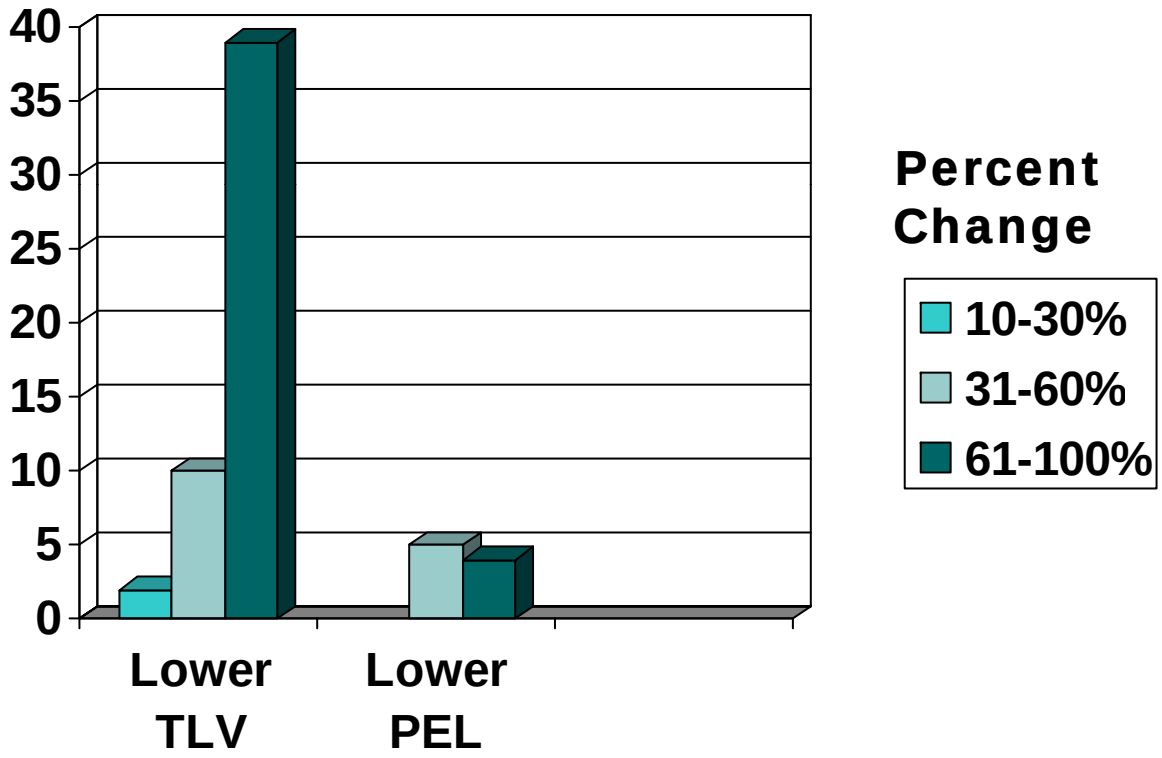


“Skin” Designations



Note: 19/36 are post-1968 TLVs

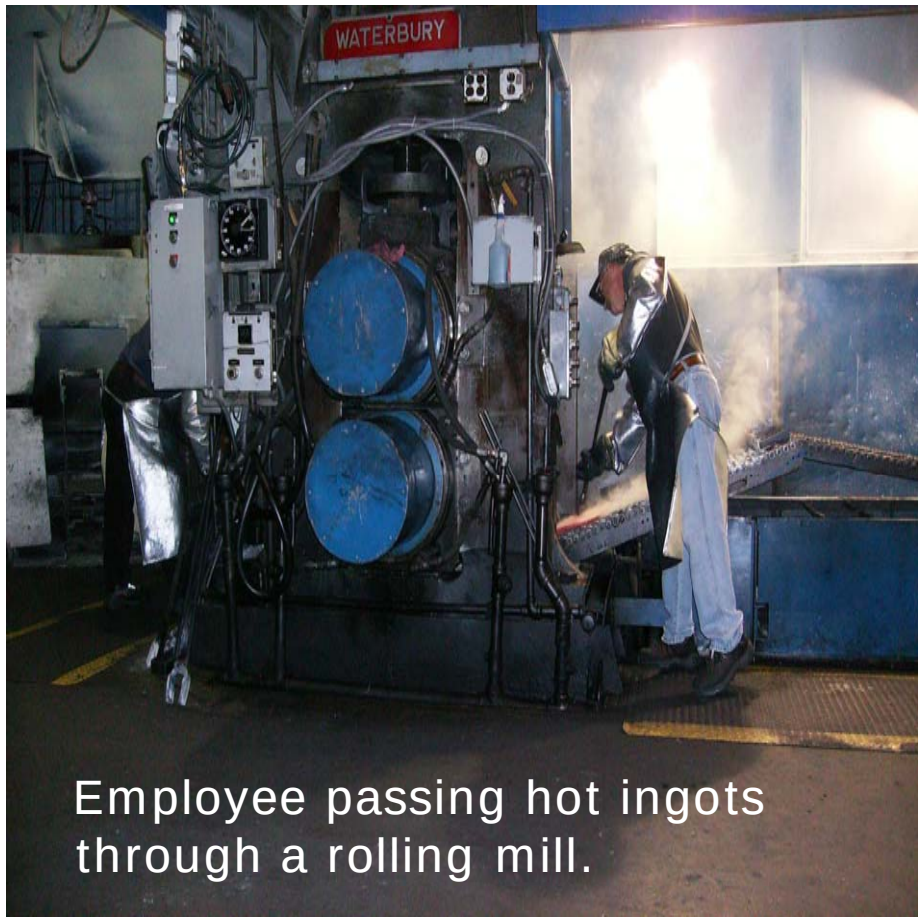
TLV/PEL Values: Magnitudes of Differences



(Note: 60/159 comparable)

Field Considerations: Molybdenum (Mo) Exposure Assessment

- Mo OELs:
  - OSHA
    - 15mg/m^3 metal
    - 5mg/m^3 soluble compounds
  - ACGIH
    - 0.5mg/m^3 (R) soluble compounds – A3
    - 10mg/m^3 (I) metal & insoluble compounds
    - 3mg/m^3 (R) metal & insoluble compounds



Employee passing hot ingots through a rolling mill.

Field Considerations: Molybdenum (Mo) Exposure Assessment

- Considerations:
  - 15mg/m3 PEL for metal/insoluble compounds est. in 1961
    - TLV lowered to 10mg/m^3 in 1971
    - 1989 Vacated PEL, proposed: 10mg/m^3
  - 5mg/m3 for soluble compounds est. in 1956
  - 0.5mg/m3 (R) TLV & A3 designation first proposed in 1999, adopted 2001
    - A2 proposed in 2001, w/drawn in 2003 due to insufficient human data
  - 3mg/m3 (R) for metalic & insoluble compounds also adopted in 2001

Field Considerations: Molybdenum (Mo) Exposure Assessment

- Is the Mo in soluble or insoluble form?
  - Depends upon oxidation
    - MoO_2 – insoluble
    - MoO_3 – soluble
- Is respirable dust present?
  - Hot processes
  - Grinding performed
- Is this assessment a regulatory evaluation or health evaluation?

Field Considerations: Molybdenum (Mo) Exposure Assessment

- Another wrinkle
  - Differences in sampling techniques & cassettes:
    - Total – 37mm cc cassette
    - Inhalable – IOM sampler
    - Respirable
      - Nylon cyclone per OSHA
      - Aluminum cyclone per ACGIH

Final Thoughts

- New paradigm for addressing exposure to substances
  - OSHA failure to update/add PELs over 40 years long standing issue in OH&S profession
  - Complexities, challenges & ethical dilemmas faced by occ. hygienists
  - TLVs & other OELs help, but not the whole solution