Hazard Communication Standard 2012 and GHS Safety Data Sheet Compliance Training

Hazard Classification

Total Safety U.S. Inc. d/b/a EHS Services
Hazard Determination vs. Classification

• Recall the 2 mandatory appendices of the HCS 1994
  • Appendix A Health Hazard Definitions
  • Appendix B Hazard Determination
• HCS 2012 has several additional mandatory appendices
  • Appendix A Health Hazard Classification
  • Appendix B Physical Hazard Classification
  • Appendix C Required Label Elements
  • Appendix D Safety Data Sheets
  • Appendix E Definition of Trade Secret
HCS 1994 Health Hazard Definitions

• Acute (ANSI Z129.1-1988 Precautionary Labeling of Hazardous Industrial Chemicals)
  – Irritation
  – Corrosivity
  – Sensitization
  – Lethal Dose

• Chronic
  – Carcinogenicity (IARC, NTP or OSHA)
  – Teratogenicity
  – Mutagenicity
  – Target Organ Effects
HCS 1994 Acute Toxicity

• Highly Toxic
  – Oral LD50 ≤ 50 mg/kg albino rat
  – Dermal LD50 ≤ 200 mg/kg albino rabbits, 24 hr or less
  – Inhalation LC50
    • ≤ 200 ppmv gas/vapor, rat, 1 hr or less
    • ≤ 2 mg/L mist, fume, dust, rat, 1 hr or less

• Toxic
  – Oral LD50 50 to 500 mg/kg, rat
  – Dermal LD50 200 to 1,000 mg/kg, rabbit, 24 hr
  – Inhalation LC50
    • 200 to 2,000 ppmv, gas/vapor, rat, 1 hr
    • 2 to 20 mg/L, mist, fumes, dust, rat, 1 hr
# Acute Toxicity Defined

<table>
<thead>
<tr>
<th>Exposure Route &amp; Standard</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Category 4</th>
<th>(Category 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral, rat, LD50 mg/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHS/HCS 2012</td>
<td>≤ 5</td>
<td>&gt; 5 &amp; ≤ 50</td>
<td>&gt; 50 &amp; ≤ 300</td>
<td>&gt; 300 &amp; ≤ 2000</td>
<td>&gt; 2000 &amp; ≤ 5000</td>
</tr>
<tr>
<td>HCS 1994</td>
<td>Highly Toxic</td>
<td>Toxic 50 up to 500</td>
<td>(&quot;not&quot; Toxic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dermal, rabbit, LD50 mg/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHS/HCS 2012</td>
<td>≤ 5</td>
<td>&gt; 5 &amp; ≤ 200</td>
<td>&gt; 200 &amp; ≤ 1000</td>
<td>&gt; 1000 &amp; ≤ 2000</td>
<td></td>
</tr>
<tr>
<td>HCS 1994</td>
<td>Highly Toxic</td>
<td>Toxic</td>
<td>(&quot;not&quot; Toxic)</td>
<td></td>
<td></td>
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</table>
Acute Toxicity Defined, Cont.

<table>
<thead>
<tr>
<th>Exposure Route &amp; Standard</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Category 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhalation, rat, LC50 gases ppmv</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHS/HCS 2012, NOTE 4 hr</td>
<td>≤ 100</td>
<td>&gt; 100 &amp; ≤ 500</td>
<td>&gt; 500 &amp; ≤ 2500</td>
<td>&gt;2500 &amp; ≤ 20,000</td>
</tr>
<tr>
<td>HCS 1994, Normalized to 4 hr; includes vapors and gases</td>
<td>Highly Toxic</td>
<td>Toxic 100 to 1000 (&quot;not&quot; Toxic ----&gt;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inhalation, rat, LC50 vapors mg/L</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHS/HCS 2012, 4 hr</td>
<td>≤ 0.5</td>
<td>&gt; 0.5 &amp; ≤ 2.0</td>
<td>&gt; 2.0 &amp; ≤ 10</td>
<td>&gt; 10 &amp; ≤ 20</td>
</tr>
<tr>
<td><strong>Inhalation, rat LC50, mist &amp; dust, mg/L</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHS/HCS 2012, 4 hr</td>
<td>≤ 0.05</td>
<td>&gt; 0.05 &amp; ≤ 0.5</td>
<td>&gt; 0.5 &amp; ≤ 1.0</td>
<td>&gt; 1.0 &amp; ≤ 5.0</td>
</tr>
<tr>
<td>HCS 1994</td>
<td>Highly Toxic</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Physical Hazards

<table>
<thead>
<tr>
<th>Hazard Classification</th>
<th>HCS 1994</th>
<th>GHS/HCS 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive</td>
<td>Explosives</td>
<td></td>
</tr>
<tr>
<td>Compressed Gas</td>
<td>Gas Under Pressure</td>
<td></td>
</tr>
<tr>
<td>Flammable Gas</td>
<td>Flammable Gas</td>
<td></td>
</tr>
<tr>
<td>Combustible Liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustible Dust*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic Peroxide</td>
<td>Organic Peroxide</td>
<td></td>
</tr>
<tr>
<td>Oxidizer</td>
<td>Oxidizing Liquid</td>
<td>Oxidizing Solid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxidizing Gas</td>
</tr>
<tr>
<td>Pyrophoric</td>
<td>Pyrophoric Liquid</td>
<td>Pyrophoric Solid</td>
</tr>
<tr>
<td>Pyrophoric Gas*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstable (reactive)</td>
<td>Self-reactive Substance</td>
<td>Self-heating Substances</td>
</tr>
<tr>
<td>Water Reactive</td>
<td>Substances which, in contact with water, emit flammable gases</td>
<td>Corrosive to Metals</td>
</tr>
</tbody>
</table>

* Unique to HCS 2012

## Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion</td>
<td></td>
</tr>
<tr>
<td>Exploding Bomb</td>
<td></td>
</tr>
<tr>
<td>Flame</td>
<td></td>
</tr>
<tr>
<td>Flame Over Circle</td>
<td></td>
</tr>
<tr>
<td>Gas Cylinder</td>
<td></td>
</tr>
<tr>
<td>No Symbol</td>
<td></td>
</tr>
</tbody>
</table>

Corrosive to Metals
# Health Hazards

<table>
<thead>
<tr>
<th>Hazard Classification</th>
<th>HCS 1994</th>
<th>GHS/HCS 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Hazard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carcinogen</td>
<td>Carcinogenicity</td>
<td></td>
</tr>
<tr>
<td>Toxic</td>
<td>Acute Toxicity</td>
<td></td>
</tr>
<tr>
<td>Highly Toxic</td>
<td>Germ Cell Mutagenicity</td>
<td></td>
</tr>
<tr>
<td>Reproductive Toxin</td>
<td>Reproductive Toxicity</td>
<td></td>
</tr>
<tr>
<td>Irritant</td>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Skin Corrosion/Irritation</td>
</tr>
<tr>
<td>Corrosive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitizer</td>
<td>Sensitization</td>
<td></td>
</tr>
<tr>
<td>Target Organ Effect</td>
<td>Specific Target Organ Systemic Toxicity</td>
<td>Simple Asphyxiants*</td>
</tr>
</tbody>
</table>

* Unique to HCS 2012

## SYMBOLS
- **Corrosion**
- **Exclamation Mark**
- **Health Hazard**
- **No Symbol**
- **Skull and Crossbones**

*SDS Sections: 2, 9 and 11*
## Environmental Hazards

<table>
<thead>
<tr>
<th>Hazard Classification</th>
<th>HCS 1994</th>
<th>GHS/HCS 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Hazard</td>
<td>Hazardous to the Aquatic Environment - Acute</td>
<td>Hazardous to the Aquatic Environment - Acute</td>
</tr>
<tr>
<td></td>
<td>Hazard - Long-term Hazard</td>
<td>Hazard - Long-term Hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazardous to the Ozone Layer</td>
</tr>
</tbody>
</table>

### SYMBOLS

- **Environment**
- **Exclamation Mark**
- **No Symbol**
Relationships Between Terms

Hazard Class

Hazard Category
(1 to 4)

Pictogram

Signal Word

Hazard Statement

Precautionary Statement
SDS Section 2: Hazards Identification

- Hazard Classes and Categories
- Hazard Statements
- Pictograms
- Precautionary Statements
- Hazards Not Otherwise Classified
Label Requirements for Shipped Containers

The following must be included on a label for each hazard category of the product:

- Product identifier
- Signal word(s)
- Hazard statement(s)
- Pictogram(s)
- Precautionary statement(s)
OSHA Pictograms and Hazards

**Health Hazard**
- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

**Flame**
- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides

**Exclamation Mark**
- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer (Non-Mandatory)

**Gas Cylinder**
- Gases Under Pressure

**Corrosion**
- Skin Corrosion/Burns
- Eye Damage
- Corrosive to Metals

**Exploding Bomb**
- Explosives
- Self-Reactives
- Organic Peroxides

**Flame Over Circle**
- Oxidizers

**Environment** (Non-Mandatory)
- Aquatic Toxicity

**Skull and Crossbones**
- Acute Toxicity (fatal or toxic)

http://www.osha.gov/Publications/HazComm_QuickCard_Pictogram.html
Classification Example: Ethylene Oxide

• 29 CFR 1910.1047 OSHA Standard for Ethylene Oxide
• Defines as a minimum, the hazards to be classified:
  – Acute Toxicity
  – Skin Sensitization
  – Skin, Eye and Respiratory Tract Irritation
  – Central Nervous System
  – Cancer
  – Mutagenicity
  – Reproductive Toxicity
  – Flammability
Acute Toxicity for Ethylene Oxide

- RTECS: KX2450000
- Acute Toxicity
  - \( \text{LD}_{50} \) oral, rat = 72 mg/kg
  - \( \text{LC}_{50} \) inhalation, rat = 800 ppm/4hr

  - Oral Category 3: > 50 and \( \leq \) 300 mg/kg
  - Inhalation Category 3: > 500 and \( \leq \) 2,500 ppm

http://www.cdc.gov/niosh-rtecs/kx256250.html#T

https://www.federalregister.gov/articles/2012/03/26/2012-4826/hazard-communication#t-11
Acute Toxicity SDS and Label Elements

• 29 CFR 1910.1200 Appendix C.4.1 and C.4.3
  – Oral and Inhalation Acute Toxicity Category 3;
    • Signal Word: Danger
    • Hazard Statement:
      – Toxic if Swallowed or Inhaled.
    • Pictogram: Skull and Crossbones
    • Precautionary Statements for Prevention, Response, Storage and Disposal
Carcinogenicity for Ethylene Oxide

• 29 CFR 1910.1200 Appendix A.6, Figure A.6.2
  – Category 1: Known or Presumed Human Carcinogens
    • Category 1A: Known to have carcinogenic potential for humans, based on human evidence.
    • Category 1B: Presumed to have carcinogenic potential for humans, largely based on animal evidence.
  – Category 2: Suspected Human Carcinogens
  – IARC: Group 1: Human, Limited Evidence/Animal Sufficient
  – NTP: Class 1: Known Human Carcinogen
  – ACGIH: Suspected Human Carcinogen
  – EPA: Class B1: Some Human, Sufficient Animal Data
SDS and Label Elements for Carcinogenicity

- 29 CFR 1910.1200 Appendix C.4.9 Carcinogenicity
  - Category 1B (Weight of Evidence/Strength of Evidence)
  - Signal Word: Danger
  - Hazard Statement: May cause cancer by inhalation
  - Pictogram: Health Hazard
  - Precautionary Statements for Prevention, Response, Storage and Disposal
Flammability for Ethylene Oxide

- Flash Point: -57°C / -71°F.
- Boiling Point: 10.6°C / 51.1°F.
- Physical State: liquid under pressure.
- 29 CFR 1910.1200, Appendix B, Table B.6.1
  - Category 1: FP < 23°C. and BP ≤ 35°C.
Flammability SDS and Label Elements

- 29 CFR 1910.1200 Appendix C.4.19
- Flammability Category 1
- Signal Word: Danger
- Hazard Statement: Extremely Flammable Liquid and Vapor
- Pictogram: Flame
- Precautionary Statements for Prevention, Response, Storage and Disposal
ETHYLENE OXIDE
(SHIPPING LABEL)

Danger

Toxic if swallowed or inhaled.
May cause cancer by inhalation.
Extremely flammable liquid and vapor.

Obtain special instructions before use. Keep away from heat/sparks/open flames/hot surfaces - no smoking. Avoid breathing dust/fume/gas/mist/vapors/spray. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISON CENTER or doctor/physician. Protect from sunlight.
Store in a well-ventilated place.

First Aid:

IF ON SKIN: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
IF IN EYES: Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
IF INHALED: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
IF SWALLOWED: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Fire:

IN CASE OF FIRE: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Supplier Name
Supplier Address
Emergency Phone Number
Obtain special instructions before use.
Keep away from heat/sparks/open flames/hot surfaces - no smoking.
Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISON CENTER or doctor/ physician. Protect from sunlight. Store in a well-ventilated place.

In Case of Fire: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

First Aid
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. If breathed in, move person into fresh air. If not breathing, give artificial respiration. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.
Ethylene Oxide

**Danger!** Toxic if swallowed or inhaled. May cause cancer by inhalation. Extremely flammable liquid and vapor.

Obtain special instructions before use. Keep away from heat/sparks/open flames/hot surfaces - no smoking. Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray. IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISON CENTER or doctor/ physician. Protect from sunlight. Store in a well-ventilated place.

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**Fire:**
IN CASE OF FIRE: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**Read Safety Data Sheet Before Use**
Supplier Name, Supplier Address, Emergency Phone Number
Mixtures: Acute Toxicity

• Does test data exist for the mixture as a whole?
• If not, is there data on similar mixtures?
  – Apply Bridging Principles: Dilution, Batching, Concentration of Mixtures, Interpolation within one toxicity category, Substantially similar mixtures, and Aerosols.
• If not, is data available for all ingredients, or able to estimate conversion values?
  – Use weighted average of acute toxicity values
• If not, convey hazards of the known ingredients
  – Use weighted average if unknown is < 10%
  – Use corrected weighted average if unknown is > 10%
Mixture Acute Toxicity Unknown < 10%

\[
\frac{100}{\text{ATE}_{\text{mix}}} = \sum_n \frac{C_i}{\text{ATE}_i}
\]
Mixture Acute Toxicity Unknown \( >10\% \)

\[
100 - \left( \sum \frac{C_{unknown}}{ATE_{mix}} \text{ if } >10\% \right) = \sum_{n} \frac{C_i}{ATE_i}
\]
Thank You

Questions?