
HAZARDOUS COMMUNICATION

Clint Guymon, PhD PE

Brigham Young University

1st Jan, 2025

created in  Curvenote

Keywords Spiritual Safety, Process Safety, Chemical Engineering, Risk Assessment

Learning Outcomes

- Understand the purpose and components of the Hazardous Communication Standard (29 CFR 1910.1200).
- Familiarity with the 9 Hazard Classes of the Global Harmonized System (GHS) and their associated pictograms.
- Understand the required 16 components of a Safety Data Sheet (SDS).
- Interpret the elements of GHS labeling and the NFPA 704 Diamond.

Reading

- Foundations of Spiritual and Physical Safety: with Chemical Processes; Chapter 10

Hazardous Communication is required by OSHA to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This information is transmitted through the use of Safety Data Sheets (SDS) and labels. The regulation requiring this is [29 CFR 1910.1200](#).

Global Harmonized System of Classification and Labelling of Chemicals (GHS) is a system for standardizing and harmonizing the classification and labelling of chemicals. It satisfies the requirement of many countries to have a single system of classification and labelling of chemicals.

1 Opening Activity

- How would you think it best to communicate hazards to a toddler or 3-5 year old on the hazards in a typical household
 - Guns?, Chemicals?, Hot Surfaces?, Electricity?, Sharp Objects?
- How would you want to be communicated to about hazards in your workplace?
 - Chemicals, Machinery, Electrical Hazards, Fire Hazards, etc.?

2 Nine (9) Hazard Classes of Materials and Articles

1. Explosives
2. Gases
3. Flammable Liquids
4. Flammable Solids
5. Oxidizing Substances
6. Toxic and Infectious Substances
7. Radioactive Material
8. Corrosives
9. Miscellaneous Dangerous Goods



Figure 1: Image of the different hazard class labels of materials and articles.

2.1 Explosives

- HD1.1: Mass explosion hazard
- HD1.2: Projection hazard
- HD1.3: Fire hazard
- HD1.4: No significant hazard
- HD1.5: Very insensitive substances
- HD1.6: Extremely insensitive substances

See Video examples from Safety Management Services, Inc.

2.2 Gases

- HD2.1: Flammable gases
- HD2.2: Non-flammable, non-toxic gases
- HD2.3: Toxic gases

2.3 Flammable Liquids

- Flammable liquids: flash point <60°C
- Combustible liquids: flash point >60°C and <93°C

2.4 Flammable Solids

- HD4.1: Flammable solids
- HD4.2: Spontaneously combustible
 - Pyrophoric: ignite spontaneously in air
 - Self-heating: heat up in air
- HD4.3: Dangerous when wet

2.5 Oxidizing Substances

- HD5.1: Oxidizing substances
- HD5.2: Organic peroxides

2.6 Toxic and Infectious Substances

- HD6.1: Poisonous substances
- HD6.2: Infectious substances

2.7 Radioactive Material

- HD7: Radioactive material

2.8 Corrosives

- HD8: Corrosives

2.9 Miscellaneous Dangerous Goods

- HD9: Miscellaneous dangerous goods

2.10 Hazardous Materials Table

The hazardous materials table is a list of hazardous materials and their proper shipping names, hazard classes, identification numbers, packing groups, and special provisions. The table is in 49 CFR 172.101: [49 CFR 172.101](#)

[49 CFR 172.101](#) has many of the details on shipping and handling of hazardous materials. You are not required to know this for any exam but it may prove valuable to you to know where to find this information.

3 SDS Components

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

See also: <https://www.osha.gov/laws-regulations/standardnumber/1910/1910.1200AppD>

3.1 SDS Examples

- Gasoline
- Water
- PETN

4 GHS Pictograms

Health Hazard	Flame	Exclamation Mark
 <ul style="list-style-type: none">• Carcinogen• Mutagenicity• Reproductive Toxicity• Respiratory Sensitizer• Target Organ Toxicity• Aspiration Toxicity	 <ul style="list-style-type: none">• Flammables• Pyrophorics• Self-Heating• Emits Flammable Gas• Self-Reactives• Organic Peroxides	 <ul style="list-style-type: none">• Irritant (skin and eye)• Skin Sensitizer• Acute Toxicity (harmful)• 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)

Figure 2: GHS Pictograms. Source: <https://www.osha.gov/sites/default/files/publications/OSHA3491QuickCardPictogram.pdf>

5 GHS Labeling

GHS Labeling requirements include:

- Product Identifier
- Signal Word
 - Danger (more severe)
 - Warning
- Hazard Statement
- Pictograms
- Precautionary Statement
- Supplier Information
- [Gasoline](#)
- [Ethanol](#)

Classwork Assignment: What would a GHS label for PETN look like? What should the SDS Contain?

6 NFPA 704 Diamond

NFPA diamonds are required by OSHA to be placed on containers of hazardous materials. The diamond is divided into four sections, each with a color and number. The colors and numbers are as follows:

- Red: Flammability
- Blue: Health

- Yellow: Reactivity
- White: Special Hazards

NFPA 704 Diamonds are not required by OSHA; however, local municipalities or fire departments may require them.

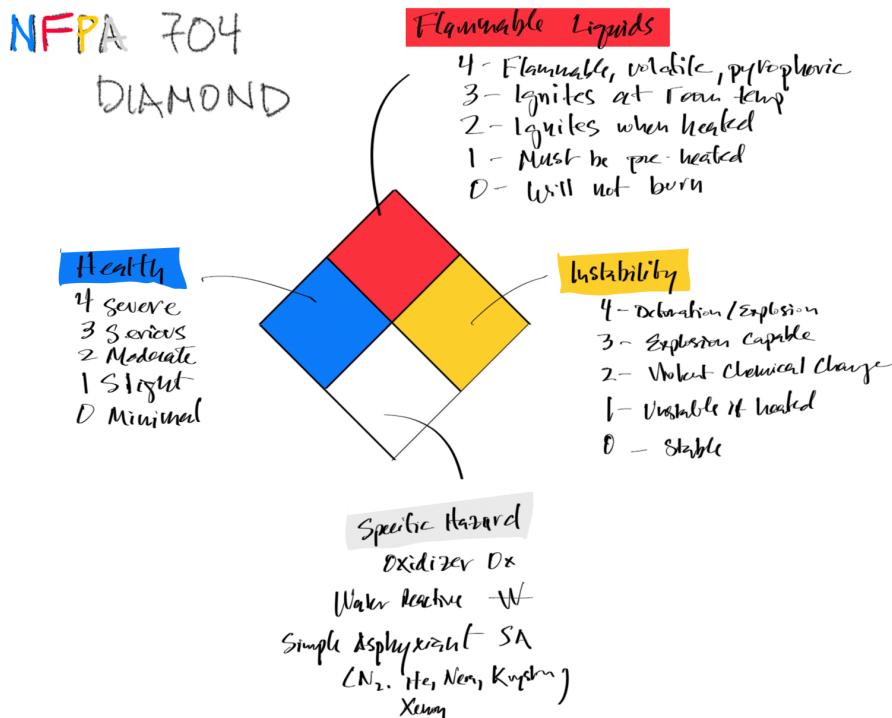


Figure 3: Drawing of the NFPA 704 Diamond with the colors and numbers for flammability, health, reactivity, and special hazards.

Action Items

1. Find the Safety Data Sheet (SDS) for two chemicals you frequently use and summarize their toxicity, flammability, and required PPE.
2. Look in the Hazardous Materials Table for TNT (trinitrotoluene) and give its hazard class and division and UN number. Why is there more than one listing?
3. Develop Sections 1-4 and 9 of a Safety Data Sheet for a chemical you have interest in. Assume you are the owner of a fictitious company producing that chemical. Be disciplined or not simply look-up or copy the information from a published SDS. Once developed, compare the information in your SDS to that of a published version. What differences are there? Submit the SDS and your comments.
4. Create a GHS label for a container of acetone, including the product identifier, signal word, hazard statement, and pictograms.
5. For the following list of scenarios, identify the UN number and use the ERG (Emergency Response Guidebook) to identify how far away the public should be evacuated in a transportation accident:

- fire near a rail car containing methyl isocyanate
- small spill of picric acid, wetted with 12% water