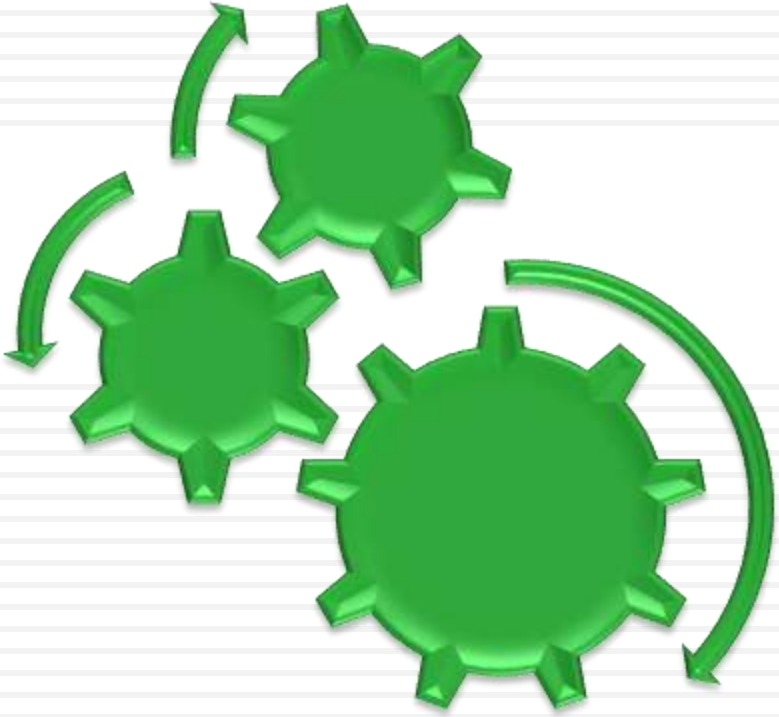
Handling of chemicals



Contents

How do... hazardous substances enter the body?

- **Inhalation (breathing in)**

  Breathing in of vapors and dust is the main way.

  In the lungs, chemicals are absorbed from the air directly into the bloodstream and are carried to all parts of the body.

  Dust particles can penetrate the lung and remain there

- **Skin or eye contact**

  Some chemicals can enter the body easily through the surface of the skin while others can enter through cuts or scratches on the skin.

- **Eating or drinking**

  People can swallow food and drink which has been contaminated with chemicals in the workplace, or through chemicals on their hands. Dust particles in the air can be swallowed.

How do... chemicals affect your body?

- Headaches
- Dizziness
- Sleepiness
- Itchiness / rash
- Nausea (feeling sick)
- Burns to skin or eyes
- Vomiting
- Hard to breathe
- Coughing
- Cancer
- Unconsciousness
- Death

Classification of hazardous chemicals

- Explosives **(E)**
- Oxidizing agents (**O**)
- Flammable substances (**F**), *highly flammable* **(F+)**
- Toxic substances classified as *very toxic* (**T+**) or *toxic* **(T)**
- Harmful substances or preparations **(Xn)**
- Corrosive substances or preparations **(C)**
- Irritants **(Xi)**
- Sensitizers
- Carcinogens classified into three categories **(Carc.)**
- Mutagens classified into three categories **(Mut.)**
- Substances that are toxic for reproduction **(Repr.)**
- Substances or preparations that are dangerous for the environment **(N)**

Explosives (E)

- **Explosive**,

  is a substance that contains a great amount of stored energy that can produce an explosion.

- **Chemical Composition**

  A chemical explosive may consist of either a chemically pure compound, such as nitroglycerin, or a mixture of an fuel and a oxidizer, such as black powder or grain dust and air.

Precautions

- Keep away from heat, sparks and flame.
- Keep container closed.
- Use only with adequate ventilation.

Oxidizing agents (O)

A chemical compound that readily transfers oxygen atoms,

or a substance that gains electrons in a redox chemical reaction

Examples

- Sulfuric acid.
- Hydrogen peroxide.
- Oxygen.

Precautions

- Keep from contact with clothing, and other combustible materials.
- Avoid contact with skin.
- Remove and wash contaminated clothing promptly.
- Store in tightly closed container.
- Wash thoroughly after handling.

FIRST AID

- In case of contact, immediately flush skin with plenty of water.
- Remove contaminated clothing and shoes.
- Call a physician if irritation develops and persists.
- Wash clothing and thoroughly clean shoes before reuse.
- In case of fire, soak with flooding quantities of water Before using,
- read Material Safety Data Sheet (MSDS) for this chemical.

Flammable (F)

Flammability is defined at how easily something will burn or ignite, causing fire or combustion

Flammable liquid is a liquid that can catch fire flammable liquids classified according to flash point and a boiling point to:-(I II III) A and B

Common name	CAS Number	Flash point	Class	Auto ignition Temperature
Acetone	67-64-1	−17 °C (1.4 °F)	IB	465 °C (869 °F)
Biodiesel	n/a mixture	>130 °C (266 °F)	IIIB	
Diesel	n/a mixture	>62 °C (144 °F)	IIIA	210 °C (410 °F)
Ethanol	64-17-5	12.8 °C (55.0 °F)	IB	365 °C (689 °F)
Gasoline	n/a mixture	<−40 °C (−40.0 °F)	IB	246 °C (475 °F)
Jet fuel	n/a mixture	>38 °C (100 °F)	II	210 °C (410 °F)
Methanol	67-56-1	11 °C (52 °F)	IB	464 °C (867 °F)

Precautions

- Keep away from heat, sparks, pilot lights, welding operations and open flame.
- Do not taste or swallow.
- Keep container tightly closed.
- Ground all equipment
- Do not breathe vapors.
- Do not get in eyes, on skin, or on clothing.
- Use only with adequate ventilation.
- Wash thoroughly after handling.
- Do not eat, drink or smoke in areas where this material is used.

FIRST AID

- EYES: Immediately flush eyes with a directed stream of water for at least 15 minutes.
  Get medical attention.
- SKIN: Immediately flush skin with plenty of water.
  Remove contaminated clothing and shoes.
  Get medical attention.
  Wash clothing and shoes before reuse.
- INHALED: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
  Get medical attention.

Precautions

- Do not taste or swallow.
- Do not take internally. Wash thoroughly after handling.
- Keep away from heat, sparks and flame.
- Keep container closed.
- Use only with adequate ventilation.

FIRST AID

- If swallowed, do NOT induce vomiting unless directed to do so by medical personnel.
- Never give anything by mouth to an unconscious person.

Keep out of reach of children

Toxic (T)

Toxicity is the degree to which a substance is able to damage an exposed organism.

types of toxic

- **Chemicals** inorganic substances such as lead, asbestos and chlorine gas, organic compounds such as methyl alcohol, most medications, and poisons from living things.
- **Biological** bacteria and viruses
- **Physically** sound and vibration heat and cold non-ionizing electromagnetic radiation such as infrared and visible light as X-rays

Precautions

- Avoid contact with eyes, skin and clothing.
- Avoid breathing vapor. Use only with adequate ventilation.
- Wash thoroughly after handling.
- Remove and wash contaminated clothing before reuse.

First Aid

- Eyes: Flush eyes with plenty of water for at least 15 minutes. Get medical attention.
- Skin: In case of contact, immediately flush skin with soap and plenty of water.
  Remove contaminated clothing and shoes.
  Wash clothing before reuse. Discard shoes.
- Ingestion: If swallowed, do NOT induce vomiting unless directed to do so by medical personnel.
  Never give anything by mouth to an unconscious person.
  Get medical attention.
- Inhalation: Remove to fresh air. If respiration stops, have a trained person administer artificial respiration.

Corrosive (C)

A corrosive substance is one that will destroy or irreversibly damage another substance with which it comes into contact.

Common corrosive chemicals:-

Strong acids

sulfuric acid, nitric acid and hydrochloric acid (H_2SO_4, HNO_3 and HCl, respectively).

Strong Bases

Caustics or alkalis, such as sodium hydroxide (NaOH) and potassium hydroxide (KOH)

Precautions

- Do not get on skin.
- Avoid breathing (dust, vapor, mist gas).
- Keep container tightly closed.
- Use only with adequate ventilation.
- Wash thoroughly after handling.

FIRST AID:

- In case of contact, immediately flush skin.
- with plenty of water for at least 15 minutes while
- removing contaminated clothing and shoes.
- Get medical attention immediately.
- Call a physician or poison control center immediately.
- Wash clothing before reuse.
- Destroy contaminated shoes.
- Thoroughly clean shoes before reuse.

Irritants (Xi)

Irritation or **exacerbation**

Is a state of inflammation or painful reaction to allergy or cell-lining damage.

Irritation - an uncomfortable feeling of mental painfulness or distress

Precautions

- Avoid breathing (dust, vapor, mist, gas).
- Keep container closed.
- Use only with adequate ventilation.

FIRST AID:

- If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
- Get medical attention.
- Get medical attention immediately.
- Call a physician.

Sensitizers

Sensitizer

Is a chemical compound, capable of light emission

after it has received energy from a molecule,

which became excited previously in the chemical reaction .

Precautions

- Do not breathe (dust, vapor, mist, gas).
- Keep container closed.
- Use only with adequate ventilation.

FIRST AID:

- If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
- Get medical attention1)
- Get medical attention immediately.
- Call a physician.

Carcinogens (Carc.),

A **carcinogen** is any substance, radionuclide or radiation that is an agent directly involved in the exacerbation of cancer or in the increase of its propagation

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

Precautions

- Use personal protection equipment:
- Gloves, safety glasses, and a coat are required.
- Use disposable sleeve protectors and disposable lab or smock, as appropriate.
- Follow emergency procedures for exposure and spills.
- Follow proper waste disposal procedures
- Access to the controlled area is prohibited.

When your work is completed, follow these steps:

- Remove all protective clothing and immediately wash your hands, forearms, face, and neck.
- Dispose of any contaminated disposable protective apparel or equipment as hazardous chemical waste, clearly labeled as carcinogenic.
- Thoroughly wash non-disposable apparel and equipment before removing it from the controlled area.
- Thoroughly clean all surfaces in the controlled area before removing the carcinogen warning sign and resuming other work.

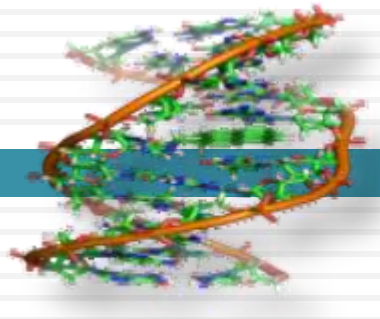
Mutagens (Mut.)

Is a physical or chemical agent that changes the genetic material, usually DNA, of an organism and thus increases the frequency of mutations above the natural background level.

Mutagens are usually chemical compounds or ionizing radiation. Mutagens can be divided into different categories according to their effect on DNA replication:

- Some mutagens act as base analogs and get inserted into the DNA strand during replication in place of the substrates.
- Some react with DNA and cause structural changes that lead to miscopying of the template strand when the DNA is replicated.
- Some work indirectly by causing the cells to synthesize chemicals that have the direct mutagenic effect.

Precaution



1. Only handle mutagen in the fume hood.
2. Keep a hazardous waste bag in the fume hood.
3. Dispose of most objects (gloves, towels, pipettes, etc.) in this bag (which might have come in contact with the
   mutagen).Arrange with Environmental Health and Safety for disposal of this bag following the experiment.
4. Cover the working surfaces and the floor with absorbent paper. Dispose of these papers in the hazardous waste
   bag after the experiment.
5. Wear gloves at all times and change them frequently. Specifically, change your gloves whenever you suspect contact
   with the mutagen or whenever you leave the fume hood. Wash your hands (and face) periodically during the
   experiment.
6. Inactivate the mutagen following the experiment by pouring the mutagen and rinses into an equal volume of 20%
   sodium thiosulfate, 1% NaOH. Make a separate inactivation bath to soak those items (beakers, mouse

Substances dangerous for the environment (N)

Substances and preparations which are dangerous for the environment: substances and preparations which, were they to enter the environment, would present or may present an immediate or delayed danger for one or more components of the environment.

Substances toxic for reproduction (Repr.)

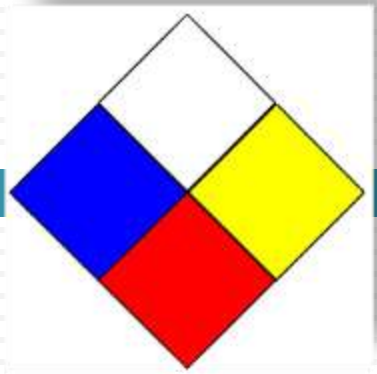
Reproductive toxicity

Is a hazard associated with some chemical substances, that they will interfere in some way with normal reproduction.

It includes adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring

labeling

American label



1. American National Standard **(ANSI)** Z-129.1,

2. U.S. Occupational Safety and Health Administration, **(OSHA)** 29 CFR 1910.1200:

3. U.S. Environmental Protection Agency, **(EPA)** 40 CFR Part 156

4. U.S. Consumer Product Safety Commission, **(CPSC)** 16 CFR 1500:

5. U.S. Department of Transportation, **(DOT)** 49 CFR Part 107:

6. National Fire Protection Association **(NFPA)** 704,

7. National Paint and Coatings Association, **(NPCA)** Hazardous Materials Identification System,

American label

NFPA (U.S.A.)

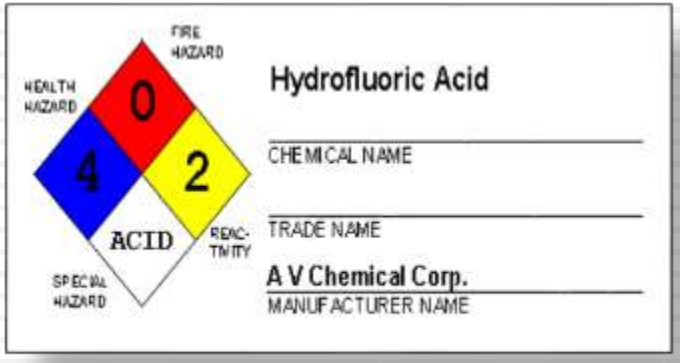
HMIS “hazardous material identification system”

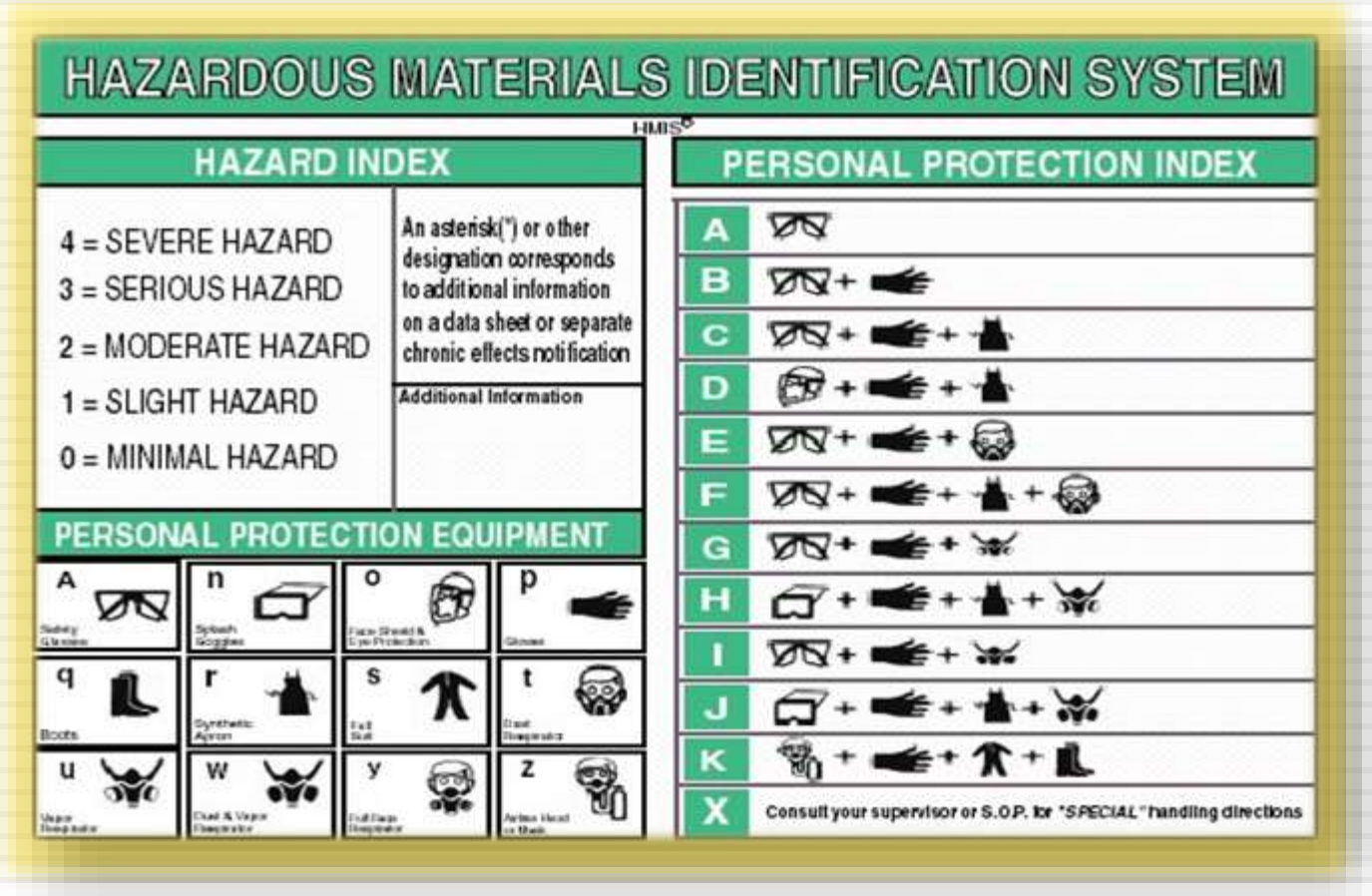
Health Hazard: 4

Fire Hazard: 0

Reactivity: 2

Personal Protection: Acid equipments




HAZARDOUS MATERIALS IDENTIFICATION SYSTEM
HMIS®
HAZARD INDEX
4 = SEVERE HAZARD
3 = SERIOUS HAZARD
2 = MODERATE HAZARD
1 = SLIGHT HAZARD
0 = MINIMAL HAZARD
An asterisk(*) or other designation corresponds to additional information on a data sheet or separate chronic effects notification
Additional Information
PERSONAL PROTECTION EQUIPMENT
A
n
o
p
q
r
s
t
u
W
y
z
PERSONAL PROTECTION INDEX
A
B
C
D
E
F
G
H
I
J
K
X
Consult your supervisor or S.O.P. for "SPECIAL" handling directions

Others label

1. European Economic Community **(EEC)** amending for the seventh time Directive 67/548/European Economic Community, (packaging and labeling of dangerous preparations).
2. Controlled Products Regulation, Hazardous Products Act, **Canada** Gazette, Part II,
3. **Australia** Work safe, National Occupational Health and Safety Commission,
4. NORMA Oficial **Mexicana** NOM-114-STPS-1994.
5. **Korean** Ministry of Labor Notice 1997-27 .
6. **Japanese** Official Notice of Ministry of Labor No. 60 .

Others label

IMDG

The objective of the

International Maritime Dangerous Goods (IMDG) Code is to:

- Enhance the safe transport of dangerous goods.
- Protect the marine environment.
- Facilitate the free unrestricted movement of dangerous goods.

Others label

IMDG

The 9 classes:

Class 1	Explosives
Class 2	Gases
Class 3	Flammable liquids
Class 4	Flammable solids
Class 5	Oxidizing substances and organic peroxides
Class 6	Toxic and infectious substances
Class 7	Radioactive material
Class 8	Corrosive substances
Class 9	Miscellaneous dangerous substances and articles

Others label

IMDG

e.g.

Class 2: Gases

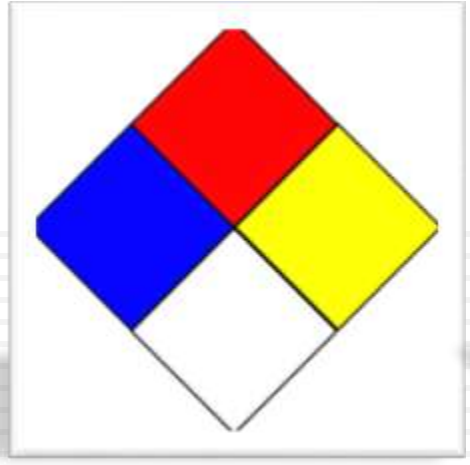
Class 2.1: flammable gases

Class 2.2: non-flammable, non-toxic gases

Class 2.3: toxic gases

Hazardous materials identification system

NFPA and HMIS shapes



Blue/Health

In the latest version of HMIS, the blue Health bar has two spaces,

4. Life-threatening, major or permanent.
3. Major injury likely unless prompt action is taken and medical treatment is given.
2. Temporary or minor injury may occur.
1. Irritation or minor reversible injury possible.
0. No significant risk to health.

Red/Flammability

4. Flammable gases, or very volatile flammable liquids with flash points below 73 °F (23 °C), and boiling points below 100 °F (38 °C). Materials may ignite spontaneously with air (eg., Propane).

3. Materials capable of ignition under almost all normal temperature conditions. Includes flammable liquids with flash points below 73 °F (23 °C) and boiling points above 100 °F (38 °C), as well as liquids with flash points between 73 °F and 100 °F.

2. Materials which must be moderately heated or exposed to high ambient temperatures before ignition will occur. Includes liquids having a flash point at or above 100 °F (38 °C) but below 200 °F (93 °C) (eg., Diesel fuel).

1. Materials that must be preheated before ignition will occur. Includes liquids, solids and semi solids having a flash point above 200 °F (eg., Canola oil).

0. Materials that will not burn (eg., Water).

Common name	CAS Number	Flash point	Class	Auto ignition Temperature
Flammable gases	67-64-1	−17 °C (1.4 °F)	4	465 °C (869 °F)
Biodiesel	n/a mixture	>130 °C (266 °F)	3	
Diesel	n/a mixture	>62 °C (144 °F)	2	210 °C (410 °F)
Ethanol	64-17-5	12.8 °C (55.0 °F)	1	365 °C (689 °F)
Gasoline	n/a mixture	<−40 °C (−40.0 °F)	0	246 °C (475 °F)

Yellow/Physical Hazard

4. Materials that are readily capable of explosive water reaction, detonation or explosive decomposition,

polymerization, or self-reaction at normal temperature and pressure

3. Materials that may form explosive mixtures with water and are capable of detonation or explosive reaction

in the presence of a strong initiating source. Materials may polymerize, decompose, self-react, or undergo

other chemical change at normal temperature and pressure with moderate risk of explosion.

2. Materials that are unstable and may undergo violent chemical changes at normal temperature and pressure

with low risk for explosion. Materials may react violently with water or form peroxides upon exposure to air.

1. Materials that are normally stable but can become unstable (self-react) at high temperatures and pressures.

Materials may react non-violently with water or undergo hazardous polymerization in the absence of

inhibitors.

Materials that are normally stable, even under fire conditions, and will not react with water,

0

White/Personal Protection

This is by far the largest area of difference between the NFPA and HMIS systems. In the NFPA system,

the white area is used to convey special hazards whereas HMIS uses the white section to indicate what **personal protective equipment** (PPE) should be used when working with the material.

White/Personal Protection

A safety glasses

B safety glasses and gloves

C safety glasses, gloves and an apron

D face shield, gloves and an apron

E safety glasses, gloves and a dust respirator

F safety glasses, gloves, apron and a dust respirator

G safety glasses, a vapor respirator

H splash goggles, gloves, apron and a vapor respirator

I safety glasses, gloves and a dust/vapor respirator

J splash goggles, gloves, apron and a dust/vapor respirator

K airline hood or mask, gloves, full suit and boots

L – Z custom PPE specified by employer

References

Basel Convention

DOT: Department of Transportation

GHS: Globally Harmonized System of Classification and Labeling of Chemicals.

HCS: Hazard Communication Standard

IMDG: the International Maritime Dangerous Goods.

OSHA: Occupational Safety and Health Administration

MSDS: Material Safety Data Sheet

UNCETDG: United Nations Committee of Experts on the Transport of Dangerous Goods

WHMIS: Workplace Hazardous Materials Information System

Thanks