NFPA Ratings / NFPA Diamond
(NFPA – National Fire Protection Association)

Primary Knowledge
Instructor Guide

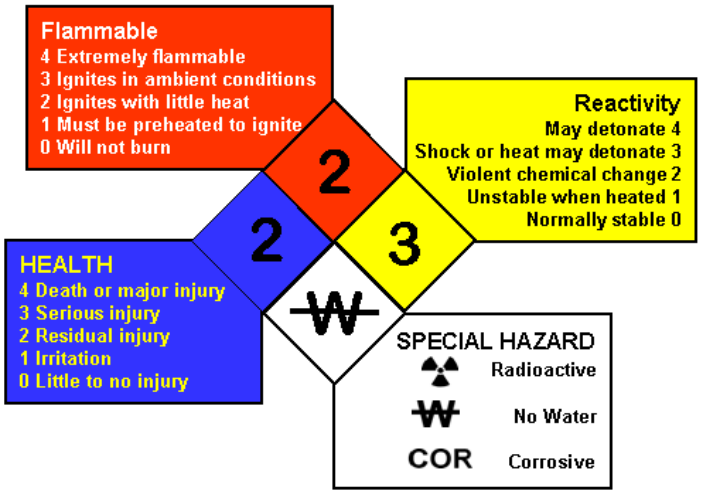
Note to Instructor

This is the second primary knowledge (PK) unit of the *Interpreting Chemical Label Learning Module*. Below are all the units in the *Interpreting Chemical Label Learning Module*.

- Interpreting Chemical Labels PK
- **NFPA Ratings / NFPA Diamond PK**
- NFPA Diamond Interpretation Activity
- NFPA in the Workplace
- Interpreting Chemical Labels Activity
- Interpreting Chemical Labels Final Assessment

A PowerPoint presentation is provided for a classroom presentation. The PowerPoint is a summary of the PG.

Description and Estimated Time to Complete



NFPA Ratings / Diamond

This unit provides content information about the NFPA (National Fire Protection Association) ratings and related NFPA diamond. By the end of this unit you will be able to interpret NFPA diamonds and relate specific chemicals to NFPA hazard types and levels. This information will prepare you to quickly identify the potential dangers associated with chemicals used in microsystems fabrication.

Estimated time to complete:
Allow 15 minutes

Introduction

When working with a chemical, the first information that one usually sees is the information on the chemical's label. The purpose of this information is to warn you of the hazards associated with the chemical. Once warned, you should consult the MSDS (Material Safety Data Sheet) for additional information.

NFPA Diamond

OSHA (Occupational Safety and Health Association) requires that all in-plant / in-lab containers of chemicals be labeled, tagged, or marked with the chemical's identity and potential hazards. One instrument commonly used to identify a chemical's potential hazards is the National Fire Protection Association (NFPA) Diamond.

Dependencies

Prior knowledge of the terminology associated with hazardous materials would be beneficial. See SCME Hazardous Materials I and II.

NFPA Standard

The NFPA ratings were developed by the U.S. National Fire Protection Association. The NFPA diamond is a pictorial representation of these ratings as defined in the NFPA 704 standard. The NFPA diamond is sometimes referred to as the "fire diamond". It is used by emergency personal, employees, students, and the general public to quickly identify the potential hazards of a chemical.

Examples of where one might see a NFPA diamond:

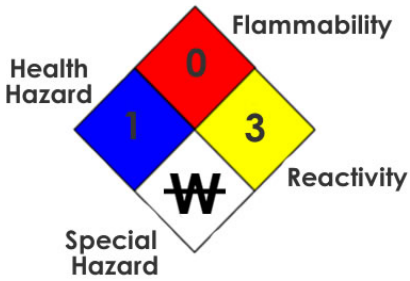
- 18-wheeler transporting a chemical
- Compressed gas cylinders
- Doors to storage rooms
- Entry doors to manufacturing facilities
- Chemical labels on bottles and crates

NFPA Hazard Warnings

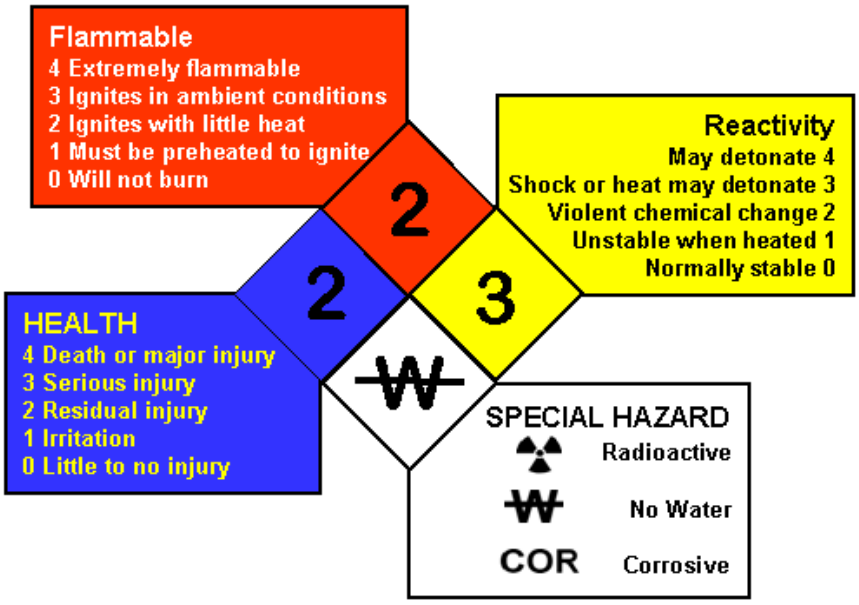
In a NFPA diamond, each smaller diamond represents a particular hazard. The hazards shown are

- Flammability (red),
- Health Hazard (blue),
- Reactivity (yellow), and
- Special (white).

The number within each diamond represents the "level" of the hazard.



NFPA Ratings



NFPA Ratings

The level of each hazard represented by a NFPA diamond is given a 0 to 4 rating:

0 = "least severe hazard"

4 = "most severe hazard"

Each level represents a specific degree of hazard depending on the category. Some sections, such as Flammability, are well defined and based on a chemical's flashpoint. However, the Health rating can be somewhat subjective. This could be dependent upon the manufacturer's interpretation of the MSDS and the concentration of a chemical. At times you might see different levels for the same chemical. Let's look into each section in more detail.

RED: Flammability Ratings

The level of hazard is based on the chemical's flashpoint.

4 – Extremely flammable.
Will vaporize at normal pressure and normal temperature
[Flashpoint below 73°F (23°C)]

3 – Ignition may occur under most ambient conditions
[Flashpoint below 100°F (38°C)]

2 – Must be moderately heated for ignition
[Flashpoint below 200°F (93°C)]

1 – Must be preheated for ignition
[Flashpoint above 200°F (93°C)]

0 - Will not burn

BLUE: Health Hazard Ratings

4 – Deadly: Exposure may cause death or major residual injury

3 – Extreme Danger: Exposure could cause serious injury even if treated

2 – Hazardous: Intense or prolonged exposure may cause incapacitation or possible residual injury

1 – Slightly Hazardous: May cause irritation or minimal residual injury

0 – Normal Material: Hazard no greater than ordinary material

YELLOW: Reactivity Ratings

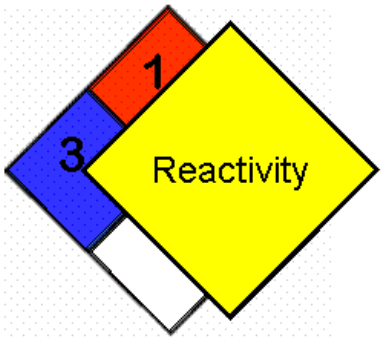
4 – Can detonate at normal temperatures or pressures

3 – Can detonate with shock or strong ignition source, or reacts explosively with water

2 – Unstable. Can undergo violent chemical change at elevated temperatures or pressures. Capable of reacting violently or forming explosive mixtures with water.

1 – Normally stable, but can become unstable at elevated temperatures and pressures. May react with water, but not violently.

0 – Stable. Not reactive with water.

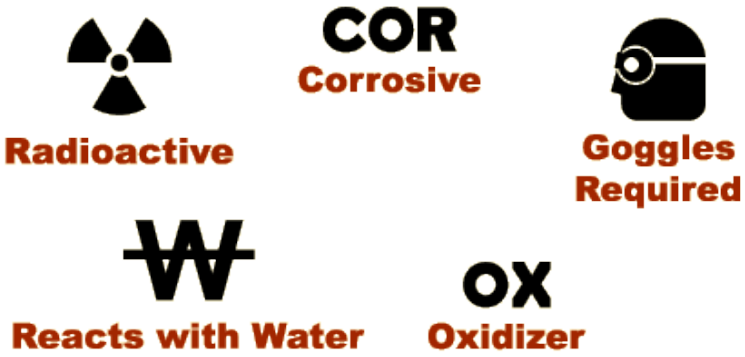


WHITE: Special Hazard / PPE

Specific symbols are used to indicate hazards such as
- Reacts with water
- Strong Oxidizer
- Corrosive
- Radioactive
- Poison

White is also used to indicate if specific personal protective equipment (PPE) is required:
- goggles
- acid gear
- respirator

Special Hazards



These are some of the symbols used in the WHITE of a NFPA diamond.

Let's check your understanding of the rating levels.

What flammability rating would be given to a chemical that may ignite under most ambient conditions and has a flashpoint less than 100 F?

Answer:
A flashpoint less than 100 F gets a flammability rating of 3.

What health rating would a chemical have that may cause irritation or minimal residual injury?

Answer:
This chemical would be given a 1 rating.

What reactivity rating would a chemical have that was capable of reacting violently or forming explosive mixtures with water?

Answer:
*This chemical would be given a reactivity rating of **2**.*

What does COR in the White diamond represent? _____

Answer:
COR means that this chemical is a corrosive.

Which of the following would one NOT find in the white section of a NFPA diamond?

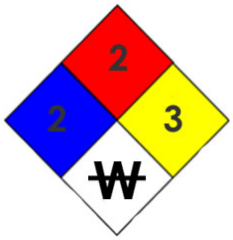
1. COR
2. Goggles required
3. OX
4. Reacts with bleach

Answer:

Reacts with bleach *would be the only one of the listed items that would NOT be in the white.*

Which of the following is NOT true in reference to the NFPA diamond?

a. Prolonged exposure may cause incapacitation
b. Flashpoint is less than 200 F
c. Can detonate at normal temperature and pressure
d. Do not mix with water



Answer:

Can detonate at normal temperature and pressure would require a reactivity rating of ***4****.*

Summary

The NFPA diamond is a reliable warning symbol used on labels, doors, compressed gas cylinders, and other chemical storage devices. Variations of this diamond are found throughout laboratories, manufacturing facilities, and microsystems fabrication facilities.

It is important to be able to interpret the information provided in a NFPA diamond.

Food for Thought

What are ways to remember the colors and their respective warning (health, fire, reactivity or special)?

Develop a formula or system for associating the level's flashpoint temperature with its rating.

Develop a formula or system for associating the level's health or reactivity rating.

References

1. OSHA (https://www.osha.gov/)
2. National Fire Protection Association (http://www.nfpa.org/)
3. The MSDS HyperGlossary (http://www.ilpi.com/msds/ref/index.html)

Related SCME Learning Modules and Units

The following learning modules can be downloaded from the SCME website (http://scme-nm.org).

- Hazardous Materials Learning Module
- Material Safety Data Sheet Learning Module
- Chemical Labels
- NFPA Ratings Interpretation Activity

Disclaimer

The information contained herein is considered to be true and accurate; however the Southwest Center for Microsystems Education (SCME) makes no guarantees concerning the authenticity of any statement. SCME accepts no liability for the content of this unit, or for the consequences of any actions taken on the basis of the information provided.

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program.