Hazardous Materials for First Responders

4th Edition

Chapter 2 — Hazardous Materials Identification

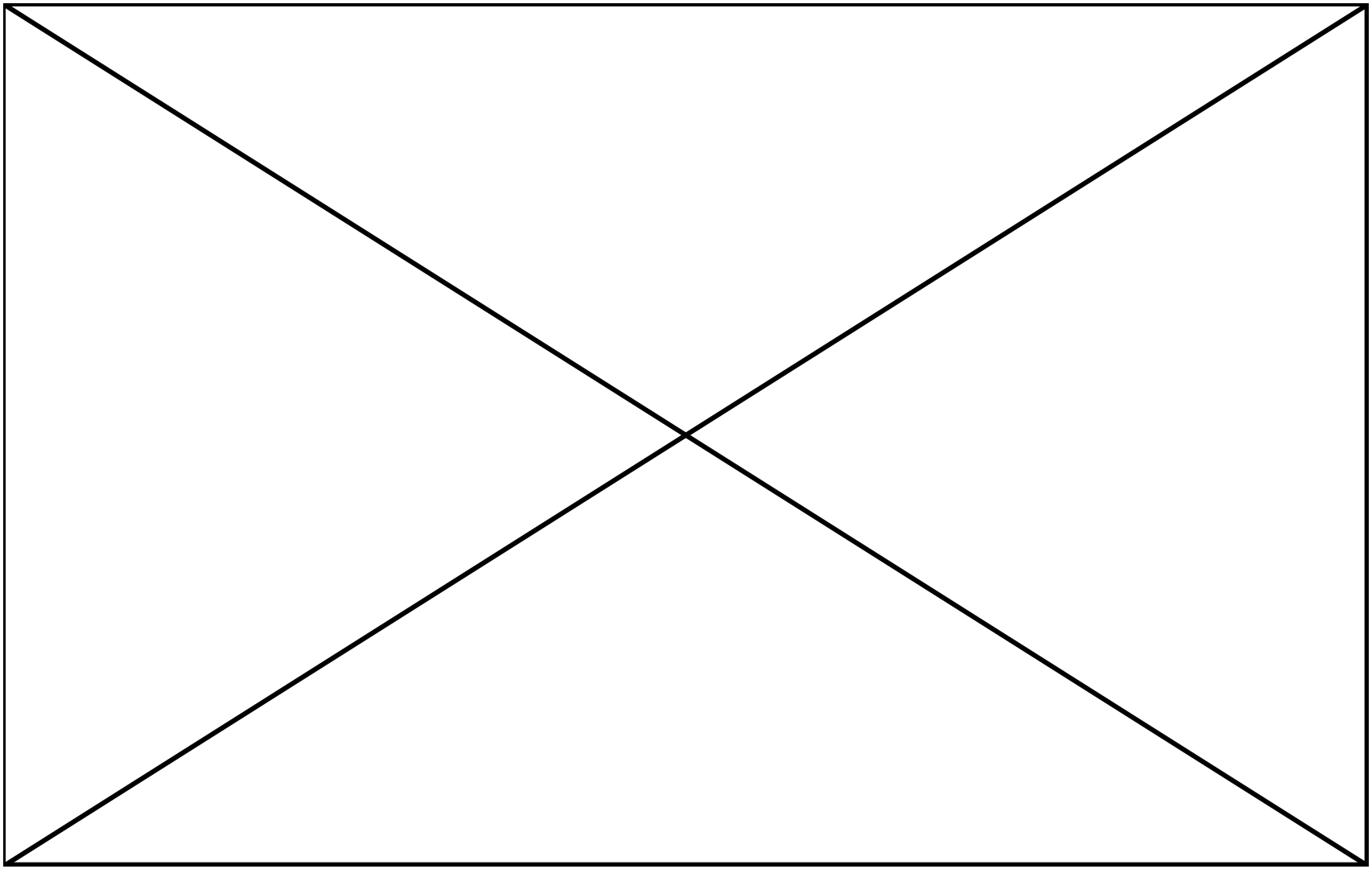
HAZ MAT FOR FIRST RESPONDERS

ifsta
International Fire Service Training Association

Learning Objective 1

Identify the seven clues to the presence of hazardous materials.

Risk increases when moving closer to identify hazardous materials.



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Learning Objective 2

Discuss the occupancy types, locations, and pre-incident surveys that may indicate hazardous materials.

Pre-Incident Surveys

- Reduce on-site decisions for first responders
- Reduce oversights, confusion, and duplication of effort
- Identify several items
- Ongoing process; includes review and updates
- Not always accurate

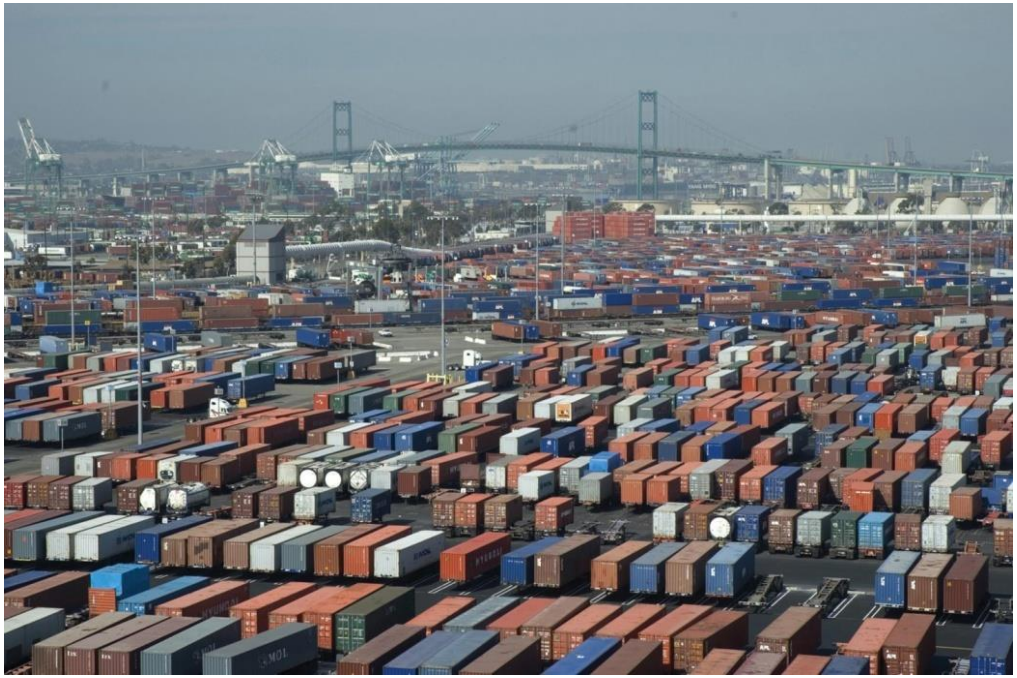
DISCUSSION QUESTION

What are exposures?

DISCUSSION QUESTION

What are some occupancies that are highly probable locations for hazardous materials storage?

Some occupancies are highly probable locations for hazardous materials.



Courtesy of U.S. Customs and Border Protection, photo by Charles Csavossy

Locations That May Indicate Hazardous Materials

- Roadways
- Railways
- Waterways
- Airways
- Pipelines
- Water level in rivers and tidal areas

Courtesy of Phil Linder

Identify where a potential attack can do the greatest harm.

Courtesy of U.S. Customs and Border Protection, photo by Gerald L. Nino

DISCUSSION QUESTION

What are some specific locations that may be terrorist targets?

Potential terrorist targets that should be considered.

Mass transportation

Critical infrastructure

Areas of public assembly and recreation

High profile buildings and locations

Industrial sites

Educational sites

Medical and science facilities

Learning Objective 3

Describe the container shapes that may contain hazardous materials.

Categories of Containers

- Bulk and nonbulk
- Pressure and nonpressure
- Bulk-capacity fixed-facility containment systems and transportation packaging

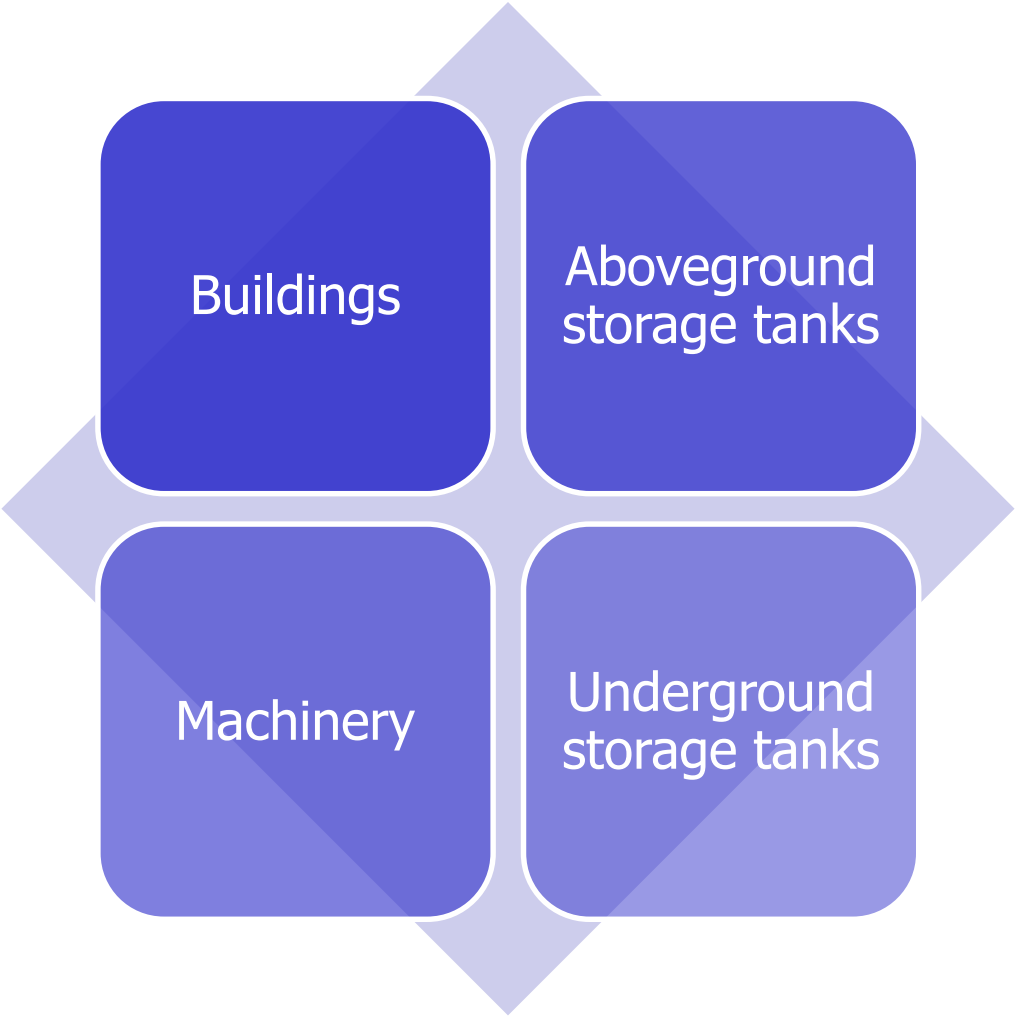
Courtesy of Rich Mahaney

DISCUSSION QUESTION

What is bulk packaging?

What is nonbulk packaging?

There are several types of bulk-capacity fixed-facility containers.



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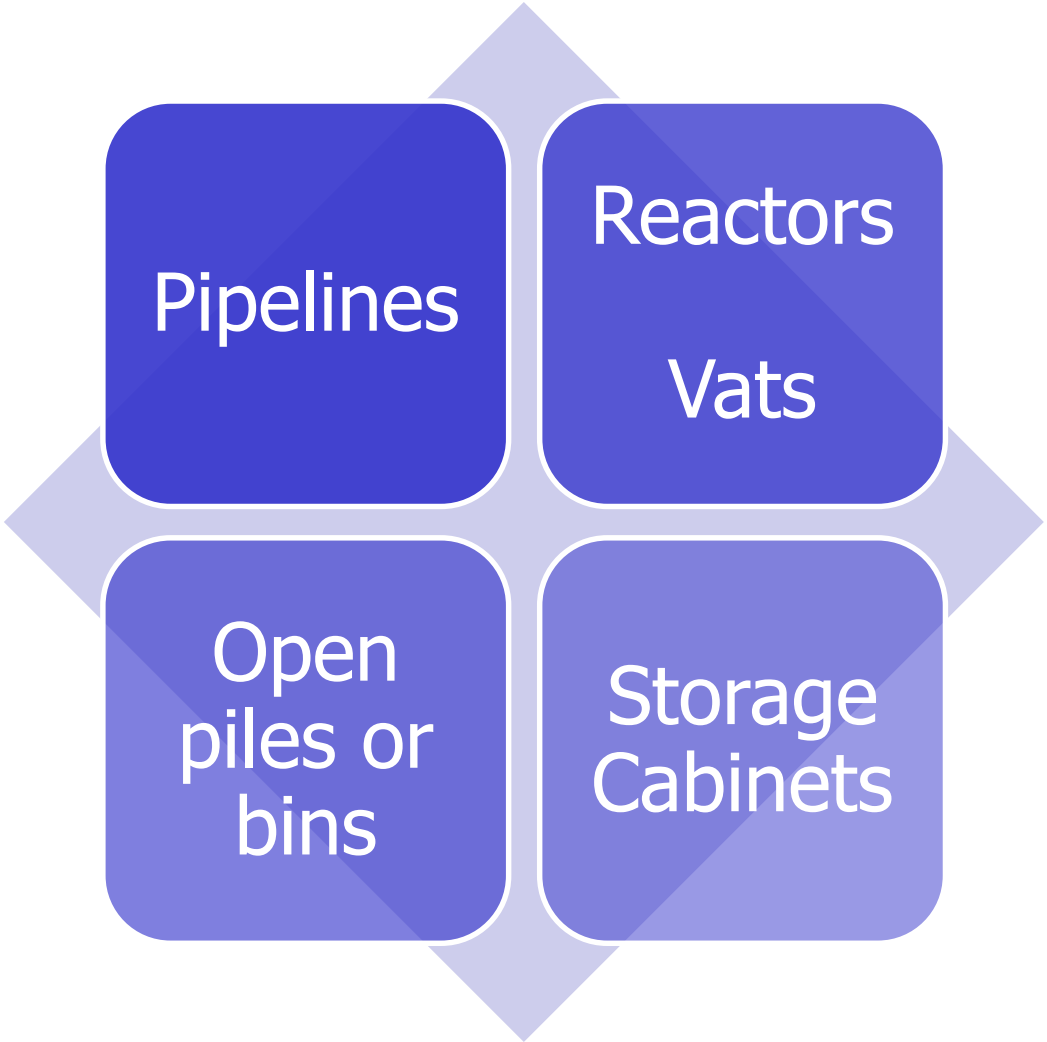

Nonpressure/atmospheric storage tanks operate under little pressure.

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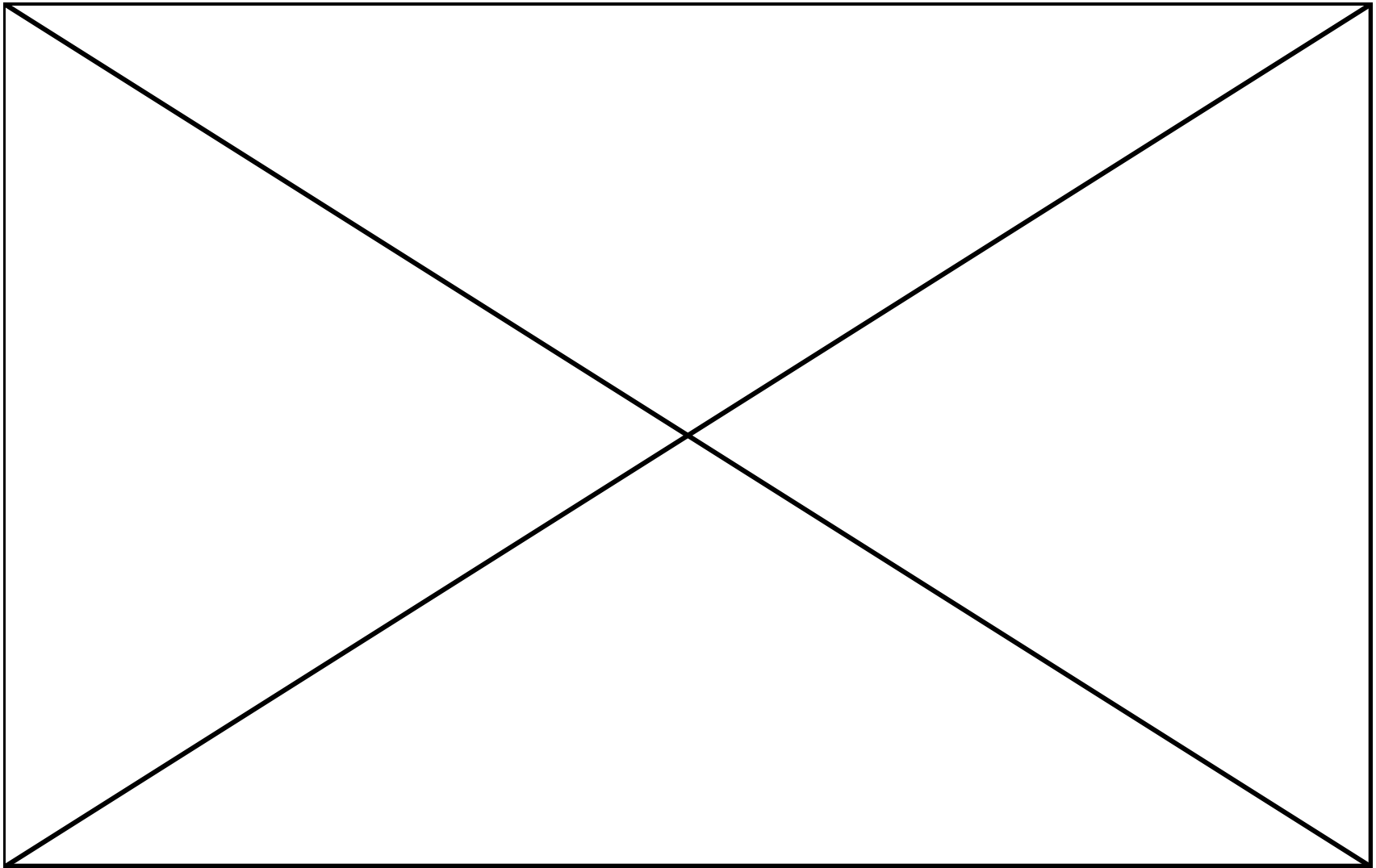

Courtesy of Rich Mahaney

Pressure Storage Tanks

- Hold contents under pressure
- Low-pressure storage tanks – Operating pressures from 0.5 to 15 psi (3.45 kPa to 103 kPa) {0.03 bar to 1.03 bar}
- Pressure vessels – Pressures of 15+ psi (103 kPa) {1.03 bar} or greater

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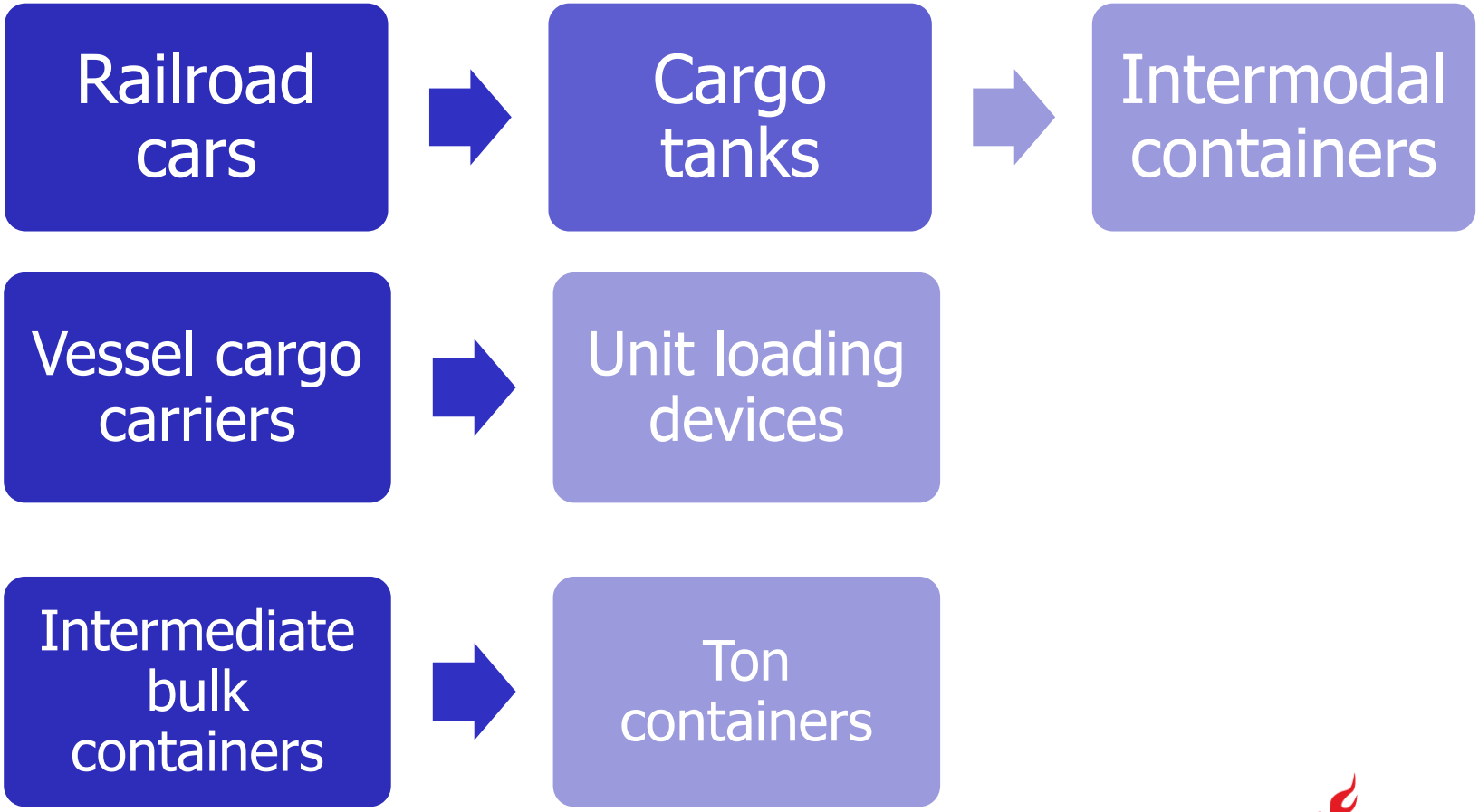
There are a variety of bulk transportation containers.



Low-pressure tank cars transport materials with low vapor pressures.

Courtesy of Rich Mahaney

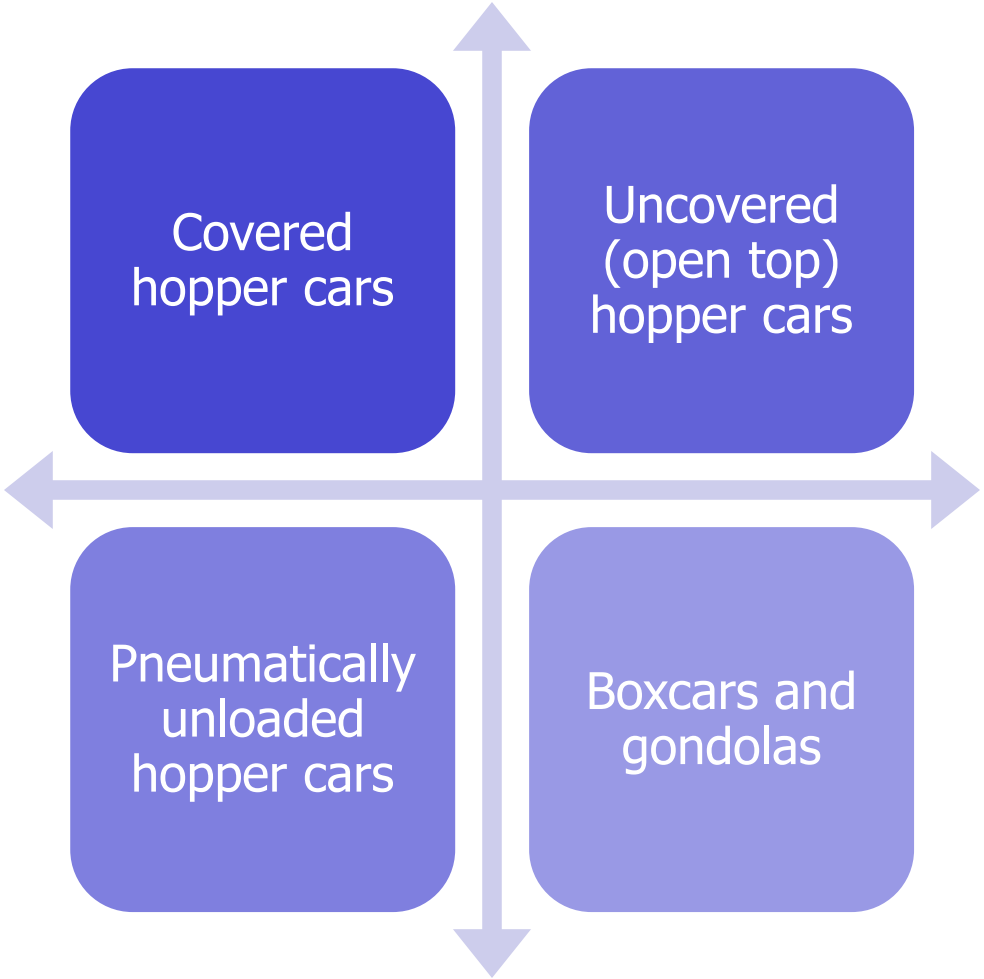
Pressure tank cars transport materials with higher pressures.

Courtesy of Rich Mahaney

Cryogenic liquid tank cars carry low pressure and refrigerated liquids.

Courtesy of Rich Mahaney

Other railroad cars carry a variety of materials.



Cargo tank construction features are designed to fit specific uses.

Courtesy of Rich Mahaney

Intermodal containers may contain hazardous materials or mixed loads.

Dry Van *(box containers)*

Refrigerated *(reefers)*

Open Top

Flat

(Continued)

Some intermodal containers are tank containers.

Courtesy of Rich Mahaney

DISCUSSION QUESTION

How can you tell if a freight container contains hazardous materials?

Low- pressure intermodal containers are the most common.

Courtesy of Rich Mahaney

Courtesy of Rich Mahaney

Intermodal containers can be pressurized or specialized.

Courtesy of Rich Mahaney

Courtesy of Rich Mahaney

There are a variety of vessel cargo carriers that are likely to contain hazardous materials.

Tanker

- Petroleum carrier
- Chemical carrier
- Liquefied flammable

Cargo vessel

- Bulk carrier
- Break bulk carrier
- Container vessel

Barge

Unit loading devices are used to consolidate air cargo into transportable units.

Courtesy of John Demyan

Intermediate bulk containers are designed for mechanical handling.

Courtesy of Rich Mahaney

Intermediate bulk containers can be flexible or rigid.

Courtesy of Rich Mahaney

Courtesy of Rich Mahaney

Ton containers require special equipment to patch.

Courtesy of Rich Mahaney

Courtesy of Rich Mahaney

CAUTION

Structural fire-fighting gear does not provide adequate protection against the hazardous materials commonly stored in ton containers.

REVIEW QUESTION

What are the criteria for bulk packaging?

Nonbulk packaging is used to transport smaller quantities of hazardous materials.

- Bags
- Carboys and jerry cans
- Cylinders
- Drums
- Deward flasks

Containers for radioactive materials protect against increasing levels of hazards.

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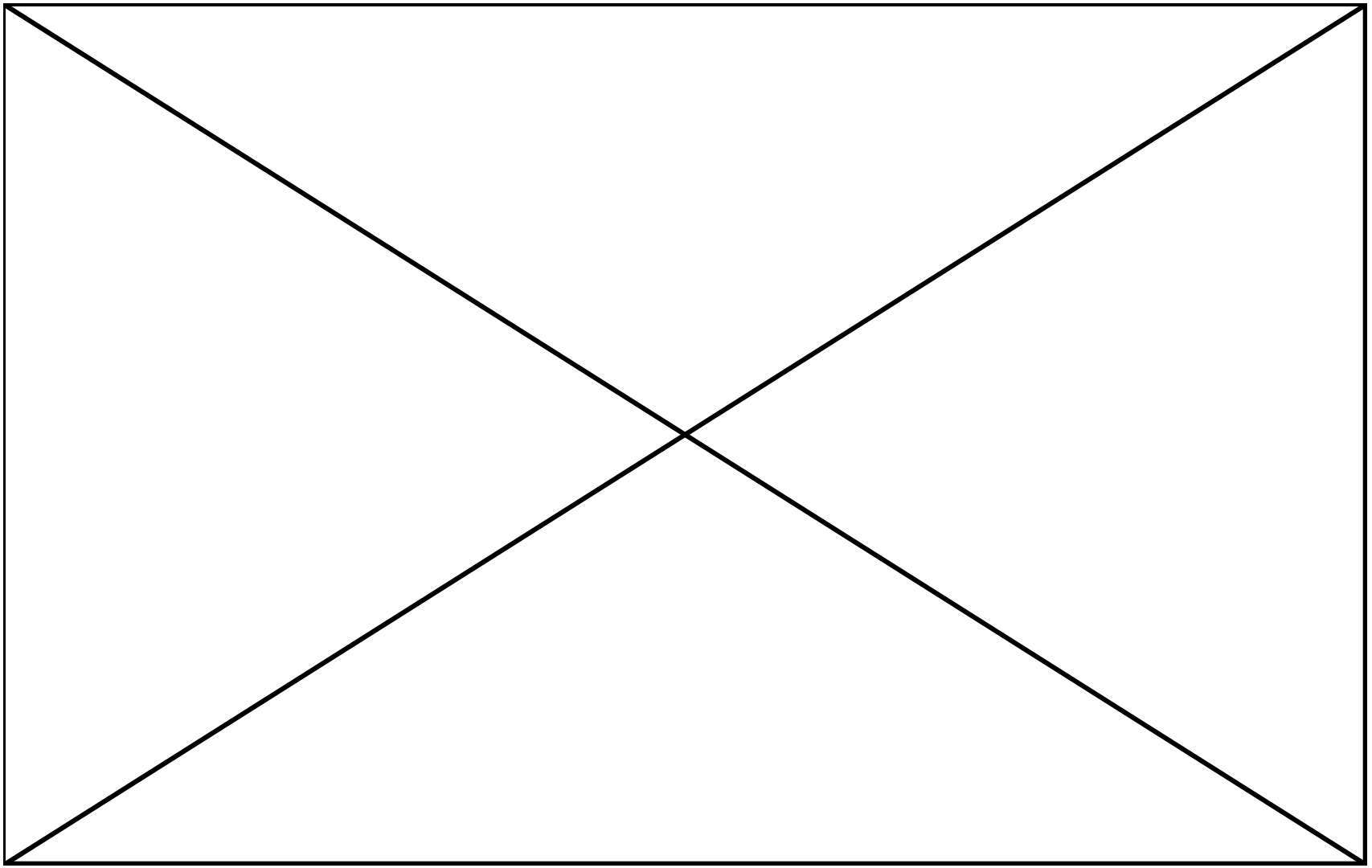


Courtesy of Tom Clawson, National Nuclear Security Administration, Nevada Site Office, and U.S. Air Force

Learning Objective 4

Identify placards, labels, and markings that designate the presence of hazardous materials.

UN Recommendations on the Transport of Dangerous Goods

- Adopted by U.S., Canada, and Mexico
- Establishes minimum requirements for transport by all modes of transportation
- Facilitates trade and safe, efficient transport
- Includes standards for packaging and multimodal tanks

(Continued)

UN hazard classes identify substances that pose significant hazard in transportation.

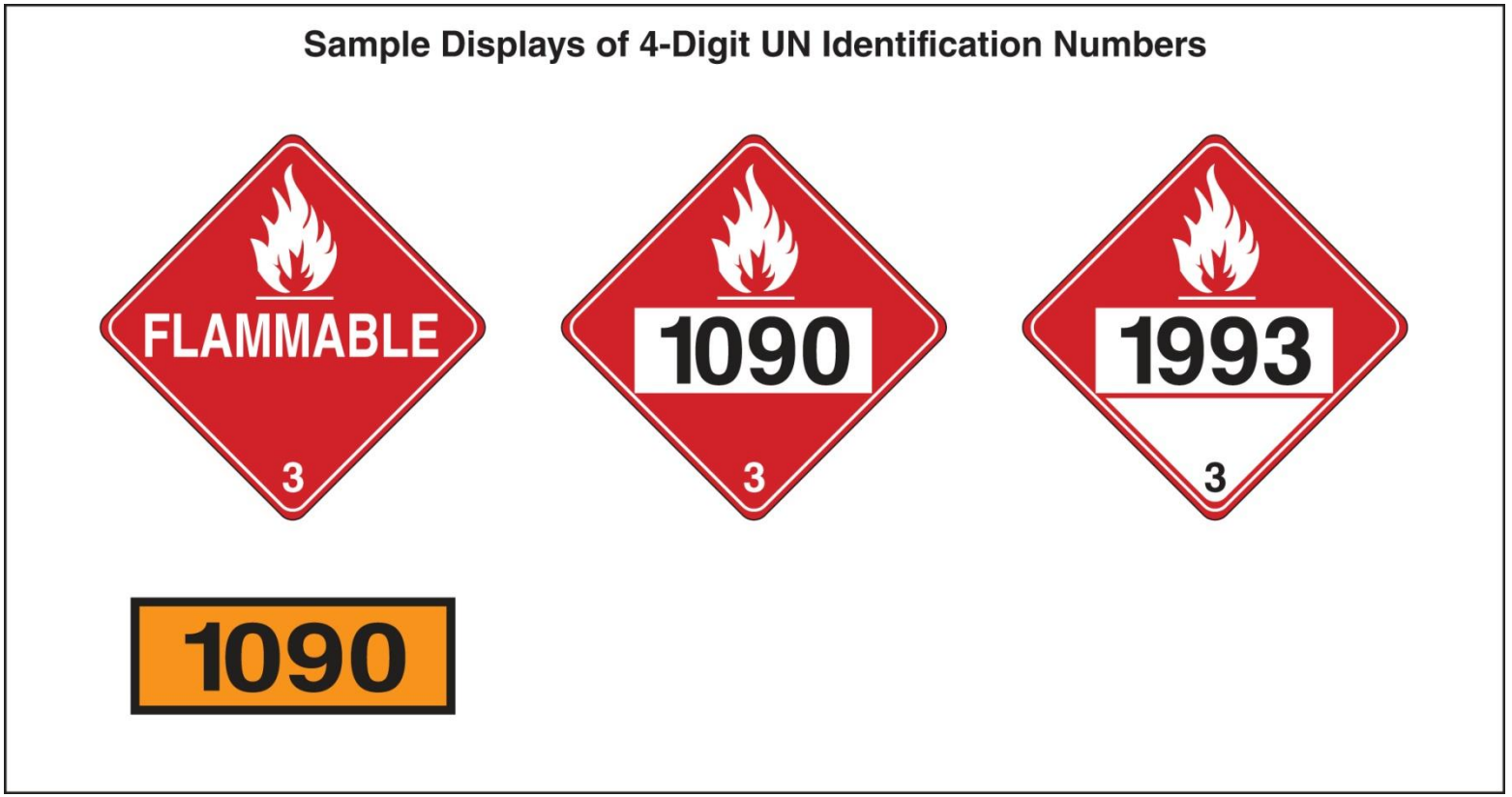
- Class 1 - Explosives
- Class 2 - Gases
- Class 3 - Flammable liquids
- Class 4 - Flammable solids, substances liable to spontaneous combustion, substances that emit flammable gases on contact with water

(Cont.)

UN hazard classes identify substances that pose significant hazard in transportation.

- Class 5 - Oxidizing substances and organic peroxides
- Class 6 - Toxic and infectious substances
- Class 7 - Radioactive materials
- Class 8 - Corrosive substances
- Class 9 - Miscellaneous dangerous substances and articles

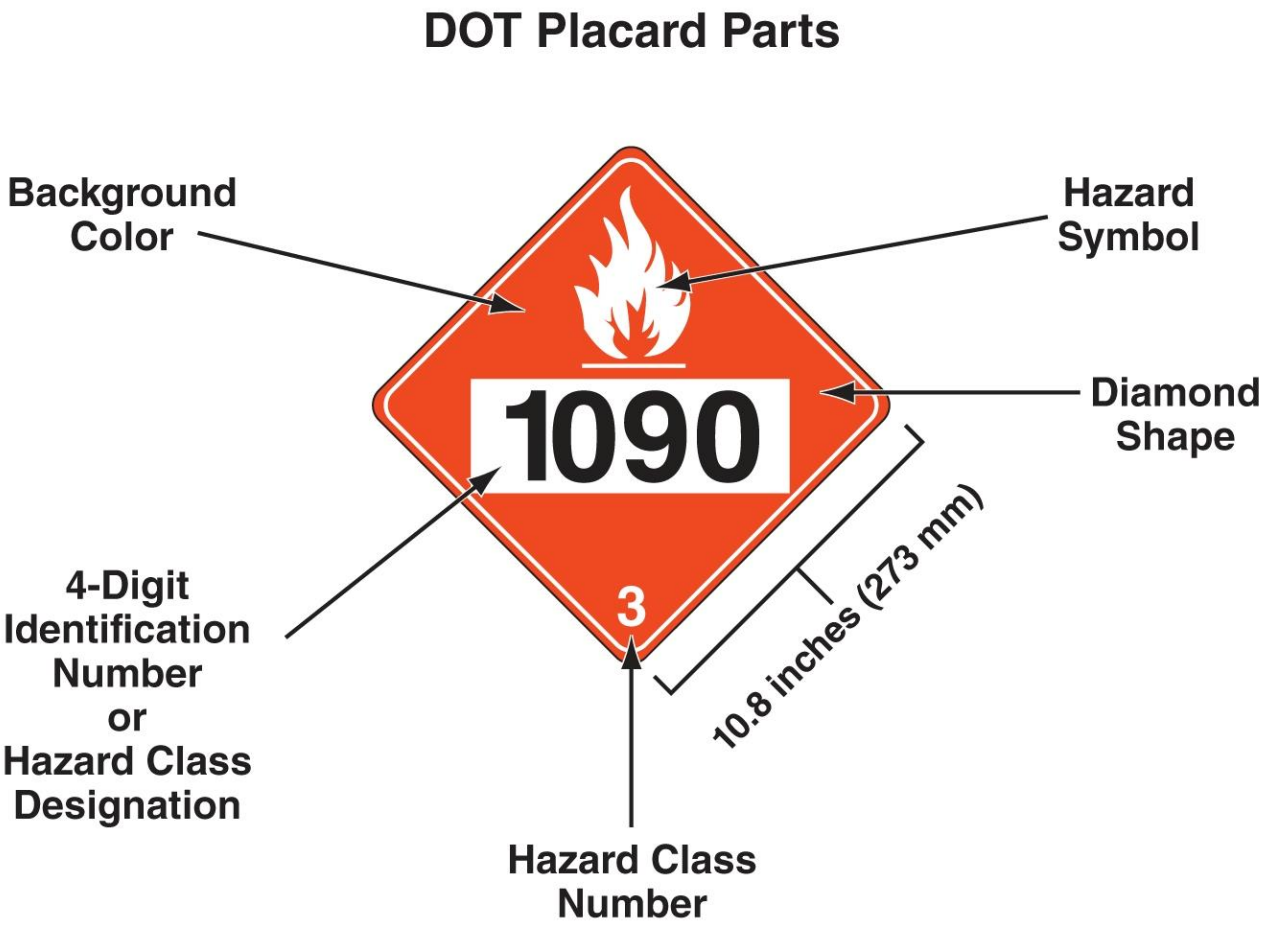
UN identification numbers are assigned to individual materials.



REVIEW QUESTION

What are the nine UN hazard classes?

U.S. DOT placards are unique for each hazard class.



DISCUSSION QUESTION

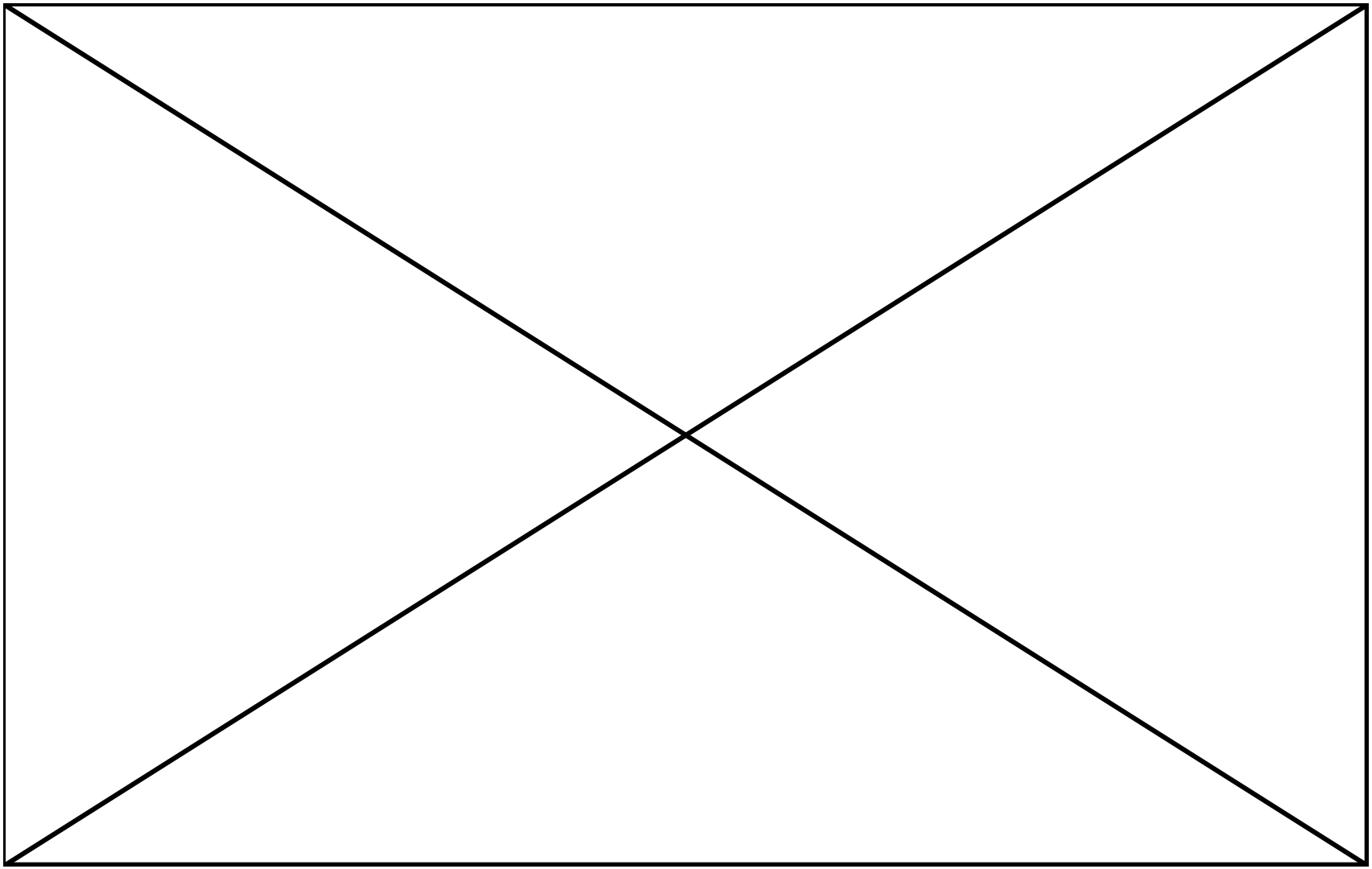
What are ORM-Ds and MOTs?

U.S. DOT labels provide the same information as placards.

REVIEW QUESTION

On DOT placards, what does the color orange indicate?

Canadian and Mexican placards, labels, and markings are based on *UN recommendations*.



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Other North American highway vehicle identification markings will include various information.

Courtesy of Rich Mahaney

North American railroad tank car markings have a variety of styles.

Courtesy of Rich Mahaney

(Continued)

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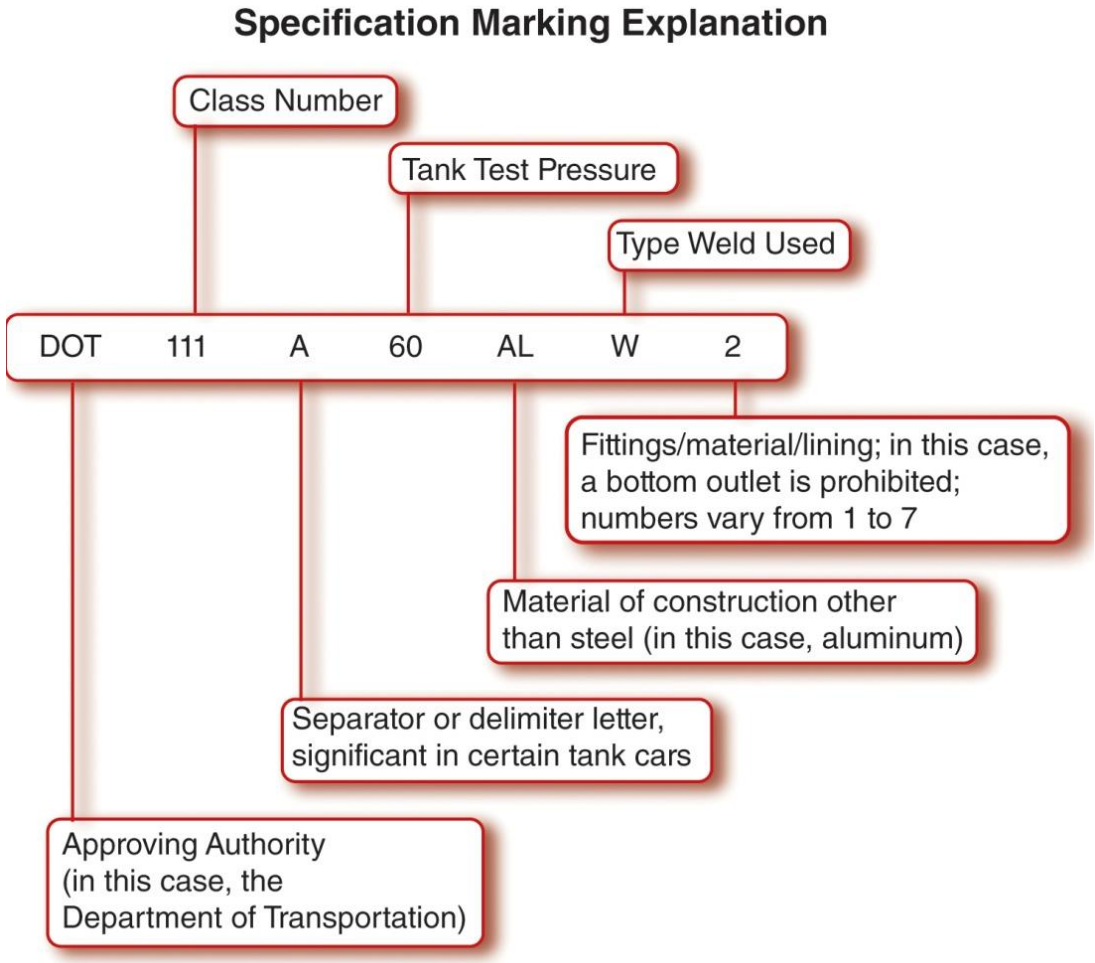
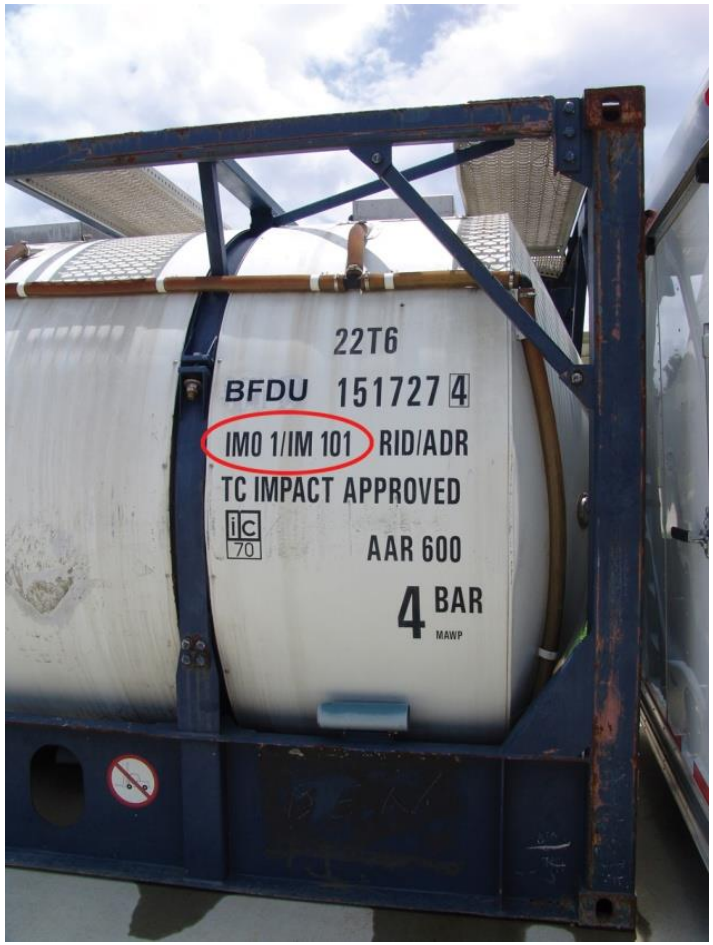


International intermodal container/ tank markings are generally on the right hand side.



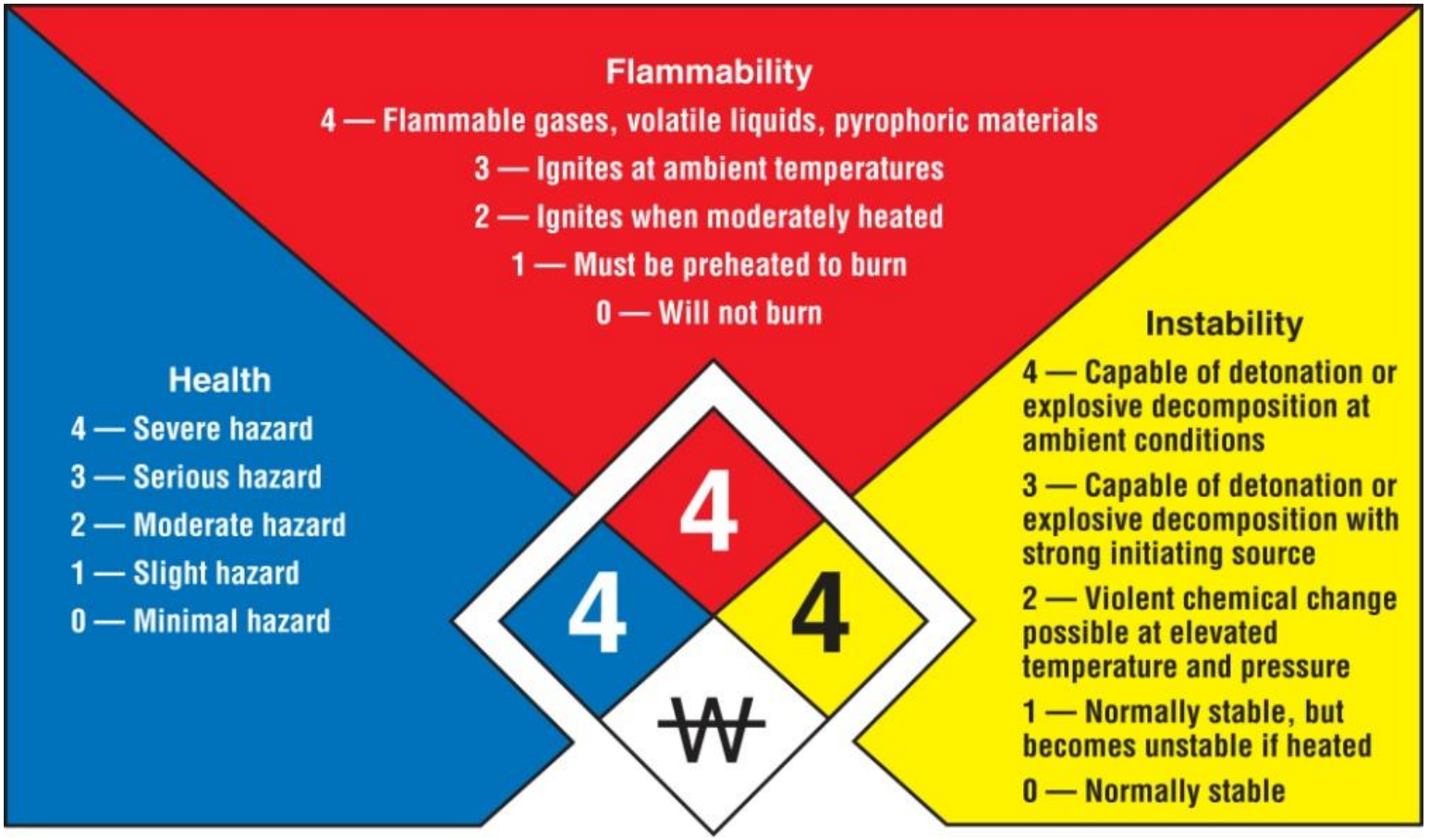
Learning Objective 5

Describe the other markings and colors that may indicate the presence of hazardous materials.

CAUTION

Read the container and understand all of the information provided!

NFPA® 704 System is commonly required for occupancies that contain hazardous materials.



DISCUSSION QUESTION

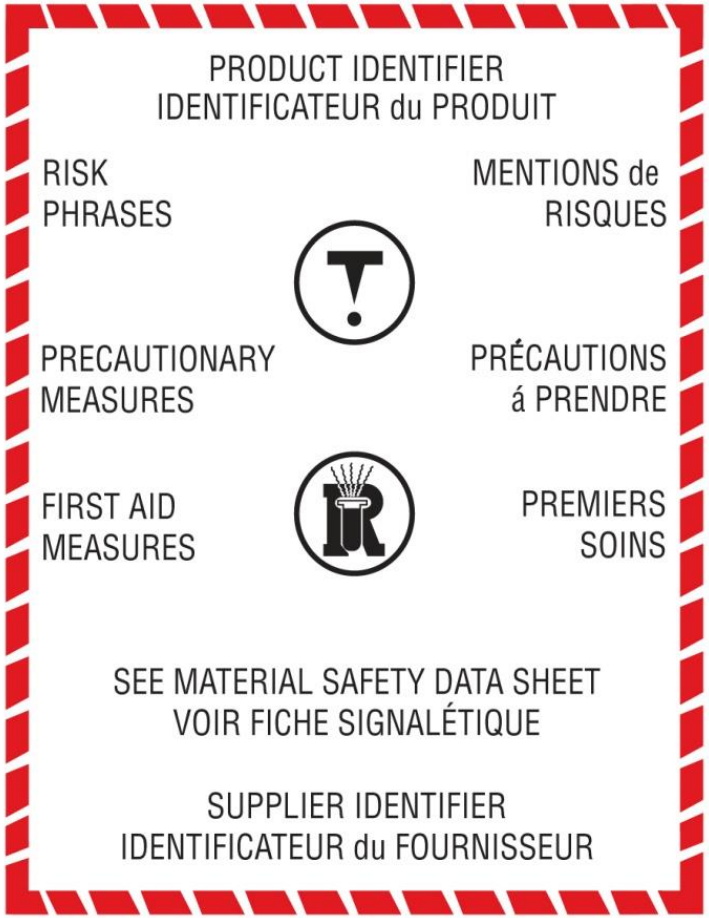
What two hazards are authorized for use in the special hazards position?

U.S. Hazard Communications Labels and Markings

- Requires employers to:
  - identify hazards in workplace and train employees how to recognize these hazards
  - ensure that all containers are labeled, tagged, or marked with identity of substances contained along with appropriate hazard warnings

Canadian Workplace Hazardous Materials Information System (WHMIS) uses two types of labels.

WHMIS Label



Mexican Hazard Communication System

- Equivalent to HCS
- Employers ensure that hazardous chemical substances in workplace are appropriately and adequately labeled
- Adopts NFPA® 704 and related label system as official
- Caution symbols triangular

FHSA requirements for household products labels uses a system of signal words.

CAUTION

- Minor health effects

WARNING

- Moderate hazards

DANGER

- Highest degree of hazard

POISON

- In addition to DANGER on labels of highly toxic materials

(*Continued*)

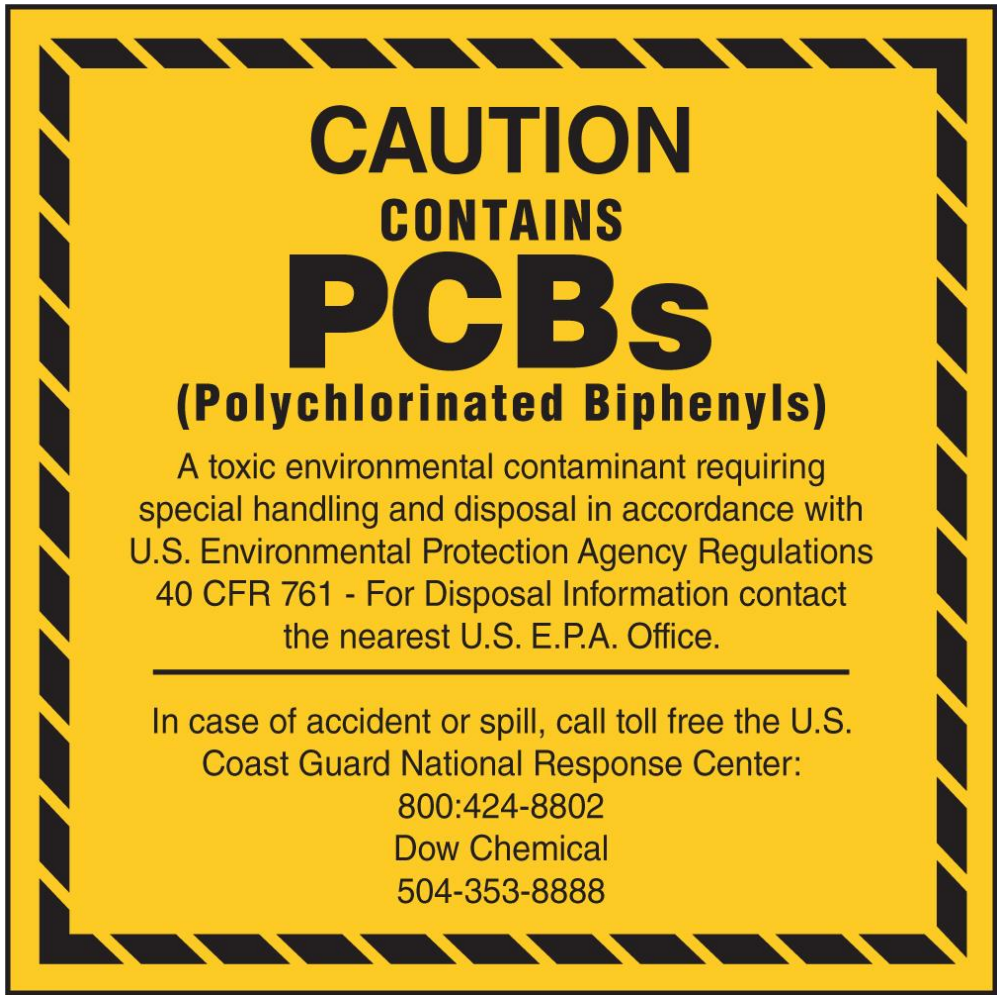
FHSA Requirements for Household Products Labels

- Name, business address of manufacturer, packer, distributor, or seller
- Common/chemical name of ingredients
- Principal hazard(s)
- Precautionary statements
- First-aid instructions
- Instructions for special handling or care
- *Keep out of the reach of children*

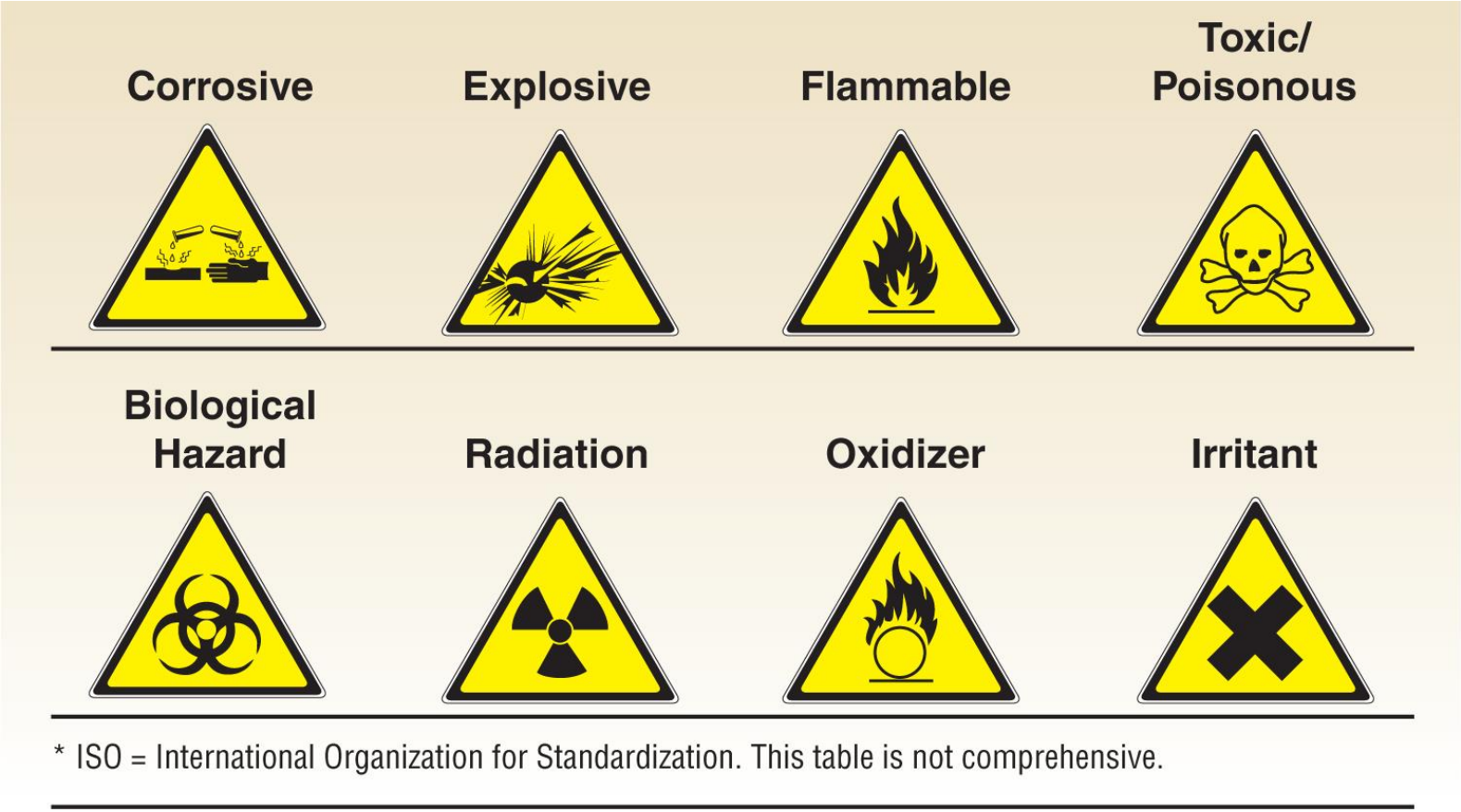
Chemical Abstract Service® (CAS ®) Numbers

- Unique numerical identifiers assigned to various products
- Can be used to search chemical databases
- Typically included on safety data sheets

This EPA sign is an example of how other symbols and signs may vary by facility.



ISO safety symbols are international safety signs used with OSHA hazard signs.



* ISO = International Organization for Standardization. This table is not comprehensive.

Globally Harmonized System (GHS) symbols help create consistent labeling standards.

Military markings are not necessarily uniform.

Courtesy of Rich Mahaney

CAUTION

The military ships some hazardous materials and chemicals by common carrier. When this is done they are not required to be marked with DOT and TC transportation markings.

Pipeline markers are required where pipelines cross under or over roads, railroads, and waterways.

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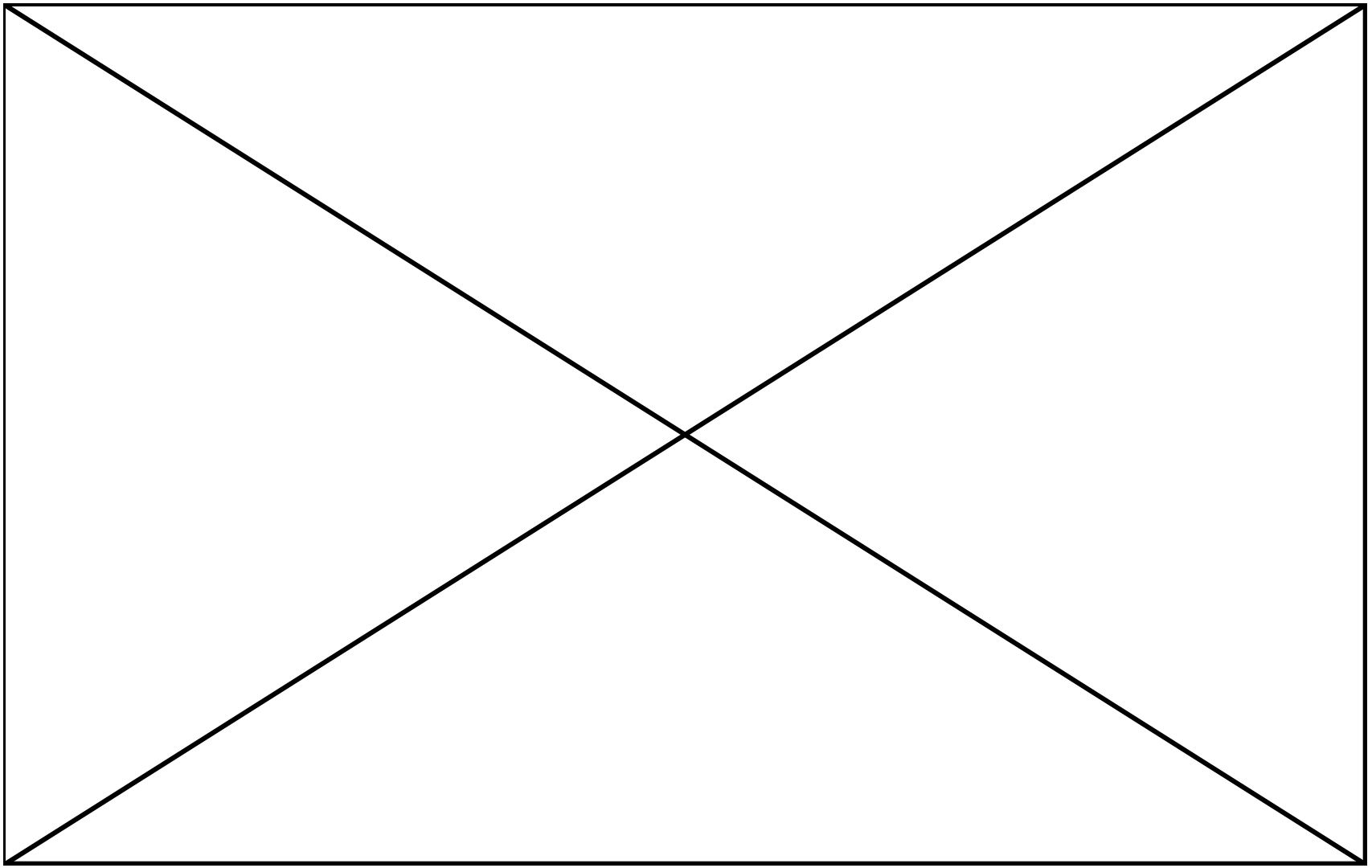


Courtesy of Rich Mahaney

Pesticide labels are regulated by the EPA.

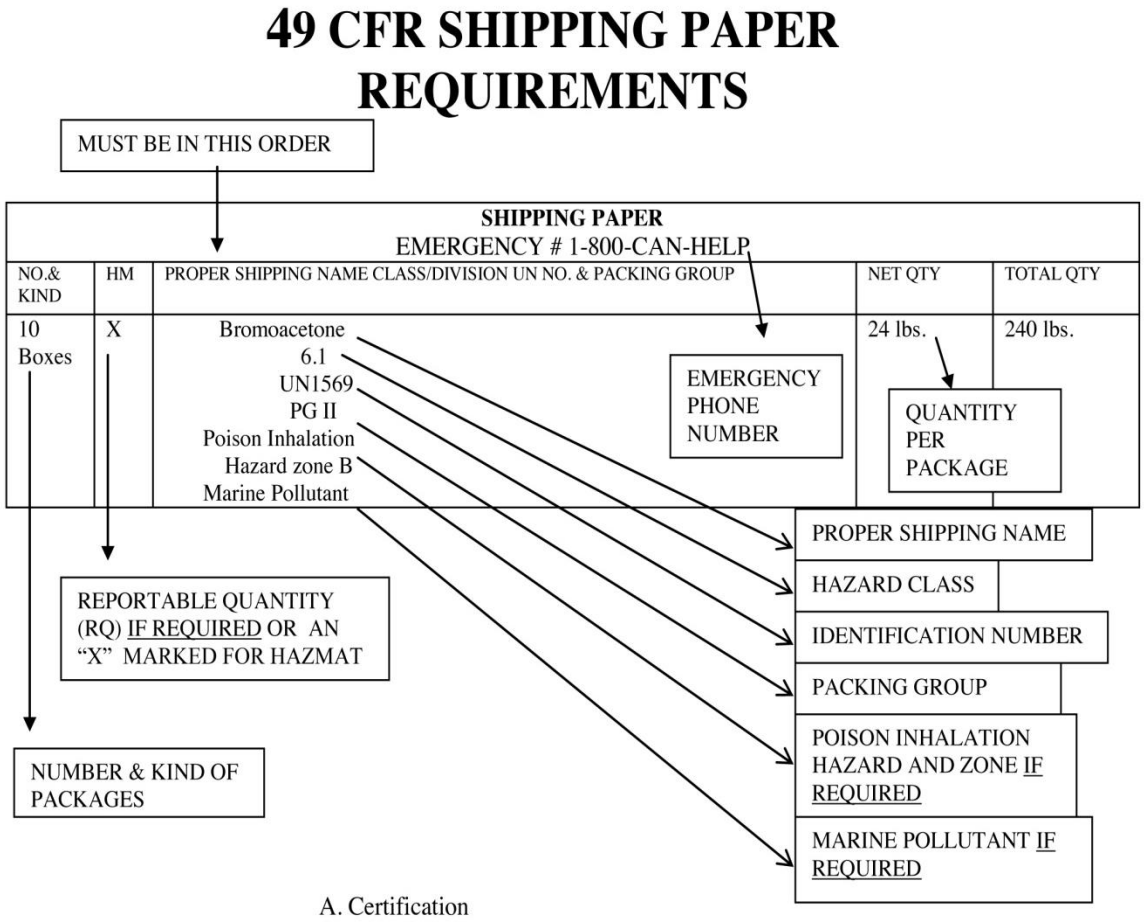
EPA registration and establishment

Color Codes – ANSI Z535.1

Learning Objective 6

Explain the written resources available to indicate the presence of hazardous materials.

Shipping papers accompany hazardous materials shipments.

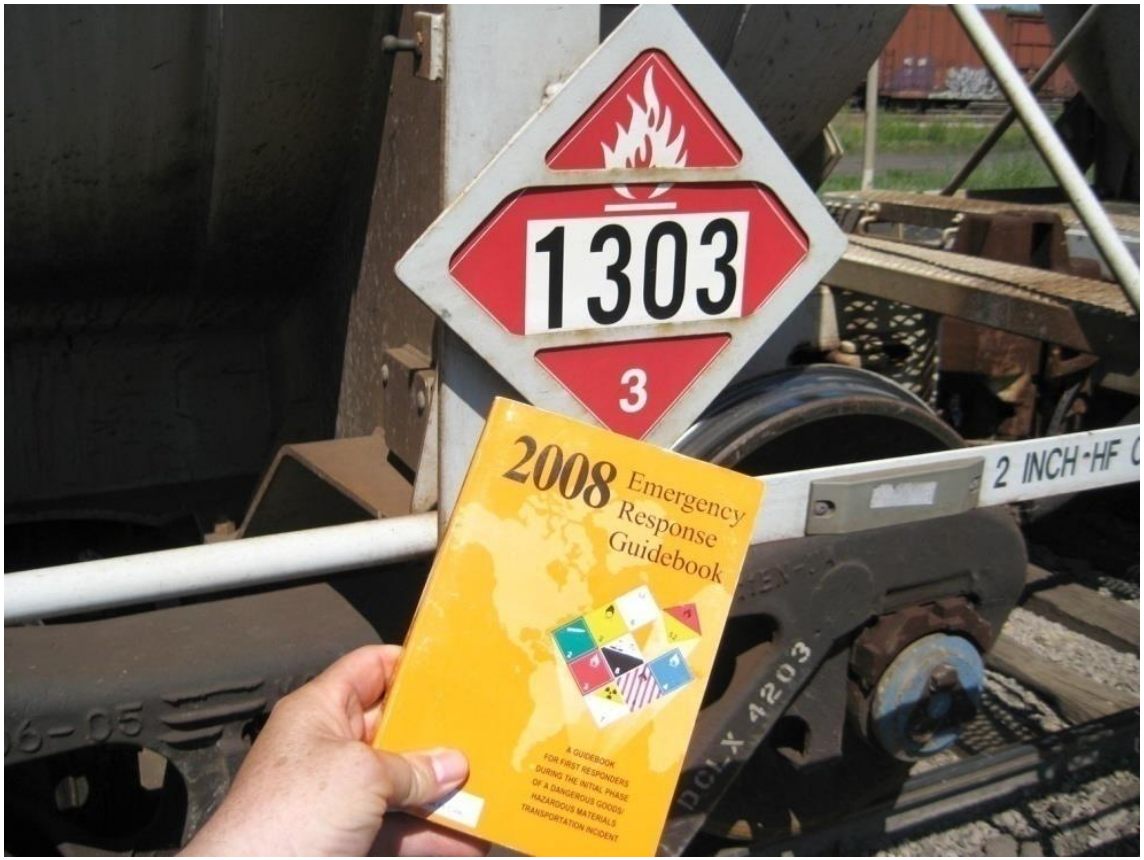


Safety Data Sheets (SDSs) are often the best source of detailed information available.

REVIEW QUESTION

What are the required sections of SDSs?

The *Emergency Response Guidebook (ERG)* helps quickly identify specific/generic hazards.



Courtesy of Rich Mahaney

Other Records That May Provide Information About Hazardous Materials

- Chemical Inventory Lists (CILs)
- Shipping and receiving documents
- Inventory records
- Risk management and hazardous communication plans
- Emergency response plans developed by the LEPC

Learning Objective 7

Discuss the limitations of using the senses to determine the presence or absence of hazardous materials.

DISCUSSION QUESTION

What is the safest of the five senses to use in the detection of a hazardous material?

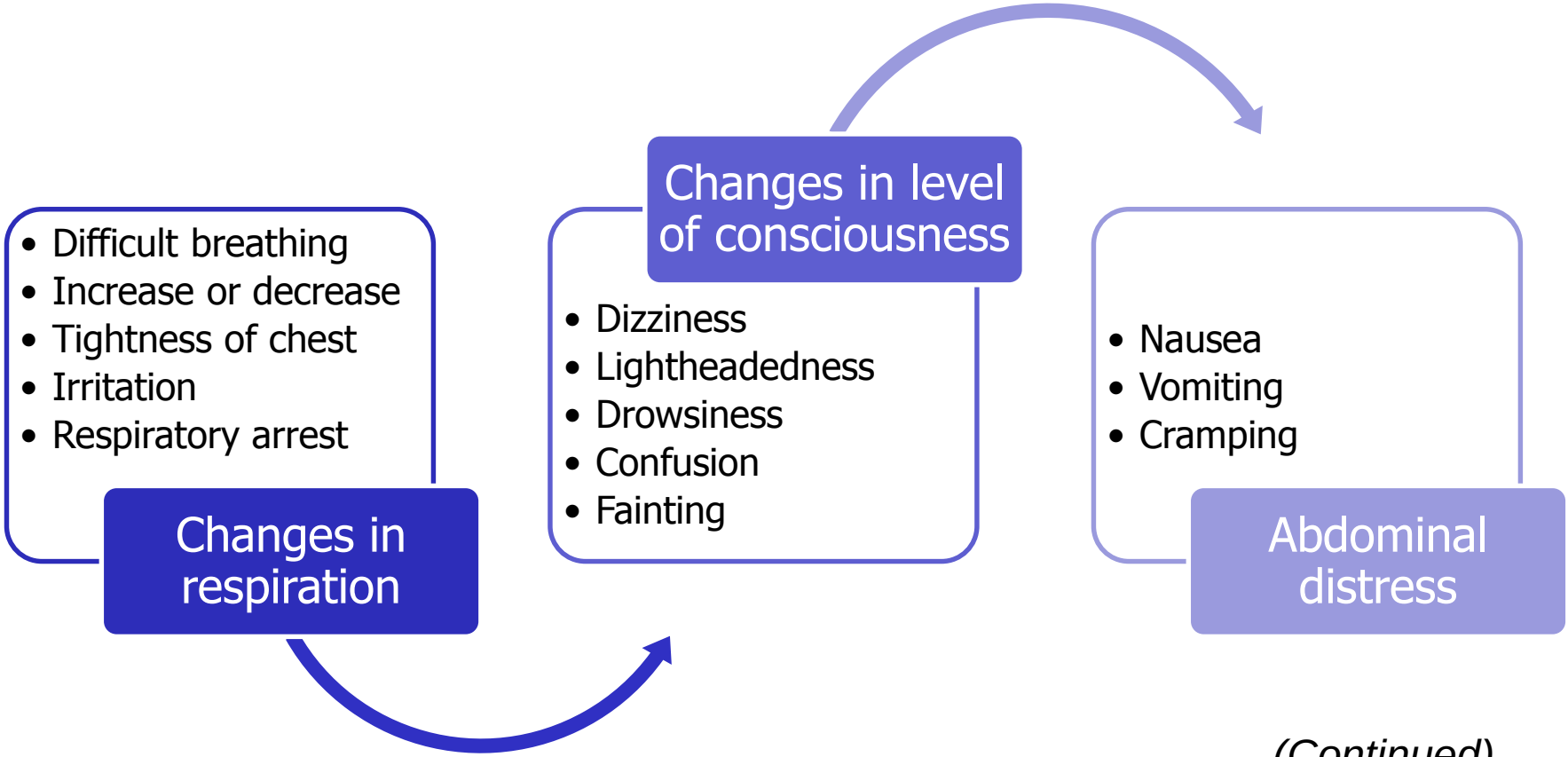
WARNING!

Deliberately using the human senses to detect the presence of hazardous materials is both unreliable and dangerous.

Visual and physical chemical indicators provide evidence of the presence of hazardous materials.

Courtesy of FEMA News Photos, photo by Liz Roll

Physical signs and symptoms of chemical exposure can occur separately or in clusters.



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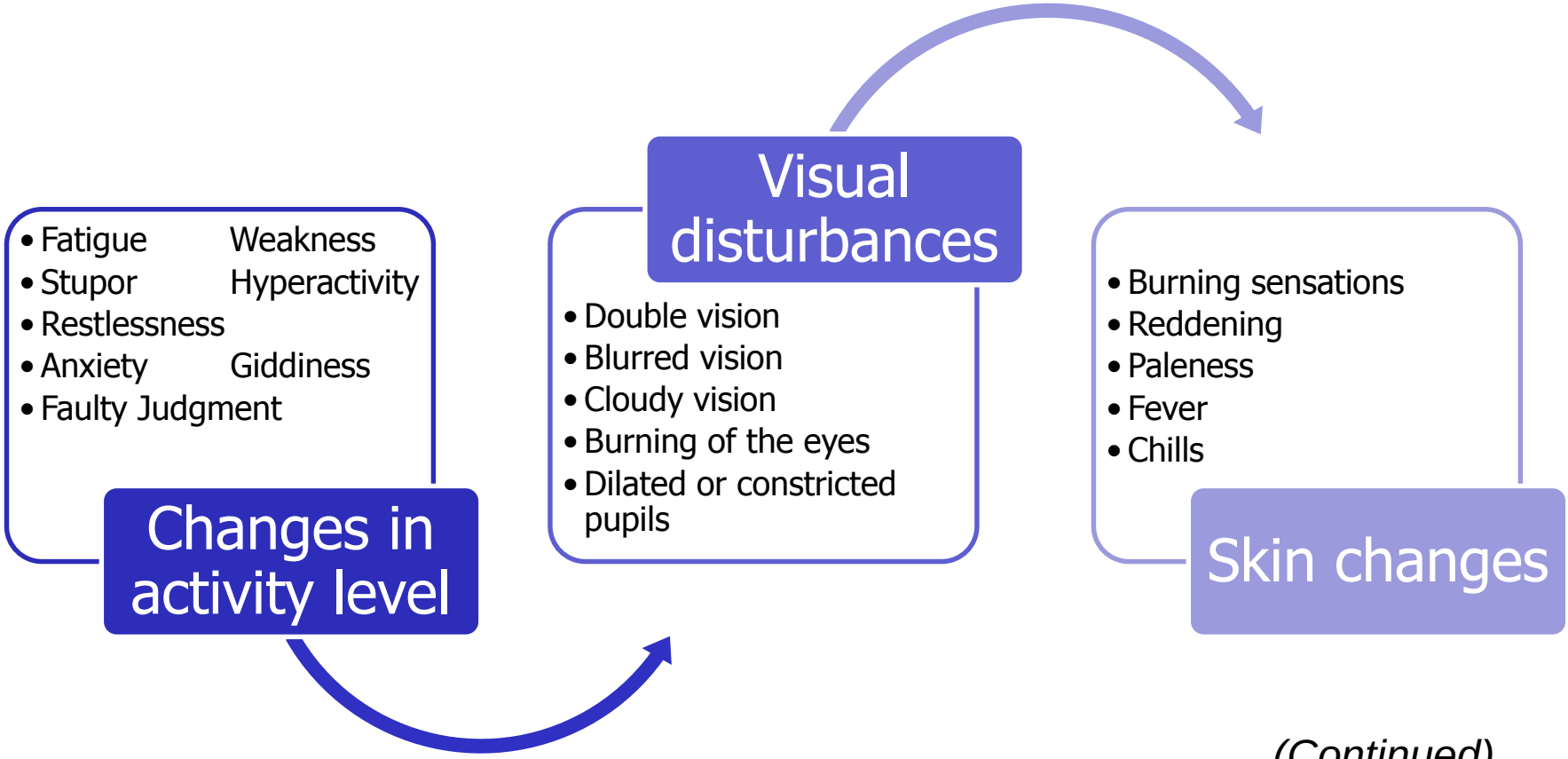

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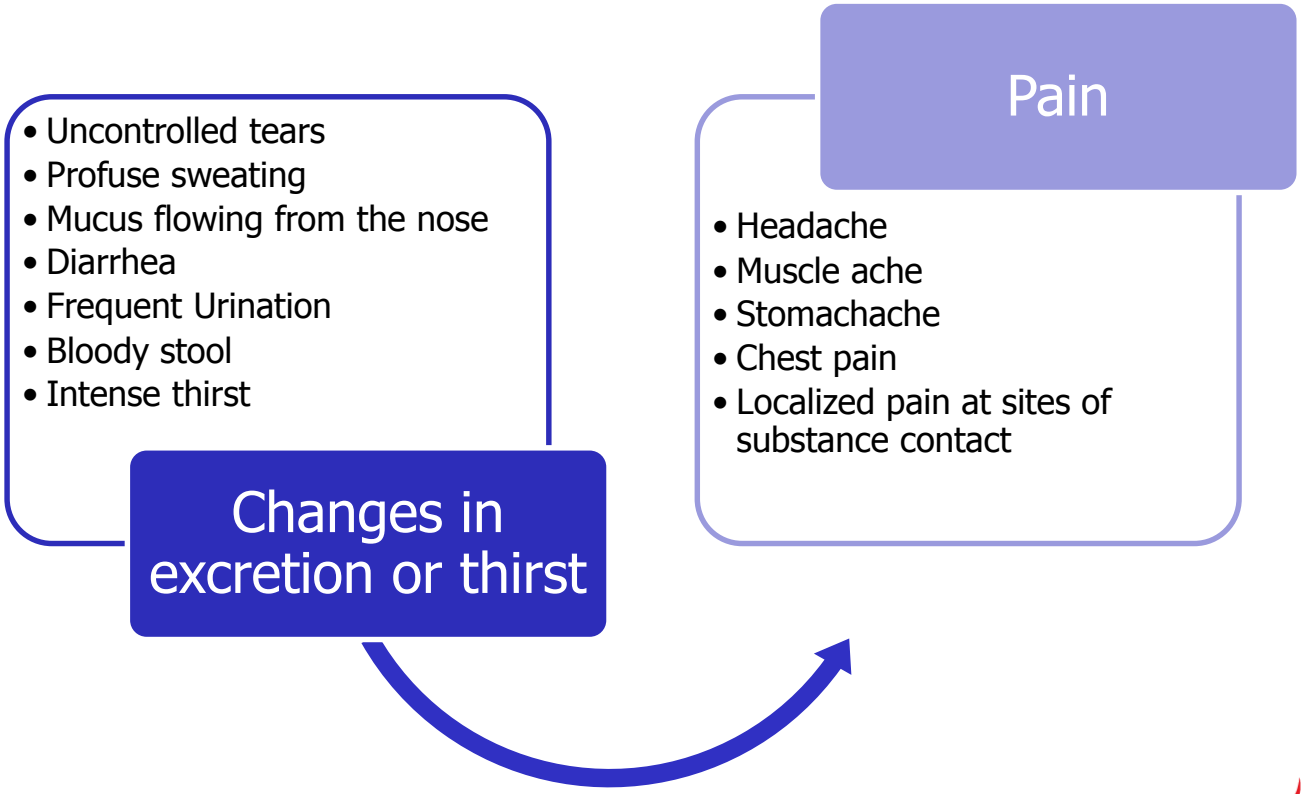


REVIEW QUESTION

What are some symptoms of chemical exposure?

Learning Objective 8

Discuss monitoring and detection devices.

Monitoring and Detection Devices

- Can be useful in determining the presence of hazardous materials and concentrations
- Can be used to determine scope of incident
- Effective use requires actual contact; outside scope for Awareness-Level personnel

Learning Objectives 9-11

Analyze scenarios to detect the presence of hazardous materials.

Interpret representative shipping papers.

Interpret a safety data sheet (SDS).

These objectives are measured in Learning Activities 2-1 through 2-3.

Learning Objective 12

Explain how to identify terrorist attacks and illicit laboratories.

There are several key differences between hazardous materials and terrorist incidents.

- Size and capacity
- Number of casualties
- Presence of extremely hazardous materials
- Potential for armed resistance
- Booby traps
- Necessity of crime scene preservation
- Secondary devices
- Higher level of risk targets

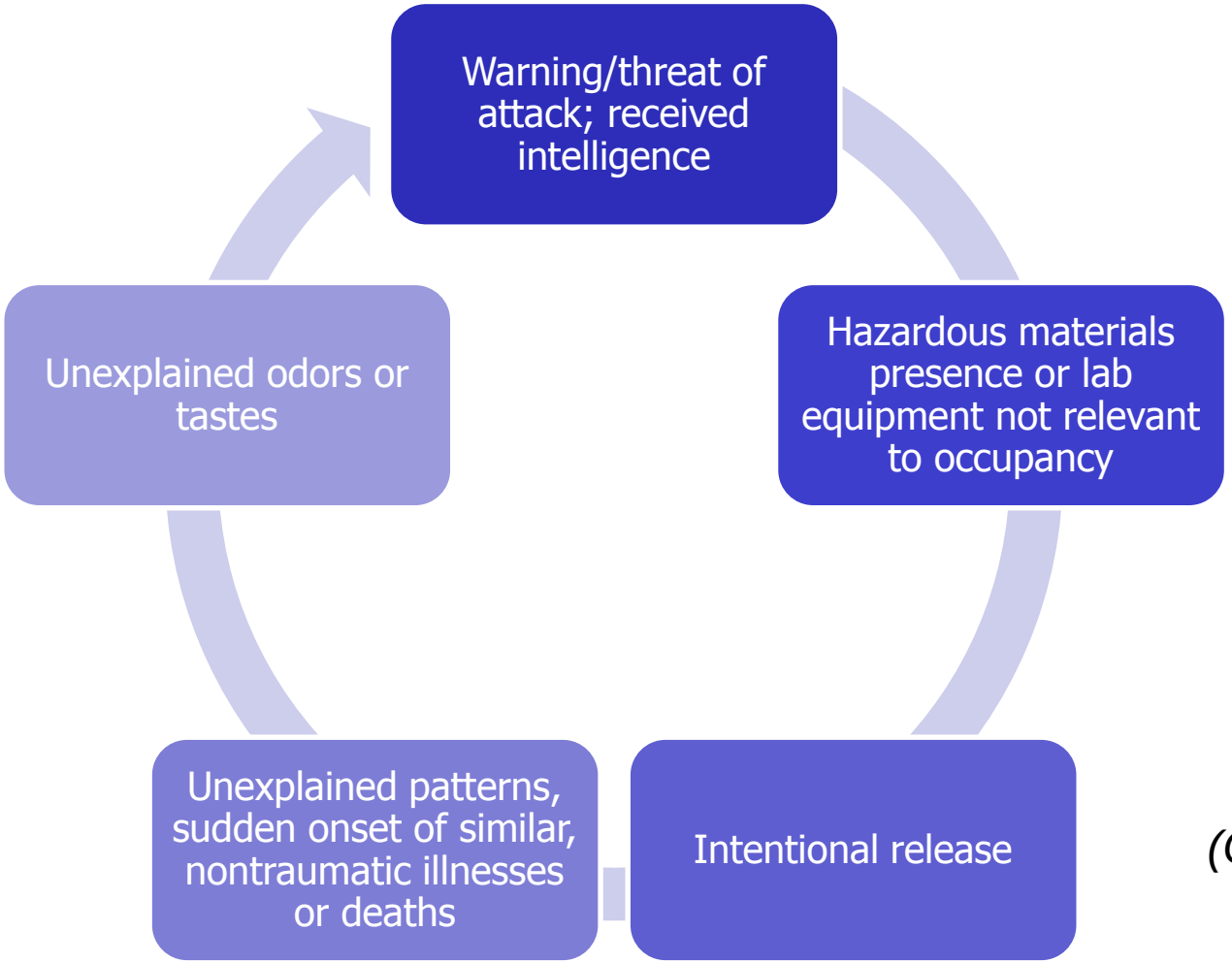
Cues to Possibility of Terrorist Attack

- Report of 2 or more medical emergencies in public locations
- Unusually large number of people with similar signs and symptoms arriving at physicians' offices or emergency rooms
- Reported explosion at public, historic, or government location

DISCUSSION QUESTION

What types of agents are used in chemical attacks?

There are a variety of chemical attack indicators.



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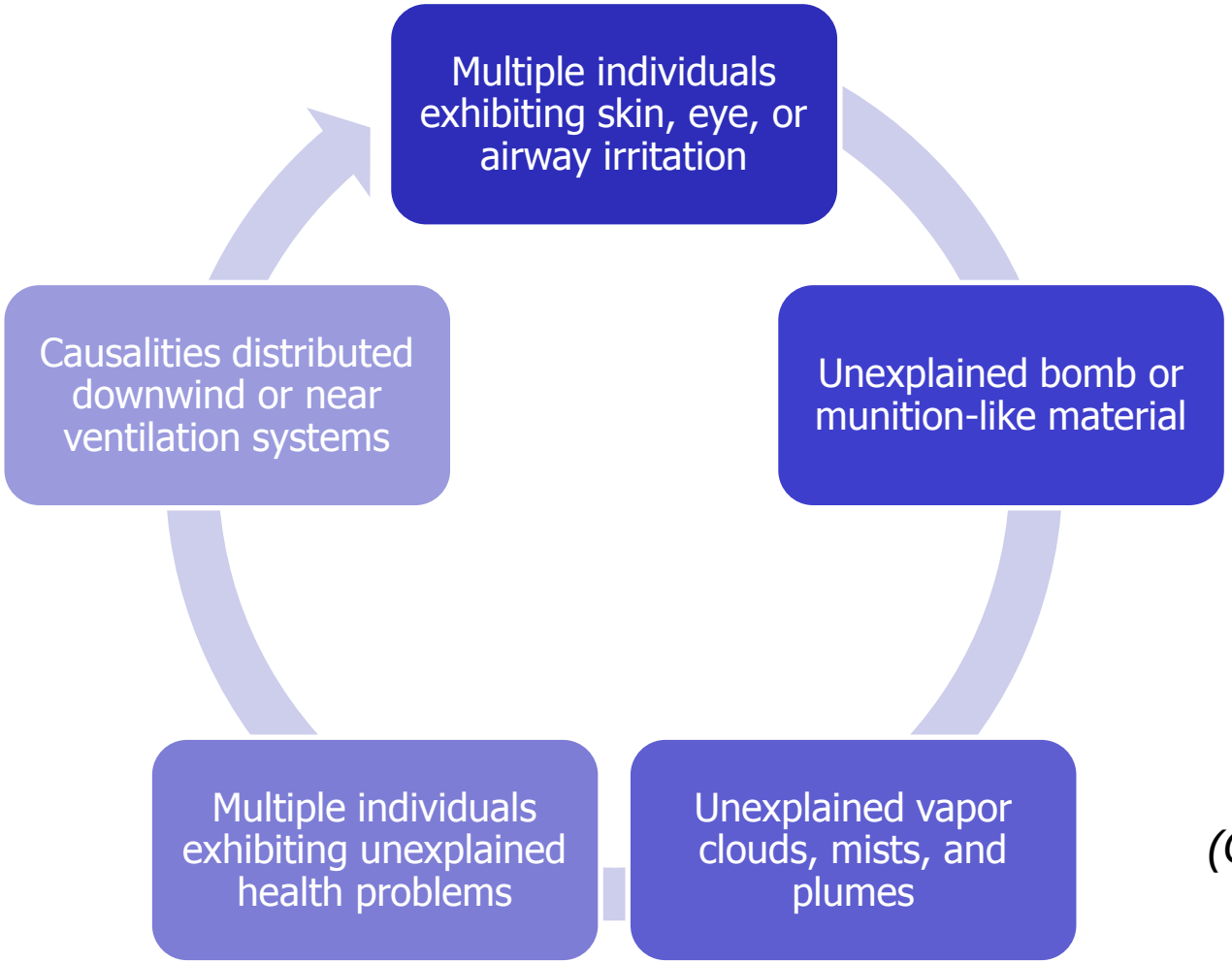

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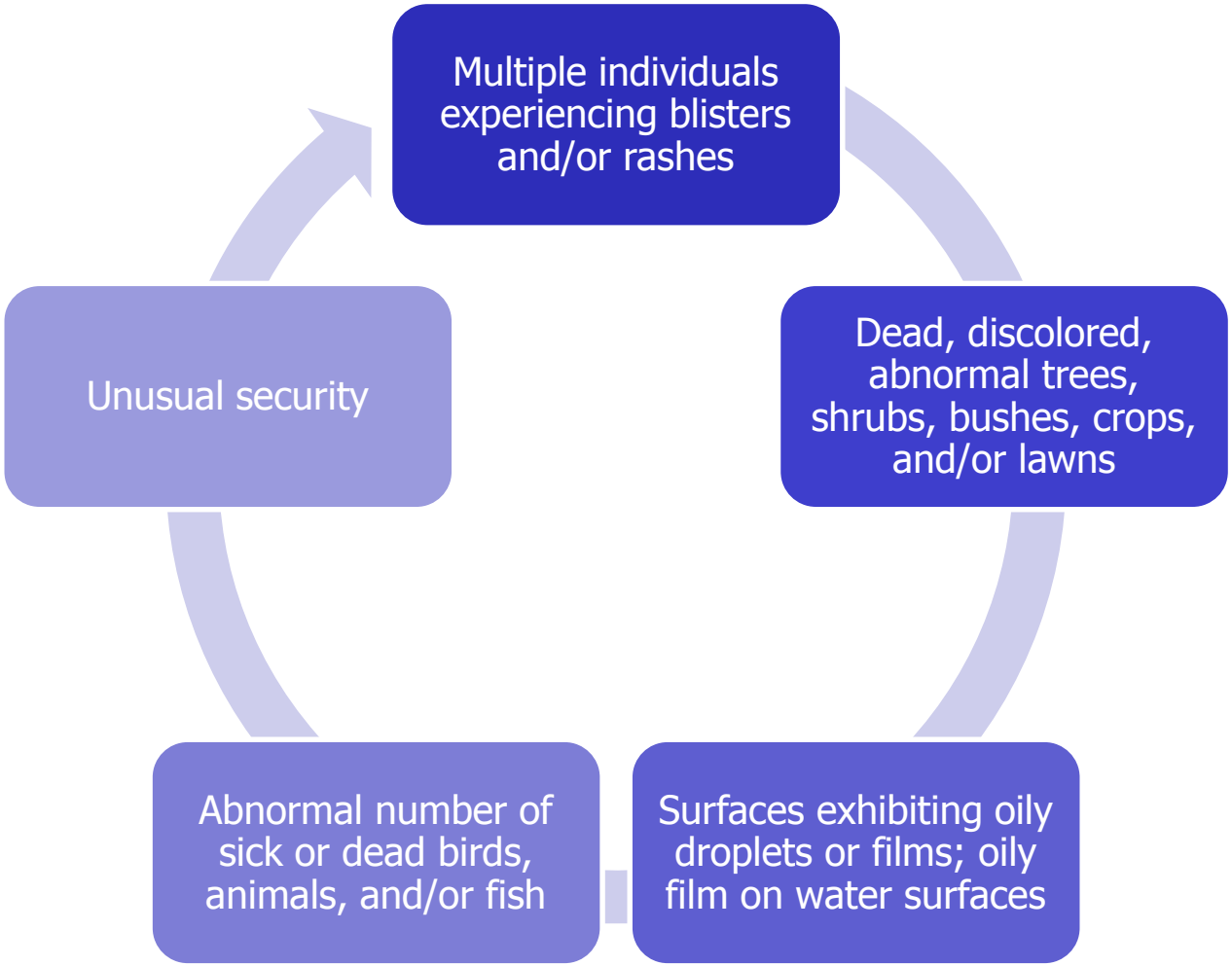


DISCUSSION QUESTION

What types of materials are often utilized in biological attacks?

Biological attack indicators may take several days to develop.

Courtesy of CDC Public Health Image Library

Courtesy of U.S. Department of Agriculture

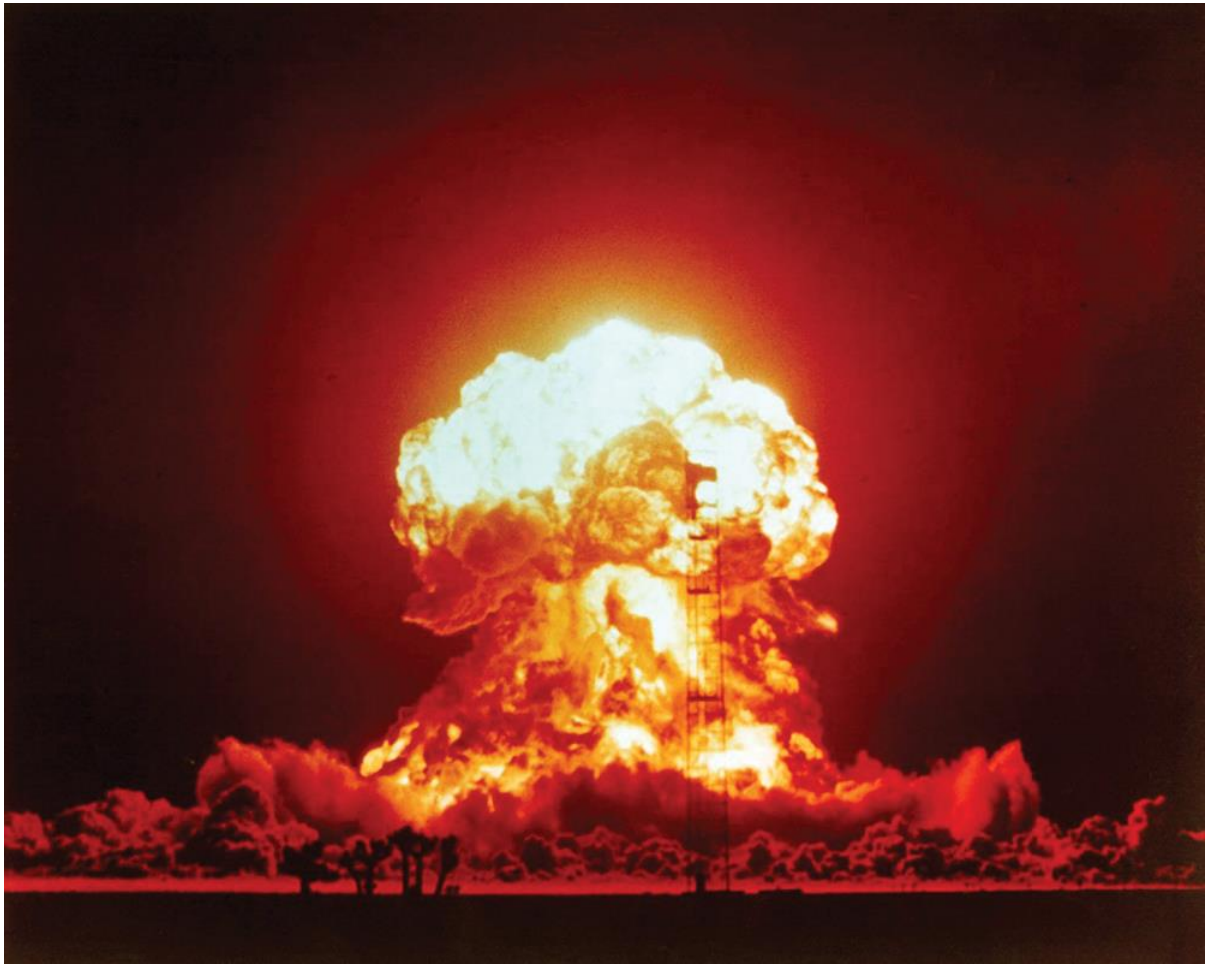
DISCUSSION QUESTION

What types of materials are used in radiological attacks?

Radiological attack indicators can be exhibited in a variety of ways.

Courtesy of Tom Clawson

There are a variety of nuclear attack indicators.



Courtesy of the U.S. Department of Energy

REVIEW QUESTION

What are several indicators of a chemical attack?

What are several indicators of a radiological attack?

Explosive/incendiary attack indicators may be involved in the majority of terrorists attacks.

Courtesy of the U.S. Department of Defense

Courtesy of the U.S. Department of Defense

Illicit Laboratories present numerous threats.

Exterior clues

- Blacked out windows
- Discarded chemical containers
- Booby traps
- Hidden or disguised entrances
- Inappropriate levels of protection and security
- Excessive amounts of trash

Illicit Laboratories present numerous threats.

Interior clues

- Covered windows in an occupied building
- Chemical odors
- Flasks and other glassware
- Unusual heat sources
- Containers of unknown substances
- Pill packages or blister packs
- Large quantities of lithium batteries
- Propane bottles

REVIEW QUESTION

What are some exterior clues to the presence of an illicit lab?

Secondary attacks and booby traps are always a possibility.

Protecting Against Possible Secondary Devices

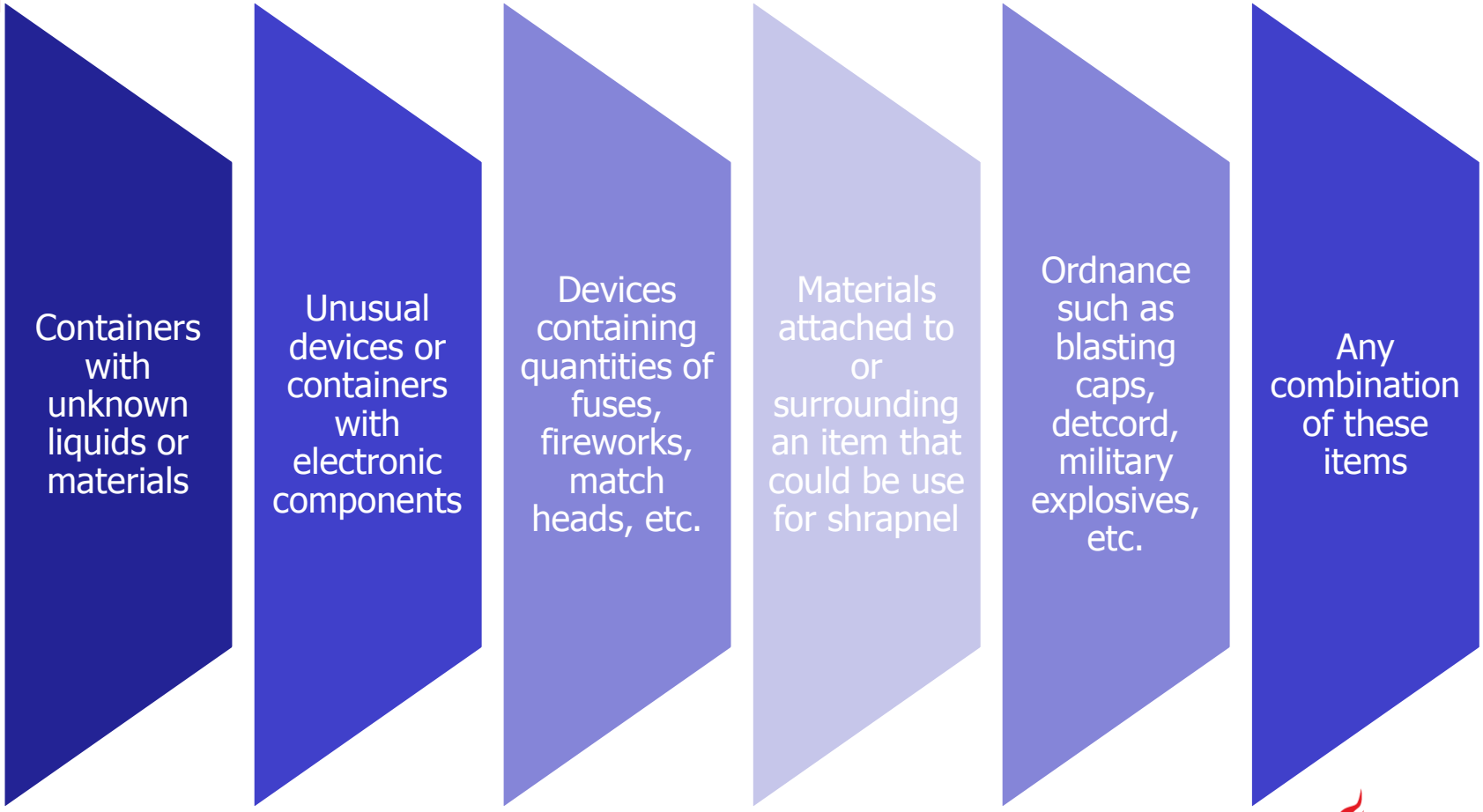
- Anticipate the presence of a secondary device at any suspicious incident
- Visually search for a secondary device before moving into the incident area
- Limit number of emergency response personnel to those performing critical tasks

(Continued)

Protecting Against Possible Secondary Devices

- Avoid touching or moving anything that may conceal an explosive device
- Manage the scene with cordons, boundaries, and scene control zones
- Evacuate victims and nonessential personnel as quickly as possible
- Preserve scene as much as possible

Items that should arouse curiosity when looking for a secondary attack.



Summary

- Using the seven clues to the presence of hazardous materials, can help first responders take the first steps toward successful mitigation of a hazardous materials incident.
- Correctly identifying a hazardous material may be difficult and dangerous.

(Continued)

Summary

- First responders must be able to recognize when an incident may be the result of a terrorist attack, and to recognize the signs of illicit laboratories.