Learning Objectives Overview

- Knowledge Objectives
- Skills Objectives
• Case study: 1971, railroad derailment Houston, Texas
• Timely identification and verification of hazmats are critical to the safe and effective management of a hazmat incident.
• Identifying the problem is the second step in the Eight Step Process©.
• Identification process upon dispatch notification
• Responders must first control the incident scene.
• Strategic goals and tactical response objectives cannot be formulated until the nature of the problem is defined.
Basic Principles: Knowing the Enemy (1 of 3)

• Managing a hazmat incident requires completion of several critical tasks.
  – Detection of hazmats
  – Identification of problem and materials
  – Identification of container and nature of release

• Efforts are made difficult by:
  – Number and variety of hazmats
  – Criminal and terrorism events
Basic Principles: Knowing the Enemy (2 of 3)

• Hazmat trends include:
  – 75% of releases occur in facilities that produce, store, manufacture, or use chemicals
  – 25% occur during transportation
  – Majority involve flammable and combustible liquids and compressed gases
  – Trailers on flat cars (TOFC) and containers on flat cars (COFC) account for the largest number of rail car movements.
• The top hazardous materials transported by rail include:
  – Liquid petroleum gas (LPG)
  – Sodium hydroxide
  – Sulfuric acid
  – Anhydrous ammonia
  – Chlorine
  – Gasoline and blended motor fuels
Basic Principles: Surveying the Incident (1 of 3)

- Identification process starts with a survey of the incident site and surrounding conditions.
- Identification process basic elements:
  - Recognition
  - Identification
  - Classification
Basic Principles: Surveying the Incident (2 of 3)

- With unknown substances, rely on monitoring instruments and chemical analytical kits.
- Usually able to determine the hazard class or chemical family
- Increasing emphasis on the potential use in terrorism or criminal events
Basic Principles: Surveying the Incident (3 of 3)

- Weapons of mass destruction (WMD) scenarios issues:
  - Use of weapons and armed assaults
  - Secondary devices
  - Booby traps

- With WMD incidents, the “bad stuff” is still a hazardous material and the basic concepts of recognition, identification, and verification still apply.
• Responders may place themselves at an unacceptable risk.

• Seven basic identification clues:
  – Occupancy and location
  – Container shapes
  – Markings and colors
  – Placards and labels
  – Shipping papers and facility documents
  – Monitoring and detection equipment
  – Senses
The closer you are to the problem when identifying the HM involved, the greater your risk of exposure.
Occupancy and Location  

• First clue in the standard hazmat identification process
• Potential locations can be categorized into four basic areas:
  – Production
  – Transportation
  – Storage
  – Use
• Use the hazard analysis process to determine potential sites.
Hazardous materials locations: the local emergency planning committee (LEPC) and the hazard analysis process are good tools for identifying hazardous materials locations within the plant and community.
Container Shapes (1 of 2)

- Second clue in the standard hazmat identification process
- Packaging used for transporting hazardous materials is regulated by the DOT.
- Other types of containers are used only at fixed facilities, such as process towers, piping systems, and reactors.
Packaging is divided into three general groups:

- Nonbulk packaging
- Bulk packaging
- Facility containment systems
Nonbulk Packaging Types

- Nonbulk packaging will hold solid, liquid, or gaseous materials.
- Nonbulk packaging includes:
  - Bags
  - Boxes
  - Carboys
  - Cylinders
  - Drums
Nonbulk Packaging Examples
(1 of 3)
Bags and Bottles

Stiched bag  Folded and glued bag  Shrink-wrapped bags

Nonbulk Packaging:Bags.

Protected bottles  Plastic bottles  Glass bottle

Nonbulk Packaging:Bottles.
Nonbulk Packaging Examples
(2 of 3)
Drums and Boxes

Nonbulk Packaging: Drums.

Nonbulk Packaging: Boxes.
Nonbulk Packaging Examples
(3 of 3)
Carboys and Cylinders

Nonbulk Packaging: Multi-cell Packaging.
Nonbulk Packaging: Carboys.

Nonbulk Packaging: Cylinders.
• Bulk packaging is any packaging, including transport vehicles, that meets DOT definition.
Bulk Packaging Types
(2 of 2)

• Bulk packages can be:
  – Integral part of a transport vehicle (e.g., cargo tank trucks, tank cars, and barges)
  – Packaging placed on or in a transport vehicle (e.g., intermodal portable tanks, ton containers, intermediate bulk containers)
Flexible Containers, Rigid Containers, and Portable Bin

Flexible Containers or “Super Sacks”.

Portable Bin.

Rigid Containers—Polyethylene and Steel Tanks or "Totes.”
Intermodal Portable Tank Containers

Intermodal Portable Tank Containers/Tank Containers or ISO-Tanks.

Intermodal Portable Tank Markings.
Pressure and Non-Pressure Tank Containers

Intermodal Portable Tank Containers.
Specialized Tank Containers: Cryogenics and Tube Modules

Cryogenics.

Tube Modules.
Cargo Tank Trucks

- Low Pressure Chemical Cargo Tank Truck
- High Pressure Cargo Tank Truck
- Dry Bulk Tanktruck
- Heated Material Cargo Tank Trucks

- Atmospheric Pressure Cargo Tank Truck
- Corrosive Cargo Tank Truck
- Compressed Gas Trailer
- Cryogenic Liquid Cargo Tank Truck
Railroad Tank Cars
(1 of 2)

Railroad Tank Cars: Markings
Railroad Tank Cars: DOT Specification Markings
Facility Containment Systems

- Facility containment systems include:
  - Pressurized and nonpressurized storage tanks
  - Process towers
  - Chemical and nuclear reactors
  - Piping systems
  - Pumps
  - Storage bins and cabinets
  - Dryers and degreasers
  - Machinery
Facility Containment Systems (2 of 5)

Atmospheric Pressure Liquid

Covered Floating Roof Tank

Open Floating Roof Tank

Open Floating Roof Tank With Geodesic Dome

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Facility Containment Systems (3 of 5)

Low-Pressure Liquid Storage Tanks

Vertical Storage Tank  
Horizontal Storage Tank

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Facility Containment Systems (4 of 5)

Underground and High-Pressure Storage Tanks

- Underground Storage Tank
- High Pressure Horizontal Tank
- High Pressure Spherical Tank
- High Pressure Underground Tank
Facility Containment Systems (5 of 5)
Cryogenic Liquid and Refrigerated Storage Tanks
The transport of radioactive materials is based on the philosophy that:

- Safety should be primarily focused on the package (i.e., packaging is the first line of defense).
- Package integrity should be directly related to the degree of hazard of the material it contains.
Radioactive Material Packaging (2 of 3)

- Five basic types of radioactive material packaging:
  - Excepted packaging
  - Industrial packaging
  - Type A packaging
  - Type B packaging
  - Type C packaging
Responders must be familiar with the basic types of radioactive material packaging.
Facility Containment Systems

- Facility containment systems are packaging, containers, and/or associated systems that are part of a fixed facility’s operations and can include:
  - Storage tanks
  - Process towers
  - Chemical and nuclear reactors
  - Piping systems
  - Pumps
  - Storage bins and cabinets
  - Dryers and degreasers
  - Machinery
Markings and Colors

(1 of 2)

• Third clue in the standard hazmat identification process

• These clues may include:
  – Color codes
  – Container specification numbers
  – Signal words
  – The content’s name
  – Associated hazards
Markings and Colors
(2 of 2)

- At facilities, clues may include:
  - Hazard communication markings
  - Piping color code systems
  - Specific signs and/or signal words (e.g., “Hydrofluoric Acid Area”)

- Markings and colors can be used as a clue for hazmat recognition, identification, and classification.
Nonbulk Package Markings (1 of 2)

- Container markings include:
  - Toxicity signal word
  - Statement of practical treatment
  - Physical or chemical hazard statement
  - Product name
  - Ingredient statement
  - Environmental information
  - EPA registration number
  - EPA establishment number
Nonbulk Package Markings (2 of 2)

- Chemical abstract service (CAS) number
  - Found on hazardous materials containers
  - Used to track chemicals in the community
  - Sometimes referred to as a chemical’s “social security number”

- Cylinder color codes
  - There are several voluntary color schemes.
Bulk Packaging and Transportation Markings (1 of 5)

- Four-digit identification numbers are assigned to a hazardous material or group of hazardous materials.

- Inhalation hazard markings
  - Poison–inhalation hazard
  - Inhalation hazard

- Marine pollutant markings
  - Mark must appear when the package moves by water.
Bulk Packaging and Transportation Markings

<table>
<thead>
<tr>
<th>FOUR DIGIT IDENTIFICATION NUMBER</th>
<th>TRANSPORTATION CONTAINER MARKINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="1090" /></td>
<td><img src="image" alt="INHALATION HAZARD" /></td>
</tr>
<tr>
<td><img src="image" alt="FLAMMABLE" /></td>
<td><img src="image" alt="MARINE POLLUTANT" /></td>
</tr>
<tr>
<td><img src="image" alt="9188" /></td>
<td><img src="image" alt="HOT" /></td>
</tr>
</tbody>
</table>

- Inhalation Hazard
- Marine Pollutant
- Elevated Temperature Materials
Bulk Packaging and Transportation Markings (3 of 5)

• Elevated temperature materials
  – Liquids at or above 212°F (100°C)
  – Liquids with a flash point at or above 100°F (37.8°C)
  – Solids at a temperature at or above 464°F (240°C)

• Except for a bulk container transporting molten aluminum or molten sulfur (which must be marked “MOLTEN ALUMINUM” or “MOLTEN SULFUR”)

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• Pipelines
  – Safest and second largest hazmat transportation mode
  – Used for both intrastate and interstate transportation
    • Transporting between industrial facilities
    • Transferring raw materials and finished products within oil, chemical, and petrochemical facilities
    • Delivering liquid and gas fuels directly to the consumer
Pipeline markers must provide the pipeline contents, the pipeline operator, and an emergency telephone number.
• NFPA 704 system
  – Not used on transport vehicles
• Hazard communication marking systems
  – Standardized hazard rating scale from 0 (minimal hazard) to 4 (extreme hazard) for health, flammability, and reactivity
  – Alphabetical designations for required level of personal protective clothing
In 2013, OSHA adopted the Global Harmonization System (GHS).

Three main elements
- Classification system
- Labeling
- A prescribed hazard statement assigned to each hazard category along with a signal word requirement (“Danger” or “Caution”)
• U.S. Military Marking System
  – Found primarily on both structures and containers at U.S. military facilities
  – Consists of both fire and chemical hazard symbols
• Fourth clue in the standard hazmat identification process

• Placards and labels provide recognition and general hazard classification by way of:
  – Colored background
  – Respective hazard class symbol
  – Hazard class/division number
  – Hazard class description wording or the four-digit identification number
Placards and labels are the fourth clue in the standard identification process and provide hazard communication information in several manners.
• Three different labels are used on radioactive material packaging:
  – Radioactive White—I
  – Radioactive Yellow—II
  – Radioactive Yellow—III
Shipping Papers and Facility Documents

• Fifth clue in the standard identification process
• Required in transport vehicles
• Responders should be familiar with:
  – Information noted
  – Location kept
  – Responsible party
Shipping Paper Requirements

• Required information:
  – Proper shipping name
  – DOT hazard class/division number
  – Subsidiary hazard class
  – Identification number(s)
  – Packing group
  – Total quantity
  – Emergency contact
• Additional entries may be required for some hazardous materials and include:
  – Compartment notation
  – Empty packaging
  – HOT
  – Technical name
  – Not otherwise specified (NOS)
  – Subsidiary hazard class
  – Reportable quantity (RQ) notation
  – Marine pollutant
Shipping Papers: Additional Entries (2 of 3)

- EPA waste stream number
- EPA waste characteristic number
- Radioactive material information
- Poison notation
- Poison–inhalation hazard (PIH) or toxic–inhalation hazard (TIH)
- Hazard zone
- Dangerous when wet notation
Shipping Papers: Additional Entries (3 of 3)

- Limited quantity
- Canadian information
- Placard notation
- Trade name
- DOT exemption notation
- Hazardous materials STCC number
- Shipper contact
Shipping Papers: Emergency Response Information

• Emergency response information must provide the following:
  – Brief product description
  – Emergency actions involving fire
  – Emergency actions involving release only
  – Personnel protective measures
  – Environmental considerations, as appropriate
  – First-aid measures
Facility Documents

- Facility document examples include:
  - Hazmat inventory forms
  - Shipping and receiving forms
  - Risk Management Plans
  - Supporting documentation
  - SDSs
  - Tier II reporting forms required to be submitted to the LEPC and the fire department under SARA Title III
Monitoring and Detection Equipment (1 of 2)

- Sixth clue in the standard identification process
- Can provide data concerning nature of the problem and specific materials involved
- Essential for identifying, verifying, or classifying the hazmat(s) involved
Monitoring helps responders to:

- Determine the appropriate levels of personal protective clothing and equipment
- Determine the size and location of hazard control zones
- Develop protective action recommendations and corridors
- Assess the potential health effects of exposure

Monitoring and Detection Equipment (2 of 2)
• Final clue in the standard identification process
• Not a primary identification tool
• Visual and hearing offer some protection.
• Examples:
  – Smells
  – Dizziness
  – Unusual noises (i.e., relief valve actuations)
  – Destroyed vegetation
• Always avoid inhalation (or smelling).
• Remember basic street smart clues of IDLH atmospheres:
  – Visible vapor clouds
  – Releases
  – Large liquid leaks
  – Below grade or confined spaces
  – Dead birds, brown foliage, sick animals, and sick humans
  – Trust your instincts.
Critical tasks in managing a hazmat incident are:
- Surveying the incident scene
- Identifying the problem and material
- Identifying the type of hazmat container
- Identifying the nature of its release

Identification process basic elements:
- Recognition
- Identification
- Classification
The seven basic clues for recognition, identification, and classification are:

- Occupancy and location
- Container shapes
- Markings and colors
- Placards and labels
- Shipping papers and facility documents
- Monitoring and detection equipment
- Senses
Responders should be able to recognize container profiles and know the general hazmat class/division of materials found within each type of container.
Markings and colors may include:

- Color codes
- Container specification
- Numbers
- Signal words
- The content’s name and associated hazards
Responders must be familiar with:
  – The information noted on shipping papers
  – Their location on each transport vehicle
  – The individual responsible for them

Various types of facility documents can be a source for hazmat recognition, identification, and classification at an emergency.