

## Unit E1.1: Basic Introductory HM Requirements

### Learning Material:

Hazardous materials (HM) are any substances or materials capable of posing a risk to health, safety, property, or the environment when transported. Understanding and complying with regulations is crucial for the safe transport of hazardous materials.

#### 1. Federal Motor Carrier Safety Regulations (FMCSR) Overview:

**Introduction to FMCSRs:** The FMCSRs are regulations established by the Federal Motor Carrier Safety Administration (FMCSA) to ensure the safe transport of hazardous materials. All drivers transporting hazardous materials must adhere to these rules to minimize the risk of accidents, spills, and exposure.

**FMCSR Part 397:** Focuses on routing and movement of hazardous materials. It specifies requirements related to transportation through cities, tunnels, and other areas, as well as permits necessary for certain materials.

**Hazardous Material Permits:** Explain which materials require permits (e.g., explosives, radioactive materials) and the process of obtaining an HM Safety Permit (HMSP).

#### 2. Hazardous Materials Communication Requirements:

Effective communication ensures that everyone involved in the transportation process is aware of the nature of the hazardous materials, how to handle them, and what to do in an emergency.

##### Shipping Papers:

**Importance:** Shipping papers are essential documents that provide emergency responders with critical information about the hazardous materials being transported. They are the first line of information in case of an accident.

##### Key Components of Shipping Papers:

**Proper Shipping Name:** Clearly defines the material, such as "Sulfuric Acid" or "Gasoline."

**Hazard Class:** Identifies the hazard (e.g., Class 3 for flammable liquids, Class 8 for corrosive substances).

**Identification Number:** A unique four-digit number (e.g., UN1993 for flammable liquids) that assists in quickly identifying the substance.

**Packing Group:** Indicates the degree of danger (I for high, II for medium, III for low).

**Quantity and Type of Packaging:** Provides the total amount and packaging used (e.g., 200 gallons in a drum).

**Emergency Contact:** A contact number for immediate assistance, often the carrier or emergency response team.

Location: Shipping papers must be easily accessible, typically in the vehicle's cab, during transport. In emergencies, they guide responders in determining the appropriate actions.

Marking and Labeling:

Marking: Involves placing specific information on the package, such as:

Proper shipping name and UN identification number.

Orientation arrows for liquids, indicating the correct upright position.

Labeling: Labels are standardized symbols or pictograms representing the hazard, such as a flame for flammable liquids or a skull and crossbones for toxic substances.

Example: A box containing corrosive material would display the Class 8 "Corrosive" label. These labels must be clear, durable, and placed on the same side as the marking.

Placarding:

Overview: Placards are large, diamond-shaped signs placed on the outside of vehicles transporting hazardous materials. They provide an immediate visual cue of the potential hazard to first responders.

Requirements: FMCSA specifies that any vehicle carrying a certain quantity of hazardous materials (e.g., more than 1,001 pounds) must display placards on all four sides.

Examples of Placards: "Explosives" (Class 1), "Flammable" (Class 3), "Corrosive" (Class 8).

Driver's Responsibility: The driver must verify that the correct placards are displayed before transportation and remain intact and visible during transit.

Emergency Response Information:

Purpose: Provides guidance on how to handle incidents involving hazardous materials. This includes fire risks, health hazards, first aid measures, and spill response.

Tools:

Emergency Response Guidebook (ERG): A key resource for identifying and managing hazardous materials emergencies. The ERG includes details on potential hazards, public safety measures, and emergency response procedures.

Availability: A copy of the ERG or equivalent emergency response information must be within the driver's immediate reach in the vehicle cab.

Shipper's Responsibilities:

Preparation: Shippers must classify, package, mark, and label hazardous materials properly. They must also provide shipping papers with the required information.

Example: A chemical manufacturer (shipper) must ensure that all containers of corrosive chemicals are correctly marked, labeled, and documented before handing them to a carrier.

Interactive Activity: Have trainees examine various sample shipping papers. They should identify errors, missing information, and make necessary corrections, emphasizing the importance of accuracy.

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## **Unit E1.2: Operational HM Requirements**

### Learning Material:

In addition to understanding regulations, drivers must know the operational aspects of safely transporting hazardous materials. This includes inspection, securement, and emergency preparedness.

#### 1. General Handling of Hazardous Materials:

**Personal Protective Equipment (PPE):** Drivers must use appropriate PPE, such as gloves, goggles, and face shields, when handling hazardous materials. The type of PPE depends on the hazard class; for example, corrosive materials require gloves and protective clothing.

#### **Proper Handling Techniques:**

**Avoiding Spillage:** Drivers must handle containers with care, avoiding rough handling, dropping, or dragging. Liquid containers must remain upright, and fragile items must be cushioned to prevent damage.

**Fire Safety:** When transporting flammable materials, drivers must avoid smoking, using cell phones, or creating sparks near the cargo.

#### 2. Driver Responsibilities:

**Pre-Trip Inspection:** Before transport, drivers must conduct a thorough vehicle inspection focusing on:

**Brake Systems:** Ensuring brakes are in proper working condition, particularly when transporting heavy loads.

**Placards:** Verifying the correct placards are displayed and securely fastened.

**Securement Devices:** Checking that straps, ropes, or other securement devices are in good condition and properly installed.

#### **During Transport:**

**Speed Management:** Drivers should maintain a speed appropriate for road conditions, especially when transporting hazardous materials with high center-of-gravity, such as bulk liquids.

**Safe Following Distance:** Maintain a larger following distance to allow for ample stopping time.

**Avoiding High-Risk Areas:** Plan routes to avoid residential areas, schools, hospitals, or other sensitive locations whenever possible.

### 3. Securement of Hazardous Materials:

**Cargo Securement:** Secure hazardous materials using tie-downs, straps, braces, and other securement devices to prevent shifting or rolling.

**Inspection During Stops:** Periodically inspect the cargo during stops to ensure that the materials remain properly secured.

### 4. Prohibited Practices:

**Smoking:** Smoking is strictly prohibited near hazardous materials, particularly around flammable liquids and gases.

**Transporting Incompatible Materials:** Drivers must not transport incompatible hazardous materials in the same cargo space. For example, oxidizers should not be transported with flammable materials due to the risk of fire.

**Scenario Exercise:** Have trainees develop a step-by-step pre-trip inspection checklist specific to a vehicle carrying hazardous materials, including checking for leaks, proper securement, and correct placarding.

## **Unit E1.3: Reporting HM Crashes and Releases**

### Learning Material:

Prompt and accurate reporting of hazardous material incidents is crucial for safety, environmental protection, and regulatory compliance. This unit will cover the procedures for reporting crashes and releases.

#### 1. Immediate Notification of Incidents:

**When to Notify:** Drivers must report any incidents involving hazardous materials immediately to emergency responders and authorities if:

There is a fatality or injury requiring medical attention.

Hazardous material is released, causing fire, explosion, or danger to public safety.

There is a release of a reportable quantity of hazardous material.

#### Who to Notify:

**Local Authorities:** Call 911 or local emergency services immediately.

**National Response Center (NRC):** Contact the NRC for significant spills, leaks, or accidents involving hazardous materials at 1-800-424-8802.

**Carrier:** Inform the carrier (employer) of the incident. The carrier is responsible for completing additional reports as required.

#### 2. Incident Reporting Requirements:

Hazardous Materials Incident Report (DOT Form F 5800.1): This form must be completed by the carrier within 30 days of the incident. It includes details such as:

Description of the hazardous material.

Circumstances and outcomes of the incident (e.g., spills, fires).

Measures taken to control or mitigate the hazard.

Documentation: Drivers must keep copies of all reports and incident-related documentation in case of follow-up inspections or audits.

### 3. Emergency Response Guidebook (ERG) Utilization:

Guidance: Use the ERG to provide first responders with vital information about the hazardous material involved, including necessary precautions and recommended emergency actions.

Example: In case of a spill involving corrosive material (e.g., sulfuric acid), the ERG outlines evacuation distances, firefighting methods, and first aid measures.

### 4. Incident Containment and Response:

Containment: If safe to do so, contain the release using spill kits, absorbent materials, or barriers to prevent further spread.

Fire Prevention: For flammable materials, extinguish any potential ignition sources (e.g., vehicle engine, electrical systems) to prevent fires or explosions.

Scenario Exercise: Create a mock incident report based on a hypothetical hazardous material spill. Include details such as material type, actions taken, and agencies notified.

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## **Unit E1.4: Tunnels and Railroad (RR)-Highway Grade Crossing Requirements**

### Learning Material:

Tunnels and railroad crossings present unique risks when transporting hazardous materials. Drivers must understand the specific procedures for safe passage through these areas.

#### 1. Tunnel Restrictions:

Tunnel Regulations: Some tunnels have restrictions on hazardous materials due to confined spaces, limited ventilation, and difficulty in managing accidents. Drivers must be aware of and comply with local and state regulations regarding tunnel usage.

#### Placarding and Notification:

Examples: Many urban tunnels (e.g., Lincoln Tunnel in New York City) restrict certain hazardous materials, such as explosives or flammable gases.

Before entering a tunnel, ensure that the vehicle displays appropriate placards, allowing authorities and tunnel personnel to identify the cargo's nature.

Alternative Routes: Drivers may need to plan alternative routes that bypass restricted tunnels, especially when transporting bulk hazardous materials.

## 2. Railroad-Highway Grade Crossings:

Stopping and Checking: Before crossing a railroad-highway grade:

Stop the vehicle 15-50 feet away from the tracks.

Open windows and doors to listen for an oncoming train.

Look both ways and ensure no train is approaching.

Crossing the Tracks:

Cross tracks only when there is sufficient space to clear the crossing on the other side. Never stop on the tracks.

Shift into the appropriate gear to avoid stalling while crossing.

Hazardous Materials Restrictions: Federal law requires vehicles transporting certain hazardous materials (e.g., explosives, flammable liquids) to stop at all railroad crossings, regardless of whether a train is visible.

Interactive Video: Show trainees a video demonstrating the correct procedure for crossing railroad tracks safely with hazardous material cargo.

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## Unit E1.5: Loading and Unloading HM

### Learning Material:

Safe loading and unloading are essential to prevent accidents, spills, and exposure during the transport of hazardous materials.

### 1. Proper Loading Procedures:

Segregation: Separate incompatible materials (e.g., acids from bases, flammable liquids from oxidizers) to prevent dangerous chemical reactions during transport.

Securement: Use tie-downs, straps, and braces to secure hazardous materials and prevent movement during transit.

Example: For gas cylinders, use specialized holders to keep them upright and immobile.

Special Handling for Liquid Poisons: Liquid poisons must be securely packaged and positioned away from foodstuffs to avoid contamination.

Inspections: Before departure, inspect all packages for signs of leakage, damage, or improper closure.

### 2. Unloading Procedures:

Precautions: Check the cargo area for spills or damage before unloading.

Step-by-Step Process:

Wear appropriate PPE (e.g., gloves, safety goggles) for the specific hazardous material.

Open container doors slowly to avoid unexpected cargo shifts.

Use appropriate equipment (e.g., forklifts, hand trucks) to handle heavy or bulky containers safely.

Emergency Measures: Have spill containment kits and fire extinguishers accessible during loading and unloading.

3. Documentation and Placarding: Update shipping papers and vehicle placards to reflect any changes in cargo during loading/unloading, especially if partial loads are being transported.

Hands-On Exercise: Conduct a simulated loading and unloading process using model packages and placards. Assess trainees on their securement techniques and adherence to safety protocols.

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## **Unit E1.6: HM on Passenger Vehicles**

Learning Material:

Transporting hazardous materials on passenger vehicles poses additional risks and restrictions to ensure the safety of passengers and the public.

### 1. Regulatory Overview:

Restrictions on HM Transport: Only limited quantities of hazardous materials are allowed on passenger-carrying vehicles (e.g., buses, taxis). The materials must be in small, manageable quantities and pose minimal risk.

Example: Small amounts of flammable liquids (e.g., nail polish remover) can be transported in their retail packaging but not in bulk containers.

Prohibited Materials: Explosives, bulk hazardous gases, and certain toxic substances are strictly prohibited from being transported on passenger vehicles.

Labeling: All hazardous materials transported on passenger vehicles must be correctly labeled to indicate their contents and associated risks.

### 2. Quantity and Packaging:

Limitations: Drivers must ensure that the quantity of hazardous materials does not exceed the limits set by the FMCSR. For example, transporting compressed gas on a passenger vehicle is generally limited to small cylinders designed for personal or medical use.

Packaging: Hazardous materials must be in containers that prevent leakage and withstand typical transport conditions. Use absorbent material for liquids to prevent spills during transport.

### 3. Vehicle Safety Measures:

**Ventilation:** Ensure adequate ventilation in the vehicle when transporting hazardous materials to reduce the buildup of toxic or flammable fumes.

**Passenger Safety:** Keep hazardous materials away from passenger seating areas, ideally in a secure, isolated compartment.

**Scenario Review:** Discuss a scenario where a passenger bus is transporting a small quantity of flammable gas for a medical purpose. Walk through the necessary precautions, communication with passengers, and handling procedures.

## **Unit E1.7: Bulk Packages**

### Learning Material:

Transporting hazardous materials in bulk packages requires specialized knowledge of vehicle handling, emergency equipment operation, and safe practices to prevent accidents, spills, or rollovers.

#### 1. Types of Bulk Packages:

**Cargo Tanks:** Large tanks permanently attached to a vehicle used to transport liquids, gases, and slurries. Examples include fuel tankers and chemical tank trucks.

**Safety Features:** Include emergency shut-off valves, vapor recovery systems, and grounding mechanisms to prevent static electricity buildup.

**Intermediate Bulk Containers (IBCs):** These are portable, reusable containers designed to handle liquids, granules, and powders in quantities larger than typical drums but smaller than cargo tanks.

**Special Handling:** Must be secured on the vehicle to prevent shifting or tipping during transit.

**Bulk Cylinders:** Designed for the transport of compressed gases (e.g., oxygen, nitrogen). They require securement to prevent movement or damage that could lead to leaks or explosions.

#### 2. Emergency Control Features:

**Shut-Off Valves:** Drivers must know how to operate emergency shut-off valves in the event of a spill or leak.

**Hands-On Practice:** Provide trainees with access to a simulated cargo tank setup to practice locating and using shut-off valves.

**Pressure Relief Devices:** Bulk packages often have pressure relief devices to prevent over-pressurization, especially in tanks carrying volatile liquids. Understanding these systems is crucial for safe operation.

#### 3. Vehicle Handling Characteristics:



Center of Gravity: Bulk liquids in cargo tanks create a high center of gravity, making the vehicle prone to rollovers. Drivers must be aware of how different loads impact vehicle stability.

Surge Effect: Liquids can move (or “surge”) inside tanks during starts, stops, and turns. Drivers must use smooth, gradual maneuvers to minimize surge and maintain control of the vehicle.

Example: During braking, the liquid shifts forward, affecting vehicle balance and increasing stopping distance.

#### 4. Rollover Prevention:

Driving Techniques: Emphasize gradual acceleration, deceleration, and turns to reduce the risk of rollovers.

Roadway Factors: Teach drivers to assess road conditions, weather, curves, and gradients before transporting bulk packages.

Vehicle Design: Modern cargo tanks may include anti-lock braking systems (ABS) and stability control features that help prevent rollovers.

#### 5. Special Considerations for Hazardous Materials:

Hazard Properties: Drivers must understand the specific properties of the hazardous material they are transporting. For instance, some materials are highly reactive to heat or static electricity.

Incident Response: In case of a bulk package breach, ensure familiarity with emergency response procedures, including spill containment, notification of authorities, and the use of personal protective equipment (PPE).

Interactive Activity: Create a risk assessment exercise where trainees evaluate different bulk materials and outline safe transport strategies, focusing on proper vehicle handling, securing the load, and emergency procedures.

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## **Unit E1.8: Operating Emergency Equipment**

### Learning Material:

Drivers must be well-versed in the operation of emergency equipment to effectively handle incidents involving hazardous materials.

#### 1. Basic Emergency Equipment:

Fire Extinguishers: Understand the types of fire extinguishers required on hazardous materials vehicles (e.g., dry chemical, foam, CO<sub>2</sub>) and the appropriate use for different classes of fires.

Training: Include hands-on training where trainees practice using fire extinguishers on simulated fires (e.g., Class B fires involving flammable liquids).

Spill Containment Kits: These kits contain absorbent materials, gloves, goggles, and disposal bags designed to handle minor spills or leaks during transport.

Contents Review: Go through the components of a standard spill kit and demonstrate how to use them to contain a leak.

## 2. Cargo Tank Motor Vehicle Equipment:

Shut-Off/Shutdown Equipment: Drivers must be able to locate and operate equipment designed to control the flow of hazardous materials, including emergency shut-off devices and pressure relief mechanisms.

Emergency Drills: Conduct drills where trainees must quickly locate and operate the shut-off controls on a simulated cargo tank.

Vapor Recovery Systems: These systems prevent the release of hazardous vapors during loading and unloading. Train drivers on how to properly connect and monitor vapor recovery lines to ensure safe operation.

## 3. Special Precautions for Fires:

Isolation: Move the vehicle to an isolated location if a fire breaks out near hazardous materials. Ensure the vehicle is at a safe distance from populated areas, buildings, or flammable substances.

PPE Usage: Drivers should don appropriate PPE (e.g., fire-resistant suits, respirators) when handling an emergency involving hazardous materials.

Scenario-Based Learning: Develop realistic emergency scenarios, such as a minor spill or fire during transit, where trainees must identify the correct emergency equipment and response actions.

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## **Unit E1.9: Emergency Response Procedures**

### Learning Material:

In the event of a hazardous material emergency, drivers must know the correct response procedures to protect people, property, and the environment.

#### 1. Identifying the Hazard:

Shipping Papers and Placards: Use shipping papers and vehicle placards to quickly identify the hazardous material involved. This information helps determine the best emergency response.

Emergency Response Guidebook (ERG): Teach trainees how to reference the ERG to find response actions for different types of hazardous materials.

## 2. Initial Response Actions:

**Evacuate and Secure the Area:** Immediately evacuate the vicinity if there's a risk to health and safety (e.g., toxic gas leak). Establish a secure perimeter around the hazard area.

**Notification Protocol:** Contact emergency services, the National Response Center (NRC), and the carrier as soon as possible. Provide specific details, including:

Material type and quantity.

Incident location.

Current conditions (e.g., fire, leak).

## 3. Containment Procedures:

**Spill Containment:** Use absorbent pads, booms, or dikes to contain small liquid spills. Avoid direct contact with hazardous substances.

**Leak Control:** For leaking cylinders or tanks, attempt to stop the leak using emergency shut-off valves if it is safe to do so.

## 4. Post-Response Operations:

**Decontamination:** In cases of exposure, ensure that personnel and equipment are decontaminated according to established protocols. This may involve washing affected areas with water or using neutralizing agents.

**Incident Reporting:** Complete all necessary reports, including the Hazardous Materials Incident Report (DOT Form F 5800.1), and cooperate with investigations by authorities.

**Emergency Response Simulation:** Design a tabletop exercise where trainees must respond to a simulated hazardous material incident, coordinating actions based on the type of material involved and the situation's severity.

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## **Unit E1.10: Engine (Fueling)**

### Learning Material:

Proper fueling procedures are critical to avoid accidents, particularly when handling vehicles carrying hazardous materials.

#### 1. Safety Precautions During Fueling:

**Engine Off:** Always turn off the vehicle's engine before starting the fueling process. This prevents accidental ignition of vapors.

**Static Electricity:** Before fueling, ground the fuel nozzle to the vehicle to prevent static discharge, which can ignite flammable vapors.

**No Smoking:** Strictly prohibit smoking or open flames within 25 feet of the fueling area.

## 2. Emergency Procedures for Fuel Spills:

**Immediate Action:** If fuel is spilled during the process, stop fueling immediately and contain the spill using absorbent materials.

**Notification:** Notify the appropriate authorities and follow the spill response procedures outlined in the ERG.

## 3. Location Considerations:

**Designated Fueling Areas:** Use only designated fueling stations that meet the requirements for hazardous material vehicles, including proper ventilation and spill containment features.

**Hands-On Practice:** Set up a controlled environment where trainees can practice the fueling process, focusing on safety measures and emergency response.

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## **Unit E1.11: Tire Check**

### Learning Material:

Proper tire maintenance is essential for the safe operation of vehicles transporting hazardous materials.

#### 1. Tire Inspection at Start of Trip:

**Visual Inspection:** Look for signs of damage, such as cuts, cracks, or bulges on the tire's surface.

**Tread Depth:** Measure tread depth to ensure it meets minimum legal requirements. Insufficient tread can compromise vehicle handling, especially under heavy loads.

**Air Pressure:** Check and adjust air pressure to the manufacturer's recommended levels. Over-inflation or under-inflation can increase the risk of blowouts.

#### 2. Tire Checks During Trip:

**Every Stop:** Inspect tires at each stop, especially when hauling hazardous materials. Excessive heat, unusual wear, or embedded debris may indicate potential issues.

**Hands-On Training:** Teach trainees to use tire pressure gauges and temperature scanners during inspections.

#### 3. Emergency Measures for Tire Failures:

**Blowouts:** In case of a blowout, maintain a firm grip on the steering wheel, avoid abrupt maneuvers, and gradually slow down to pull over safely.

**Practical Exercise:** Conduct a tire inspection workshop where trainees check tires on a vehicle using proper tools and techniques.

## **Unit E1.12: Routes and Route Planning**

### Learning Material:

Selecting safe and compliant routes is crucial when transporting hazardous materials.

#### 1. Route Restrictions:

**Radioactive and Non-Radioactive Materials:** Some routes, especially through densely populated areas, have restrictions on the transport of hazardous materials.

**Designated Routes:** Use established routes such as those specified for hazardous material transport, which often avoid tunnels, bridges, and other high-risk areas.

#### 2. Route Planning:

**Rest Stops:** Plan rest stops in secure, designated areas that accommodate hazardous materials. Avoid parking near residential areas, schools, or other sensitive locations.

**Weather Conditions:** Assess weather forecasts before starting the trip. Inclement weather can affect vehicle handling, especially when carrying hazardous loads.

#### 3. Navigational Tools:

**GPS with Hazmat Settings:** Utilize GPS systems programmed for hazardous materials routing to avoid restricted areas and identify safe parking locations.

**Simulation Exercise:** Assign trainees the task of planning a route for a hazardous material transport, considering legal, safety, and logistical factors.

## **Unit E1.13: Hazardous Materials Safety Permits (HMSP)**

### Learning Material:

Hazardous Materials Safety Permits (HMSP) are required for the transportation of certain hazardous materials and involve specific operational and procedural requirements.

#### 1. Overview of HMSP:

**Definition and Purpose:** The HMSP is a permit issued by the Federal Motor Carrier Safety Administration (FMCSA) that ensures compliance with safety regulations for transporting high-risk hazardous materials.

**Example Materials:** Radioactive materials, certain explosives, and materials classified as high hazard due to their quantity or characteristics.

**Permit Application:** Explain the process for applying for an HMSP, including required documentation and the regulatory body's review process.

#### 2. Operational Requirements:

**Communications:** Drivers must have a means of communication (e.g., two-way radio, cell phone) to contact authorities or emergency services during transport.

**Emergency Contact List:** Maintain an updated list of contacts, including emergency response teams and local regulatory agencies.

**Constant Attendance:** For certain types of hazardous materials, the vehicle may need constant attendance by the driver or a designated representative.

**Example:** Transporting high-level radioactive materials often requires that the vehicle be attended at all times.

**Parking Regulations:** Specific rules may apply to parking, such as avoiding residential areas, schools, and other sensitive locations. Ensure understanding of where and how to park safely.

**Regulated Areas:** Use only designated parking areas that comply with safety regulations for hazardous materials.

### 3. Compliance Monitoring:

**Regular Inspections:** Regularly inspect and maintain vehicles and equipment to ensure they meet HMSP standards.

**Record Keeping:** Keep accurate records of all permit-related activities, including transportation logs, maintenance records, and training documentation.

### 4. Penalties for Non-Compliance:

**Fines and Penalties:** Explain potential fines and legal consequences for failing to comply with HMSP requirements, such as transporting without a valid permit or failing to adhere to safety protocols.

**Example Penalties:** Monetary fines, suspension of operating privileges, or legal action depending on the severity of the non-compliance.

**Interactive Activity:** Create a role-playing exercise where trainees review and process a mock HMSP application, including verifying compliance with operational requirements and addressing potential issues.