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Hazardous Materials Incident

Advanced Care Paramedicine

Module: 11

Section: 06b

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Lecture Outline

- Role of the Paramedic
- Incident Assessment
- Specialized Terminology
- Contamination and Toxicology Review
- Approaches to Decontamination
- Hazmat Protection Equipment
- Medical Monitoring and Rehabilitation

Hazardous Material

- Any substance that causes adverse health effects upon human exposure
- A hazardous materials emergency can involve countless substances and occur in many situations

Countless Substances in Many Situations

Role of the Paramedic

- Scene and risk assessment
- Activation of the incident management system
- Establish command
- Paramedics generally do not perform containment or control functions

Requirements and Standards

- Transport Canada
  - Developed Transport of Dangerous Goods Regulations
  - Adopted by all Provinces and Territories
- CANUTEC
  - Canadian Transport Emergency Centre
  - Developed Emergency Response Guidebook
- NFPA Standard 473
  - American standard often referred to

Levels of Training

- Awareness level
  - Recognition
- EMS Level I (operations level)
  - Patient care in cold zone
- EMS Level II (technician level)
  - Patient care in warm zone

Incident Assessment

- Priorities for a hazmat incident are the same as for any other major incident.
  - Life safety
  - Incident stabilization
  - Property conservation

Incident Awareness

- Every emergency site has the potential to be a hazmat scene
- Awareness that a dangerous substance is present is critical
  - Transportation
  - Fixed facilities
  - Terrorism

FIGURE 3-28 Don't take any chances. Use binoculars to make a visual inspection of a potentially hazardous situation.

Do not rule out the presence of a hazardous material at an MVA just because you do not see a placard.

Weapons of Mass Destruction

- Chemical, biological, or nuclear devices used by terrorists to strike at government or high-profile targets
- Designed to create a maximum number of casualties

Potential Terrorist Targets

- Public buildings
- Multinational headquarters
- Shopping centers
- Workplaces
- Sites of assembly

At terrorist incidents, remember that a secondary device may exist!

Recognition of Hazards

- Two systems:
  - Placards
  - Fixed facilities

Placards

- Indicate hazmat classification
  - Colour code
  - Hazard class number
- Some carry a four digit UN number
  - Specific identification number given to a specific chemical
- The absence of a placard does not mean that there is not a hazardous material

- Vehicles carrying hazardous materials are required to display placards

- Packages and storage containers must be marked

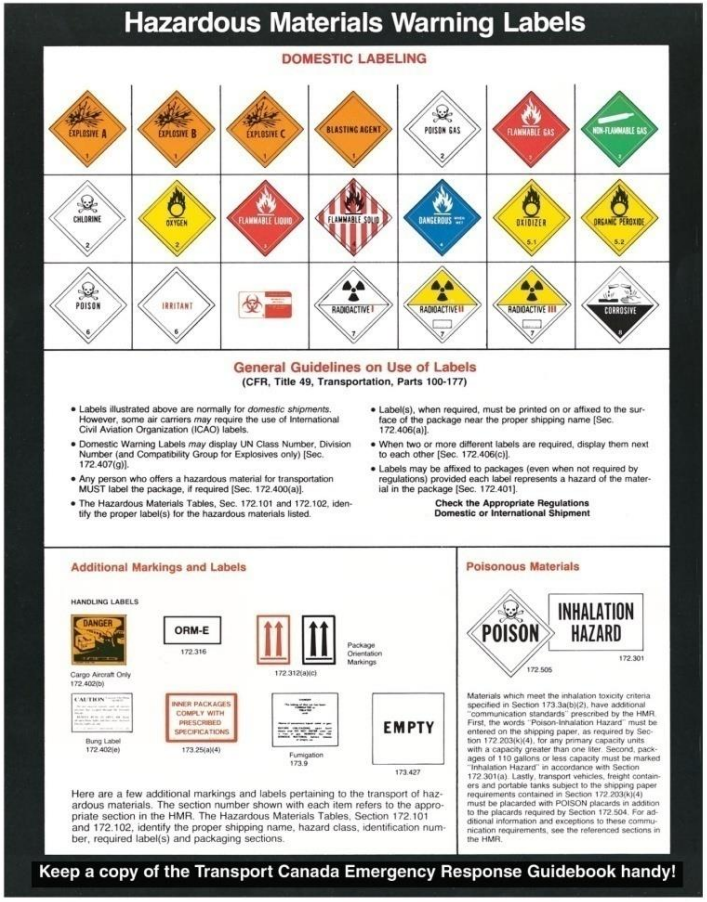


FIGURE 3-30A Transport Canada requires packages and storage containers to be marked with specific hazard labels.

- Display placards must be placed on the outside of vehicles

FIGURE 3-30B Transport Canada also requires display placards to be placed on the outside of vehicles.

NFP 704 System

- Identifies hazardous materials at a fixed site
- Uses diamond-shaped figures divided into four sections:
  - Red—Flammability
  - Blue—Health hazard
  - Yellow—Reactivity
  - White—Specific information

NFP 704 System

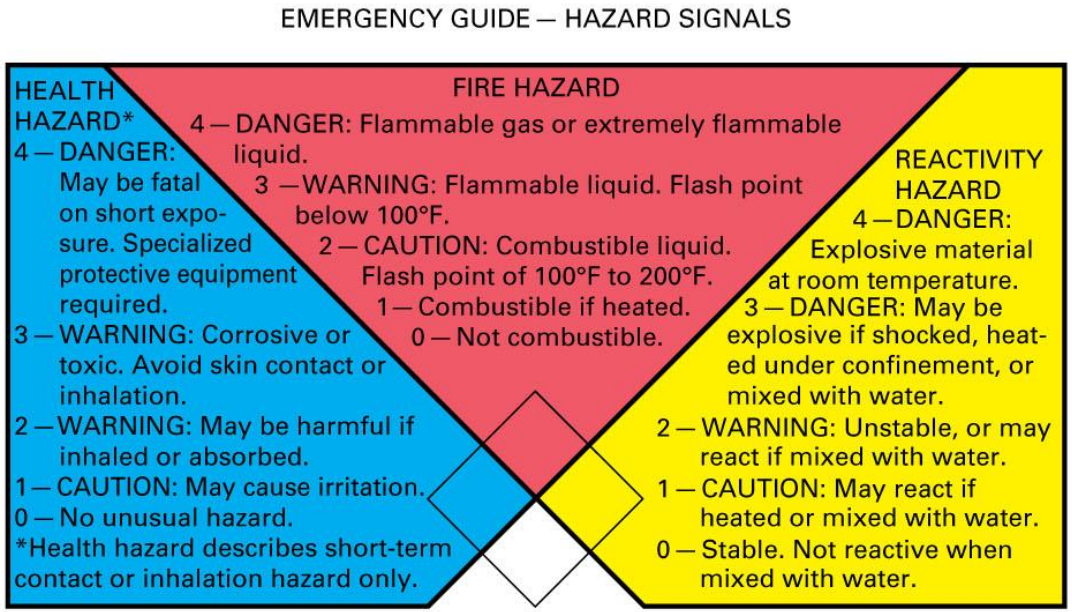
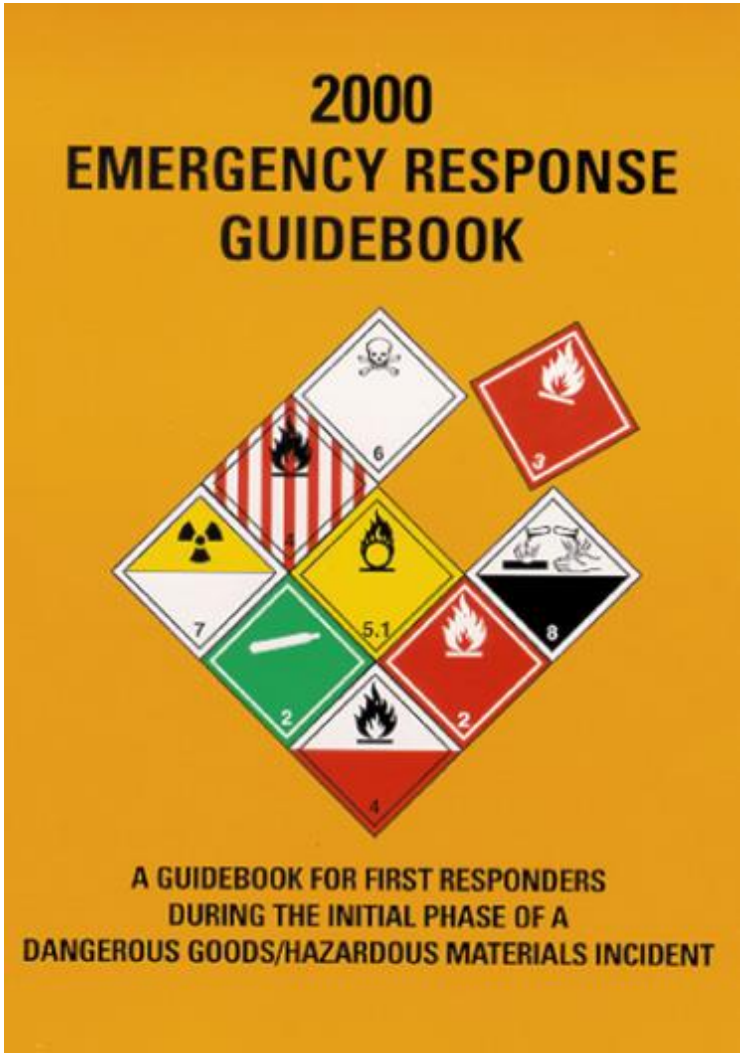


FIGURE 3-30C The NFPA 704 system helps you identify health, reactivity, and fire hazards.

Identification of Substances

- Emergency Response Guidebook
- Shipping Papers
- Workplace Hazardous Materials Information System
- Material Safety Data Sheet (MSDS)
- Other sources

Emergency Response Guidebook



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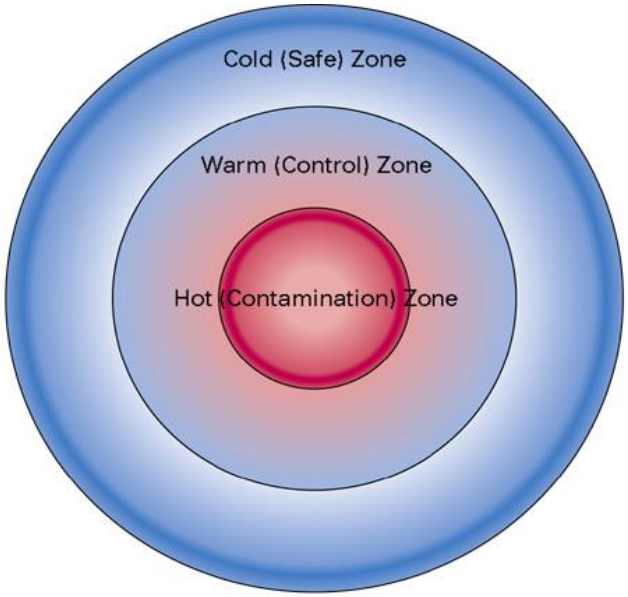
Material Safety Data Sheet

Hazardous Materials Zones

- Set up around an incident to assure safety
- Keep a bad situation from getting worse
  - Set up an incident command
  - Evacuate uncontaminated people from the area around the incident

Hazardous Materials Zones

- Hot (red) zone
  - Site of contamination
  - Must have appropriate high level PPE
- Warm (yellow) zone
  - Buffer zone
  - Decontamination corridor
- Cold (green) zone
  - Safe zone where incident operations take place



Hot (Contamination) Zone

- Contamination is actually present.
- Personnel must wear appropriate protective gear.
- Number of rescuers limited to those absolutely necessary.
- Bystanders never allowed.

Warm (Control) Zone

- Area surrounding the contamination zone.
- Vital to preventing spread of contamination.
- Personnel must wear appropriate protective gear.
- Life-saving emergency care is performed.

Cold (Safe) Zone

- Normal triage, stabilization, and treatment are performed.
- Rescuers must shed contaminated gear before entering the cold zone.

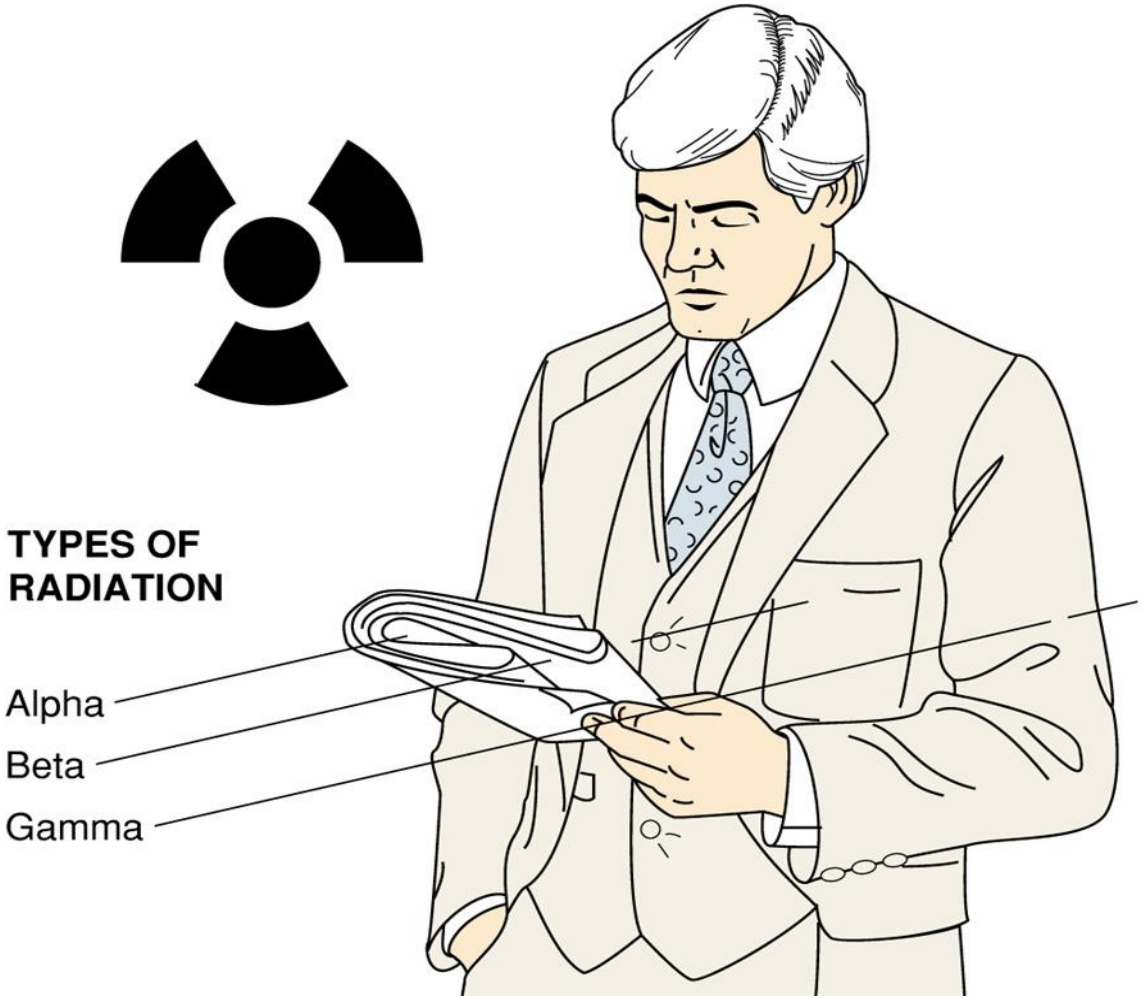
Terminology

- Boiling point
- Flammable/explosive limits
  - LEL
  - UEL
- Flash point
- Ignition temperature
- Specific gravity
- Vapor density
- Vapor pressure
- Water solubility

Radiation

- Alpha
  - Very weak
  - Stopped by paper, clothing, or intact skin
  - Hazardous if inhaled or ingested
- Beta
  - More energy than alpha particles
  - Will penetrate a few millimeters of skin
- Gamma
  - High energy (e.g. x-rays)
  - Penetrates most substances
  - Can damage any cells in the body
  - Heavy shielding required

Alpha, beta, and gamma rays.



Toxicological Terms

- Threshold limit value/time weighted average (TLV/TWA)
- Threshold limit value/short-term exposure limit (TLV/STEL)
- Threshold limit value/ceiling level (TLV/CL)
- Lethal concentration/lethal doses (LCt/LD)
- Parts per million/parts per billion (ppm/ppb)
- Immediately dangerous to life and health (IDLH)

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Contamination and Toxicology Review

Types of Contamination

- Primary
  - Direct contact
- Secondary
  - A contaminated person or object comes in contact with an uncontaminated person or object

Routes of Exposure

- Respiratory inhalation
- Topical absorption
- Parenteral injection
- Gastrointestinal ingestion

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Cycles and Actions of Poisons

- Acute effects
- Delayed effects
- Local effects
- Systemic effects
- Biotransformation
- Synergism

Common Exposures

- Corrosives
- Pulmonary irritants
- Pesticides
- Chemical asphyxiants
- Hydrocarbon solvents

Corrosives

- Brush off dry particles.
- Flush liquid corrosives with large quantities of water.
- Tincture of green soap may help in decontamination.
- Irrigate eye injuries, possibly with proparacaine hydrochloride to assist.

Corrosives

- If the corrosive has been ingested, do not induce vomiting.
- If the patient can swallow and is not drooling, give the person 5cc/kg water up to 200 cc.
- Support the ABCs.

Pulmonary Irritants

- Cannot be decontaminated.
- Remove patient's clothing.
- Flush exposed skin with large quantities of water.
- Irrigate eyes with water; proparacaine hydrochloride may assist.
- Treat pulmonary edema with furosemide and albuterol.
- Support the ABCs.

Pesticide Actions

- S—Salivation
- L—Lacrimation
- U—Urination
- D—Diarrhea
- G—Gastrointestinal distress
- E—Emesis
- Involuntary muscle contraction
- Pinpoint pupils

Pesticide Treatment

- Remove all clothing and jewelry.
- Maintain and support ABCs.
- Suction if needed.
- Administer atropine 2 mg IV push until SLUDGE symptoms resolve.
- If an adult has seizures, administer 5–10 mg of diazepam.
- If the patient can swallow, give 5cc/kg up to 200 cc of water.

Chemical Asphyxiants

- The most common chemical asphyxiants include:
  - Carbon monoxide
    - Has a high affinity for hemoglobin and displaces oxygen on the red blood cells
  - Cyanides
    - Inhibit cytochrome oxidase that enable oxygen to create adenosine triphosphate (ATP) required for muscle energy

General Treatment

- Decontamination is usually not necessary.
- Remove from the toxic environment.
- Remove patient's clothes to prevent trapped gasses.

CO Exposure

- Extricate
- Oxygenate patient.
- Hyperbaric therapy is necessary in some cases.

Cyanide

- Use a cyanide kit.
- Administer amyl nitrate.
- Administer sodium nitrite, 300 mg IV push over 5 minutes.
- Follow with an infusion of thiosulfate, 12.5 g IV push over 5 minutes.
- Repeat at half doses if necessary

Hydrocarbon Solvents

- Decontaminate the exposed area with warm water and tincture of green soap.
- If the patient has ingested the solvent, do not induce vomiting.
- If the patient can swallow and is not drooling, administer 5 cc/kg up to 200cc of water.
- If the patient has seizures, give 5–10 mg diazepam.
- Support the ABCs.

Decontamination

- Dilution
- Absorption
- Neutralization
- Isolation

Dilution

- Application of large quantities of water to the person.
- Water is the universal decontamination solution.
- Water may be aided by soap.

Absorption

- Use of pads or towels to blot up the hazardous material
- Usually applied after lavage
- More commonly used during environmental cleanup

Neutralization

- Almost never used by EMS personnel
- A substance reduces or eliminates the toxicity of another substance

Isolation

- Involves separating the patient or equipment from the hazardous substance.
- Zones are established to prevent further contamination.

Decontamination Decision Making

- Fast-Break Decision Making
  - Immediate action needed to prevent contamination and handle life threats
- Long-Term Decision Making
  - Takes place at extended events with hazmat teams

Field Decontamination

- When dealing with unknowns, do not attempt to neutralize.
- Brush off dry chemicals.
- Apply large quantities of water with green soap if available.

Two-Step Process

- Usually a fast-break method.
- Remove patient's clothing and jewelry.
- Wash and rinse the patient two times.

Eight-Step Process

- Rescuers enter the decontamination area at hot end of corridor and mechanically remove contaminants.
- Rescuers drop equipment in a tool-drop area, and remove outer gloves.
- Decontamination personnel shower and scrub all victims and rescuers using gross decontamination. Victims can be moved to step 6 or step 7.
- Rescuers remove and isolate their SCBA.

Eight-Step Process

- Rescuers remove all protective clothing. Victims who are still clothed have their clothes removed.
- Rescuers remove all personal clothing.
- Rescuers and victims receive a full-body washing.
- Patients receive rapid assessment and stabilization before transport.

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Field Decontamination

Hazmat Protection Equipment

- Level A
  - Highest respiratory and splash protection
  - Fully encapsulating
- Level B
  - Full respiratory protection
  - Non-encapsulating, but chemically resistant

Hazmat Protection Equipment

- Level C
  - Uses an air-purifying respirator
  - Nonpermeable suit, boots, and eye and hand protection
- Level D
  - Structural fire-fighting gear

The level of protection needed depends on the chemical or substance involved.

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Assisting with an air tank

Putting on a mask

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Assisting with a hood

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Hazmat team fully suited

Entry Readiness

- Hazmat team members are assessed for readiness and the following checked and documented:
  - Blood pressure
  - Pulse
  - Respiratory rate
  - Temperature
  - Body weight
  - ECG
  - Mental/ Neurological status

After Exit “Rehab”

- The team completes decontamination and reports to rehab.
- Measure and document the same parameters as during entry readiness.
- Rehydrate the members of the team.
- Team members are not allowed to reenter the hot zone until their parameters are within normal limits.

Heat Stress Factors

- Take into account:
- Temperature and humidity
- Prior hydration status
- Duration and degree of activity
- Level of protective suit used

Importance of Practice

- High acuity, low frequency skills
- Practice, practice, practice

Summary

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- Medical Monitoring and Rehabilitation