

Hazardous Materials: Managing the Incident

CHAPTER 2 Health and Safety

Learning Objectives Overview

- Knowledge Objectives
- Skills Objectives

Introduction

- Toxicology
- Exposures
- Toxicity
- Health and Safety Management Program
- Personal Protective Equipment
- Site Safety Practices and Procedures

Toxicology

- Toxicology is the study of agents that produce adverse responses in the biological systems with which they interact.
 - Chemical agents
 - Physical agents



Exposure Concerns (1 of 2)

- Exposure types:
 - Acute
 - Chronic



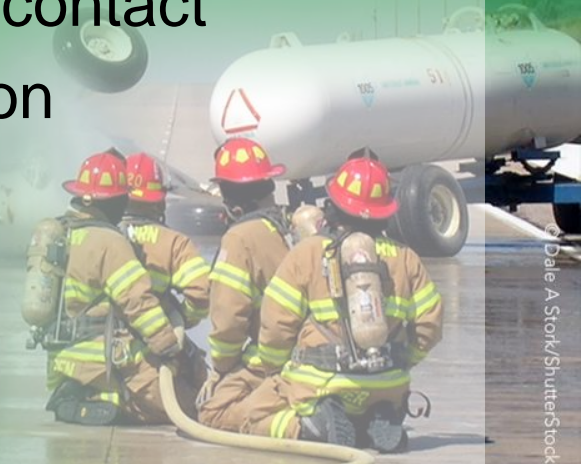
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Exposure Concerns (2 of 2)



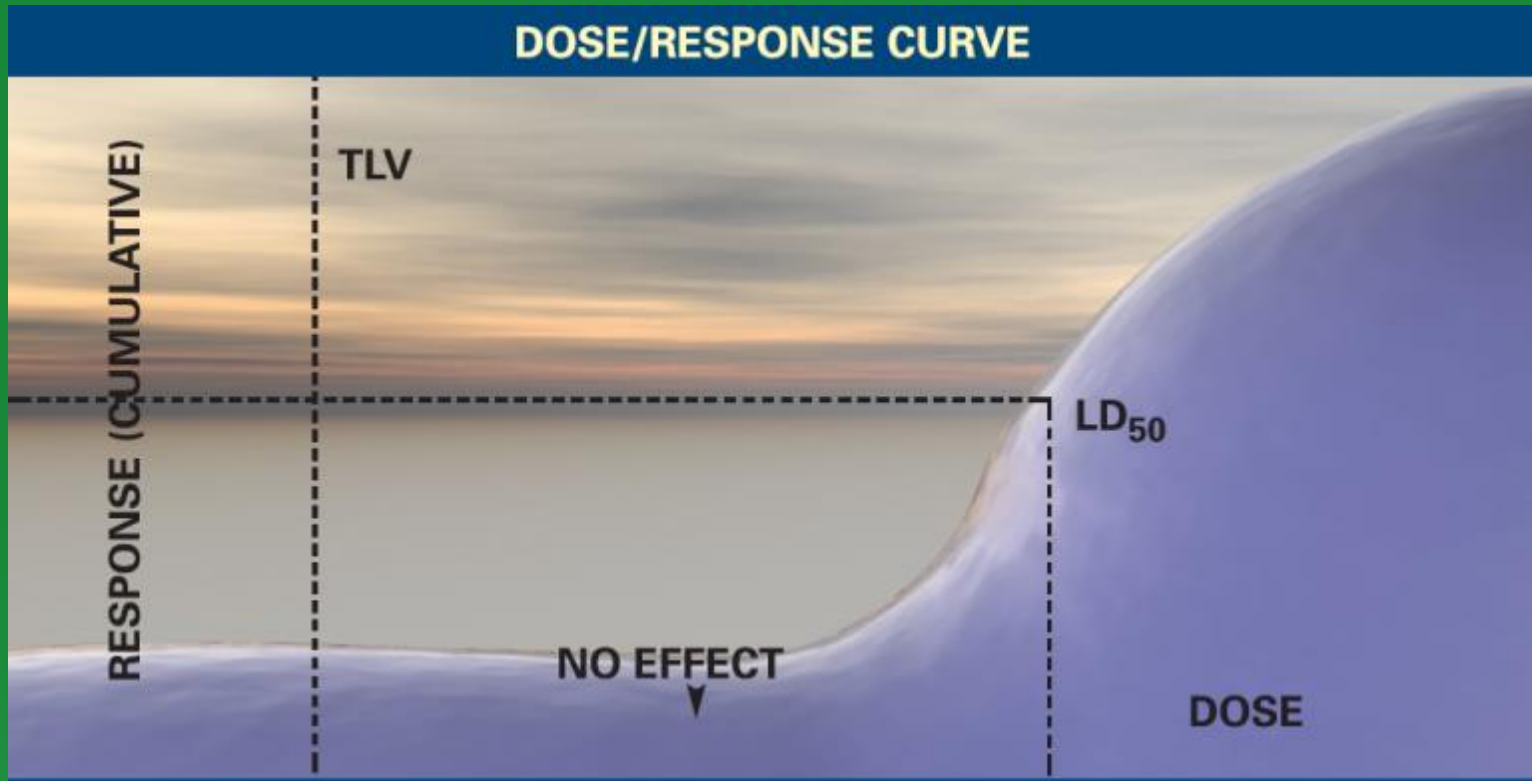
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- Routes of exposure:
 - Inhalation
 - Skin absorption
 - Ingestion
 - Direct contact
 - Injection



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Dose/Response Relationship



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Effects of Hazardous Materials Exposures (1 of 2)

- Local effect
 - Effect at the point of contact
- Systemic effect
 - Enters the bloodstream and attacks target organs

Effects of Hazardous Materials Exposures (2 of 2)

- Types of harm events:
 - Thermal
 - Mechanical
 - Poisonous
 - Corrosive
 - Radiation
 - Etiological

Toxicity Concerns (1 of 2)

- Factors that influence toxicity:
 - Concentration or dose
 - Rate of absorption
 - Rate of detoxification
 - Rate of excretion
 - Miscellaneous factors

Toxicity Concerns (2 of 2)

- Toxicity is measured in terms of the ability of a material to injure living tissue.
 - Lethal dose
 - Lethal concentration

Exposure Values and Guidelines

Table 2-6 Health Exposure Guidelines

Exposure Guideline	Target Group	Sponsoring Organization	Definition	Exposure Duration
Threshold Limit Value (TLV)	Workers	ACGIH	Occupational exposure for 8-hour time-weighted concentration	8 hours/day 20 to 30 years
Permissible Exposure Limit (PEL)	Workers	OSHA	Occupational exposure for 8-hour time-weighted concentration	8 hours/day 20 to 30 years
Recommended Exposure Limit (REL)	Workers	NIOSH	Occupational exposure for 10-hour time-weighted concentration	8 hours/day 20 to 30 years
Short-Term Exposure Limit	Workers	ACGIH	Occupational exposure for 15-minute time-weighted concentration	15 minutes
Immediately Dangerous to Life or Health (IDLH)	Workers	NIOSH	Concentration poses a dangerous to immediate threat to life or from which escape is possible without permanent damage	No exposure duration
10% (1/10th) of IDLH	General public	EPA / FEMA	Level of Concern (LOC)	30 minutes
Emergency Response Planning Guideline (ERPG)	General public	AIHA	Three-tiered emergency planning guideline for emergency response estimate based on 1/10th of the published IDLH	1 hour
Acute Emergency Exposure Guideline (AEGL)	General public	National Research Council—Committee on Toxicology	Three-tiered emergency guideline for emergency response for five different exposure durations	10 minutes 30 minutes 1 hour 4 hours 8 hours

Controlling Personnel Exposures (1 of 3)

- Originally developed by Mike Callan and Frank Docimo, there are three basic atmospheres at an incident involving hazardous materials:
 - Safe atmosphere
 - Unsafe atmosphere
 - Dangerous atmosphere



Controlling Personnel Exposures (2 of 3)

- What is safe?
 - Remain below these values
 - Exposure to multiple chemicals may have additive or synergistic effects.
- What is unsafe?
 - If the material has been released from its container, assume that an unsafe atmosphere may exist.
 - Prolonged exposures at high concentrations
- What is dangerous?
 - When concentrations continue to increase above unsafe levels
 - This concentration level is the IDLH.

Controlling Personnel Exposures (3 of 3)

- Outside or open air environment
- Inside or limited air environment
- Biological indicators
 - Dead birds
 - Discolored foliage
 - Sick animals
 - Signs and symptoms exhibited by humans



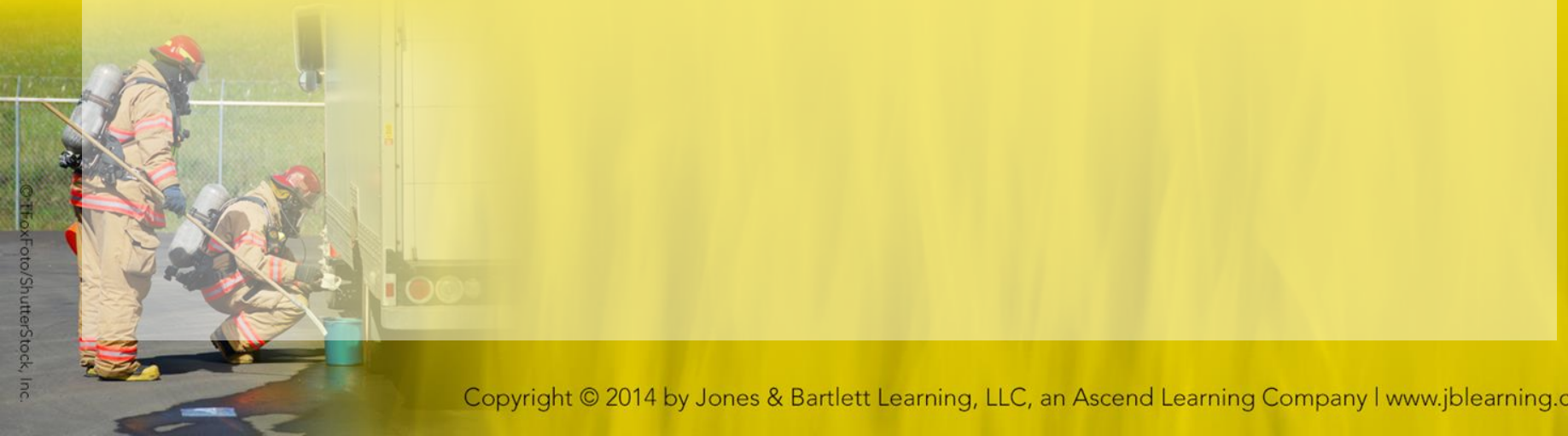
Carcinogens

- Carcinogens are physical or chemical agents that cause abnormal cell growth and spread.
- There are as many as 2000 substances that various scientific and regulatory groups have labeled as “suspect,” “probable,” or “definite” human carcinogens.



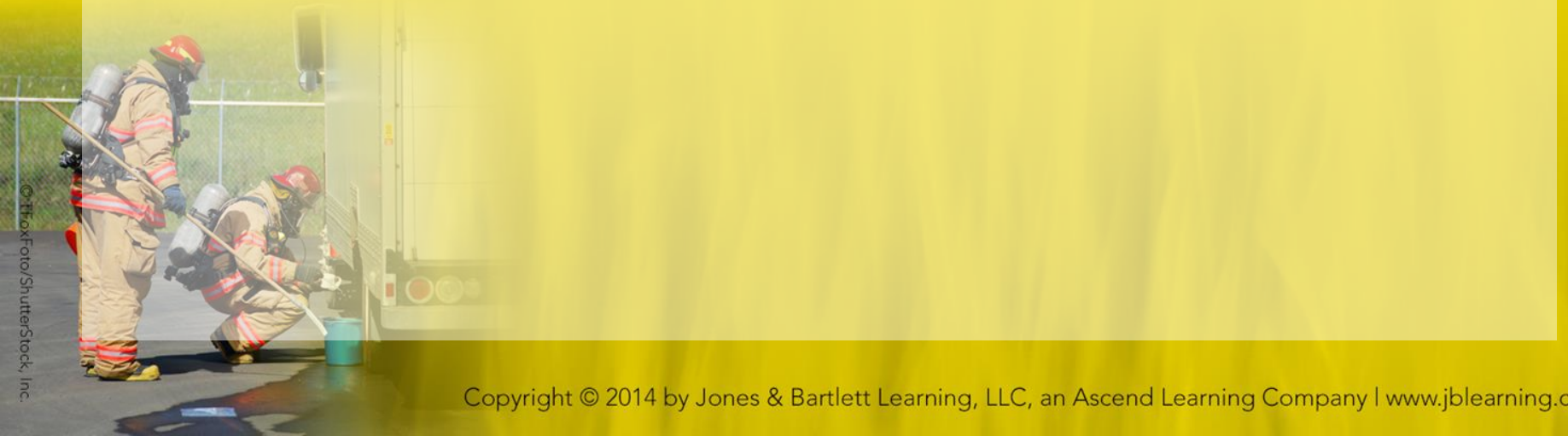
Radioactive Materials (1 of 3)

- Radiation can be classified into two types:
 - Nonionizing radiation
 - Ionizing radiation



Radioactive Materials (2 of 3)

- Ionizing radiation
 - Alpha particles
 - Beta particles
 - Gamma rays
 - Neutron particles



Radioactive Materials (3 of 3)

- Radiation exposure
- Radiation contamination
- Basic site safety concepts:
 - Time
 - Distance
 - Shielding



Exposure to Environmental Conditions (1 of 6)

- During an incident, the physical working environment must constantly be evaluated.
 - Exposure to either hot or cold weather conditions over a sustained period of time can adversely affect both the physiological and psychological conditions of response personnel.



Exposure to Environmental Conditions (2 of 6)

- Factors that influence an individual's susceptibility to environmental conditions include:
 - Lack of physical fitness, acclimatization to the elements
 - Age
 - Level of hydration
 - Obesity
 - Alcohol and drug use (including prescription drugs), infection, allergies, chronic disease



Exposure to Environmental Conditions (3 of 6)

- Physical reactions to heat include the following:
 - Heat rash
 - Heat cramps
 - Heat exhaustion
 - Heat stroke



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Exposure to Environmental Conditions (4 of 6)

Table 2-10 Heat Stress Emergencies Signs And Symptoms

Signs and Symptoms	Condition		
	Heat Cramps	Heat Exhaustion	Heat Stroke
Muscle Cramps	Yes	No	No
Breathing	Varies	Rapid Shallow	Deep Then Shallow
Pulse	Varies	Weak	Full Rapid
Weakness	Yes	Yes	Yes
Skin	Moist-Warm No Change	Cold Clammy	Dry-Hot
Perspiration	Heavy	Heavy	Little or None
Loss of Consciousness	Seldom	Sometimes	Often



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Exposure to Environmental Conditions (5 of 6)



- Exposure to severe cold may cause severe injury.
 - Factors that influence cold injuries:
 - Ambient temperature
 - Wind velocity



Exposure to Environmental Conditions (6 of 6)

- Hazardous materials incidents can often involve excessive noise levels.
- Excessive noise levels can include the following:
 - Personnel being annoyed, startled, or distracted
 - Physical damage to ears
 - Interference with communications



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A person wearing a full-body blue protective suit and gloves is working on the side of a yellow truck. The person is using a long-handled tool to clean or inspect the lower part of the truck's body. The background is a solid orange color.

Health and Safety Management Program (1 of 4)

- Key areas:
 - Medical surveillance
 - Personal protective equipment
 - Site safety practices and procedures

Health and Safety Management Program (2 of 4)

- Medical surveillance
 - The success of any medical program depends on management support and employee involvement.
 - NFPA 1582

Health and Safety Management Program (3 of 4)

- Medical surveillance
 - Pre-employment screening
 - Periodic medical examinations
 - Emergency treatment
 - Nonemergency treatment
 - Recordkeeping and program review
 - Critical incident stress



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Health and Safety Management Program (4 of 4)

- Critical incident stress
 - Although not an element of the medical surveillance program, critical incident stress should be recognized as an issue that can potentially impact the health and welfare of responders.

Personal Protective Equipment Program

- A comprehensive PPE program should include the following:
 - Hazard assessment
 - Medical monitoring of personnel
 - Equipment selection and use
 - Training program
 - Inspection, maintenance, and storage program

Site Safety Practices and Procedures (1 of 12)

- Safety is not simply an organizational rule or a government regulation.
- Safety is an attitude, a behavior, and a culture.
- Safety **MUST** be an inherent part of all operations from the development of SOPs to the selection and purchase of PPE.



Site Safety Practices and Procedures (2 of 12)

- Safety truths
 - “What occurs during the initial 10 minutes will dictate what will occur for the next hour, and what occurs during the first hour will dictate what will occur for the initial eight hours of the incident.”



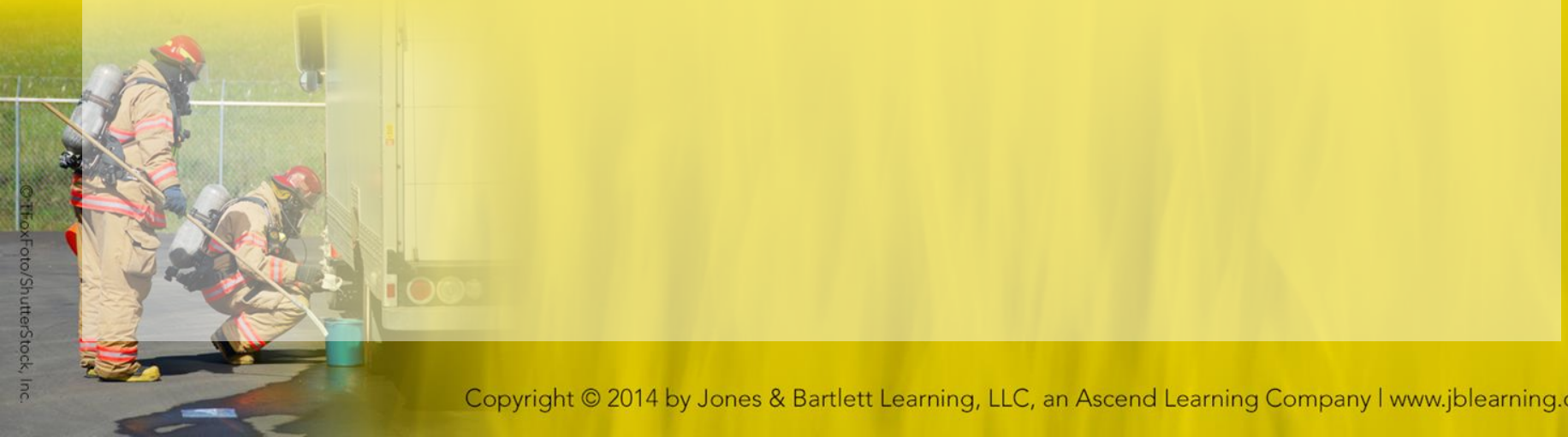
Site Safety Practices and Procedures (3 of 12)

- Safety truths
 - “There is nothing wrong with taking a risk. However, always remember that there are good risks and bad risks—if there is much to be gained, then perhaps much can be risked. Of course, if there is little to be gained, then little should be risked.”



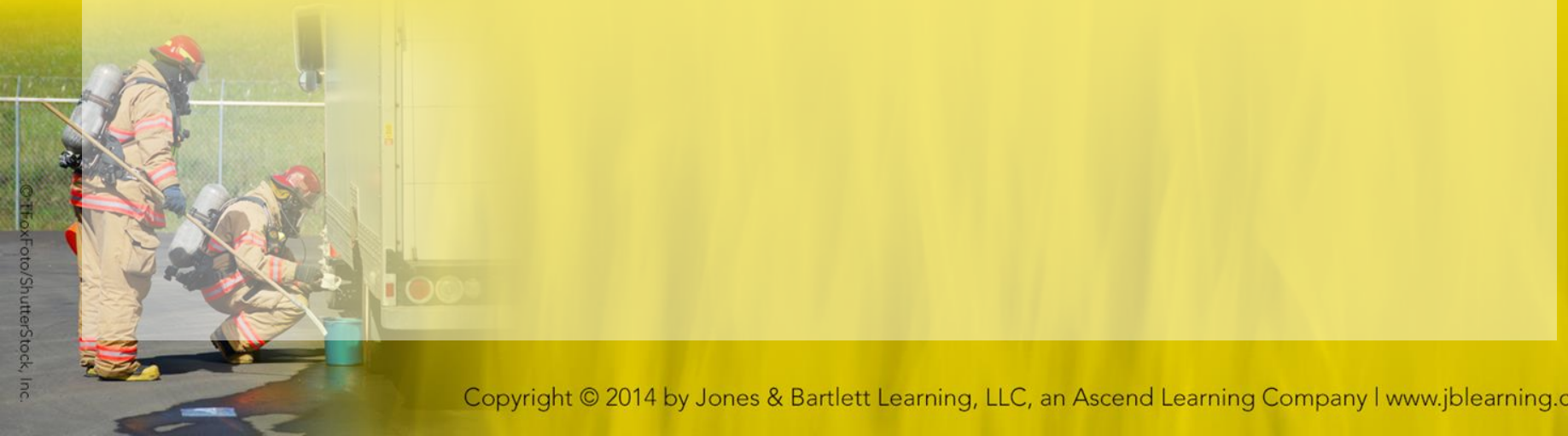
Site Safety Practices and Procedures (4 of 12)

- Safety truths
 - “Safety must be more than a policy or procedure... it is both an attitude and a responsibility that must be shared by all responders.”



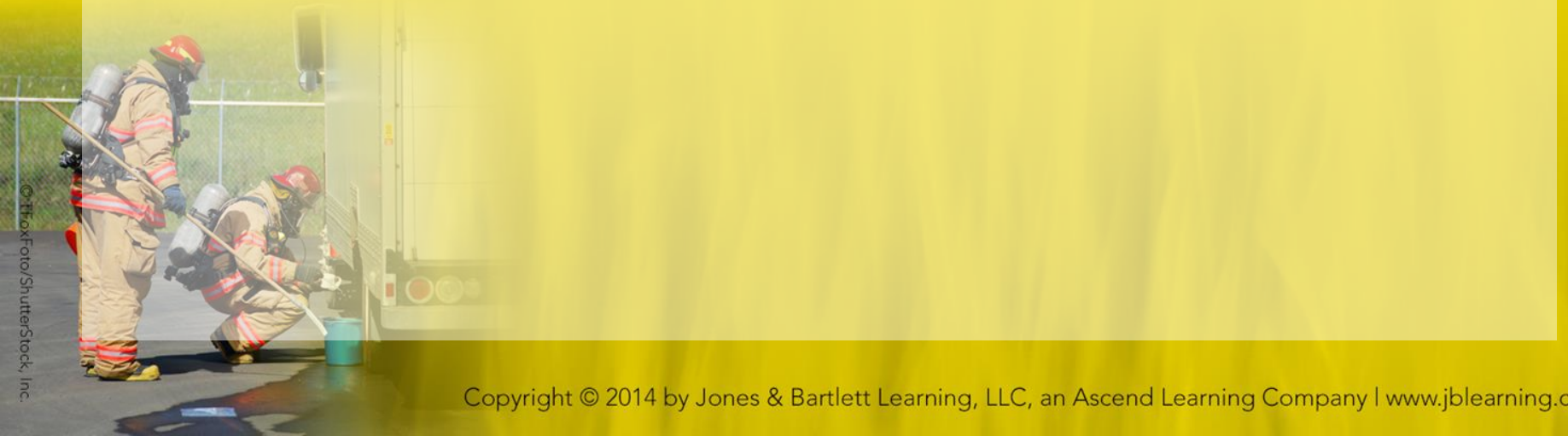
Site Safety Practices and Procedures (5 of 12)

- Safety truths
 - “Protective clothing is not your first line of defense but is your last line of defense.”



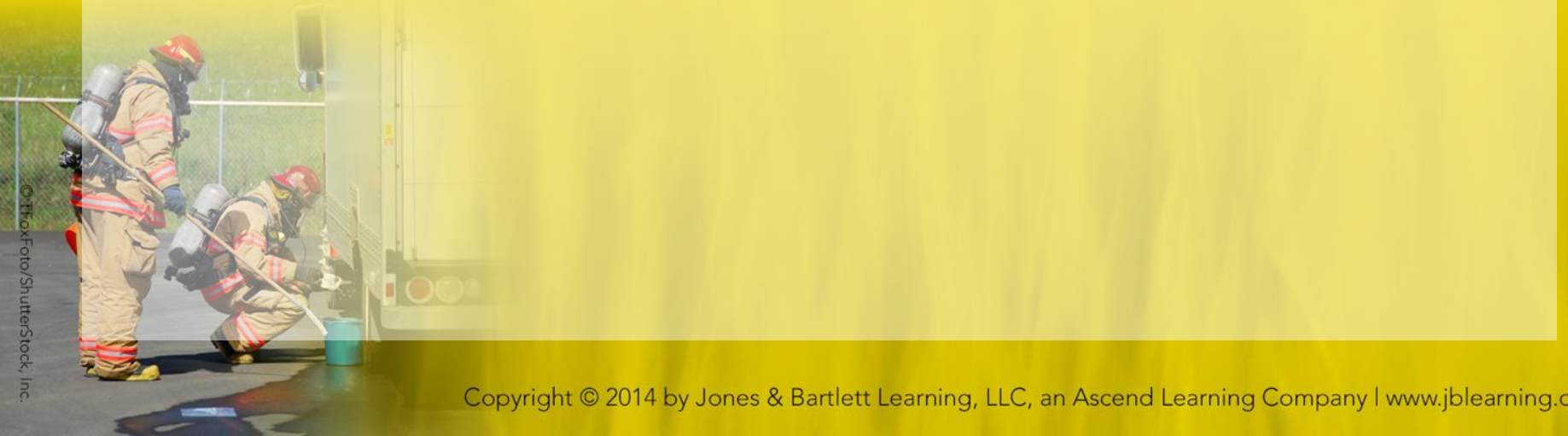
Site Safety Practices and Procedures (6 of 12)

- Safety truths
 - “Final accountability always rests with the incident commander.”



Site Safety Practices and Procedures (7 of 12)

- Site safety plan
 - Using operational checklists to meet the site safety requirements helps to ensure that specific organizational guidelines and SOPs are followed.



Site Safety Practices and Procedures (8 of 12)

- Safety officer and safety responsibilities
 - Overall site safety
 - Entry operations



Site Safety Practices and Procedures (9 of 12)

- Hazmat medical monitoring and support
 - Medical monitoring is defined as an ongoing, systematic evaluation of individuals at risk of suffering adverse effects of stress or exposure to heat, cold, or hazardous environments.
 - Obtain baseline vital signs.
 - Identify and preclude from participation individuals who are at increased risk.



Site Safety Practices and Procedures (10 of 12)



- Entry shall be denied if the following criteria are not satisfied:
 - Blood pressure
 - Pulse
 - Respirations
 - Body weight
 - EKG
 - Mental status



Site Safety Practices and Procedures (11 of 12)

- Other criteria:
 - Lungs
 - Nausea and vomiting, diarrhea, fever, or heat exhaustion within the last 72 hours
 - Use of medication
 - Heavy alcohol consumption within the previous 24 hours or any alcohol within the past 2 hours



Site Safety Practices and Procedures (12 of 12)

- Emergency incident rehabilitation
 - Incident scene rehabilitation (or rehab) is an excellent risk management tool.
 - Coordinating for EMS support, treatment, and monitoring
 - Responsible for providing food and fluid replenishment, mental rest, and relief from the extreme environmental conditions associated with the incident

Summary (1 of 4)

- Personnel protection is the number one priority at any hazmat incident.
- Chemical exposures and their health effects are commonly described as:
 - Acute
 - Chronic

Summary (2 of 4)

- The human body can be subject to seven types of harm events:
 - Thermal
 - Mechanical
 - Poisonous
 - Corrosive
 - Asphyxiation
 - Radiation
 - Etiological

Summary (3 of 4)

- Medical surveillance is the cornerstone of an effective employee health and safety management system and site safety practices and procedures.

Summary (4 of 4)

- The fundamental operating philosophy of every emergency response organization should be, “If we cannot do this safely, then we will not do it at all.”