NEW JERSEY HAZMAT EMERGENCY RESPONSE COURSE

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LEVEL 2 **COURSE NUMBER: 06009**

FIRST RESPONDER OPERATIONAL TRAINING

PRESENTED THROUGH:

NEW JERSEY STATE POLICE
OFFICE OF EMERGENCY MANAGEMENT
HAZARDOUS MATERIALS EMERGENCY RESPONSE PLANNING UNIT

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Edition 0201

PREFACE

The development and revisions of this course were the result of the efforts of many individuals. The New Jersey State Police, Office of Emergency Management, wish to thank the current members of the Technical Committee for their roles in the development of this course. (see Preface in student manual)

The New Jersey-New York Hazardous Materials Worker Training Center, a consortium comprised of several agencies both public and private, develop worker protection programs for those employees handling hazardous materials. This consortium receives partial funding through the National Institute of Environmental health Sciences (NIEHS). Additional funding for the OEM emergency response programs is provided by the Federal Emergency Management Agency (FEMA), and the U.S. Department of Transportation through the Hazardous Materials Transportation Uniform Safety Act.

Members of the Training Center:

New Jersey State Police Office of Emergency Management

New Jersey Department of Labor

University of Medicine and Dentistry of New Jersey

Hunter College

New York Committee for Occupational Safety and Health

University at Buffalo, SUNY

N.Y. District Council of Carpenters, Labor Technical College

LEVEL 2

FIRST RESPONDER OPERATIONS

MODULE 1 Introduction

MODULE 2 Understanding Basic Chemistry, Biological and Radiological Terms.

MODULE 3 Basic Hazard and Risk Assessment Technique.

MODULE 4 Personal Protective Equipment (PPE) Available to the First Responder.

MODULE 5 Health and Safety.

MODULE 6 Basic Hazardous Materials Control, Containment and/or Confinement Operations.

MODULE 7 Basic Decontamination Procedures.

MODULE 8 SOPs, Record Keeping and Termination Procedures

MODULE 9 Fire Fighting Foams

LEVEL 2: First Responder Operations

MODULE 1: Introduction

Time: 50 minutes

<u>Time Plan</u>

10 min.Welcome

10 min.The Role of the Operational Responder

5 min.The Basis of the Course Content.

10 min.Review of the Incident Command System

5 min.Summary

10 min.Administrative Matters

MODULE 1: INTRODUCTION

Slide 1-1 First Responder Operations

Welcome the students and acknowledge the facility.

Introduce instructors.

Ask the students to introduce themselves and give a brief statement as to what they expect from this course.

Refer to Preface in the student manual for modular

Explain that this course consists of eight stand alone modules. This course can be initially presented as an eight hour course or broken up into modules for evening or weekend presentation. After the initial training the modules can be used seperately for refresher training. Each module, including this one, has learning objectives.

Slide 1-2 Knowledge Survey

Ask students to complete the 15 question knowledge survey in the front of the manual (pp 13-15). Emphasize that this "test" will NOT be graded. It is only used to sensitize them to the material that will be discussed in the course and to stimulate discussion.

PRE-TEST ANSWERS:

1. OSHA has defined the actions of "first responder - operations" (which would include firefighters, some police officers, EMS personnel and industrial spill teams) as:
C. Containing the spill and minimizing harm to people and environment.

2. The three preferred methods of protecting responders at hazmat incidents are:
B. Time, Distance and Shielding

3. The _____ is the temperature to which a material must be heated to produce enough vapor for sustained combustion.
A. Fire point

4. The _____ is the temperature to which a liquid must be heated to produce a vapor flash if an ignition source is present.
B. Flash point

5. A pan of oil, left on an electric range where there is heat but no apparent spark or flame, which suddenly bursts into flames is an example of:
C. Auto-ignition

6. Which emergency response guide (in the NAERG) should be used when the material

cannot be identified?
A. Guide # 111

7. When attempting to control and extinguish a fire involving flammable hydrocarbon fuels that don't mix with water, the best agent to use is:
C. Mechanical foam

8. Sodium metal is an example of which of the following hazard classes:
D. Class 4, Division 4.3

9. An MC 306 non-pressure liquid carrier...usually transports:
A. Alcohol, gasoline, fuel oils, combustible liquids

10. Pale, cool, moist skin, heavy sweating, dizziness, nausea, and fainting are signs and symptoms of:
D. Heat exhaustion

11. Liquid nitrogen would most likely be transported in what specification cargo tank?
D. MC-338

12. While in transit, shipping papers must be kept:
D. In the vehicle's cab within reach of the driver while wearing a seatbelt.

13. A flammable material with a wide flammable range... is _____ than a material with a small flammable range.
B. Easier to ignite

14. The percentage of vapor needed in the air for combustion is called the explosive limit, and is also known as the:
B. Flammable range

15. Any liquid that spontaneously ignites in the air at or below 130oF is:
B. A flammable liquid

Slide 1-3 Introduction / Objectives Pg 21

This modules objectives state that after it is presented you will be able to:
(refer to student manual page 21)

1. describe the modular nature of the course and the two ways that it can be presented.

2. describe the role of the operational responder.

3. list the two sources that the course content was based on.

4. describe the six competencies required by Federal OSHA and the seven

competencies required by the National Fire ProtectionAssociation.

5. list the amount of initial and refresher training required by Federal OSHA.

6. describe the elements of the Incident Command System.

Slide 1-4 - Competencies required under OSHA

At a hazardous material incident, the Operational responder is part of the initial response to protect nearby

refer to SM page 22 section ii

persons, property or the environment from the effects of a release. They respond in a defensive fashion. This means that they should try to contain the release from a safe distance to keep it from spreading and prevent exposures.

Slide 1-5 Defensive vs. Offensive Actions

Remember Defensive operations mean that there is no contact with the hazardous material.

refer to Defensive - Offensive operations in the student manual page 23

The First Responder Operational person just doesn't have the equipment to safely respond Offensively.

WHERE DOES THIS POLICY COME FROM?

NFPA & OSHA

The National Fire Protection Association and the Federal Occupational Safety and Health Administration.

The NFPA published a standard on the Professional Competence of Responders to Hazardous Materials Incidents and Federal OSHA passed a law based on that standard. The law and standard established levels of responder training which require certain competencies at each level.

The competencies required at this level will allow the operational responder to fulfill the role we just described. The content of this course is based on those competencies.

NFPA 472

Explain the training requirements of NFPA 472 for First Responder Operational.

refer to student manual page 24 & 25

-awareness training a prerequisite

-go over the NFPA goals (a) thru (g)

(a)The ability to make initial basic hazard and risk assessment;

(b)The ability to determine when the personal protective equipment provided to the first responders by the authority having jurisdiction for use in their normal response activities is adequate for a particular hazardous materials incident, and the ability to use that equipment properly;

(c)An understanding of basic hazardous materials terms;

(d)The ability to perform hazardous materials control operations within the capabilities of the resources and personal protective equipment available;

(e)An understanding of decontamination procedures;

(f)The ability to perform basic record keeping tasks; and

(g)The ability to expand the Incident Command System.

OSHA 29CFR 190.120

Explain the training requirements in OSHA's Final Rule for First Responder Operational.

refer to student manual page 22

- awareness training or demonstrated competence a prerequisite.

- go over OSHA's first responder operational competencies (A) thru (F)

(A)Knowledge of basic hazard and risk assessment techniques.

(B)Know how to select and use proper personal protective equipment provided to the first responder operational level.

(C)An understanding of basic hazardous materials terms.

(D)Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.
(E)Know how to implement basic decontamination procedures.

(F)An understanding of the relevant standard operating procedures and termination procedures.

Annual refresher training or demonstration of competence is required in addition to the initial eight hours.

Record Keeping
When the lead instructor returns the training support package to the county he will give the coordinator the necessary paperwork to be forwarded to the University of Medicine and Dentistry who will enter the records into a computer. The NJSP OEM will issue the certificates.

Have students go over the copy of the training registration form and answer all questions.

Administrative matters

-assist students in filling out the registration form
-explain break procedure
-explain the facility layout
-explain meal procedure

Slide 1-6 The Incident Command System

In Awareness training you were given an introduction to the ICS. As an operational responder you will need to have a more in-depth understanding of it.

See SM page 25

Slide 1-7 The Features of the ICS

Adaptability
Flexibility
Span of Control
Unity of Command

Go back over the main points covered

LEVEL 2:First Responder Operations

MODULE 2:Understanding basic Chemical, Biological, and Radiological Terms.

Time: One Hour

Time Plan:

5 minutesWelcome

15 minutesBasic classes of hazardous substances:

30 minutesPhysical properties (NFPA 472)

10 minutesRadiation

MODULE 2: CHEMISTRY

Slide 2-1CHEMISTRY MODULE

Introduction:
At the operational level, we are trying to give students practical information that they need to deal safely and defensively with hazardous material incidents. At this point, we don't want to burden them with too much detail or theory.

Slide 2-2 Objectives

Refer students to the outline and objectives in their guide PAGE 29.

1)Define the following eight basic chemical and physical properties:

- boiling point
- flash point
- flammable (explosive) limits
- ignition (autoignition) temperature
- specific gravity
- vapor density
- vapor pressure
- water solubility

2)Use knowledge of physical properties to determine the actions of a material in a haz mat incident given a specific incident.

3)Differentiate among alpha, beta, and gamma particles and rays on the basis of their penetration and the protection required to deal with them.

4)Define the following terms:

- radioactive contamination
- half-life
- radioactive exposure

5)Describe how time, distance, and shielding can affect exposure to radioactive contaminants.

HAZARDOUS SUBSTANCES:

Functional Classification: Every time you respond to a hazardous material incident, you are dealing with a list of hazards to your life and health. Hazardous materials will either blow you up, burn you, asphyxiate you, infect you, irradiate you, poison you, or freeze you. There are many sources of information to help in classifying the hazards you may face in the field.

Slide 2-3 Basic sources of hazard to the Emergency Responder: FUNCTIONAL

The general sources of hazards are:
Physical - slip/trip/fall accidents are still the most likely source of injury at a hazmat site
Chemical - hazardous materials - of course
Biologic - (Etiologic agents) - "Universal Precautions" will be effective against bloodborne pathogens (OSHA 29 CFR 1910.1030) but remember that the most common biologic hazards to the first responder are stinging insects and poison ivy.
Radiologic - New Jersey is a leading producer of radioactive isotopes used for medical treatments and research. These materials are often moved by commercial transport vehicles that are usually not placarded.

These four categories can be used to describe the hazards at ANY worksite.

Slide 2-4 Problems associated with chemicals: Pg 30

Generally, we can classify the chemical hazards you may face on a functional basis. If you remember the basic dangers you face and plan how to avoid them, you are on your way to the safe conclusion of an incident.

Fire
Explosion
Reactions
Corrosives
Toxicity
Radiation

Explosives are materials such as TNT, blasting caps, or nitrates used in the manufacture of fertilizers.

Flammable substances
include organic solvents, finely divided metals and powders, some classes of fibers, textiles, or plastics, and chemicals that evolve or absorb oxygen during storage (oxidizers) and constitute a fire hazard.

Materials in which dangerous heat buildup occurs during storage
Heat buildup occurs as a result of either oxidation or microbial action. Examples are fish meal, wet waste papers, and other organic waste material.

Oxidizer exposure
Materials such as hydrogen peroxide are a subclass of flammable substances. They release oxygen and produce heat on contact with organic substances thus constituting a fire hazard. Organic peroxides are a combination of oxidizer and organic substance; they may burst into flame upon exposure to air or light.

Asphyxiation

Asphyxiants are materials that deprive body tissue of oxygen. Their action can be simple or chemical.

Toxic Effects (Poisoning)
Toxic materials are drugs, chemicals, and natural or synthetic products that are in any way harmful to life or health. Some terms that you should be familiar with when discussing toxic materials are:

(These terms are defined in the student manual; NJRTK requires us to review them with the students) page 31	Toxicity Acute/chronic effects Local/systemic effects Carcinogens Mutagens Teratogens

Biological hazards
or
Etiologic agents
are living germs and viruses or the toxins they produce that can cause human disease.

Radiation
Materials that emit ionizing radiation.

Corrosives
(a pH scale with some common substances is in the student manual)Corrosives can be either acids or bases (caustics). The **acidity** or **basicity** of a substance is measured by pH. A pH of 7 is neutral (neither acidic or basic); a pH less than 7 is acidic; and a pH higher than 7 is basic.

Cryogenic exposure
Cryogenic materials are extremely cold materials like liquid oxygen or nitrogen. They have temperatures below -130 degrees Celsius.

Slide 2-5 Physical Properties

PHYSICAL PROPERTIES OF HAZARDOUS SUBSTANCES:

Before we go further with this discussion, there is some basic terminology that we should review. These terms will help us understand the information that we will find in other sources.
(Eight definitions required by NFPA:)

Slide 2-6 Pg 32

Density Density is the mass per unit volume of a substance. It is usually expressed in grams per cubic centimeter (g/cc). The density of water is 1g/cc since 1cc has a mass of

1g.

Vapor density (VD) Whether a material sinks or rises in air will affect your incident control strategy.

Propane (found in Barbecue grills) is heavier than air. If it leaks out of the grill and is near an open basement window, it may flow in through the window and, once it fills the bottom of that space, and reaches the level of an ignition source (like the pilot light of a gas powered water heater) it will ignite and burn the house down.

Slide 2-7 thru 2-9

Specific gravity Knowing if the substance sinks or floats in water will help determine your containment strategy.

Slide 2-8

Water, poured on a low SG material, will sink through it and fail to extinguish a fire. Of course, if it is sprayed or thrown on, it can splash the burning product around and spread the fire.

Slide 2-9

Water, poured on a high SG material will float on it and may smother a fire. Remember that there are other factors at work here; type of containment, method of application (avoid splashing) etc.

Slide 2-10

Vapor pressure Higher VPs (approaching 760mm Hg) indicate a volatile substance and suggests that there will be high concentrations in the air at an incident involving that substance. Vapor pressure generally increases as a substance is heated.

As an aside; atmospheric pressure varies with altitude. The higher you go, the less pressure, so chemicals boil at lower temperatures at higher altitudes and at higher temperatures at low altitudes. The variation isn't enough to significantly affect us in New Jersey.

Slide 2-11
As a "rule of thumb":
Low volatility is <10 Vpress.
Moderate volatility is 10 - 100 Vpress.
High volatility is >100 Vpress.

Low volatility suggests that most of the product will still be in liquid form when responders arrive on scene. Moderate volatility - there should be an airborne release

hazard with a significant product “reservoir” to maintain the hazard. High volatility - a lot of product will be in the air.

Slide 2-12

Boiling point (BP) Boiling point is just a specific case of dealing with vapor pressure. It is the temperature where the vapor pressure of a liquid equals the pressure exerted by the surrounding atmosphere. This is why water boils at a lower temperature is Denver, CO that it does in Atlantic City. Less atmospheric pressure as altitude increases.

Slide 2-13

Flash point (FP) This is only a flash, not a sustained fire. As a rule of thumb, the lower the FP the more volatile the substance.

Ignition temperature (Also Called the Auto ignition temperature) The minimum temperature required to initiate self-combustion of a material or compound.

Slide 2-14

Flammable (explosive) limits The highest and lowest concentrations of a substance that can explode or burn. In this chart we plot the concentration of TOLUENE in an air sample Vs the oxygen that it displaces. At the lower left of the chart, toluene = 0% and oxygen = 20.8%. When toluene conc. is increased to 0.01%, oxygen is depressed to 20.79%, not enough of a change to register on the average oxygen meter.
As Toluene conc. is increased to its IDLH conc (0.2%), oxygen is depressed to 20.75% - still within the OSHA defined range for breathing air (19.5-23.5%).

Even when the concentration of toluene is increased to the lower explosive limit (LEL) of 1.2%, the oxygen conc. is still within the breathable range (20.55%)

The warning beeper on your oxygen meter will not alert you to a problem until the oxygen conc. reaches 19.5% and the toluene conc. is well within its flammable range of 1.25 to 7.1%.

The point here is that an oxygen meter alone is not enough to alert you to problems in the air. A multi-meter (like a CGI) will simultaneously monitor the presence of oxygen, flammable products and one or more specific toxic materials in the area where you are working and warn you if ANY of them reaches a concentration that should concern you.

Water solubility The solubility of a substance will affect your situation control strategy.

Slide 2-15 THRU 2-17

pH - stands for “potential Hydrogen” - a measure of the free (chemically active)

hydrogen ions in a solution. The scale is logarithmic - that is - each number is 10x more or less than the one before it. 7 is considered neutral, more than 7 is basic (alkaline), and less than 7 is acidic.

Slide 2-18 Expansion Ratios

Simply put - if you store a gas in a container at greater than atmospheric pressure - when you release it, it re-expands and occupies more space. A LOT more space.

Slide 2-19 thru 2-23 Expansion of heated liquids

If you heat a liquid, it expands according to a general formula.

$$V2=(((T2-T1) \times C) V1) + V1$$

Where V1 is the initial volume, V2 is the final volume, and T1 and T2 are the beginning and final temperature of the product. C is the coefficient of expansion (different for each chemical and different for Fahrenheit or Celsius temperature)
Read the formula as: the final volume of the product is equal to the change in temperature times its coefficient of expansion times the initial volume plus the initial volume of the product. Simple, neh?

Slide 2-24

Toxicology is the study of the effects of hazardous materials on living organisms. It is based on the assumption that there is a relationship between the dose (amount) of an agent and the response of the exposed individual.

You will depend on data published by various groups to determine what a “safe” exposure level is to different chemicals. Chiefly, you will look to the publications of the American Conference of Governmental Industrial Hygienists (ACGIH), the National Institute of Occupational Health Sciences (NIOSH) and the Occupational Safety and Health Administration (OSHA). All three groups publish data concerning the “...time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.” but they derive their numbers by differing means.

The ACGIH bases their **TLV-TWA** (Threshold Limit Values-Time Weighted Average) numbers based on studies of worker’s diseases in typical industrial environments. The **TLV-STEL** (Short Term Exposure Limit) is the concentration that that workers can endure for short periods (four 15 minute exposures per day with an hour rest in between) provided the **TLV-TWA** is not exceeded. The **TLV-C** (Ceiling) is the concentration that should not be exceeded at any point during the work day.

NIOSH publishes a book of RELs (Recommended Exposure Limits) for workers based

on laboratory studies with animals. The **REL** is an eight hour average exposure (TWA) just like the TLV. You will also find references to **IDLH** (Immediately Dangerous to Life or Health) concentrations, a concentration that will cause irreversible health effects or escape impairing symptoms in 30 minutes.

OSHA determines the **PEL**s (Permissible Exposure Limits), the legal requirement for workplaces based on data collected from all published sources and factoring in the cost of compliance and publishes the resulting numbers as 29 CFR 1910.1000.

Slide 2-25 Median Lethal Dose

Toxicity data for new chemicals is usually obtained in the laboratory by administering the chemical to lab animals. Two of the numbers that come out of the statistical analysis of the data obtained are:

LD50 - the dose expected to be lethal to 50% of an experimental group

LC50 - the airborne concentration expected to be lethal to 50% of an experimental group exposed for a specified time period

Slide 2-26 Median Lethal Dose & Dose / Response Curve

The LD and LC numbers provide an index of comparative toxicity for a chemical. Animal data provides information on effects that can be expected in humans and is often the only data available.

The slope of the curve (dose-response curve) plotted from the MLD (Minimum Lethal Dose) to LD100 (100% Lethality) suggests the range between the no-effect level and absolute lethality. That range is referred to as the margin of safety. If the dose-response curve is steep, the margin of safety is small.

Slide 2-27 Extremes of Toxicity

LD values are expressed as a ratio: grams of product to Kilograms of body weight. The larger this number, the smaller the problem you have. For example, the LD50 of saccharin, the artificial sweetener, is 2000g/Kg (or 2Kg/Kg). This means that the median lethal dose is roughly twice your body weight. By comparison, the LD50 of sarin (neurotoxin) is about 0.01mg/Kg or 1/100,000 of your body weight. In other words, a pile of saccharin won't cause much of a problem but a drop of sarin will kill.

LC values (airborne hazards) are usually reported as ppm (parts per million in the air) or mg/m3 (milligrams in a cubic meter of air). Again, the larger the number, the less toxic the product. The conversion equations are:

TLV in mg/m3 = {(TLV in ppm)(gram molecular wt of substance)}/24.45

TLV in ppm = {(TLV in mg/m3)(24.45)}/(gram molecular wt of substance)

Toxicity is a major factor determining the hazard and risk associated with a substance. Toxicity is the level of a material's ability to cause injury to living tissue in a given situation. It is dependant on the route of exposure, metabolization, excretion and speed of action. These factors affect how quickly the material will build up in the body and how long it will stay there.

An emergency responder's exposure to a hazardous material may occur as an acute, chronic or subacute dose. The size of the dose will be affected by the physical characteristics of the substance.
Acute toxicity is the sudden onset of symptoms after short term exposure. Often reversible in 24 hours.

Chronic toxicity is long or permanent duration effects or symptoms. Local toxicity refers to symptoms that show at the site of exposure. Systemic toxicity refers to absorption and transport via bloodstream to a susceptible or "target" organ.

TERMS TO DESCRIBE TOXICITY: HOW POISONOUS IS IT?

COMMON TERM LD (SINGLE ORAL DOSE FOR RAT) g/Kg VAPOR EXPOSURE (30-60% LETHAL IN 6-RAT GROUP) PPM LD (SKIN EXPOSURE IN RABBITS) g/Kg PROBABLE LETHAL DOSE IN HUMANS Extremely Toxic 0.001 or less <10 0.005 or less Taste (1 grain) Highly Toxic 0.001 - 0.05 10 - 100 0.005 - 0.043 1 tsp (4cc) Moderately Toxic 0.05 - 0.5 100 - 1,000 0.044 - 0.340 1 oz (30g) Slightly Toxic 0.5 - 5.0 1,000 - 10,000 0.35 - 2.81 1 pt (250 g) Practically Nontoxic 5.0 - 15.0 10,000 - 100,000 2.82 - 22.6 1 qt Relatively Harmless 15.0 100,000 22.6 1 qt

To complicate the issue, two or more chemicals can interact with each other once they enter your body. That interaction can take one of the following forms:
- Synergists - combined toxicity is greater than the additive effect
- Potentiation - chemical with no particular toxicity that increases the toxicity of another
- Antagonistic - Chemical that diminishes the toxicity of another

Topical and inhalation are the two most common exposure routes in industrial settings with "contact dermatitis" (skin irritation or damage) being the most prevalent chemically induced disease in the workplace. In other words; people forget to wear their protective gloves and get stuff on their hands.

As a rule-of-thumb;
LD(skin) = 10XLD(oral) = 100XLD(intravenous).
Where LD(skin) = LD(oral) = LD(iv); the material is EASILY skin absorbable.

Slide 2-28
Your total exposure to a chemical in the air can be expressed by the formula:

$$TWA = [(C1XT1)+(C2XT2)+(C3XT3)...]/8$$

Where Cn is the measured concentration of a substance, Tn is the time you are exposed and “8" is a typical 8-hour work shift.

The concentration of substance in a work environment can vary significantly during the work day. We are concerned about several measurements:
IDLH - Immediately Dangerous to Life or Health - An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere. [29 CFR 1910.120]
PEL - Permissible Exposure Limit - Legislated by OSHA, PELs are regulatory limits on the amount or concentration of a substance in the air. They may also contain a skin designation. PELs are enforceable. OSHA PELs are based on an 8-hour time weighted average (TWA) exposure.

Slide 2-29 Exposure Limits

Three exposure limits are commonly cited:
TLV - Threshold Limit Value - published by the ACGIH
REL - Reccommended Exposure Limit - Published by NIOSH
PEL - Permissible Exposure Limit - Published by OSHA

CATEGORIES OF TOXIC MATERIALS

Toxic materials can be sorted in to categories according to their general effects. As you look up information on various chemicals there are other terms you must bear in mind in order to reasonably assess the risk you are facing.

Irritants are those corrosive materials that attack the mucous membranes of the body. They can also be fatal if encountered in high enough concentrations.

> **Water-soluble irritants** are very soluble in water and will dissolve in the first moisture they encounter, usually the eyes, mouth, nose and upper respiratory tract. They include: halogen acid gases (HCl, HF, HBr, HI), sulfur dioxide (SO_2) and ammonia (NH_3). Although these substances are considered “nonflammable by DOT, ammonia will burn at concentrations of 16% - 25% in air.

Moderately water soluble irritants do not dissolve as readily in water so their effects are felt further down that respiratory tract, in the upper respiratory tract and the lungs. They include the halogens (F_2, Cl_2, Br_2 & I_2), ozone (O_3), phosphorus trichloride (PCl_3) and phosphorus pentachloride (PCl_5).

Slightly water soluble irritants affect the lungs and destroy the alveoli by chemical action. They can be fatal with delayed effects (4-48 hours) in high concentrations. They include oxides of nitrogen, phosgene ($COCl_2$) and trichloroethylene (C_2HCl_3).

Slide 2-30

Asphyxiants are substances that interfere with the oxidation process in living tissue.

Simple asphyxiants are materials that may not be toxic of themselves but will kill you by displacing air and the oxygen you need to breath. The most common is carbon dioxide (CO_2). While carbon dioxide is considered mildly toxic, it usually causes death by acting as a simple asphyxiant. It is heavier (Vden about 1.5) than air and will accumulate in low-lying areas, especially below-grade rooms and basements. The noble gases and saturated hydrocarbon gases and vapors can also act in this mode.

Blood asphyxiants are materials that combine with red blood cells and render them incapable of transporting oxygen to the cells of your body. The most common blood asphyxiant is carbon monoxide (CO) which binds to hemoglobin 250 times more strongly than oxygen. Two other examples are aniline ($C_6H_5NH_2$) and nitrobenzene ($C_6H_5NO_2$). Both are toxic by inhalation, ingestion and absorption.

Tissue asphyxiants are carried by the blood cells to the cells of the body and render them incapable of ever accepting oxygen. The most common is hydrogen cyanide (HCN). HCN is produced when plastics and organic materials are burned.

Respiratory paralyzers are materials that affect the respiratory nervous system and stop your breathing. The most common is hydrogen sulfide (H_2S) which first, paralyzers the olfactory nerves (so you cease to smell its characteristic rotten-egg odor) then paralyzes the nerves controlling your breathing. Other respiratory paralyzers include carbon disulfide, and materials having narcotic or anesthetic effect like acetylene, ethylene, diethyl ether, acetone and ethyl alcohol.

Slide 2-31

Systemic poisons are materials that interfere with any vital bodily process. They can be separated into groups according to their “target organs”.

Liver and kidney poisons (hepatotoxins and nephrotoxins) include arsenic, heavy metals and halogenated hydrocarbons.

Bone marrow poisons affect the marrow’s ability to produce red blood cells resulting in anemia or, if acting as carcinogens, leukemia. Benzene is the most common bone marrow toxin and has been identified as a human carcinogen. It is commonly found in gasoline. Other suspected bone marrow toxins are toluene, xylene and naphthalene.

Muscle poisons attack muscle tissue causing spasms. Strychnine is the muscle toxin you will generally encounter. It has no use except as a poison and causes muscle spasms severe enough to break most of the victim’s bones before death ensues.

Nerve poisons (neurotoxins) interfere with nerve impulses. The largest group of neurotoxins are the organic phosphates, commonly used in pesticides, carbon disulfide (also a respiratory paralyzer) and methyl alcohol (wood alcohol - specifically attacks the optic nerve).

RADIOACTIVITY:

Slide 2-32 Radiation Pg 35

Radioactivity Ionizing radiation can be either particles or pure energy.

Radioactive substances are materials whose atoms have an unstable nucleus. There are two general types of radioactive substances; those with induced radioactivity and naturally occurring radioactive substances. In either case, the atoms of the substance emit particles and energy to attain a stable state.

DECREASING EXPOSURE TO RADIOACTIVE CONTAMINANTS

Time: The amount of time you spend in proximity to a radioactive source affects the amount of radiation your body absorbs. Less time = less absorption. Time of exposure can be limited by adjusting work schedules.

Distance: The farther you are from a radiation source, the less radiation your instruments will find. Distance can protect you from exposure. This is the "Inverse Square Law". Concentration varies with the square of the distance.

Shielding: Different types of radiation require different types or thickness of shield. Shields can be obtained in the form of "portable" walls, transparent plastic windows, or lead-lined clothing. A health physicist will determine what type of shielding is appropriate to a site given the radiation source and the time that workers will be exposed.

Slide 2-33 Shielding and types of radiation pg 36

Particles and rays are, generally, emitted in three forms during radioactive decay; alpha and beta particles, or gamma rays.

Alpha particles are, essentially, helium nuclei (two protons and two neutrons) that have been stripped of their electrons. They are massive and travel only three or four inches from a radioactive source. Alpha particles can be stopped by several sheets of paper.

Beta particles are more energetic and less massive than alpha particles. They can be either electrons, carrying a negative electrical charge, or positrons, carrying a positive charge. Beta particles can travel up to one hundred feet from their source and can penetrate firefighter's turnout gear. They can be stopped by one millimeter of aluminum.

Gamma rays or **photons** are not particles but are a form of pure energy. They are like X-rays and can travel great distances from their source. Gamma rays can only be ATTENUATED by three inches of lead. We measure these particles and rays (radiation) in terms of roentgens, rads, and rems.

Radioactive Contamination
Radioactive contamination is the presence of undesired radiation. It can occur in several ways:

Radioactive dust from a site can settle and adhere to your equipment or body exposing you to radiation. This dust can usually be removed by washing.

If you are not wearing properly selected respiratory protection, there is a chance that you may inhale some of this dust. If radioactive dust becomes lodged in your lungs it can be a serious health problem.

Slide 2-34 Half-life **Pg 35**

Half-life (**t**1/2) is an expression of the rate of radioactive decay. The half-life of a substance is the time it takes for half of a given quantity to decay.

Natural radioactivity refers to the decay of naturally occurring unstable isotopes.

Slide 2-35 & 36

This information is available from numerous printed manuals, computer programs and the internet.

Examples::
NJ DHSS (Dept. of Health and Senior Services) Fact SheetsMSDS (Material Safety Data Sheets)
Merck Index
Hawley's Condensed Chemical Dictionary (Sax & Lewis)
Hazardous Chemicals Desk Reference (Sax & Lewis)
Emergency Handling of Hazardous Materials (AAR)
Handbook of Toxic and Hazardous Chemicals and Carcinogens (Sittig)

<u>Some Useful Websites:</u>
CAMEO and the associated county maps can be downloaded for free from the web.
http://response.restoration.noaa.gov/cameo/toolkit.html
CAMEO stands for: Computer Aided Management of Emergency Operations. It's worth the time it takes to download.
NIOSH Pocketguide Online: http://www.cdc.gov/niosh/npg/pgdstart.html
CHRIS Manual online: http://www.chrismanual.com/
NJ Right to Know Hazardous Substance Fact Sheets:
http://www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm

Emergency Response Guidebook: http://hazmat.dot.gov/gydebook.htm
OSHA Homepage: http://www.osha.gov/

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McGraw-Hill Book Co.
New York, NY

DHSS Hazardous Substance Fact Sheets
DHSS RTK Project
CN 368
Trenton, NJ 08625

General College Chemistry-5th ed.;1976,Charles W Keenan, Jesse H. Wood, Donald C. Kleinfelter
Harper & Ron; Publishers
New York, NY

Genium Publishing Corporation: Source for generic MSDSs
P.O.Box 1436
Schenectady, NY

Hazardous Materials Training Handbook; David Shafer
BLR
64 Wall Street
Madison, CT

Living Chemistry; 1977, David A. Ucko
Academic Press Inc.
111 Fifth Ave
New York, NY

Right To Know Training Manual
New Jersey Department of Environmental Protection
CN 408
Trenton, NJ 08625

MODULE 3: Basic Hazard and Risk Assessment Techniques

Time: 2 hours 30 minutes

Time Plan

30 min.Introduction

20 min.Assessing the Hazards & Risks

40 min.Identifying Hazardous Materials

30 min.Identifying Haz Mat Characteristics
& Behavior

30 min.The DECIDE Process

MODULE 3: BASIC HAZARD AND RISK ASSESSMENT

Slide 3a-1: Basic Hazard and Risk Assessment

Slide 3a-2: Objectives

The student will be able to:

1.Describe the purpose of Hazard Risk Assessment.

2.Differentiate offensive and defensive actions, given several scenarios.

3.List and describe the six clues for detecting the presence of hazardous materials.

4.Describe the characteristics that make up the United Nations classification system.

5.List four reference publications readily available to first responders.

6.State two reasons for using 3 references to identify the properties of hazardous materials.

7.List and describe the four factors effecting the behavior of hazardous materials.

8.List what each letter in the D.E.C.I.D.E. process means.

9.Determine the level of an incident, using the Planning Guide Chart, given several scenarios.

10.Use techniques outlined in this module to develop an initial defensive action plan, given a scenario.

Hazard and risk assessment is a process of detecting and identifying hazardous materials, obtaining information on the properties of the material in order to predict and slide a likely outcome of an incident and using this information to formulate an initial defensive action plan.

Slide 3a-3 Define Hazard Assessment

Hazard/Risk Assessment consists of
(1) obtaining information on Hazardous Materials, population density, and environmental sensitive areas
(2) mapping the data collected
(3) determining the types of hazards present
(4) identifying vulnerable areas and
(5) calculating the risks.

Slide 3a-4 Risk Assessment

Assessment of the Risks

The collected data determines the risk factors:

What are the chances of an incident in the future?
Have there been incidents in the past?
How can we minimize the risks?
*pre-plans
*law enforcement

Slide 3a-5 Purpose of ID **The Purpose of Identification is to:**

Identify the specific name of the material,

Determine the hazards and risks associated with the release,

Help in determining the likely outcome, and;

Predict likely harm without intervention.

Discuss some important points about the identification process.

Slide 3a-6Three Points **Remember three important Points:**
Ask for the information you need.

REMEMBER...You must ask for the information you need. Realize the need for information long before anyone else does. Do not wait for outsiders to contact you. Know where to go to get the needed information.

You need to get some information before other sources can give you more.

You need to know how to use the information defensively.

Information may confuse you if you do not know how to use it. Events analysis helps you figure out how to put new information to work as fast as you can get it. Look for information that helps you estimate likely harm without intervention.

Slide 3a-7 DEFENSIVE VS. OFFENSIVE ACTIONS
"Defensive" is no contact with the product.
"Offensive" means that there is the strong potential for contact with the product.
Emphasize that Awareness AND Operations trained personnel should only conduct "Defensive" actions against hazmat incidents.

Slide 3a-8 DECIDE The D.E.C.I.D.E. Process
Student Manual pg 79

(D)etect Hazardous Materials *identification is critical to protection
(E)stimate The Likely Harm Without Intervention

(C)hoose Response Objectives
(I)dentify Action Options
(D)o the best Option
(E)valuate Progress

Basically, determine that you're dealing with hazardous materials, ask what will happen if you isolate the area and let the incident play itself out. If the results of a hands-off response are unacceptable, identify your objectives (goals) and determine the actions required to bring them about. Then perform the actions you deem appropriate and STEP BACK PERIODICALLY TO DETERMINE IF YOU'RE MAKING THE INCIDENT BETTER OR WORSE.

Slide 3a-9 Where to begin?

FIRST - DETECT THE PRESENCE OF HAZARDOUS MATERIALS USING THE SIX CLUES:

Occupancy/location - Whose property is it on? What kind of business do they run? What chemicals do you expect to find there?
Container shapes - What is the container shaped like? Does this give you a clue about the type of product contained?
Marking/colors - Is there a legislated marking system being used? Is there a marking system unique to this site?
Placards/labels - Are UN placards being used? Is RTK labeling observed?
Shipping papers - Are shipping papers available or can they be retrieved from the vehicle without risk?
Senses - If you can smell it, you're being exposed. Don't lead with your nose but pay attention to the symptoms and observations of victims on the scene.

Slide 3a-10 OCCUPANCY/LOCATION (1) Pg 45

Where is the incident taking place? - What chemicals do you normally expect there?

Slide 3a-11 Fixed Facilities

REVIEW CHART FOUND ON PAGE 44 IN Student Manual.

Types of facilities, types of transportation tend to have characteristic accident histories. What is the accident history for businesses and transportation in your jurisdiction?
Slide first shows an oil refinery - petroleum products.
next click shows a picture of a chemical plant - storage tanks, MC-307 tank truck, pipes. Note that the unjacketed mc 307 (DOT 407) looks a lot like an mc 312 (DOT 412) at a glance. The 307/407 has unloading valves underneath near the center, the 312/412 does not.
next click shows a garden supply store - fertilizer (explosive precursor), pesticides, herbicides.

Slide 3a-12 Storage Facilities Container Shapes pg 49/52

The six containers show (clockwise from upper left) are:
MC-331 tank truck - hi pressure liquified gases
Cryogenic storage tank - fixed facility storage
MC-306 (DOT-406) tandem tank truck - petroleum products
Hi pressure storage tank - fixed facility
Vapor trapping storage tank
Lo pressure storage tank - LPG

Slide 3a-13 Cylinders Pg 53

Generally - short, broad cylinders are used for low pressure gasses. The first group of cylinders are LPG containers of various sizes and capacities. Remember expansion ratios from the last module.
The next click brings up a barbecue grill - 20 lb cylinder of propane gas. - one of these was used as the core of an expanding gas fireball bomb by the perpetrators of the Littleton, CO. school incident. Luckily, the device failed to function.
Next click -Four one-ton chlorine cylinders. Compressed chlorine gas is commonly shipped this way to water or sewage treatment facilities. They are often loaded on a flatbed truck but can also be shipped in a 40 foot container box.
Last click brings up a picture of high pressure cylinders. There is no uniform color coding of cylinders. They may contain nearly anything.

Slide 3a-14 Rail Tank Cars Pg 53-54

The four cars pictured are:
Upper Left - Cryogenic Tank
Upper Right - Pressurized tank
Lower Right. - Non pressurized tank dome
Lower Left - Non pressurized tank
You might mention that response to rail car incidents is taught as a specialty course.

Slide 3a-15 Rear view of MC-306 (DOT-406)

Often used to move petroleum products.
Oval cross-section.
Aluminum skinned, if it flips, it must be unloaded before anyone attempts to upright it.
The visible placard is #1203 (gasoline/gasohol) but it may be loaded with home heating oil or a similar petroleum product that poses a lesser hazard than gasoline.
These tankers are often divided into four or five storage sections by internal bulkheads. If this one is, there will be other placards on the side identifying the contents of those sections. We can't be sure how many sections there are or what they contain from this viewpoint.
Refer to diagrams on page 54/55 for profiles of rail and road transport vehicles.

Slide 3a-16 Cargo Tank Trucks
MC-331 - Hi pressure Tanker - transports LPG and anhydrous ammonia
MC-312 (DOT-412) - corrosive transport
MC-307 (DOT-407) - chemical transport
MC-338 - cryogenic liquid transport

The MC307 and MC312 shown in these pictures look similar but note the placement of the dome and unloading valves. The 307 unloads from valves at the bottom and the dome is most often centered. The 312 unloads from the top of the tank and the dome is most often at the rear.
There is a 40-hour specialty course taught on tank trauck incident response.

Slide 3a-17 Intermodal Transport

Intermodal containers were introduced in Europe in the mid 60's. The tanks are mounted in a rigid frame that can be attached to a mobile chassis (road or rail) or detached and carried on ship. The capacity of a tank is 24,000 liters or 6,340 gallons.

Slide 3a-18 Markings & Colors
Sources for identifying hazardous materials in fixed facilities.
Page 57-58
pipeline markers - In general, pipeline markers or warning signs should be located:
a. at each public road crossing, railroad crossing, and sufficient number along remainder. May be at fence lines, property lines, & right of way boundaries.

Markings and Colors (names stenciled on containers).

Hazardous Materials Identification System (HMIS) labels. Pg 59 Somewhat similar in setup to NFPA system.

NFPA 704 Marking System Review

Diamond shaped label with four colored areas representing health (blue), flammability (red), reactivity (yellow), and special information (white).

Numerical rating of hazard in five (5) degrees from 0 to 4. 0 (zero) represents no hazard and a 4 (four) represents the worst hazard. (See student manual page 60.)

NJ Right-to-Know law

SARA Title III

Pre-Emergency Planning (Identify the material handled).

In any case, write down the information. Do not rely on your memory.

Identification numbers. Only for tank car, tank truck, and portable tank shipments.

Slide 3a-19 PLACARDS AND LABELS

DOT Placarding System - note the three placards presented

(explosives; 1)Note the placement of the UN/NA hazard class in the lower corner of the placard and label. Explosives are color coded orange.

Refer to placard diagram on pg 72. Remind students of color coding on placards and labels. This information was covered in the "Awareness" level course.

Class 6 is poisons. Note the “x”ed out wheat. Flammable solids are class 4 - red and white stripes.

There should be a copy of the DOT Emergency Response Guidebook 9ERG 2000) in each response vehicle that will help decode this information in the field.

Placards are displayed on the transport vehicle and are 10.5 inches on a side. Labels are displayed on the containers and are 4.5 inches on a side.

How can you classify the dangers more specifically than UN/NA class or DOT placards or labels?

UN/NA hazard classes:

Class 1 - Explosives
- Division 1.1
- Division 1.2
- Division 1.3
- Division 1.4
- Division 1.5
- Division 1.6

Class 2 - Gases
- Division 2.1
- Division 2.2
- Division 2.3

Class 3 - Flammable liquids

Class 4 - Flammable solids
- Division 4.1
- Division 4.2
- Division 4.3

Class 5 - Oxidizers and organic peroxides
- Division 5.1
- Division 5.2

Division 5.3
Class 6 - Poisonous or etiologic
Division 6.1
Division 6.2
Class 7 - Radioactive materials
Class 8 - Corrosives
Class 9 - Miscellaneous hazardous materials

The chemical industry has said that more than 38,000 substances meet the criteria of being hazardous. These materials are broken into several unique classes of hazards. However, though for the most part they are classified by a single, primary hazard, many hazardous substances present multiple dangers. The following is a brief description of the hazard classes. Remember, these definitions and descriptions are paraphrased from those found in the U.S. Code of Federal Regulations, Title 49, which are promulgated by the Department of Transportation. They should not be considered as the legal parameters which govern the transport of these materials, but rather an abstract of those definitions.

1)Explosives:

An explosive means any substance or article, including a device, which is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner.

The Department of Transportation divides explosives into six divisions. They are:

a)**Division 1.1** - explosives that have a mass explosion hazard.

Examples: Octolite, Nitroglycerin

b)**Division 1.2** - explosives that have a projection hazard but not a mass explosion hazard.

c)**Division 1.3** - explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both.

Example:

d)**Division 1.4** - explosives that present a minor explosion hazard and that which the explosive effects are largely confined to the package.

e)**Division 1.5** - consists of very insensitive explosives. It may be comprised of substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation.

f)**Division 1.6** - extremely insensitive articles which do not have a mass explosive

hazard.

2)Gases: DOT divides gases into three divisions. They are:

a)**Division 2.1** - Flammable gases are any compressed gas which meets the technical requirements such as low flammability limits and flame projection, and often ignite immediately when leaks or punctures occur.

Examples: LPG, propane, acetylene, silane

b)**Division 2.2** - Non-flammable and non-poisonous gases that do not fall under the flammable gas limits. However, it is important to note that several of the gases which carry the green "non-flammable gas" label or placard can burn or cause fires and have, in several cases, led to death and injury. Furthermore, nonflammable gases often present other serious health hazards which should be considered.

Examples: anhydrous ammonia, oxygen, compressed nitrogen, Helium compressed

c)**Division 2.3** - A gas poisonous by inhalation known to be so toxic to humans as to pose a hazard to health during transportation.

Examples: Silicon tetrafloride, Phosphorus pentaflouride, Phosgene

3)Flammable and Combustible Liquids

a)**Flammable liquids** are liquids which have a flash point of not more 141 degrees (F)

Examples: gasoline, acetone, toluene, benezene.

b)**Combustible liquids** means any liquid that does not meet the definition of any other hazard class and has a flashpoint above 141 degrees (F).

Examples: fuel, oil, kerosene, asphalt, creosote.

Flammable Liquids - (NFPA definition).

Any liquid having a flash point (FP) below 100 degrees F and having a vapor pressure not exceeding 40 psi absolute at 100 degrees F shall be known as Class 1 liquids.

Class 1- as above
Class 1A- FP below 73 degrees F and BP at or below 100 degrees F
Class 1B- FP at or above 73 degrees F and BP at or above 100 degrees F
Class 1C- FP at or above 73 degrees F and below 100 degrees F

Combustible Liquids - any liquid having a flash point (FP) at or above 100 degrees F.
Class 11- FP at or above 100 degrees F and below 140 degrees F

Class 111A FP at or above 140 degrees F and below 200 degrees F
Class 111B FP at or above 200 degrees F

4)Flammable Solids

a)**Division 4.1** are flammable solids that include wetted explosives, self reactive materials, readily combustible solids which may cause a fire through friction, and any metal powders that can be ignited and react.

Examples: matches, highway fusee, camphor

b)**Division 4.2** are spontaneous combustible materials that include pyrophoric materials and self heating materials.

Examples: Phosphorus (white), Sodium hydrosulfite, Sodium methylate

c)**Division 4.3** are dangerous when wet materials that, by contact with water, are liable to become spontaneously flammable or may give off flammable or toxic gas.

Examples: Barium, Sodium, Magnesium Powder

5)Oxidizers and Organic Peroxide

a)**Division 5.1** are materials that may, generally by yielding oxygen, cause or enhance the combustion of other materials.

Examples: Magnesium bromate, Copper chlorate, Calcium chlorite

b)**Division 5.2** are materials which have any organic compound containing oxygen in the bivalent structure and which may be a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.

Examples: Organic peroxide

6)Poisons

a)**Division 6.1** are materials, other than a gas, which are known to be so toxic to humans as to afford a hazard to health during transportation.

Examples: aniline oil, arsenic, Ammonium fluoride

b)**Division 6.2** are infectious substances which are viable microorganisms, or its toxin, which may cause or may cause disease in humans or animals. Infectious substances and etiologic agents are synonymous.

Examples: Anthrax, botulism, rabies, tetanus

7)Radioactive Material

Those products which spontaneously emit ionizing radiation, which could be capable of damaging living tissue. It is any material having a specific activity greater than 0.002 microcuries per gram.

Examples: Cobalt, Uranium hexafluoride

8)Corrosives Materials

A liquid or a solid that causes visible destruction or irreversible alterations to human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum.

Examples: Nitric acid, Sodium hydroxide, Sulfuric acid

9) MISCELLANEOUS HAZARDOUS MATERIALS

A material which presents a hazard during transport, but which is not included in another hazard class.

Examples: Adipic acid, Molten sulfur, Hazardous substances (e.g., PCSs)

ORM-D MATERIALS

A material which presents a limited hazard during transportation due to its form, quantity, and packaging.

Examples: Includes consumer commodities

Relate the classes to functional hazards.

NOTE: Many of the following terms have been discussed in module 2 and in the Awareness Level 1 training. You may want to review these terms at this time.

Vapor Pressure - molecules of a substance are moving and attempting to escape when the substance is heated (primary reason to tank rupture). Escaping molecules build pressure above the liquid -- reach a point of equilibrium. Pressure that is exerted is measured as the vapor pressure. It will vary with outside temperature.

Vapor Density - a measure of substance in relation to air which is rated 1.0.

Boiling Point - when vapor pressure meets atmospheric pressure.

BLEVE - Boiling Liquid Expanding Vapor Explosion

Major container failure which may result in the container separating into two or more pieces at a moment in time when the contained liquid is at a temperature well above its boiling point at normal atmospheric pressure. A portion of the liquid is vaporized (often 1/3-1/2), and this large liquid-to-vapor expansion provides tremendous energy.

Note: May occur even though relief valve operating!

Limits of Flammability - the upper and lower percentage limit beyond which fire cannot propagate.

Flash Point - the lowest temperature at which a substance emits a flammable vapor and if an ignition source is present, the vapor will ignite.

Explosive Range - the range of combustible vapor or gas/air mixture between the upper and lower flammable (explosive)limits.

Upper Explosive Limit (UEL) - measure in percent; above the point of the explosive mixture -- too rich. Refer to as the UEL (upper explosive limit).

Lower Explosive Limit (LEL) - measured in percent; below the point of producing an explosive mixture -- too lean. Refer to as LEL (lower explosive limit).

Specific Gravity - a measure of a substance in relation to water which is rated 1.0.

Slide 3a-20 SHIPPING PAPERS/DOCUMENTATION page 67

Shipping papers will contain:

(**For Highway**)
* Proper shipping name of material;
* Technical name when applicable;
* Hazard class or division number;
* UN/NA Identification number;
* Packing group when applicable (Classes 2,7, combustible liquids and ORM-Ds do not have packing groups);
* Hazard zone designation when applicable;
* Emergency Response telephone number;
* Quantity of material;
* Correct weight (except cargo tanks & cylinders);

(**For Rail**)
* Proper shipping name of material;
* Technical name when applicable;

* Hazard class or division number;
* UN/NA Identification number;
* Packing group when applicable;
* Hazard zone (associated with Division 6.1, packing group I materials)
* Emergency Response telephone number;

Terms associated with rail transport

* "waybill" specifies the contents of a specific car of a train

* "consist" lists all the cars in train by its identifying number and contents

* "Standard Transportation Commodity Code" (STCC) is a 7 digit code number which corresponds to a specific commodity. Hazardous materials STCC numbers will always begin with the number 49.

Slide 3a-21 Example of shipping paper

Slide 3a-22 DHSS Fact Sheet: Sample Gasoline HSFS is in Appendix 1, pg 182 in SM

Department of Health and Senior Services **Hazardous Substance Fact Sheets** will tell you about the behavior of over 1000 of the pure substances that the NJDHSS has placed on the New Jersey Right to Know list. The Fact Sheet is written in a six-page standard format.

Page six is, arguably, the most important page for emergency responders.

This page gives you the physical characteristics of the substance and tells you the equipment you need to deal with an incident.

PAGE 1:Identification, hazard summary, exposure limits, how to determine if you are being exposed, and ways to reduce exposure. This page is of most use to industries.

PAGE 2:Health hazard information, medical testing to detect exposure, and workplace controls. The general public is most concerned about the information on this page.

PAGE 3:Personal protective equipment and training required by industrial workers.

PAGE 4:Handling and storage procedures, common questions from the public.

PAGE 5:Glossary of terms.

Available online at www.state.nj.us/health/eoh/odisweb

Manufacturer's Safety Data Sheet: The **MSDS** is an information source supplied by manufacturers on materials that they produce. While the DHSS Fact Sheet deals with pure chemicals, the **MSDS** deals with products as they come from the shelf. The sections of the document (not necessarily in this order) are:

(1)Identification of the manufacturer and the chemical.

(2)Description of hazardous components.

(3)Physical data.

(4)Fire and explosion data.

(5)Health hazards.

(6)Reactivity data.

(7)Spill or leak procedure.

(8)Special protection information.

(9)Special precautions.

All MSDS's will have the same kind of information but there is no standard format and each manufacturer will list this information their own way.

NOTE: Spell the name of the material correctly.
Look at the difference between ethanol and ethanal.

Ethanol -Clear, colorless liquid. Aromatic odor. Flash point of 59 degrees Fahrenheit.

Ethanal -Clear, colorless liquid. Pungent, choking odor. Highly flammable; flash point of 36 degree Fahrenheit. Vapors are irritating to eyes and mucous membranes. May spontaneously polymerize. Forms unstable oxides in air.

Some sources of information and behaviors of hazardous materials

PRINTED MATERIAL SOURCES:

Emergency Response Guidebook, by the
Department of Transportation. (Approximately 2,400 names).

Indexed by name and identification.

CHRIS Manual (Volume 2), by the U.S. Coast Guard (Approximately 900 names.)
Also available online.

Dangerous Properties of Industrial Materials, by N. Irving Sax

Provides descriptive information about 16,000 common industrial and laboratory materials

Fire Officer's Guide to Dangerous Chemicals by Charles W. Bahme

Condensed Chemical Dictionary revised by Gessner G. Hawley

Handbook of Reactive Chemical Hazards by Betherick

Toxic and Hazardous Industrial Chemicals - Safety Manual from The International Technical Information Institute

GATX Tank Car Manual

Farm Chemicals Handbook

Shell Safety Manual Agricultural Chemicals

There is no one single resource that has all the information on all the hazardous materials. You have to use more than one.

Sometimes there are contradiction between resources. If you have a contradiction, play it safe-look at the worst case.

VERBAL SOURCES OF INFORMATION.
CHEMTREC Located In Washington, D.C.

On-call chemical emergency assistance center established by the Chemical Manufacturers Association in 1971.

CHEMTREC communicator available 24 hours a day, 7 days a week, 365 days a year.

Provides information about chemicals

Links callers to experts who know the hazardous material

System contains the most up-to-date information available.

Telephone contact: 800-424-9300 **only in emergencies**

When you call in an incident - Provide communicator with:

Your name, location, and telephone number

Name of material

If name of the material is not known, provide any information you might have:

Shipper/Manufacture

Carrier

Consignee

Container Type

Identifying container numbers

Location of the emergency

Local conditions

Chemical and transportation industries can indicate local contacts and activities.

SOME ONLINE RESOURCES:

NJ DHSS (RTK) www.state.nj.us/health/eoh/odisweb
Chemfinder: chemfinder.camsoft.com/

Chemical Abstracts Service: www.cas.org

MSDS Search: www.msdssearch.com/

OSHA: www.osha.gov/

DOWNLOADABLE HAZMAT PROGRAMS:

CAMEO (Computer Aided Management for Emergency Operations:
response.restoration.noaa.gov/cameo/toolkit.html

SLIDE 3a-23 Senses

If you can smell it, you're being exposed. Don't lead with your nose but pay attention to the symptoms and observations of victims on the scene. During the Sarin incident in the Tokyo subway system (1995),

SLIDE 3a-24 Chemical /Biological Agents

While the possibility of chemical/biological terrorism has been grabbing the news we must remember that this type of incident is still a hazmat incident. The actions of many chemical weapons is similar to that of organophosphorus pesticides. A biological attack would appear musch like an outbreak of a “wild” pathogen. The key is to remember that you are dealing with extremely toxic materials.

SLIDE 3a-25 Public safety

Your plans for handling a chem/bio terrorist attack must address:
Evacuation of the public
Containment of the problem and decontamination of victims
Neutralization of the agent used in the attack
Removal of contaminated materials and victims
Cleanup of the affected area
Disposal of contaminated articles

In addition, the area must be treated as a crime scene. Your local plans must include ways to preserve evidence, documentation of the site.

SLIDE 3a-26 Likely Scenarios

Ask the question - What would a terrorist ‘hit’ in my jurisdiction?
The answer combines the likely targets with the agenda of the perpetrator.
The “Earth Activist” might target new construction sites and contractor’s equipment.
The “Animal Activist” might target restaurants, furriers, and laboratories.
The “Doomsday Cult” might target any location with lots of people.
Etc. Use your imagination.

Summarize Identification.

The information you need is out there somewhere, whether you are calling CHEMTREC for guidance, or referencing action guides, or wherever your search leads you, the key to your success is your persistence. You must obtain correct and accurate information if you are going to accurately estimate likely harm without intervention.

SWITCH TO MODULE 3B

Slide 3b-1 Estimate (E)stimate The Likely Harm Without
Intervention
*visualize the likely
behavior of the HM and/or its container, and the likely harm that is associated with that behavior; and
*describe the outcome of that
behavior
ANALYZE to determine the magnitude
1) Survey the incident - gather information

2)Collect information - What does it do? What is the site like? What are the health and environmental effects? What can I do?
3) Predict behavior of the material if:
(a) it stays in the container
(b) it leaks out of the container
4) Estimate harm in each likely scenario

Slide 3b-2 (C)hoose Response Objectives

Select the harm you want to prevent (the exposures you want to protect) before you act in a rational manner.
Plan an initial response within the capability and competency of your department.

1) Describe the objective you hope to achieve in a clear, conscise manner.
2) Describe the defensive actions that will be taken
3) Determine (and document) the PPE that will be appropriate to the hazards faced
4) Identify and describe the emergency decontamination procedures that are appropriate to the materials faced

Slide 3b-3 (I)dentify Action Options

What options do you have to accomplish with the objectives selected?

Consider all practical options (including doing nothing) before you act.

Slide3b-4 (D)o the best Option

Pick the defensive option that helps to solve the problem, one with the greatest gain and the least loss.
IMPLEMENT THE PLANNED RESPONSE.

1) ESTABLISH AND ENFORCE SCENE CONTROL (WORK ZONES,ETC)
2) USE INCIDENT COMMAND SYSTEM AND DOCUMENT ACTIONS
3) DON, WORK IN, AND DOFF APPROPRIATE PPE
4) PERFORM DEFENSIVE CONTROL FUNCTIONS

Slide 3b-5 (E)valuate Progress

Periodically STOP and LOOK at what's happening -
Is what you expected to happen actually happening?

If not, you must review the problem and choose another option to lead to the desired result.

DECIDE Summary
Basic Hazard/Risk Assessment must be considered in both pre-plan and incident analysis. It should be considered as the initial safe step to Hazardous Materials response.

The Incident -

Slide 3b-6 Risk Assessment & Events Analysis

Events Analysis

Events analysis is the process used to help you "visualize what is likely to happen in an emergency."

It is a process of breaking down complex actions (such as an emergency), into smaller, more easily understandable parts.

Who or what is involved?

What is happening? (What is happening now with the people or things involved?)

What is likely to happen next? (What do you predict these people/things are likely to do as the emergency progresses?)

How will these actions affect the sequence of events in the emergency?

As we discuss emergencies, keep one thing in mind, always name the person/thing doing something first, then indicate what the person/thing is doing.

Events analysis should help you:

Understand, track, and predict a given sequence of events.

Decide if, when, and how to change that sequence of events.

The concept of events analysis helps define your problems in a sequential and logical way, thus minimizing confusion, guesswork, mistakes, delays, unnecessary harm, and loss of control at an emergency.

Slide 3b-7 Estimating Likely Harm Without Intervention"

Define the problem that exists.

There are two activities in "estimating likely harm without intervention":

1) Visualizing (or predicting) what is likely to happen in an emergency if nothing at all is done-visualize the behavior of the hazardous material.
2) Describing the likely outcome in the emergency based on the predicted behavior.

Slide 3b-8 Several Resources

Use several reference sources when describing the hazardous materials at the scene: Any single source may show editorial errors.

Sources may describe the same hazard in slightly different language or formats. These differences may help you focus on the problem.

Four Factors
There are four factors affecting the behavior of hazardous materials in an emergency:

Slide 3b-9 Inherent properties and quantity of the hazardous material;
Slide 3b-10 Built-in characteristics of the container;

Slide 3b-11 Natural laws of physics and chemistry;

Slide 3b-12 Environment,
including exposures, the physical surroundings (terrain) and the conditions (weather).

Determining the interrelationship among these factors can help considerably in visualizing what is likely to happen in the emergency.

Slide 3b-13 Dealing with Hazmat Events

Stress
Breach
Release
Engulf
Impinge
Harm

Slide 3b-14 STRESS:
If the container is under stress you can:
Influence applied stresses (eg Brace the load on the container)
Redirect impingement (Lighten the load impinging on the container)
Shield stressed systems (erect barriers - apply foam or water as heat shield)
Move stressed system (pull the container to a diffrent location)

Slide 3b-15 BREACH
Change the size of the breach - patch/plug
Cool the material - influence flammability
Limit stress on the container to slow the flow of escaping product
Vent the container to prevent a breach under pressure.

Slide 3b-16 RELEASE
Roll the container so that the leak is above the fluid level
Release pressure so that material is not being forcibly ejected
Cap leak or plu and patch

Slide 3b-17 ENGULF
To prevent people from being engulfed in the event of a container failure;
evacuate the area you expect to be affected

initiate a controlled burn to affect the amount of material present
erect dikes and dams to control material that may be released
dilute material already released for safer handling (but consider the size of the problem you will have to deal with)

Slide 3b-18 IMPINGE:
Influence exposures impinged
Provide shielding
Begin isolation and/or evacuation

Slide 3b-19 HARM:
Influence severity of injury
Rinse off contaminant
Increase distance from source
Provide shielding

Practice in Events Analysis

Introduce events analysis exercise.

Student Manual p. 81-96.
Have students turn to page 81.

Slide 3b-20 Scenario one: Railroad Tank Car Incident
Let's use this situation to practice the process of events analysis.

The tank car is placarded “1051" and there is a small leak.
Have students use references on pages 84-96 to determine:
What is the product?
What are the hazards associated with the product?
What is likely to happen in this situation?
What level of incident do we have (chart on pg 82)
What would they do ?

Let students discuss this question for a short time. List the points that the students make as they make them.

Let the students verbalize their thoughts. Use these thoughts when you need to bring them on track.
Students should describe the likely outcome in terms of:

Fatalities.
Injuries.
Property damage.
Critical systems disruption (such as hospitals, utilities, communications, etc.)

Environmental Damage.

Slide 3b-21 Scenario two: Truck carrying gas cylinders
Nitrogen cylinder on the truck is leaking from an open valve.
Have students use references on pages 84-96 to determine:
What are the hazards associated with the product?
What is likely to happen in this situation?
What level of incident do we have (chart on pg 82)
What would they do ?

Let students discuss this question for a short time. List the points that the students make as they make them.

Let the students verbalize their thoughts. Use these thoughts when you need to bring them on track.

Students should describe the likely outcome in terms of:

Fatalities.
Injuries.
Property damage.
Critical systems disruption (such as hospitals, utilities, communications, etc.)
Environmental Damage.

Slide 3b-22 Overturned tank truck
Truck is placarded “1203" and a dome cover is leaking.

Have students use references on pages 84-96 to determine:
What is the product?
What are the hazards associated with the product?
What is likely to happen in this situation?
What level of incident do we have (chart on pg 82)
What would they do ?

Let students discuss this question for a short time. List the points that the students make as they make them.

Let the students verbalize their thoughts. Use these thoughts when you need to bring them on track.

Students should describe the likely outcome in terms of:

Fatalities.
Injuries.
Property damage.
Critical systems disruption (such as hospitals, utilities, communications, etc.)

Environmental Damage.

Slide 3b-23 Overturned tank truck
Truck is placarded “1203"
Dikes have been erected to contain the leaking product
Foam has been applied to mitigate the possibility of ignition
The dome cover is still leaking.
A dome cover clamp must be placed on the leaking dome

What are the hazards associated with the action decided on?
Is this a defensive or offensive action?
What level of incident do we have (chart on pg 82)
What would they do ?

Let students discuss this question for a short time. List the points that the students make as they make them.

Let the students verbalize their thoughts. Use these thoughts when you need to bring them on track.

Students should describe the likely outcome in terms of:

Fatalities.
Injuries.
Property damage.
Critical systems disruption (such as hospitals, utilities, communications, etc.)
Environmental Damage.

MODULE 4: Personal Protective Equipment (PPE) Available to the First Responder

Time: 60 minutes

Time Plan:

5 min.Introduction

10 min.The First Responder At Hazardous Materials Incidents.

10 min.Understanding The Difference and Operating Limitations Between Structural Firefighting PPE and Hazardous Materials PPE.

15 min.Personal Protective Equipment For The First Responder.

5 min.Routes Of Entry Of Hazardous Materials Into The Human Body.

5 min.The Means By Which Personal Protective Equipment Performance May Become Compromised.

10 min.When To Remove Personal Protective Equipment.

MODULE 4: Personal Protective Equipment (PPE) Available to the First Responder

Slide 4-1 Personal Protective Equipment PPE

Slide 4-2 Objectives

SM page 99
The student will be able to:

1.identify two limitations of the standard response uniforms worn by police, firefighters and emergency medical personnel.

2.identify the four levels of chemical protective clothing.

3.list the four routes of entry by which hazardous materials may enter the body.

4.list three chemical means by which personal protective equipment's performance may be compromised.

5.list when and where personal protective clothing can be removed, following a haz mat incident.

Section I. Introduction to the Hazardous Materials Problem

Review offensive and defensive actions

Slide 4-3 Defensive Action
Emphasize that defensive means that there is no intentional contact with the hazardous material.

Slide 4-4 Offensive Action
There is possible contact with the hazardous material.

Slide 4-5 Work Uniform vs PPE
“Globe Label” on pg 102 of the Student Manual. A fire fighter’s turnout gear is NOT designed for chemical protection. It is designed as a moisture and thermal barrier only.

Slide 4-6 No Leather
Leather is a porous material (even when waterproofed) and WILL absorb hazardous materials. Leather that goes into the hot zone STAYS in the hot zone. It cannot be decontaminated.

Slide 4-7 Four levels of PPE

Refer to SM page 103/104
Review the four categories of PPE and Briefly summarize each level (as described in parenthesis).

Slide4-8 Level A
fully encapsulated - protection from splashed product and vapor. There are many different manufacturers, styles and materials of level A suit. Like all PPE, they must be chosen for compatibility with the products expected on the scene.
Level A is chosen when there are unknown gas/vapor concentrations, skin absorbable gases or vapors, or IDLH conditions.
You should be wearing long sleeved garment under any protective gear. A sweatsuit is hot but will give you some padding and thermal insulation. A nomex (TM) jumpsuit also makes a good undergarment. Basically - avoid synthetics - they melt in a fire.
Remember that most chemical protective suits are not fire resistant and will melt and stick to your skin or actually burn if you get too near a fire or source of heat.
You should also be wearing a hardhat inside your level A suit.

Slide 4-9 Level B
respiratory, and splashed product protection. This suit is more frequently used than the level A suit - it does not afford vapor protection.

Slide 4-10 Level C
Non-emergency site workers often use level C protection. The APR Air purifying Respirator that characterises this level of protection can only be used if the airborne contaminants at the site are known AND their concentration in the air is known. (And only if an appropriate filter type is available).

Slide 4-11 Level D
I a work utility uniform. The ensemble required for a specific job may offer some respiratory or chemical protection specific to that job but it is not suitable for emergency operations.

Slide 4-12 Fire Fighter’s turnout gear
Firefighting gear is considered a level D work uniform despite the SCBA that is required. The turnout gear offers no chemical protection (refer back to the Globe label) even though the SCBA offers a great deal of respiratory protection.
The choice of chemical protection is based on factors which must be critically assessed:

1. the work to be done at the incident site:

2. the type and measured concentration of chemical substances in the ambient atmosphere

3. the toxicity of the chemicals that may be encountered

4. the potential for exposure to substances in the air

5. the potential for exposure to splashes of liquids

6. the potential for direct contact with materials or substances

Structural fire fighting clothing is usually the most available and typically first used at hazardous materials incidents.
Emphasize that only positive pressure SCBAs can be worn at a Haz Mat scene.

Have students turn to the SM page 102 Section III - "Full protective clothing" as referenced to structural fire fighting clothing is not the same as personal protective equipment which is designed for operations in hazardous environments.

While an SCBA does afford respiratory protection, the rest of the equipment won't protect against poison gases and may not be able to be decontaminated if exposed to hazardous materials.

This level of protection, corresponds with Level D hazardous materials personal protective equipment.

Review additional personal protective equipment considerations:

1.ear flaps down (on helmet)
2.collar up with neck covering flap in place
3. boots up
4. note that turnout pants are better than 3/4 length boots because they provide more protection.
5. gloves on
6. flame resistant hood on
7. should have PASS device on
8. should make an inspection of all equipment before entering the operational area

Structural fire fighting clothing consists of a three layer system:
1. outer shell with some thermal and direct flame resistance
2. intermediate vapor barrier affords some protection from gases, vapors, and liquids.
3. inner thermal barrier with some measure of thermal protection

This protection does not protect against chemicals which can pass through the vapor barrier, nor against chemical permeation and clothing degradation.
Structural F/F clothing can be worn in safe work areas, up wind of the incident, and in safe areas where equipment and service activities are being carried out.

Slide 4-13 Respiratory Protection Air Purifying Respirators (p 107)
APRs are Limited by several factors:
Limited to chemicals with approved filters available

limited to areas with **known** contaminants in **known** concentrations
Negative pressure breathing system. That is, air is drawn through the filter by a vacuum created by the user inhaling. This system may allow infiltration of contaminated air into the mask around the face seal.
APRs require fit testing prior to use.
APRs are not approved for use by emergency responders at a hazmat scene where the contaminants and their concentrations are unknown.

Slide 4-14 Self-Contained Breathing Apparatus (SCBA)
Three basic types:
1 Demand
2 Pressure-Demand
3 Re-Breather

The Demand type is not approved for use at Hazmat scenes as there is negative pressure in the face mask at some point in the breathing cycle. This could allow infiltration of contaminated air into the facemask.

The Pressure-Demand type SCBA is the type commonly encountered in emergency response. It maintains positive pressure in the face mask during the entire breathing cycle. If there is a leak around the facepiece seal, air will be blown out rather than allowing contaminated air in.

Pressure-Demand systems may also be fitted with an airline to extend the time a responder can spend in the hot zone. In this event, the SCBA must be fitted with and escape pack with, at least, a 10 minute supply of air. This will allow the responder to safely exit in the event that their airline is damaged or stuck on something.

Both Demand and Pressure-Demand systems are called “open circuit” systems. The “opening” is the exhaled “exhaust” air, which is released into the surrounding environment.

Re-breathers are “closed circuit” systems where exhaled air is recirculated, has its carbon dioxide removed and oxygen replaced so it can be re-used by the wearer. Re-breathers can supply their wearers with breathable air for as much as eight hours before they require refilling. Drawbacks to this type of system include the necessity of using tanks of 100% oxygen (an obvious drawback in working near flammable materials) and using chemicals which, themselves, are considered hazardous to remove carbon dioxide from the breathing mix.

Slide 4-15 Limitations (p109)

Limitation on PPE arise from both the equipment, itself, and the person wearing it

Slide 4-16 Physical limitations

Wearing PPE of any sort places stress upon the person wearing it: (p112)
1 Communication trough a mask is difficult at best. Additionally, it is difficult to hear through several layers of protective head gear.
2 Face masks reduce your field of vision. Be aware of your surroundings and move cautiously to avoid injury.
3 Your senses, in general, will be dulled or completely isolated from your surroundings while wearing PPE. Imagine trying to pick up a dime while wearing two pair of gloves and a pair of leather gauntlets.
4 Psycological stress - you will feel confined and, perhaps, claustrophobic while wearing PPE. Additionally, it becomes physically challenging to move while wearing several layers of ill-fitting chemical protection and 25 pounds of breathing apparatus.
5 You must be aware of the symptoms that indicate you are being exposed to the chemicals involved in the hot zone where you are working. It is still nearly impossible to guarantee that the suit you are wearing is completely impervious to all the chemicals on site.

Finally - be aware of the symptoms of heat stress. Chemical PPE tends to retain body heat. You can lose as much as four pounds an hour through perspiration which can lead to dangerous dehydration.

These limitations can be complicated by the Type and mixture of chemicals at the site. Weather (temperature, cloud cover…), Accessibility (how far you have to go to get into the hot zone), deris to be avoided, Time of day (sun), terrain (Uphill/downhill) and other complicating factors.

Slide 4-17 Equipment Limitations

The greater the protection offered by a piece of equipment, the greater the limitations it tends to impose on the wearer.

Slide 4-18 Limitations
Overcoming the limitations of PPE requires training and practice time in your equipment.

Slide 4-19 Choosing PPE
PPE chosen for a response is based on:
Identity and measured concentration of hazmat at a site
Compatibility of PPE material with the hazmat on the site
Potential routes of exposure - airborne, splashed material, direct contant
Work that must be performed

When making decisions - err on the side of caution.

Slide 4-20 Choosing PPE
What are the characteristics of the material? How strong is it? How flexible is it?
Slide 4-21 Choosing PPE

How will high and low temperatures affect the PPE material? Does it become brittle in cold weather? Does it degrade in high temperature?

Slide 4-22 Choosing PPE
Life expectancy - doe the PPE resist aging from UV exposure? Can it withstand general use and repeated decontamination? Should the material be considered for one-time use only?

Slide 4-23 The Four Routes of Entry to the Body (p115)
Inhalation. (respiratory tract)
Absorption. (through the skin)
Ingestion. (swallowing)
Injection. (cuts and lacerations of the skin)

Slide 4-24 Acute/Chronic exposure
Acute exposure to a material is considered a large amount of material delivered to the body over a short period of time. This most often refers to an accidental exposure from being splashed, knocking off your SCBA, etc…
Chronic exposure is generally considered a small amount of material delivered to the body, repeatedly, over a long period of time. An example would be - waiting to don your SCBA at every fire until you smelled the smoke. The health effects and symptoms of this type of exposure are less obvious immediately but can still be disastrous over your working lifetime.

Slide 4-25 Chemical resistance of PPE (p 115)
Degradation (a break down of the material's protective properties through exposure to chemicals)
Permeation (like a drop of liquid that goes through a paper towel)
Penetration (directly through existing holes such as stitches, seams and zippers)

Slide 4-26 Degradation
Loss of beneficial properties due to breakdown over time or upon exposure to a material or condition

Slide 4-27 Permeation
Moving through the protective material by absorption. Nothing is completely impermeable - you want materials with permeation times that exceed the amount of time you expect to wear the PPE with a goodly safety margin.

Slide 4-28 Penetration
Is a physical process of material moving through holes, rips, zippers, or seams in the PPE

P 116 - Section IX. <u>When to Remove Contaminated PPE</u>

Despite precautions, you or your PPE may become contaminated. People that were on

the scene before your arrival may be contaminated. If this happens, what is the procedure? The answers to the following questions will help you make your decisions.

ONLY the Incident Commander his designate or the Safety Officer can order the removal of PPE

All equipment that passes the CONTAMINATION CONTROL POINT must be decontaminated and removed

Remove contaminated PPE EVERY time you cross the CONTAMINATION CONTROL POINT

Remove contaminated PPE:
A. in an area designated and designed for PPE removal (DECON)
B. NEVER in "HOT ZONE"
C. NEVER in contaminated areas

You are never safe from contamination until all protective equipment and contaminated clothing are decontaminated removed under supervision of personnel assigned decon responsibilities.

Slide 4-29 Types of Protective Clothing
There are many types of chemical protection garments on the market because no one garment can protect you from every chemical. Even different garment made for the same chemical protection application will have unique strengths and weaknesses.

Slide 4-30 Duct Tape
Duct tape is often used to secure PPE but remember: it has not been tested for chemical protection.

Slide 4-31 Duct tape
There are alternatives - a hard plastic cuff may be inserted in the PPE suit sleeve and gloves secured over this by wide rubber bands.

Slide 4-32 Inspection
PPE must be regularly inspected and that inspection must be documented. When in doubt as to inspection procedures or frequency, fall back on the manufacturer's recommendations.

Slide 4-33 Inspection Points
In general, when you inspect a suit, you will check:
Seams, stitches and binding, surface abrasions, zippers or other closure, face shields, head gear, exhaust valves, and exposure records.

Slide 4-34 Testing
Most manufacturers will also recommend a combination of light, air, and water tests.

Light test - in some way (Manufacturer's recommendation) visually checking for light penetration of the suit.
Air - filling the suit with compressed air to check for leaks.
Water - filling the suit with water to check for leaks

Slide 4-35 Storage
Do not store PPE while wet nor should they be stored in direct sunlight or at extreme temperatures.

Slide 4-36 Storage Methods
Store PPE in soft bags for physical and dust protection or in boxes.
Store them on open shelves for air circulation.
Hang them on hangers (air circulation)

Slide 4-37 Buddy System
Work in groups of AT LEAST two for aid and support.

Slide 4-38 Backup
Whenever a team is in the hot zone, a backup team must be standing by to rescue them if they run into a problem. When setting up your backup team, it's a good idea to plan for a worst case scenario - what if the first team in goes unconscious and cannot help in their own evacuation?
OSHA requires that a hazmat team consist of at least five members; 2 for entry, 2 for backup, and one safety officer. Beside that, there must be 2 emergency medical personnel on standby. (29 CFR 1910.120). This number assumes that decontamination is being handled by another group - generally the fire department.

Slide 4-39 Not all fun & games

MODULE 5: Health and Safety

Time: 50 minutes

Time Plan

2 min. Introduction

15 min. Chemical Hazards, Signs & Symptoms & Initial Treatment

18 min. Other Hazards, Signs & Symptoms & Initial Treatment

5 min. Victim Recovery SOP

10 min. Confined Space Rescue

MODULE 5: HEALTH & SAFETY

Recognize Hazards
*Health and safety concerns resulting from the nature of the site and the work being performed.

Slide 5a-1 Health & Safety

Slide 5a-2 Objectives
The student will be able to:

1.Define exposure, doses and warning properties.

2.Identify (5) five common symptoms of chemical exposure.

3.Differentiate between chronic and acute effects of chemical exposure and given an example of each.

4.Identify (6) six safety and health hazards other than chemical contamination that may be encountered at a hazardous materials incident.

5.Define a confine space and list (4) four hazards commonly found there.

6.List (4) four precautions to be taken when attempting a rescue of a haz mat victim.

Slide 5a-3 Exposure and Dose
"Exposure", is coming into contact with the material
"Dose", is how much of it you received

Slide 5a-4 Acute or Chronic dose
Remember the "Four Routes of Entry" from the last module:
Inhalation. (respiratory tract)
Absorption. (through the skin)
Ingestion. (swallowing)
Injection. (cuts and lacerations of the skin)

Acute/Chronic Dose Page 122
Acute dose of a material is considered a high dose of material delivered to the body over a short period of time. A dose large enough to cause immediate effects. This most often refers to an accidental exposure from being splashed, knocking off your SCBA, etc…
Chronic dose is generally considered a small amount of material delivered to the body, repeatedly, over a long period of time. The size of the dose is generally small enough to cause no immediately observable effect but the symptoms will show up over time. An example would be - waiting to don your SCBA at every fire until you smelled the smoke. The health effects and symptoms of this type of exposure are less obvious immediately

but can still be disastrous over your working lifetime.

Slide 5a-5 Warning properties **Pg 122**

Warning properties are those minor symptoms (sneezing, tearing of the eyes, disorientation, etc) or sensory clues (smell) that warn you that you are being exposed to a material.

Slide 5a-6 Carcinogen / mutagen / teratogen

Health effects of exposure can be either immediate or delayed. Three delayed health effects that are of major concerh to us are:
Carcinogens - materials that cause cancer
Mutagens - materials that cause damage (mutations) to the gonads that affect eggs or sperm and can lead to problems with any children you produce.
Teratogens - materials that cause damage to developing fetuses leading to birth defects or the death of the developing child.

Slide 5a-7 signs and Symptoms of Exposure

Symptoms of chemical exposure may be immediate or delayed. Contact dermatitis (reddening of the skin - like a rash) is the most common symptom of chemical exposure in industry. Dermatitis is most often observed on the hands and lower arms.
May be a problem of recognition of symptoms from over- exposure:

1. Obscured by other physical problems before exposure. (smoking, medications, Physical condition)

2. Exaggerated victim complaints due to anxiety. (Rapid heart beat, shallow respiration, chest pain, nausea. Sometimes appears to be a heart attack.)

3. Some contaminant doses result in no immediate symptoms. Ex. Inhalation of asbestos fibers

Slide 5a-8 Other Signs and Symptoms of Exposure

Other common symptoms of chemical exposure include:

Behavior changes	Irritation of eyes, nose, throat
Breathing problems	Headache
Changes in skin color	Lightheadedness
Dizziness	Nausea
Drooling	Sneezing
Diarrhea	Sweating
Fatigue	Tearing of eyes
Irritability	Tightness in chest

Slide 5a-9 Chemical Warfare Agents

Since the Tokyo subway incident in 1995 when sarin was employed by a terrorist group to attack the general population of a city we have become much more concerned with the possibility of similar attacks in this country. Chemical warfare agent can be divided

into four general categories:
Nerve agents
Blood agents
Blister agents
Choking agents

Slide 5a-10 Nerve Agents
Agents that effect the transmission of nerve impulses by reacting with the enzyme cholinesterase, permitting accumulation of acetylcholine and continuous stimulation of muscles and glands. Can be lethal in very small quantities. A lethal dose is often measured as one drop of the material and can be delivered as an oral, inhalation, skin contact or skin contact exposure to the vapor. The ‘good news’ is that these materials are not highly volatile. Sarin, the most volatile of the group, evaporates at a rate similar to water. In order to be effectively used a weapon, the material must be aspirated into the air by some mechanical means such as an explosive or a spray device.

Slide 5a-11 Blood Agents
chemical warfare agents which are inhaled and bind to enzymes which prevent cells from using oxygen. High concentrations can cause rapid death by asphyxiation, lower concentrations cause breathing problems, gastrointestinal distress, dizziness and headaches.

Slide 5a-12 Blister Agents
Chemical warfare agents which produce local irritation and damage to the skin, eyes and respiratory tract. Symptoms may be delayed for hours.

Slide 5a-13 Choking Agents
Chemical warfare agents that affect the lungs and result in the accumulation of large amounts of fluid in the alveoli of the lungs (pulmonary edema). Lower concentrations result in severe coughing.

Slide 5a-14 Irritating Agents
Riot control agents have a severe effect on the eyes, nose and throat.
Shortness of breath and coughing follow immediately (within seconds) after exposure.
Effects decrease and disappear after 15-30 minutes in fresh air.
Seldom have serious effects (skin blistering).

Slide 5a-15 Biological Warfare Agents - Quote Pg 126
“Any biological warfare attack would be by aerosol. Clinical manifestations follow exposure by aerosol within 1 to 7 days depending, in part, on the dose of the organisms.” David L. Brunner

Slide 5a-16 Pathogens
are infectious living, reproducing microorganisms that cause disease in humans, animals or plants.

Slide 5a-17 Toxins
Non-living poisonous substances produced through metabolic activities of living organisms.

Slide 5a-18 Initial Treatment
Depends on route of exposure and particular hazard. Treatment starts by removing the victims from the contaminated area.

Slide 5a-19 Other Hazards
Thermal stress
Electrical hazards
Ionizing radiation
Slip/Trip/Fall hazards

Symptoms of Heat Stress See Student Manual pg. 129-130
Heat Exhaustion
Heat Stroke
Cold exposure

Slide 5a-20 Rescue of Overexposed personnel **Pg. 131**
1 - approach and observe
2- if hazmat is suspected, position assets at a safe distance
3- notify proper authorities-DEP Hotline (1-877-927-6337) ***{the old hotline number is in the book - instruct the students to change it}*** and local hospital.
4 - don PPE
5 - determine the presence of injured victims
6 - assess victim when it is safe for rescuers to enter the area.
7 - move victims away from hazard (avoiding further injuries). Do not bring them into the cold zone if cantamination is still present.
8 - decontaminate victim prior to transport
9 - transfer victim to an ambulance after they have been decontaminated. Do not remove victim from backboard if one was used.
10 - victim transport should be handled by people who have not entered the hot zone. Ambulance personnel should wear gloves and other PPE deemed necessary just in case te victim was not completely decontaminated.
11 - hospital should be completely informed about the materials the victim was exposed to. Ambulance crew should request any special instructions the hospital may have.
12 - follow hospital's protocol on arrival
13 - ambulance and crew should not return to service until they have undergone monitoring and any required decontamination.

Slide 5a-21 Confined Space Pg 132
Defined by OSHA 29 CFR 1910.146 as an enclosed space that:
is large enough for a person to enter it
has limited means of entry/exit
is not designed for continuous employee occupancy

Slide 5a-22 Confined space Hazards Refer to case histories on Page 133-134

Slip/Trip/Fall
Asphyxiating atmosphere
Toxic atmosphere
Flammable/Explosive atmosphere
Engulfment
Mechanical hazards
Untrained/Unequiped rescuers

Confined spaces must be carefully monitored for hazardous atmospheres. You do not enter a confined space until you have had training and can meet all the conditions specified for that particular space.

SWITCH TO MODULE 5B

Slide 5b-1 Disclaimer

check the manufacturer's recommendations for operation of your instruments.

Slide 5b-2 IDENTIFYING AIRBORNE CONTAMINANTS

on-site use of direct-reading instruments
or
laboratory analysis of samples collected at the site

Slide 5b-3 Don't overlook a piece

Air at a hazmat incident must be monitored for:

- oxygen
- flammables/explosives
- toxic materials
- radioactive materials

Slide 5b-4 OBJECTIVES OF AIR MONITORING

detect and quantify airborne contaminants
assist in defining work zones
define evacuation areas and control tactics
ensure proper selection of work practices
determine the level of worker protection
document exposure for post-incident medical surveillance

Slide 5b-5 Monitoring decision tree Page 138

Slide 5b-6 GENERAL CONSIDERATIONS IN MONITORING

PURPOSE OF MONITORING EQUIPMENT

- Detect the presence of a hazard
- Determine if material is dispersing or concentrating
- Ensure responders have adequate protection
- Determine if hazard is affecting surrounding areas

Ensure proper selection of work practices.

Slide 5b-7 FACTORS INFLUENCING THE READING

INSTRUMENT FACTORS

- Proper equipment operation
- Instrument calibration & calibration checks
- Equipment detection range
- Device relative response (compared to calibration gas)
- Response time
- Inherent safety

Slide 5b-8 FACTORS INFLUENCING THE READING

NON-INSTRUMENT FACTORS

- nature of the hazard
- environmental conditions
- location that monitoring samples are taken
- radio interference

Slide 5b-9 Action Levels Pg 136

Oxygen - normal concentration in air is approximately 20.8% according to OSHA 1910.120 {in confined space regs, 1910.146, OSHA refers to ANSI Z88.2 standards which use 20.9%}. Any concentration below 19.5% is considered an oxygen poor environment. Your instruments are not able to function reliably below this concentration. The question is, of course, what is in the atmosphere to depress the oxygen reading so much. An oxygen concentration above 23.5% is considered an oxygen rich environment. It is hazardous because there is an increased risk of fire in this environment.

Combustible Gas - Concentration of combustible gases is measured as a percentage of the Lower Explosive Limit, the lowest concentration in the air of a substance that will burn or explode. 10% LEL is considered the action level when you must exit the area. Your instruments are calibrated with one specific gas. The concentration readings they give with all other gases must be multiplied by a correction factor to give the right reading - so we set the action level low to err on the side of caution and not take the chance of working in a combustible atmosphere. If you detect combustible gases in your work area, you should exit, then arrange ventilation of some sort to correct the hazardous condition.

Slide 5b-10 Readings

Hazardous material comcentration are often measured in parts per million (PPM)

Converting PPM to %

- 1 PPM = .0001%
- 10 PPM = .001%
- 100 PPM = .01%
- 1,000 PPM = .1%
- 10,000 PPM = 1%

100,000 PPM = 10%
1,000,000 PPM = 100%

Slide 5b-11Gas Concentration
1 ppm is approximately 1 cup in a 8,448cubic foot space.

Slide 5b-12 Instrument for the Field
CGI - Combustible Gas Indicator
PID - Photo-Ionization Detector
O2 meter Oxygen Meter
Detector Tubes - Colorimetric Indicators
Radiation Survey Instruments - Geiger Counters
OVA - Organic Vapor Analyzer

Slide 5b-13 Field Instruments:
In order to be useful they must be:
Portable - and able to absorb a reasonable amount of abuse and still work.
Inherently Safe - no unshielded ignition sources
Able to produce reliable results - you are relying on them for your safety
Sensitive and selective - minimum ‘cross sensitivity’. You don’t want to have to wonder what you just detected.

Slide 5b-14 Explosion proof vs. intrinsically safe
Explosion proof means there are no ignition sources exposed to the atmosphere.
Intrinsically safe means the ignition sources are shielded by flame arresters.

CGIs are intrinsically safe - they actually pass atmosphere over an ignition source to test for flammability. There are flame arresters that prevent ignited gases from reaching the surrounding atmosphere.

Slide 5b-15 Combustible Gas Indicator
The venerable MSA-360 - measures oxygen, combustible gases, and toxic gas (usually set up for carbon monoxide or hydrogen sulfide)

Slide 5b-16 Combustible Gas Indicators
The MSA Passport - later model than the 360

Slide 5b-17 Combustible Gas Indicator
The MSA Passport - closeup - it is self calibrating and easier to use than the 360

Slide 5b-18 Combustible Gas Indicator
“Ph D +” different company - same function

Slide 5b-19 Relative Response
Every CGI is calibrated with a single gas and will give a relative response to other

gases. Multiplying by a correction factor (printed in the instruction manual for the instrument) will give you the correct reading for other gases.

Slide 5b-20 CGI readings
Remember that the CGI does not give you a true reading for flammable gas concentration - it tells you how close you are to 100% of the LEL. That is; Methane has an LEL of 5.3%. A reading of 60% on the LEL meter is telling you that you have a concentration of 3.18% (60% of 5.3%)
A reading of 100% LEL tells you that you have at least 5.3% methane in the air OR you may have any concentration in the explosive range of methane (5.3% - 14%)
On an older meter with a needle gauge, a concentration above the UEL (Upper Explosive Limit - 14% for methane) will cause the needle to rise to 100%, pause, then drop back to 0%. On newer meters, with LCD displays, there will usually be a warning message telling you that the concentration is above the UEL. On older meters, you must watch the needle constantly.

Slide 5b-21 CGI Summary
Remember the limitations - CGIs are sensitive to lead, and require at least 19.5% oxygen to operate reliably.

Slide 5b-22 Oxygen meter summary
Oxygen meters can be “poisoned” by carbon dioxide and moisture.

Slide 5b-23 Converting Readings
Percentage reading from the LEL meter can be converted to ppm to make useful health and safety descisions.

Slide 5b-24 Colorimetric Tubes
Follow manufacturer’s directions. Basically there is a vacuum pump to get air through the glass tube and the chemical inside will change color to indicate a positive reaction. The level of color change indicates concentration.

Slide 5b-25 Improvising
using all the capabilities of your instruments.

Slide 5b-26 Tube Summary

Slide 5b-27 Photo Ionization Detector
Schematic operation of the PID (Hnu)
Basically, air enters the probe, is ionized by UV light, and the degree of ionization is measured. Different chemicals are ionized by different frequencies of UV light so some identification of unknowns is possible with the PID.

Slide 5b-28 PID summary

Slide 5b-29 Flame Ionization Detector

Similar to PID but heat is used for ionization

Slide 5b-30 Geiger Counters
This is the contents of a “White Kit” from the state of New Jersey RERP unit. From top of slide to bottom, it contains:

Alpha emission detector
Beta/gamma emission detector
Gamma detector (weak source)
Gamma detector (strong source) - the old Civil Defense CDV-715

To the lower right is the dosimeter calibration box; the white rings above it are dosimeters.

Slide 5b-31 CDV-715 geiger Counter
Measures the rate of gamma radiation in r/hr - roentgens per hour. Also note that there are different sesitiveties that can be selected.
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MODULE 6: BASIC HAZ MAT CONTROL

Time: 55 Min

Time Plan

5 minutesIntroduction

10 minutesDistinguishing Defensive and Offensive Control Actions

10 minutesDefinitions

10 minutesControl Techniques

10 minutesAvailable Equipment and Reference Materials

10 minutesStudent Activity

MODULE 6: BASIC HAZMAT CONTROL

Slide 6-1 Basic Hazmat Control

Slide 6-2 Objectives

1 Distinguish between defensive and offensive actions.
2 Define:
- control
- confinement
- containment

3 Name 2 of 3 control techniques available to the operational responder.
4 List three items commonly found on fire fighting apparatus that can be used for defensive control measures.
5 List three additional items of equipment that are redily accesible and can be used for defensive control measures.
6 Name two reference books that can be used by the first responder for basic hazmat control.

Slide 6-3 Work procedures

Identify the material
Select and use proper PPE
Stop the release at the source DEFENSIVELY - that is, with no contact
Confine the spilled material to the immediate area

Slide 6-4 Defensive actions

Page 142

Actions that do not bring you into intentional contact with the material
Advantages:
1)No direct exposure
2)Specialized equipment may not be required
3)Operations require minimal supervision from command

Slide 6-5 Offensive actions

Page 143

For technician and specialist trained responders only.
Actions that may or intentionally do bring you into contact with the material.
Operations training does not qualify you to take offensive actions.
Examples:
1) transferring the product
2) plugging and patching damaged containers
3) uprighting leaking containers

Slide 6-6 Hazmat Control

PHYSICAL METHODS:
- _ABSORPTION
- _COVERING
- _DIKES, DAMS, DIVERSIONS, RETENTION
- _OVERPACK

_PLUG / PATCH
_VAPOR SUPPRESSION
_VENTING

Slide 6-7 Absorption
Drop absorbant materials (loose or in pads) onto liquids to facilitate removal.

Slide 6-8 Covering
simply dropping a lid on to an open container or placing a tarp over a spill will reduce the material getting into the air.

Slide 6-9 Diking
A dike of booms, plastic, earth, etc. placed around a spill will confine it and prevent its spread.

Slide 6-10 Stream Booming Page 144
Booms across a stream may stop a lighter than water hazmat flow (such as oil) BUT the booms should be placed at an angle to the current. This will lead the product to the downstream side of the boom where it can be collected with a skimmer.

Slide 6-11 wire fence boom (cartoon)
If booms are not available - a wire fence across the stream will hold loose absorbant in place to intercept the hazmat flow

Slide 6-12 Wire Fence Boom Photo
Remember, this strategy is useful only for materials with low specific gravity

Slide 6-13 Earth Dam and Weir
A wide plank is used to hold back floating material.

Slide 6-14 T-siphon and earth dam
This is an underflow dam. The “T” siphon, made of pipe allows the flow of water from under the floating hazmat. The “T” prevents the formation of a vortex that would suck the floating material down into the pipe.

Slide 6-15 Overflow dam
If the hazmat is “heavier” than water and sinks, hold it back by erecting a dam that allows water to spill over its top. Protect the spillway with plastic tarps or your dam will erode away quickly. You can also erect a series of dams across the stream. If one fails, there will be another as backup.

Slide 6-16 Underflow dam
Like the “T” siphon. The intake end of the pipe must be deep enough so it doesn’t form a vortex and suck the hazmat down and through.

Slide 6-17 Photo of underflow Dam

Slide 6-18 Barrier foe Manhole Cover

Slide 6-19 Culvert weir
Wide board used to hold back floating hazmat and prevent it's entering a culvert.

Slide 6-20 Retention method
Damming around a sewer grate to prevent material from entering. This is a commercially available, 'rubber' dam.

Slide 6-21 Overpack drum
Overpacking is, potentially, an offensive task.

Slide 6-22 Plug/Patch
Plugging and patching is, potentially, an offensive task. You may be able to modify the procedure to avoid contact, but think before you act.

Slide 6-23 Plugs
This is an insert plug to protect a floor drain system.

Slide 6-24 Venting
If containers are being impinged by fire, venting product may prevent a tank rupture or BLEVE. This is generally an offensive action.

Slide 6-25 Tools
Typical emergency responder tool kit. The tools are made from bronze so they will not make sparks. {think - are there flammable products in the hot zone.}

Slide 6-26 Methods of Control Page 146
Adsorption
Gelation
Neutralization
Dispersion
Controlled burning

Slide 6-27 ADSORPTION
Here, you want the hazmat to interact with the surface of a solid adsorbant. In essence - it sticks to the outside as opposed to absortion {note spelling}

Slide 6-28 Neutralization
Shovel a WEAK acid onto a base to neutralize it.
Shovel a WEAK base onto an acid to neutralize it.
AVOID CONTACT

Slide 6-29 Controlled burn
Igniting product is an OFFENSIVE ACTION. But if it's already burning when you get there, you should ask if putting out the fire will cause more problems than it solves. How

will you clean up all the spilled product?

Note: Explain to student that they can only act in a defensive mode and no intentional contact with the material.

Emphasize that if it is known that contact will be made with material due to the action you plan to take, then DO NOT TAKE THIS ACTION

Note: Inform student thatmat.
an absorbent does not change
the chemical properties of the
haz mat. It only makes it
easier for disposal.

III.Readily available Haz Mat equipment and supplies. Page 147

Slide 7-19A.Commonly found equipment on Fire Apparatus Equipment fire apparatus that can be used for defensive control measures:

1)Tarps
2)Pressurized hose can be used
3)Shovels, axes, brooms
4)Fans
5)Spray nozzles

Other equipment that is readily accessible

1)Plastics, drop cloths, pool liners, etc.
2)Rakes, hoes, picks
3)Buckets, Pails, tubs, kiddie pools, etc.
4)Air Splints
5)Speedy dry, kitty litter, peat moss, etc.
6)Air mattress, inner tubes, inflatable pools, etc.

IV.Reference materials that are available to the first responder to assist in plans for defensive action.

1)DOT Hazardous Material Guidebook
2)Fire Protection Guide on Hazardous Material
3)Fire Protection Guide
4)Hazardous Chemicals DATA Book
5)The Merck Index
6)NIOSH Pocket Guide to chemical hazards
7)Dangerous Goods Guide to initial emergency response (Canada)
8)CHRIS manual
9) PC based programs such as CAMEO

Student Activity

When students are asked to determine defensive actions make sure they include:

CASE #1 Jackknifed tractor trailer

1)Isolate and secure scene
2)Identify material using appropriate reference books
3)If necessary, move people
and equipment upwind. Keep equipment from becoming an ignition source
4)Placard 1993 refers to Guide page 27 in the DOT Guidebook
5)No flares, smoking, or flames in hazard area
6)Control leak with one or more of the control methods discussed in this module
7)Water spray may reduce vapor
8)Wait for trained personnel to transfer the material to another trailer
9)Can prepare a barrier of dirt, sand, etc. around area for preventive measures during transfer procedure
10)Also begin basic decon for those rescuers who removed the driver from the vehicle. Remove and isolate contaminated clothing and shoes at the site
11)Obtain more information on the type of material without contact with material

CASE #2 Dry cleaning establishment

1)Isolate and secure scene
2)Identify the materials involved and consult with reference books on health and safety hazards
3)With safety in mind, (using a fan to blow smoke in opposite direction and wearing PPE) use a vapor suppression technique by blanketing the material
4)Begin basic decon if necessary

CASE #3 Multi-vehicle accident

1)Isolate and secure scene
2)Attempt rescue of trapped victim if rescue is not in area of haz mat and rescue tools will not be a source of ignition
3)Attempt to put fire out if water will not react with any haz mat or cause runoff of haz mat into the stream
4)Make certain that the tractor trailer is safe from electrical arching. Do not make contact with any material in doing so.
5)Lay out pressurized hose across the stream as a boom to prevent material from going downstream. This might be a difficult task since you should make no contact with the material in the water
6)Depending on type of batteries, the material may react violently with water. If it does, stay away.
7)Begin basic decon if necessary

MODULE 8 BASIC DECONTAMINATION PROCEDURES

Time: 30 Min

<u>Time Plan</u>

5 minutes Introduction

10 minutes Definitions & Types

10 minutes Procedures

5 minutes Key Points

Slide 7-1 Basic Decontamination

Slide 7-2 Objectives Page 153

The student will be able to:
1 Identify the two types of decontamination.
2 List two common sense techniques to follow prior to leaving an incident
3 Name two criteria to be considered when selecting a basic decontamination site.
4 Describe two precautions that could eliminate or reduce the need for basic decontamination.
5 List two types of equipment that can be used to perform Basic Decontamination.

Slide 7-3 Are you prepared to perform decon?
Slide shows a decon area being set up. Outer booms (square shape) form a dam to keep water and decon solutions on the plastic tarp. The rings (made from booms) are acting as improvised decon pools to contain product scrubbed off the entry people. Note that the decon area is being set up in the cold zone NEAR the hot zone. No chemical protective clothing is required for the people setting it up.

Slide 7-4 Definitions
Decontamination is
The process of removing potentially harmful contaminates from exposed individuals and equipment in order to reduce the spread of contamination in the work area and to prevent inadvertent and unnecessary contact with contaminated materials.

Slide 7-5 Basic decon Page 154
Basic Decon - Common sense approach with unintentional contact with Haz Mat. Keep material outside of suit. Remove the product. Leave product at scene.
Generally this is emergency decon.

Slide 7-6 Full Decon
Full Decon - stations are involved. Technician level or above.
Multi-step decon to remove all product from entry people. Workers go through several showers and are helped to shed equipment piece by piece until they reach the end of the decon line wearing inner gloves (the last of the three pairs they wear) and their SCBA. They then proceed to remove their own SCBA mask and finally their inner gloves.

Slide 7-7 Common Sense
Common sense rules:

1 check your own hands and feet for product
2 observe each other for product
3 if you are not sure that an article is decontaminated - leave it behind
4 while performing decontamination -avoid contact with contaminated articles/people

Slide 7-8 Remove contaminated articles while avoiding contact with the product.

Slide 7-9 Brush Off vs Hose Off
BRUSH OFF METHOD - physically brushing the product off people (unto a plastic sheet for disposal) with brooms, mops or other such. Avoid contact with contaminated articles/people. Powders and dust.
HOSE OFF METHOD - person is directed to a tarp lined area and hosed off counting on the dilution with water to clean them off. Check to make sure that the product is compatible with water. Liquids and paste.

Explain the differences between the Hot, Warm, and Cold Zones. Emphasize the dangers involved with the Hot Zone and why PPE is mandatory.

Hot Zone - Contamination is expected. Only personnel properly equipped are allowed to enter this zone.
Warm Zone - Located between Hot and Cold Zone. Decon team would be located in this zone.
Cold Zone - Located upwind and uphill of Hot and Warm Zone. Command and other support located here.
A log should be kept to keep a record of who enter or exit the scene.

Slide 7-10 Basic Decon Site Selection
A.Precautions
B.Procedures

Depending on the Haz Mat, the Decon site should be within 100 yards of the incident to reduce the problems of transporting personnel and to eliminate further contamination of the surrounding area.

Selection of the decontamination site should be based on the accessibility to the incident, water supplies, secure dike or basin areas, and proximity to environmentally sensitive areas such as streams and ponds.

Decon should be set up within 15 minutes of contamination.

The entire area for decon should be taped off and isolated. No one working in the decon area should be there without personal protective equipment.

NOTE: Provisions should be made to bag personal property separately from clothing to avoid reopeningl contaminated clothing bags.

Equipment, clothes, or material that becomes contaminated should be left in the decon area until they can be properly decontaminated, evaluated and analyzed, or disposed of. Household type plastic trash bags may suffice as containment for contaminated items.

All bags should be labeled for identification.

Remember: If you have entered the Hot Zone (only for Defensive Action), the conservative action is always assume contamination, therefore, you must go through the basic decon process.

Key Points

Emphasize again to the students that a common sense approach to the prevention of contamination could eliminate any dangers to personnel or equipment.

Prevention of contamination can be thought of as decontamination.

Decontamination personnel should be in full protective clothing.

If possible, victims are not to be transported until decontaminated.

NOTE: SCBA is the last item of PPE to be removed when processing through basic decon.

Slide 7-11 Equipment that is available for basic decon:
Brooms, brushes, dust mops, shovels, utensils such aspitchforks, etc.

Other pieces of equipment readily available
Moderate pressure and low volume hose line.
Catch basins to contain cleansing water for proper disposal.
8 mm Polyfilm placed on ground will eliminate ground absorption.
Polyfilm or plastic sheeting.
Household type plastic garbage bags.

Liquids can soak into wood and flow into metal cracks and seams and under bolts. Fire

apparatus should be completely washed with detergent and rinsed.

Slide 7-12 Chemical Warfare Agent Decon
The greatest problem when considering WMD decon is thinking in terms of MASS CASUALTIES. How do you decon 500 people in the next ten minutes?

One possibility - define a corridor with two fire trucks. Set up spray nozzles aimed into the corridor. March everyone down the corridor to hose them off.

MODULE 8:SOPs, Recordkeeping and Termination Procedures

Time: 55 Min

<u>Time Plan</u>

5 minutesIntroduction

10 minutesSOPs

10 minutesPre-Incident Records

10 minutesAlarm

10 minutesOn-Site

10 minutesTermination

Slide 8-1 SOPs, Recordkeeping and Termination Procedures

Slide 8-2 Objectives
The student will be able to:
1.State the main reason for establishing SOPs.
2.State the definition of a Standard Operating Procedure.
3.Identify who has the authority to deviate from a procedure.
4.List three pre-incident records.
5.Describe (3) items of information which you have the right to obtain from your employer under RTK.
6.List 2 employer RTK requirements.
7.List and describe the most important on-site record.
8.List three phases associated with termination.

Slide 3 FOUR PHASES OF RECORDKEEPING
PRE-INCIDENT (maintenance and training records) ALARM (document particulars of the alarm call) ON-SCENE (Log of everything that occurred) POST (after incident reports and analysis)

Slide 4 SOP PHILOSOPHY
Written procedures preserve the experience gained from dealing with a recurring problem.

Slide 5 SOPs SHOULD INCLUDE:
Effective date
Authority
Introduction & purpose
Mechanics
Key point in this paragraph is a deviation of an SOP occurs when the situation exceeds the intent of the SOP, and the persons deviating has the authority

It is also important to understand the "whys" behind an SOP so that personnel can easily recognize when conditions are such that additional or alternative action is required.

In most cases the SOP will be worded such that the company officer or incident commander have the authority to deviate from the SOP when the situation exceeds the original intent of the SOP. Of course they should be held accountable for the consequences of any such deviations.

As your implement SOPs make sure that appropriate training and education for all personnel is part of the implementation program so that everyone knows, not just what the SOP is, but also why it must be followed.

Introduction to parts of an SOP
Let's examine the parts of an SOP to gain a better understanding of them, and to

familiarize you with their construction so that you'll be better equipped to write an SOP if the requirement is ever placed upon you.

Refer students to the generic State Police. guide for SOP format in their Student Manual page 165

Parts of an SOP
Authority: A brief statement, indicating the legal or quasi- legislative sources or base, from which the SOP is drawn - if applicable.

II.Purpose: A concise explanation of the SOP should include a policy statement if applicable.

III.Mechanics: A guide to carrying out the intended purpose or policy of the order. General or specific instructions as to what must, what may, and what must not be done.

Orders must always serve the user, not the originator. Since a single user may receive orders written by many people, it is extremely important that the content of orders be presented in a clear, consistent way. As a guide to the originator, the following suggestions are presented:

Be specific
Be brief
Write directly to the reader

Key Words: Freedom of Choice on the part of the reader can be suggested by certain words. Use "will" and "will not", "shall" and "shall not" when reader will have no choice. Use "should" when he is to do something if he is able or if circumstances permit, but he should not do if time, equipment, skill, cooperation, or other circumstances make it impossible or at least difficult. Use "may" when there is freedom of choice, i.e., "You shall make out a daily activity report." "You should make it out upon completion of shift." "You may make a copy of it if you wish."

Remember, in order to be effective, SOPs must be written, officially sanctioned, activated whenever applicable, consistently enforced, trained on, reviewed and revised to remain viable.

Slide 6 The Worker and Community Right to Know Act (NJAC 8:59) page 169
Reporting of hazardous substances on site.
Training for employees and maintenance of training records.
Maintenance of health/exposure records.
Labeling of containers.
What is the Right-To-Know Act?
The New Jersey Worker and Community Right-To-Know Act requires employers to provide information about hazardous substances at their facilities in order to:
-Give workers information about their working conditions and workplaces.

-Give residents information about their community environment.
-Help firefighters, police, and other first responders at emergencies such as spills, explosions, or fires.
-Help public officials develop contingency plans in the event of an industrial accident.
-Provide data to use to monitor and track hazardous substances in the workplace and the environment.
How does the Act work?

Emphasize the Right-To-Know Survey is sent to the local Police Department Fire Department, NJDEP, County lead agency.

Employers covered by the act must complete Right-To-Know Surveys, reporting the names and quantities of hazardous materials present. The completed surveys are sent to the New Jersey Department of Environmental Protection (DEP), local fire and police departments, and county health agencies. Employers selected by DEP are required to complete an Environmental Survey Part II, providing detailed information about releases and disposal practices. The public has access to both surveys. (See "Access to Information.")

Also, employers are required to label containers and train employees about hazardous substances. Manufacturers follow federal rules regarding labeling and training. All other employers are subject to the provisions of the New Jersey Right-To-Know Act jointly administered by the New Jersey Department of Health (DHSS), Labor, and Environmental Protection.

Hazardous Substance Fact Sheets, developed by DHSS, provide information about the hazardous substances covered by the law, and are available to employers, workers and the public. Soon to be adopted by USEPA.

Who is covered by the act?

The New Jersey Legislature designated the types of employers covered under the Right-To-Know Act. More than 35,000 employers who potentially use hazardous materials must complete Right-To-Know Surveys.

Refer students to sample survey forms in Student Manual marked Figure 1 & 2. Information and directions for completing the survey are contained in Appendix C of this module in the Instructor Guide. Cover items A through J

Employers covered by the law include manufacturers and employers from the following groups: lawn and garden services; pipelines; transportation services; communications; utilities; car dealers; gas stations; commercial testing labs;

on Figure I and 1 through 9 on Figure 2.

dry cleaners; automotive repair, hospitals; schools; and state, county, and local government.

Contact your county agency, DEP, or DHSS for more information about the businesses that are covered and their responsibilities under the law.

Slide 7 OTHER RECORDS
Training records and certifications of employees.
Maintenance records on all equipment.
Incident record keeping begins long before the actual incident. Records are kept on both the individuals and equipment which will respond to an incident. This includes your department's training records for all courses and drills attended by members.

Additionally, annual face piece fit test records will be maintained for persons using SCBA's as per OSHA 1910.134.

Medical records maintained on all individuals will include exposure records.

Records should be kept for equipment as well, to show maintenance and inspection of each piece. Monitoring equipment needs to be calibrated on a routine basis, which also should be recorded.

Slide 8 ALARM Page 170
Use an initial contact message form.

Slide 9 ON-SCENE
Chronological Log pg 172
Access Control Log
Exposure Records
Method(s) of Decontamination

Chronological control log should be maintained at the command post. This may be the most important document at the completion of the incident to determine why decisions were made, actions taken and who performed them, are vital pieces of information needed in post incident analysis.

While operations are taking place, an Access Control Log should be maintained for information as to the specific individual who may be on site at any given time. Should an on site emergency take place, the Safety Officer has to know who was on site and what they were doing. This log should also show the time an individual went on SCBA air, the estimated duration, and anticipated exit time. The type of exposure to each individual along with decontamination methods used are part of the reporting process.

Finally, a record must be kept on the list of all resources used, who supplied them, when and what. Upon completion of the incident reimbursement and payment will take place for

many resources used. Your log will be important in settling these claims.

Slide 10 Termination pg 173

Phase down
Follow up

Termination activities should concentrate on funnelling accurate information to the people who need it the most. Initially, this group is a small number of emergency responders who may be briefed on the signs and symptoms of a particular product or on special decon procedures. On larger incidents, the number of people with a "need to know" expands and may even include the representatives from contractors or other agencies.

Release of inaccurate information may have many long-reaching effects. Incorrect hazard data could result in illness to those exposed, improper clean-up techniques, and unsafe disposal procedures. Failure to properly manage termination activities may also result in inaccurate assessments form the public and news media.

Slide 11 Phase Down Activities

ALL personnel are notified that emergency is terminated.
Contaminated material of any description does NOT leave the site until it is decontaminated.
Identify funding source before private contractors are called.
Evidence is turned over to proper authority with chain of custody.
Final medical monitoring performed and all records consolidated.

Slide 12 Incident Follow-up

Slide 13 Debriefing

Inform responders
Equipment damage
Gather information
Summarize activities
Reinforce positive aspects

An effective debriefing should:

1.Inform responders exactly what haz mats they were (possibly) exposed to and their signs and symptoms.

2.Identify equipment damage and unsafe conditions requiring immediate attention or isolation for further evaluation.

3.Assign information-gathering responsibilities for a post-incident analysis and critique.

4.Summarize the activities performed by each sector, including topics for follow-up.

5.Reinforce the positive aspects of the response.

Debriefings should begin as soon as the "emergency" phase of the operation is completed. Ideally, this should be before first responders leave the scene, and it should include the sector officers, and other key players such as public information officers and agency representatives who the Incident Commander determines have a need to know.

On larger incidents, these representatives will return to their personnel and pass on the essential information including, when applicable, who to contact for more information.

Debriefings should be conducted in buildings or vehicles which are free from distractions such as cold or hot weather, emergency services radios, loud generators, etc.

Debriefings should be:

-Conducted by one person acting as the Chairperson-The Incident Commander may not be the best facilitator or may not be available for the entire debriefing. He should at least be present to summarize his feelings about the entire incident and to reinforce its positive aspects. The Chairperson should be someone of authority who can take a "big picture" view of the incident.

-Limited to a maximum of 45 minutes-Its intent is to briefly review the incident and send everyone home, not analyze every action of every player. If more interaction is needed on a specific subject or operation, continue it after the debriefing.

Debriefings should cover certain subjects, in the following order:

1.Health information-Exactly what each ERP has been (possible) exposed to and signs and symptoms of oncoming illness. Some substances may show delayed signs and symptoms of exposure for 24 to 48 hours. When appropriate, cover responsibilities for follow-up evaluations and log exposure levels for future reference.

2.Equipment and apparatus exposure review-Ensure that equipment and apparatus that is unfit for service is clearly marked and plans made for special cleaning or equipment disposal. It is common to have firefighting gear and personal clothing laundered upon return to the estation. Someone must be specifically delegated the responsibility for contaminated garments and a follow-up date set.

3.Provide a follow-up contact person-Ensure that anyone involved after the release of ERP from the scene, such as clean up contractors and investigators, have access to a single information source who can acquire the needed data. The contact person is also responsible for collecting and maintaining all incident documents until their delivery to the appropriate investigator.

4.Identify problems requiring immediate action-Equipment failures, safety, major personnel problems, or potential legal ramifications should be quickly reviewed on-scene. If it is not crucial, save it for the critique.

5.Say "thank you"-Most haz mat incidents are hard work and often test personal endurance and everyone's sense of humor. Reinforcement of the things that went right, a commitment to work on the problems uncovered, and a thank you form the boss goes a long way. Never end on a sour note.

Slide 14 Post-Incident Analysis

Financial responsibility
Clear picture of response
- Command and control
- Tactical operations
- Resources
- Support services

Post-Incident Analysis

There are many agencies and individuals who have a legitimate need for information about any significant haz mat incident. They may include manufacturing and shipping company representatives, insurance companies, government agencies and even citizens groups. This section will review post-incident analysis (PIA) as it relates to improving emergency response. It will not discuss who is responsible for fact-finding missions.

Post-incident analysis is the reconstruction of the incident to establish a clear picture of the events that took place during the incident. It is conducted to:

-Determine the level of financial responsibility. (Who pays?)
-Establish a clear picture of the emergency response for further study. The PIA differs from investigations which are usually conducted to establish the probable cause of the accident for administrative, civil, or criminal proceedings.

The PIA begins with the designation of one person (or office) to collect information about the response during the debriefing. They will, in turn, provide all available data to those who need to know.

This method guarantees that sensitive or unverified information (e.g., injured personnel) is not released to the wrong organization or in an untimely manner.

The IC and the person conducting the PIA should meet as soon as practical to review the key events of the incident and to identify subjects for immediate follow-up.

As soon as practical, construct a brief chronological review of who did what, when, and where during the incident. A simple timeline placing the key players at specific locations at different times is a good start.
Cooperation between the PIA team and other official investigators will save time and combine resources to reconstruct the incident completely.

Additional information can be acquired from:

-Tape recordings of the communications center(s) involved
-Videotape recordings made by the media
-Interviews of ERP
-Photographs, film, and videotape taken by ERP.

Slide 15 Critique
Direct answers to direct questions
Play by the rules
Observations from each operational group
Documentation
Summarize lessons learned

Critiques

Many injuries and fatalities have been prevented as a result of critique sessions. An effective critique program is supported by top management as a positive way to outline lessons learned. The more severe the incident, the more important to share what you have learned.

A commitment to critique all haz mat responses will improve ERP performance by improving efficiency and pinpointing weaknesses. A good critique mentality promotes:

-Trust in the response system as being self-correcting
-Willingness to cooperate through teamwork
-Continuing training of skills and techniques
-Preplanning for significant incidents
-Sharing information between response agencies

Although every organization has a tendency to develop its own critique style, never use a critique to assign blame (public meetings are the worst time to discipline personnel). Do use it as a valuable learning experience (everyone came to the incident with good intentions).

The crucial player in this scenario is the critique leader, who acts as a director of the entire performance. A critique leader can be anyone who is comfortable and effective working in front of a group. This may not always be an officer. Local experts or informed third parties, such as a local fire brigade safety officer, can also fill this role.

The critique leader should:

-Control the critique. Introduce the players and procedures, keep it moving, and end it on schedule.

-Ensure that direct questions receive direct answers.

-Ensure that all participants play by the critique rules.

-Ensure that each operational group presents their observations.

When practical, each individual should:

-Keep notes of important points.
-Sum up the lessons learned.

Summary

Hazardous materials incidents should be formally terminated to ensure ERP safety, to establish a record of events, and to document the lessons learned from the entire incident.

Termination activities are divided into three phases; an incident debriefing, a post-incident analysis of what actually happened, and a formal critique designed to emphasize successful, as well as unsuccessful, operations.