Hazardous Materials

First Responder Operations

Participant Notebook
Governor's Office of Emergency Services
California Specialized Training Institute

Chapter A

Welcome and Course Overview

Main Points

- Introductions and Welcome
- Course Overview
- Key Administrative Announcements
- Need for First Responder Training
- "SAFE" Acronym Theme
- Class Groups and Teams

Chapter Outline

1. Introductions and Welcome.

a. Course Manager welcome.

b. Staff introductions.

c. Class participant introductions.

2. Course Overview.

a. Course purpose and goal.

b. Class schedule.

3. Key Administrative Announcements.

a. Break and lunch info. (Start on time, finish on time.)

b. Restroom location(s).

c. Policy on smoking and/or eating in the facility.

d. Emergency telephone number.

e. Class evaluation form.

f. Certification Requirements.

Course Goal

Purpose/Goal: To Train first responders to recognize a hazardous materials incident and implement actions to protect themselves, the public, the environment and nearby property while responding in a defensive fashion.

Course Requirements

Hours: 16 Minimum.

Exercise: Participate in simulated Hazmat exercise/event, requiring participants to explain safe and proper First Responder Operations actions, per exercise objectives; *and*

Demonstrate proper use of USDOT Emergency Response Guidebook during a Hazmat exercise; *and*

Exam: Complete a state certified written examination.

Performance Full class attendance at minimum hours, participate in an exercise, *and*

Minimum 70% score on exam required for certification.

4. Need for First Responder Training.

a. Primary need: Overall safe and competent response, within the *Operations* level.

b. To give responders the ability to:
   1) Recognize potential or actual Hazmat incidents.
   2) Safely isolate the scene and make proper notifications.
   3) Conduct initial identification and assessment.
   4) Initiate command.
   5) Conduct containment and protective actions.
   6) Contribute to effective and efficient response.

5. "SAFE" Acronym Theme.

a. **S**afety first, last and always.

b. **A**nalyze all information per *your* needs.

c. **F**ocus on First Responder Operations safety and competence.

d. **E**nthusiastic involvement by all.

6. Class Groups and Teams.

Chapter B

Introduction to Hazardous Materials at the First Responder Operations Level

Main Points

- The Hazmat Problem
- OSHA Hazwoper Regulation
- OSHA Hazwoper Levels
- Hazmat Definitions, Terms and Acronyms
- DOT Hazmat Classes and Examples
- Multiple Hazards
- Hazmat Commons and Typicals
- Hazmat Tactical Operations Acronym

Chapter Outline

1. The Hazmat Problem.

a. Hazardous Materials are made, transported, stored and used in every state, city and town.
   1) Standard of living requires hazmat use and transport.
   2) Millions of chemicals in existence, thousands classified as hazardous and hundreds as extremely hazardous.

b. Major elements of the Hazmat problem include:
   1) Volume of hazardous materials,
   2) Variety of hazardous materials,
   3) Widespread presence of hazardous material, and
   4) The human factor.

c. Because of these elements, "Events" (accidents, emergencies and incidents) *will* happen.

d. Hazmat Events can have negative outcomes on life/health, environment, and property.

e. Government or industry can't eliminate events, but can:
   1) Prepare for events.
   2) Effectively respond to events.
   3) Training helps us do all of the above!

f. Hazmat events are different from other emergencies:
   1) Many hazmats can injure or kill before you see or smell them.
   2) Some hazmat events can get suddenly worse (e.g. BLEVEs).
   3) Must respond *safely, slowly and methodically.*

Hazardous Materials Problem

California

Over 1,300 transportation-related accidents involving hazardous materials each year.

Over 150 chemical manufacturers.

Over 144,000 business selling or using chemicals.

Over 7000 hazmat/oil spills each year.

Over 1,000,000 tons of petroleum products, hazardous materials and hazardous waste shipped each year.

Fundamental difference in a Hazmat response:

We must respond:

- *Safely*
- *Slowly*
- *Methodically*

Hazmat events cannot be eliminated—***interaction of hazmats and human beings will create hazmat events!***

2. OSHA Hazwoper Regulation.

a. **Haz**ardous **W**aste **Op**erations and **E**mergency **R**esponse (Hazwoper). 29 CFR 1910.120 (federal regulation) and Title 8 CCR 5192 (California regulation).
   1) Regulates three activities:
      a) Hazardous waste site cleanup. (e)
      b) Operation of treatment, storage and disposal facilities. (p)
      c) Emergency response to hazmat releases. (q)
   2) Requires employers to:
      a) Plan for response and cleanup.
      b) Train employees for assigned roles.
      c) Follow basic response requirements.

b. Focus of this course is on emergency response.

c. Hazwoper specifies training for various levels of responders.

3. OSHA Hazwoper Training Levels.

a. The first people there (i.e. "First Responders") are the first line of defense to protect Life, Environment & Property.

b. Primary First Responder role is to *safely and competently respond within appropriate level, resources and capabilities.*

c. First Responder at the "Awareness" Level:
   1) Definition: One likely to witness/discover a Hazmat release and can initiate notifying authorities and take *no further actions*. [29 CFR 1910.120(q)(6)(i) & 8 CCR 5192(q)(6)(A) See page B-16 & B-17 for more complete definitions.]

OSHA Policy for FRO Training

Law Enforcement "Generally, law enforcement and facility security personnel should be trained to the first responder awareness level since they are likely to witness or discover a release of a hazardous substance."

Fire "Firefighters expected to respond to releases of hazardous substances must be trained to at least the **first responder operations** level, since they will respond to releases, or potential releases, of hazardous substances for the purpose of protecting nearby persons, property, or the environment."

EMS "…employers with emergency medical personnel who would be exposed to hazardous substances because they are expected to treat contaminated patients at the release area (i.e., ambulance personnel) are required by 1910.120(q) to train these personnel to safely perform their duties."

Zones "Areas surrounding the danger area need to be controlled during emergencies by prohibiting unauthorized personnel from entering the emergency release area…Personnel expected to set up boundaries designating safe and unsafe areas must be trained to the first responder operations level. An employee trained to the first responder awareness level may not set up safe distances…Once these areas have been established, first responder operations level personnel must control entry and exit from the area of the release. (Note: Awareness level trained personnel may assist in preventing unauthorized entry into the area of the release providing all of their activities are done at a safe remote location.)"

Source: OSHA CPL 02-02-073

3. OSHA Hazwoper Levels. *(continued)*

d. First Responder at the "Operations" Level:

1) Definition: One who responds to a hazmat release to protect nearby persons, environment or property (trained to act in a *defensive* fashion without trying to actually stop the release). [29 CFR 1910.120(q)(6)(ii) & 8 CCR 5192(q)(6)(B)]

e. First Responders at *both* levels have limits:

1) Equipment: Lack adequate protective equipment.
2) Training: Not trained/equipped to **stop** the release.

f. Other Responders levels:

1) Technicians — "...individuals who respond to releases or potential releases of hazardous substances for the purpose of stopping the release. They assume a more aggressive role than a first responder..."
2) Specialists — "...respond with and provide support to [hazmat] technicians...require a more directed or specific knowledge of the various substances...also act as the site liaison with federal, state, local and other government authorities..."
3) Incident Commander (IC) — "will assume control of the incident scene..." (Overall *management* of the incident.)
4) Skilled Support Personnel—"Personnel…skilled in the operation of certain equipment, such as mechanized earth moving or digging equipment or crane and hoisting equipment, and who are needed temporarily to perform immediate emergency support work… are not required to meet the training required in this paragraph…"
5) Specialist employees—"Employees who…work with and are trained in the hazards of specific hazardous substances, and…provide technical advice or assistance…"

g. Know your level, role/responsibility **and** limits!

First Responder Awareness vs. Operations

Awareness	Operations
Likely to witness or discover a release.	Likely to witness or discover a release.
Initiate an emergency response.	Initiate an emergency response.
Notify the authorities of the release.	Notify the authorities of the release.
	Respond to release in defensive fashion.
	Protect persons, property & environment.
	Contain the release from a safe distance.

First Responder vs. Technician/Specialist

First Responder	Tech/Spec
Part of *initial* response.	Implement emergency response plan.
Respond to release in *defensive* fashion.	Assume a more aggressive role.
Contain the release from a safe distance.	Control or stop the release.

4. Hazmat Definitions, Terms and Acronyms.

a. No one universal term or definition.
   1) In the workplace: **hazardous chemical** (OSHA).
   2) When transported: **hazardous material** (DOT).
   3) If it's otherwise regulated: **hazardous substance** (EPA).
   4) When you can't use it anymore: **hazardous waste** (EPA).
   5) See facing page for definitions.

b. Other hazmat terms.
   1) **Extremely hazardous substance** (EPA): Stricter reporting requirements than other hazmats.
   2) **Highly hazardous chemical** (Fed OSHA), **Acutely Hazardous Material** (CalOSHA): Regulated by Process Safety Management regulations.
   3) **Toxic chemical** (EPA): Annual reporting required for releases.

c. Different laws, different definitions.
   1) Laws/regs passed at different times for different purposes.
   2) Some (definitions and laws) may overlap.
   3) For FROs, "hazardous" means what it says.

d. Hazmat terms and acronyms.
   1) There are a lot.
   2) Some may be confusing.
   3) Don't be afraid to ask (See Annex).

e. Classification of hazardous materials in transportation.
   1) UN and USDOT classification system.
   2) Uses 9 hazard classes.
   3) Used worldwide (and in this course!).

What are hazardous materials?

Definitions: **There is no one definition!** Here are the important ones.

OSHA **Hazardous Chemical**: Any substance to which exposure "results or may result in adverse affects on the health or safety of employees:" or "any chemical which is a physical hazard or a health hazard." 29 CFR 1910.1200(c)

EPA **Hazardous Substance**: "Any substance designated pursuant to section 311(b)(2)(A) of the CWA [Clean Water Act]; any element, compound, mixture, solution or substance designated pursuant to section 102 of CERCLA; any hazardous waste having the characteristics identified under or listed pursuant to section 301 of the Solid Waste Disposal Act... any toxic pollutant listed under section 307(a) of the CWA; any hazardous air pollutant listed under section 112 of the clean Air Act; and any imminently hazardous chemical substance or mixture with respect to which the EPA Administrator has taken action pursuant to section 7 of the Toxic Substances Control Act." 40 CFR 300.5

DOT **Hazardous Material**: "...substance or material, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce… The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials as defined in this section..." 49 CFR 171.8

5. DOT Hazmat Classes and Examples.

a. USDOT Hazmat classes and divisions.

1) Explosives (Class 1) — Trinitrotoluene (TNT).
   1.1 Mass explosion hazard.
   1.2 Projection hazard.
   1.3 Predominately a fire hazard.
   1.4 No significant blast hazard.
   1.5 Very insensitive explosives or blasting agents.
   1.6 Extremely insensitive detonating substances.
2) Gases (Flammable or Poisonous) (Class 2) — Ammonia.
   2.1 Flammable gas.
   2.2 Non-flammable compressed gas.
   2.3 Poisonous gas.
3) Flammable and Combustible Liquids (Class 3) — Gasoline.
4) Flammable Solids (Class 4) — Naphthalene.
   4.1 Flammable solid.
   4.2 Spontaneously combustible.
   4.3 Dangerous when wet.
5) Oxidizers and Organic Peroxides (Class 5) — Calcium Nitrate.
   5.1 Oxidizer.
   5.2 Organic peroxide.
6) Poisonous and Infectious Materials (Class 6) — Acrolein.
   6.1 Poisonous.
   6.2 Infectious substance (etiologic agent).
7) Radioactive Materials (Class 7) — Uranium Hexafluoride.
8) Corrosive Materials (Class 8) — Sulfuric Acid.
9) Misc. Hazardous Materials (Class 9) — Asbestos.

Definitions & Major Hazards of Hazard Classes.

Class 1	Any substance, article or device designed to function by explosion (extremely rapid release of gas and heat).
Class 2	Flammable gas: Ignitable at low concentrations (<13%). Compressed gas: Shipped at >41 psia. Poisonous gas: Toxic to humans or hazardous to health (or LC50 of not more than 5000 ml/m3 for laboratory animals). (i.e. Toxic in low concentrations.)
Class 3	Flammable Liquid: Flash point <141°F. Combustible Liquid: Flash point >141°F. (100°-200°F for domestic shipments.)
Class 4	Explosives shipped with sufficient wetting agent to suppress explosive properties. Substance that can ignite if in contact with air <5 minutes. Substance that gives off flammable or toxic vapors or is spontaneously flammable upon contact with water.
Class 5	A material that can cause or enhance the combustion of other materials (usually by giving up oxygen.)
Class 6	Toxic to humans, hazardous to human health or presumed toxic to humans based upon tests on laboratory animals.
Class 7	Substance with specific activity > 0.002 microcuries per gram.
Class 8	Substance that causes visible destruction or irreversible alterations in human skin tissue or a liquid that has a severe corrosion rate on steel or aluminum.
Class 9	Material with anesthetic, noxious or similar property that could cause extreme annoyance or discomfort to flight crew and prevent performance of assigned duties. Does not meet the definition of any other class.

6. Multiple Hazards.

a. DOT regulations are performance standards—a material is "hazardous" because it meets the DOT definition. Not all materials neatly fall into those definitions. It's possible for a substance to meet the definition of more than one hazard class.

b. Substances that meet the definition of more than one hazard class are classified according to the highest applicable hazard class (49 CFR 173.2a) and are placarded accordingly.

c. Shipping papers and placards may not indicate all subsidiary or multiple hazards. A material may not be classified as "hazardous" by these regulations but still, under certain circumstances, be hazardous (e.g. ammonia and flammability).

d. *Responders should always think of multiple hazards regardless of how a substance is placarded or labeled!*

7. Hazmat Commons and Typicals.

a. Commons:
   1) Common release: Petroleum products (diesel or gasoline).
   2) Common release locations: Fixed facilities (in over 25% of the incidents the surrounding area was *residential*).
   3) Common release factor: Equipment failure.

b. Typicals:
   1) Typical responder exposure: *Inhalation;*
   2) Typical number of response agencies: *Four;*
   3) Typical first responder: ***You!***

Multiple Hazards.

49 CFR 171.8 A material may meet the defining criteria for more than one hazard class but is assigned to only one hazard class.

49 CFR 172.505 Hazardous materials that possess secondary hazards ***may*** exhibit subsidiary placards.

Examples

Material	**Primary Hazard**	**Subsidiary Hazard(s)**
Acrolein	Poisonous	Flammable
Bromine	Corrosive	Poisonous
Chlorine	Poisonous	Corrosive
Denatured Alcohol	Flammable	Poisonous
Hydrazine, anhydrous	Corrosive	Flammable, Poisonous
Hydrofluoric Acid	Corrosive	Poisonous
Methanol	Flammable	Poisonous
Nitric Acid, red fuming	Corrosive	Oxidizer, Poisonous
Phosphorous, white	Spontaneously Combustible	Poisonous
Sulfur Dioxide	Poisonous	Corrosive
Uranium Hexafluoride	Radioactive	Corrosive

Commons and Typicals

The most commonly released hazardous substance in my location is: _____

The most commonly shipped or manufactured hazardous substance in my location is: _____

The most common release location where I live/work is: _____

8. Hazmat Tactical Operations Acronym.

a. **S**afety.

b. **I**solate and deny entry.

c. **N**otifications.

d. **C**ommand.

e. **I**dentification and hazard assessment.

f. **A**ction planning.

g. **P**rotective equipment.

h. **C**ountermeasures.

i. **P**rotective actions.

j. **D**econtamination.

k. **D**isposal.

l. **D**ocumentation.

m. Use it or, *develop your own acronym/checklist/memory jogger!*

Hazmat Tactical Operations/Priorities Acronym

S	*Safety*
I	*Isolate and Deny Entry*
N	*Notifications*

C	*Command/Management*
I	*Identification and Hazard Assessment*
A	*Action Planning*

P	*Protective Equipment*
C	*Containment and Control*
P	*Protective Actions*

D	*Decontamination and Cleanup*
D	*Disposal*
D	*Documentation*

First Responder Awareness

29 CFR 1910.120(q)(6)(i), Title 8 CCR 5192(q)(6)(A)

General "(6) Training. … based on the duties and function to be performed by each responder of an emergency response organization. The skill and knowledge levels required for all new responders…shall be conveyed to them through training before they are permitted to take part in actual emergency operations on an incident. Employees who participate, or are expected to participate, in emergency response, shall be given training in accordance with the following paragraphs:"

FRA "(i) First responder awareness level. …individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the authorities of the release. First responders at the awareness level shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:"

Competencies "(A) An understanding of what hazardous substances are, and the risks associated with them in an incident.
(B) An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.
(C) The ability to recognize the presence of hazardous substances…
(D) The ability to identify the hazardous substances, if possible.
(E) An understanding of the role of the first responder awareness individual in the employer's emergency response plan including site security and control and the [ERG].
(F) The ability to realize the need for additional resources, and to make appropriate notifications…"

Minimum hours None specified.

First Responder Operations

29 CFR 1910.120(q)(6)(ii), Title 8 CCR 5192(q)(6)(B)

FRO

"(ii) First responder operations level. …individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:"

Competencies

"(A) Knowledge of the 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."

Minimum hours

8 hours.

DOT Classifications of Hazardous Materials

Class #	Division #	Name of Class or Division	49 CFR §
1	1.1	Explosives (with mass explosion hazard)	173.50
1	1.2	Explosives (with projection hazard)	173.50
1	1.3	Explosives (with predominately a fire hazard)	173.50
1	1.4	Explosives (with no significant blast hazard)	173.50
1	1.5	Very insensitive explosives; blasting agents	173.50
1	1.6	Extremely insensitive detonating substances	173.50
2	2.1	Flammable gas	173.115
2	2.2	Non-flammable compressed gas	173.115
2	2.3	Poisonous gas	173.115
3		Flammable and combustible liquid	173.120
4	4.1	Flammable solid	173.124
4	4.2	Spontaneously combustible material	173.124
4	4.3	Dangerous when wet material	173.124
5	5.1	Oxidizer	173.128
5	5.2	Organic peroxide	173.128
6	6.1	Poisonous materials	173.132
6	6.2	Infectious substance (Etiologic agent)	173.134
7		Radioactive material	173.403
8		Corrosive material	173.136
9		Miscellaneous hazardous material	173.140
None		Other regulated material: ORM-D	173.144

Definitions of DOT Hazard Classes

Class 1	Any substance, article or device designed to function by explosion (extremely rapid release of gas and heat).
Class 2	Flammable gas: Ignitable at low concentrations (<13%).
	Compressed gas: Shipped at >41 psia.
	Poisonous gas: Toxic to humans or hazardous to health (or LC_{50} of not more than 5000 ml/m^3 for laboratory animals). (i.e. Toxic in low concentrations.)
Class 3	Flammable Liquid: Flash point <141°F.
	Combustible Liquid: Flash point >141°F. (100°-200°F for domestic shipments.)
Class 4	Explosives shipped with sufficient wetting agent to suppress explosive properties.
	Substance that can ignite if in contact with air <5 minutes.
	Substance that gives off flammable or toxic vapors or is spontaneously flammable upon contact with water.
Class 5	A material that can cause or enhance the combustion of other materials (usually by giving up oxygen.)
Class 6	Toxic to humans, hazardous to human health or presumed toxic to humans based upon tests on laboratory animals.
Class 7	Substance with specific activity > 0.002 microcuries per gram.
Class 8	Substance that causes visible destruction or irreversible alterations in human skin tissue or a liquid that has a severe corrosion rate on steel or aluminum.
Class 9	Material with anesthetic, noxious or similar property that could cause extreme annoyance or discomfort to flight crew and prevent performance of assigned duties. *Does not meet the definition of any other class.*

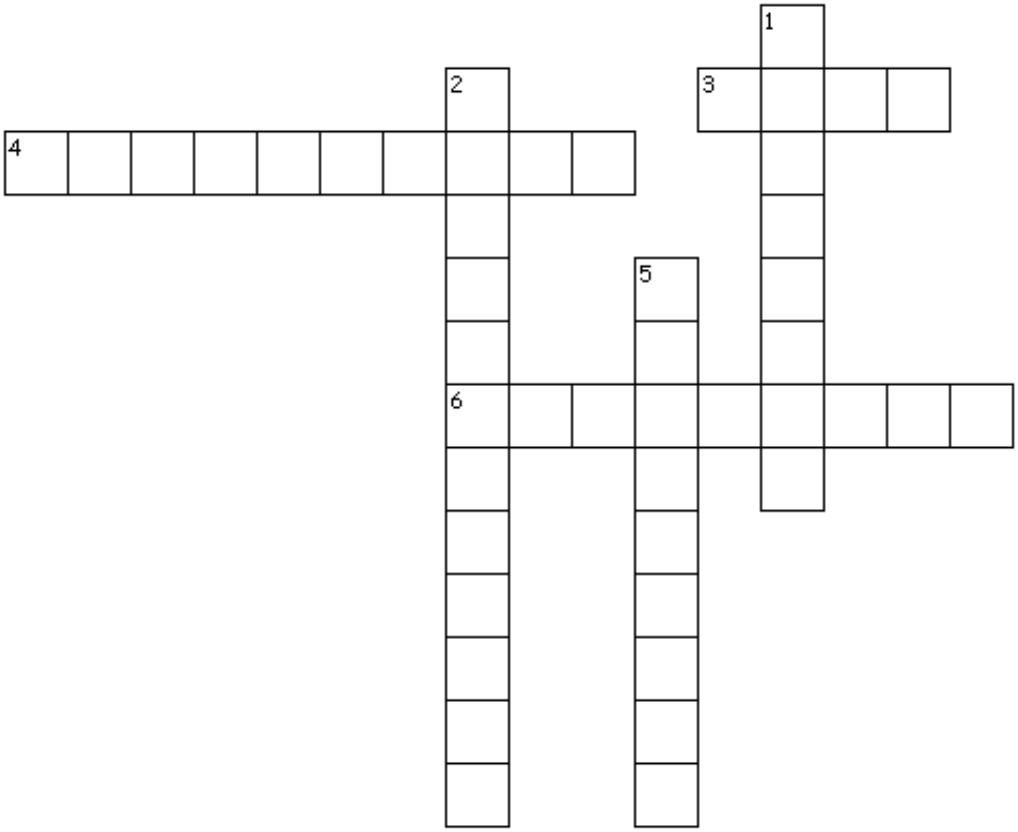
Acronyms and Abbreviations

AB	Assembly Bill
ACGIH	American Conference of Governmental Industrial Hygienists
AFFF	Aqueous Film Forming Foam
AIHA	American Industrial Hygiene Association
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
APR	Air Purifying Respirator
ATSDR	Agency for Toxic Substances and Disease Registry
AQMD	Air Quality Management District
BLEVE	Boiling Liquid Expanding Vapor Explosion
CAA	Clean Air Act (1980)
CAC	California Administrative Code
CAER	Community Awareness/Emergency Response Program
CAL-OSHA	California Occupational Safety and Health Administration
CAMEO	Computer-Aided Management of Emergency Operations
CAS	Chemical Abstracts Service
CCR	California Code of Regulations
CDF	California Department of Forestry
CEEL	Community Emergency Exposure Level
CEO	Chief Executive Officer
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (1981)
CFIRS	California Fire Information Response System
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CGC	California Government Code
CHEMTREC	Chemical Transportation Emergency Center
CHLOREP	Chlorine Emergency Program
CHP	California Highway Patrol
CHRIS	Chemical Hazards Response Information System
CIH	Certified Industrial Hygienist
CMA	Chemical Manufacturer's Association
CP	Command Post
CPC	Chemical Protective Clothing
CRWQCB	California Regional Water Quality Control Board
CUPA	Certified Unified Program Agency
CVC	California Vehicle Code
CWA	Clean Water Act (1972) = FWPCA
DFW	California Department of Fish and Wildlife
DOT	Department of Transportation
DTSC	Department of Toxic Substances Control
EOC	Emergency Operations Center
EOD UNIT	Explosives Ordnance Disposal Unit
EPA	Environmental Protection Agency
ERD	Emergency Response Division (EPA)
ERG	Emergency Response Guidebook
EHS	Extremely Hazardous Substance
EMS	Emergency Medical Service
EPCRA	Emergency Planning and Community Right-to-know Act
ERP	Emergency Response Plan
FAA	Federal Aviation Administration

FEMA	Federal Emergency Management Agency
FHSA	Federal Hazardous Substance Act (1960)
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FIRESCOPE	Fire Fighting Resources of California Organized for Potential Emergencies
FOSC	Federal On-Scene Coordinator
FRA	First Responder Awareness
FRO	First Responder Operations
FWPCA	Federal Water Pollution Control Act (1972) = CWA
HAZ CAT	Hazard Categorization
HAZMAT	Hazardous Material
HEPA	High Efficiency Particulate Air filter
HHS	U. S. Department of Health and Human Services
HMTA	Hazardous Materials Transportation Act
IC	Incident Commander
ICS	Incident Command System
ICP	Incident Command Post
IDHA	Identification and Hazard Assessment
IDLH	Immediately Dangerous to Life or Health
IMO	International Maritime Organization
LC_{LO}	Lethal Concentration, low
LC_{50}	Lethal Concentration, 50%
LD_{50}	Lethal Dosage, 50%
LEL	Lower Explosive Limit
LEPC	Local Emergency Planning Committee
MSHA	Mine Safety and Health Administration
NBC	Nuclear, Biological & Chemical
NCP	National Contingency Plan
NCRIC	National Chemical Response and Information Center
NEPA	National Environmental Policy Act (1970)
NFPA	National Fire Protection Association
NIIMS	National Interagency Incident Management System
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NOS	Not Otherwise Specified
NPR	Notice of Proposed Rulemaking
NRC	National Response Center
NSC	National Safety Council
NSF	National Strike Force
OES	Office of Emergency Services (State or County)
OPA '90	Oil Pollution Act of 1990
ORM	Other Regulated Material
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
OSPR	Office of Spill Prevention and Response (DF&W)
PCB	Polychlorinated Biphenyls
PEAC	Palmtop Emergency Action for Chemicals
PEL	Permissible Exposure Limit
PIO	Public Information Officer
PPB	Parts Per Billion
PPE	Personal Protective Equipment
PPM	Parts Per Million
RCRA	Resource Conservation and Recovery Act (1976)
RQ	Reportable Quantity
RTECS	Registry of Toxic Effects of Chemical Substances

RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SB	Senate Bill
SCBA	Self-Contained Breathing Apparatus
SDS	Safety Data Sheet
SDWA	Safe Drinking Water Act (1974)
SEMS	Standardized Emergency Management System
SERC	State Emergency Response Commission
SINCIAPCPDDD	Safety, Isolation & Deny Entry, Notifications, Command/Management, Identification & Hazard Assessment, Action Planning, Protective Equipment, Containment & Control, Protective Actions, Decontamination & Cleanup, Disposal, and Documentation
SLC	State Lands Commission
STEL	Short Term Exposure Limit
SWRCB	State Water Resources Control Board
TLV	Threshold Limit Value
TOMES	Toxicology, Occupational Medicine & Environmental Series Database
TSCA	Toxic Substances Control Act (1976)
TSCD	Toxic Substances Control Division
TSDF	Treatment, Storage and Disposal Facility
UBC	Uniform Building Code
UFC	Uniform Fire Code
UL	Underwriter's Laboratories
USA	Underground Services Alert
USCG	U. S. Coast Guard
USDOT	U. S. Department of Transportation
USEPA	U. S. Environmental Protection Agency (EPA)
USGS	U. S. Geological Survey
USFWS	U. S. Fish and Wildlife Service
USNRC	U. S. Nuclear Regulatory Commission
UV	Ultraviolet radiation
WMD	Weapons of Mass Destruction
VOC	Volatile Organic Compound
Z list	The OSHA table of Permissible Exposure Limits, so named because the tables are identified as Z-1, Z-2, and Z-3, and because they are found in “Subpart Z - Toxic and Hazardous Substances” of the OSHA regulations. This subpart contains 29 CFR 1910.1000 through 29 CFR 1910.1500.

Module Review – Crossword Puzzle



Across
3. # of DOT Hazard Classes
4. Person who stops the release
6. Level that Witnesses or Discovers Release

Down
1. # of Chemicals Existing
2. Tactical Acronym
5. Hazard Class Eight

Chapter C

Hazardous Materials Recognition and Safety

Main Points

- Recognizing Hazmat Incidents
- Basic Recognition Clues
- Hazmat Outward Warning Signs
- Hazmat Locations and Occupancies
- Hazmat Containers and Packages
- US DOT Placards and Labels
- Special Markings
- Global Harmonization System (GHS)
- Shipping Papers and SDSs
- First Operational Thought

Chapter Outline

1. Recognizing Hazmat Incidents.

a. *Any responder* can encounter hazardous materials. According to an ongoing federal government study (ATSDR HSEES 2009), of the injuries to responders in Hazmat incidents:
   1) 31% are law enforcement personnel.
   2) 58% are firefighters (career and volunteer).
   3) 11% are other responders (includes EMS).

b. If you don't know it's there you can't protect yourself.
   1) Recognition leads to safety,
   2) Safety leads to lives preserved!

c. ***Initial reports may not indicate the presence of hazardous materials! May be reported as:***
   1) Traffic accident,
   2) Medical aid,
   3) Fire,
   4) Person down.
   5) Or, _____

Hazmat Recognition

Reporting Hazmat events may be reported as:

Traffic accident,

Medical aid call,

Fire,

Investigation, etc.

2. Basic Hazmat Recognition Clues.

a. Occupancy/Location (e.g. plating shop or highway).
   1) Occupancy/Location: who's there and what they are making, selling, storing, transporting, etc.
   2) Hazmats manufactured/stored/used/transported anywhere but be aware of common locations.

b. Container Shapes (e.g. compressed gas cylinder).

c. Markings & Colors (e.g. package label).

d. Placards & Labels (e.g. orange placard = Explosive).

e. Shipping Papers and MSDS (e.g. "Consist" for railroad incident).

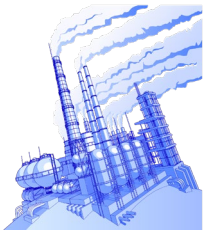
f. Senses (e.g. sight, hearing and smell - *last resort*).

g. Other Clues (e.g. responsible party, witness, business plan, etc.).

h. "Clues" are *clues*, not absolutes! They are…
   1) A warning,
   2) A note of caution,
   3) An indication of things to come,
   4) *But not always all the answers you need.*

Recognition—Standard Hazmat Recognition Clues:

Occupancy/Location



Container Shapes

Markings & Colors

Placards & Labels

Shipping Papers & MSDS

Senses

3. Hazmat Outward Warning Signs.

a. General examples:
   1) People running from, or collapsed in the area,
   2) Evidence of leak (fire, smoke, visible vapors, unusual colors/odors, sheen on water),

      "Clouds are bad. Clouds with color are worse."

      Michael Callan, *Street Smart Hazmat Response*
   3) Activated pressure relief valve.
   4) Evidence of recent fumigation (e.g tented building).
   5) Dead animals/insects or discolored vegetation.
   6) People in the area reporting symptoms of exposure.
   7) Damaged/deteriorated container.
   8) Discolored containers, valves, piping or containment.
   9) Something just doesn't look right…

b. Industrial facilities examples:
   1) Alarm from installed monitoring system.
   2) Activation of emergency decontamination shower.
   3) Change in paint color on piping or storage system.
   4) Signs warning of unspecified hazards.
   5) Presence of unknown liquid within containment system.
   6) Something just doesn't look right…

c. Remember: *If you see any warning sign then assume hazardous materials are there* and look for other clues or warning signs until you confirm the absence of hazardous materials!

Excerpts from Recognition Case Studies

"On June 13, 1992, the two boys, who had been playing in the company's trash dumpster, were overcome by — and later died as a result of inhaling — fumes from toluene…"

"…a department store employee…was ordered to dispose of some outdated Ortho products in a waste oil drum in the back of the store. The employee was caught in the act by the Fire Lt. after Fire/EMS was called to an adjacent store by a sick clerk complaining of a strong offensive odor."

"My partner and I responded to a burglary in progress at a house that was being tented for termites. …A few minutes later here comes Dumbcrook out from underneath the tent. We move in on him and the chase was on. We finally catch up to him, and the fight is on. We get him into custody and see this guy isn't doing too well so we call the paramedics (No, not from being taken into custody…). As the paramedics arrive we start to have difficulty breathing."

"Our engine company (3 man fire engine) arrived on scene at the local high school for an apparent poisoning. The male student ingested Lannate pesticide (quarter pound mixed in water). The student was unconscious with vital signs dropping rapidly. The powder was airborne and floating freely with movement of the patient and wind. The captain started to cough and nearly vomited."

"I treated a 28 year old for trouble breathing after she was trying to clean her house. She was using a 'flea' powder to help control fleas in her home from the family dog… As it turned out, her husband got an industrial strength pesticide…"

4. Hazmat Locations and Occupancies.

a. Obvious locations.
   1) Petroleum refinery (flammable liquids).
   2) Welding supply business (compressed gases).
   3) Garden supply business (pesticides).
   4) Auto parts store (flammable liquids).

b. Not so obvious locations.
   1) Swimming pool supply business (acids and chlorine).
   2) Hardware store (flammable liquids).
   3) Refrigerated warehouse (anhydrous ammonia).
   4) Soft drink distributor (compressed and/or cryogenic gases).

5. Hazmat Containers and Packages.

a. Physical properties of cargo often determine shape of container and material it's made of.

b. Shape of container/package and material it's made of can provide clues about the contents. They are made the way they are for a reason.

c. DOT specification containers for motor vehicle transportation.
   1) DOT 406/MC 306.
   2) DOT 407/MC 307.
   3) DOT 412/MC 312.
   4) MC 331.
   5) MC 338.

   (Note: See facing page for information about cargos each type carries. See the pages in the last part of this chapter or the DOT ERG for diagrams of each trailer.)

DOT Specification Vehicles

406/306 Elliptical cross section. Designed to carry liquid products. Usually carries petroleum products such as gasoline and diesel fuel. Usually made of aluminum (it will melt if the cargo catches fire so the tank won't explode). 49 CFR 178.346.

407/307 Horseshoe-shaped cross section due to external insulation around the circular tank. Outer covering is usually aluminum. Designed to hold liquids with low vapor pressures. 49 CFR 178.347

412/312 Circular cross section with external "ribs" for added strength. Often carries corrosives but may be used to carry petroleum products. 49 CFR 178.348.

331 Circular cross section with spherical ends. Designed to carry compressed gases. Usually made of steel. 49 CFR 178.337.

338 Cylindrical shape. Covered with external insulation. Designed to carry cryogenic materials (i.e. liquefied gases). 49 CFR 178.338.

5. Hazmat Containers and Packages. *(cont.)*

d. Radiological containers.

1) Excepted. (Designed to survive normal conditions of transport.)
2) Industrial. (Designed to survive normal conditions of transport and at least the Drop test and Stacking test for Type A containers.)
3) Type A. (Designed to survive normal transportation, handling, and minor accidents.)
4) Type B. (Designed to survive severe accidents.)
5) Type C. (Designed to contain high-activity materials transported in aircraft. Not allowed for domestic shipments.)

e. Other types of containers.

1) Carboys. (Rigid container often made of plastic or gas. Used to hold liquids. Often used in laboratories. 5-15 gallons capacity.)
2) Dewar flasks. (Glass or metal bottle, with a double-layer construction; two thin-walled bottles nested one inside the other and sealed together at the neck. The narrow space between is evacuated almost entirely of air. Commonly used to carry cryogenic gases such as liquid nitrogen.)
3) Intermediate bulk containers. (Container used to transport and store fluids and bulk materials. Usually cube-shaped with rigid frame. Designed to be stackable and moveable with a forklift. Flexible IBCs commonly called totes.)
4) Marine portable tanks. (Tank designed to be carried on a vessel without being permanently attached to the vessel. Capacity is 110 gallons or more. Usually carry liquids.)
5) Compressed gas cylinders. (Used to store gases above atmospheric pressure. Store a variety of DOT hazard classes. If used in transportation the must comply with DOT regulations. *No standard for color-coding. Can't rely on color of cylinder to identify contents.*)

Radiological Material Containers

Excepted	Designed to survive normal conditions of transport. Used for transportation of materials that are either Low Specific Activity (LSA) or Surface Contaminated Objects (SCO) and that are limited quantity shipments, instruments or articles, articles manufactured from natural or depleted uranium or natural thorium; empty packagings are also excepted.
Industrial	Designed to survive normal conditions of transport and at least the DROP test and stacking test for Type A packagings. Industrial packagings (IP) are used for transportation of materials with very small amounts of radioacitivity that are either Low Specific Activity (LSA) or Surface Contaminated Objects (SCO).
Type "A"	Container used to transport low-level radioactive material. Used to transport limited quantities of radioactive material that would not result in significant health effects if they were released. They are often steel drums, thick plastic containers or steel boxes.
Type "B"	Large, heavy metal cask used to transport large quantities of radioactive material with a high level of activity. A Type B package may be a metal drum or a huge, massive shielded transport container. Must meet severe accident performance standards that are considerably more rigorous than those required for Type A packages.
Type "C"	Used for high-activity packages transported by aircraft. Meets same performance standards as Type B packages as well as a puncture/tearing test; an enhanced thermal and drop test, and a 200 meter water immersion test.
	Details found in 49 CFR 173 and 10 CFR 71.

5. Hazmat Containers and Packages. *(cont.)*

f. Above-ground storage tanks.

1) Cryogenic liquid tank.

a) Used to store liquefied gases.

b) Thick external insulation gives them a distinctive appearance.

c) Internal pressure can be over 300 psi.

2) Non-pressure tank. (May have some internal pressure due to evaporation of product.)

a) Horizontal. (Usually have flat ends.)

b) Vertical. (Will have either open or covered roofs. Open-top tanks normally have floating roofs as do many covered tanks.)

3) Pressure tank.

a) High pressure: May be "bullet" shaped or spherical.

b) Low pressure: Vertical dome roof tanks. (Usually have less than 15 psi internal pressure.)

c) Often painted white or silver to reflect solar heat.

4) Above-ground storage tanks will normally have easily recognizable secondary containment. (e.g. Dikes, containment curbs, and pits.)

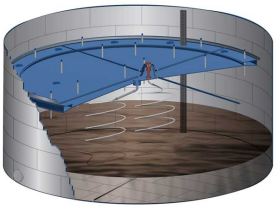
Note: Above-ground tanks may be partially or, in some circumstances, almost completely covered with earth, sand, gravel, asphalt, or other material.

Above-Ground Storage Tanks

Cone Roof Tank

Cryogenic Tank

Floating Roof Tank



Horizontal Pressurized Tank

Spherical Pressurized Tank

5. Hazmat Containers and Packages. *(cont.)*

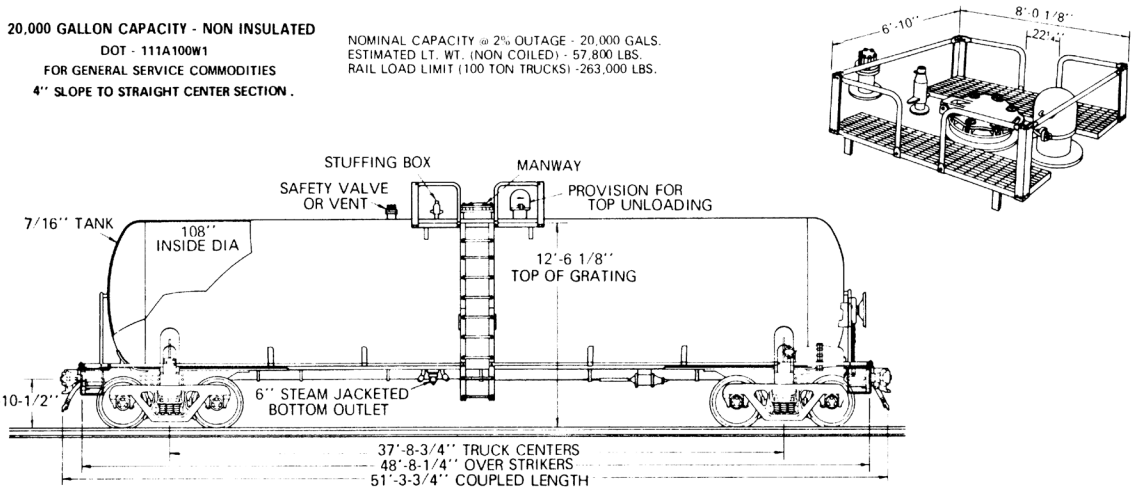
g. Railcars.

1) Cryogenic liquid car.
   a) Used to transport liquefied gases.
   b) Fittings are on end of car rather than on top.
2) General service car (low or non-pressure). (May have some internal pressure due to evaporation of product.)
   a) Car shape similar to pressure car. (Rounded ends.)
   b) Tank fittings on top of car.
   c) Fittings normally lack protective housing.
   d) May have multiple cargo compartments.
3) Pressure car.
   a) Car shape similar to non-pressure car. (Rounded ends.)
   b) Tank fittings on top of car.
   c) Fittings normally in protective housing.
   d) May be thermally protected (insulation, jacket and/or white paint).
   e) Non-compartmentalized.
4) Container-stack car.
   a) Carries standard intermodal containers.
   b) Containers often stacked two high.
   c) Carries all standard sized containers.
   d) Containers can carry a wide variety of hazmats.
   e) Also called “container on flatcar” or COFC.

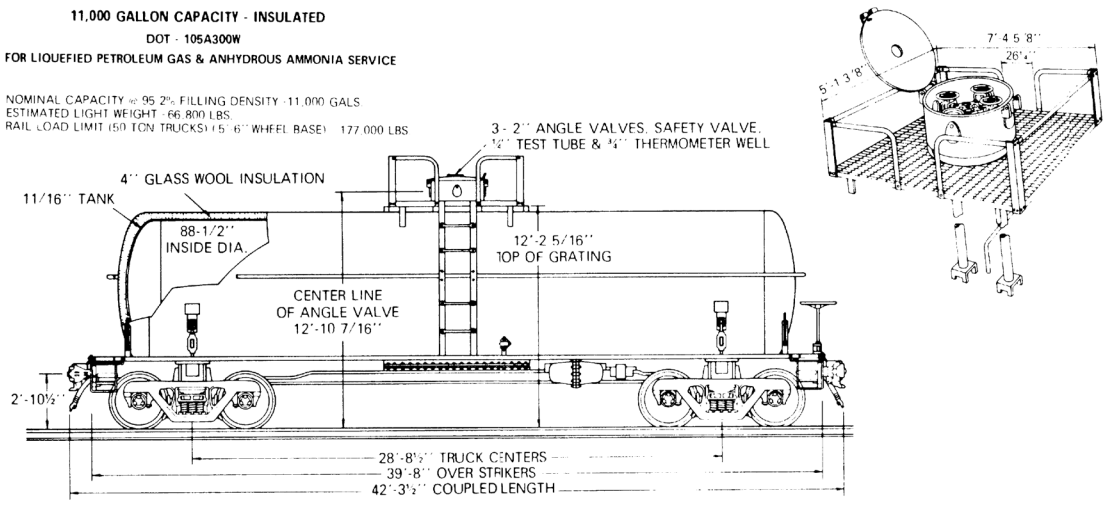
Rail Tank Car Recognition

Rail tank cars may have visual clues that will help you distinguish between pressure and non-pressure tank cars. Non-pressure tank cards may have visible fittings and/or one or more expansion domes. Pressure tanks cards typically have all fittings out of sight under a single protective housing on top of the tank (although some non-pressure tank cars may also have this protective housing).

Non-Pressure Car



Pressure Car



5. Hazmat Containers and Packages. *(cont.)*

h. Intermodal containers.

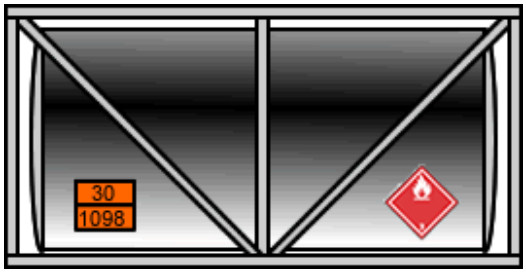
1) Called "intermodal" because they can be transported on multiple modes of transportation.
2) Non-pressure. (Variety of shapes, types and sizes. General types: Box containers, Closed top, open top and refrigerated.)
3) Low pressure.
   a) IM-101. (Can have working pressure up to 100 psi. Can carry solids and low vapor pressure liquids from a variety of hazard classes as well as non-hazardous cargoes.)
   b) IM-102. (Can have working pressure up to 25 psi. Can carry solids and low vapor pressure liquids from a variety of hazard classes as well as non-hazardous cargoes.)
4) Specialized.
   a) IMO Type 7. (Cryogenic liquid tank.)
   b) Tube modules. (Multiple high pressure cylinders. 3000-5000 psi. Carries gases such as oxygen, nitrogen, helium, and hydrogen,)
   c) DOT Specification 51/IMO Type 5 (Pressurized tank, 100-500 psi. Carries LPG, anhydrous ammonia and other high vapor pressure liquids.)
5) Sizes. (Most are 20 or 40 feet long, 8 feet wide and 8.5 feet high. Many are 53 feet long.)

i. Others.

1) Bags. (Made from variety of materials.)
2) Drums. (Made from metal, plastic or fiberboard.)
3) Dry bulk railcar/trailer. (Carries pellets, powders or prills (small dry spheres. Can carry oxidizers or corrosives.)
4) Bottles. (Are often enclosed in boxes.)

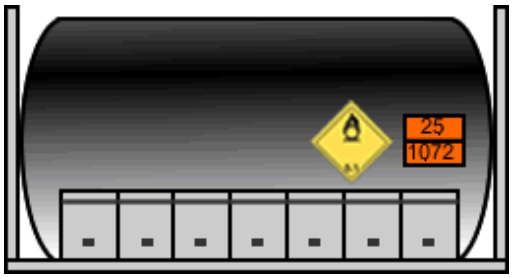
Intermodal Containers

IM-101/102

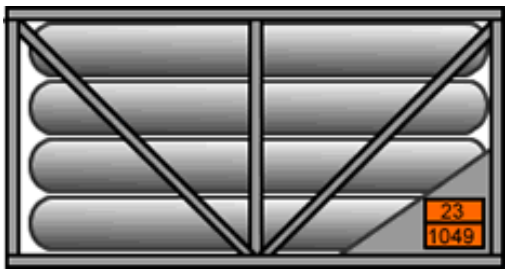


DOT Spec 51

IMO Type 7



Tube Module



6. USDOT Hazmat Placards and Labels.

a. Purpose of system.

1) Provide visible warning that hazardous materials are present.
2) Provide responders with general information about the type of hazardous material(s) present.

b. General marking requirements for transport vehicles or freight containers.

1) Must be marked with the identification number and the applicable placard (ID number may be on an orange panel or on the placard).
2) Markings must be on each side and each end.

c. Placards.

1) Displayed on a shipping vehicle (e.g. trailer, railcar, shipping container, bulk package, etc.).
2) Diamond shaped, at least 10.8 inches on each side.
3) Background color, symbol and digit at the bottom of the placard correspond to the hazard class.

d. Labels.

1) Displayed on "packages or containment devices" (e.g. bag, drum, box, bottle, compressed gas cylinder, etc.).
2) Diamond shaped, at least 3.9 inches on each side.
3) Background color, symbol and digit at the bottom of the label correspond to the hazard class.

Placarding Requirements (49 CFR 172.504)

Display

Must placard each bulk packaging, freight container, unit load device, transport vehicle or rail car on each side and each end. Required on two opposite sides of portable tanks (less than 1000 gallons capacity).

"Dangerous"

May use a "Dangerous" placard on a freight container, unit load device, transport vehicle or rail car containing two or more categories of hazardous materials, with a combined weight of 1,001 pounds or more, that require different placards specified in Table 2. However, if they load more than 2,205 lbs of one category of a hazardous material at one loading facility then they must use the placard for that category in addition to any other required placards or the "Dangerous" placard.

Exception

Regulations allow some shipments of hazardous materials (e.g. consumer commodities in small packages) of less than 1,001 lbs aggregate gross weight to be shipped without *any* placards.

Subsidiary Hazards

The regulations *require* some hazardous materials to include placards for subsidiary hazards and *allows* the use of multiple placards for other hazardous materials that have subsidiary hazards. If the subsidiary hazard is Dangerous When Wet or Poison Inhalation Hazard then the shipment must display placards indicating those hazards.

6. USDOT Hazmat Placards and Labels. *(cont.)*

e. Hazmat Placard colors/symbols and examples:

1) Explosives — Trinitrotoluene.
   a) Division 1.1-1.3 (Orange/Bursting Ball)
   b) Division 1.4-1.6 (Orange/Division Number)
2) Gases.
   a) Division 2.1 (Red/ Flame) — Propane.
   b) Division 2.2 (Green/Cylinder) — Carbon Dioxide.
   c) Division 2.3 (White/ Skull & Crossbones) — Chlorine.
3) Flammable Liquids (Red/Flame) — Gasoline.
4) Flammable Solids.
   a) Division 4.1 (Red & White Stripes/Flame) — Fusee.
   b) Division 4.2 (White over Red/Flame) — White Phosphorus.
   c) Division 4.3 (Blue/Flame) — Calcium Carbide.
5) Oxidizers.
   a) Division 5.1 (Yellow/Flaming "O") — Hydrogen Peroxide.
   b) Division 5.2 (Red over Yellow/Flame) — MEKP.
6) Poisons/Toxics.
   a) Division 6.1 (White/Skull & Crossbones)— Arsenic.
   b) Division 6.2 (No Placard) — Infectious Substances.
7) Radioactives (Yellow over White/Trefoil) — Thorium.
8) Corrosives (White over Black/Test Tube) — Sulfuric Acid.
9) Miscellaneous Hazardous Materials (White & black vertical stripes over solid white/no symbol): Asbestos.

f. Specialized placards.

1) "Dangerous" placard.
   a) Used for mixed loads of Table 2 commodities.
2) "Oxygen" placard.
3) "Inhalation Hazard" placard.
   a) Used for both Hazard Classes 2 and 6.

DOT Placarding Tables (Table 1)

Category	Placard Name	49 CFR §
1.1	EXPLOSIVES 1.1	172.522
1.2	EXPLOSIVES 1.2	172.522
1.3	EXPLOSIVES 1.3	172.522
2.3	POISON GAS	172.540
4.3	DANGEROUS WHEN WET	172.548
5.2*	ORGANIC PEROXIDE	172.552
6.1[a]	POISON INHALATION HAZARD	172.555
7#	RADIOACTIVE	172.556

*Type B, liquid or solid, temperature controlled.
[a]Packing Group I (Zone A and B, inhalation hazard).
#Radioactive Yellow III label only.

DOT Placarding Tables (Table 2)

Category	Placard Name	49 CFR §
1.4	EXPLOSIVES 1.4	172.523
1.5	EXPLOSIVES 1.5	172.524
1.6	EXPLOSIVES 1.6	172.525
2.1	FLAMMABLE GAS	172.532
2.2	NON-FLAMMABLE GAS	172.528
3	FLAMMABLE	172.542
Comb. Liq.	COMBUSTIBLE	172.544
4.1	FLAMMABLE SOLID	172.546
4.2	SPONTANEOUSLY COMBUSTIBLE	172.547
5.1	OXIDIZER	172.550
5.2	ORGANIC PEROXIDE	172.552
6.1[a]	POISON	172.554
6.1#	KEEP AWAY FROM FOOD	172.553
6.2	(none)	
8	CORROSIVE	172.558
9	CLASS 9	172.560
ORM-D	(none)	

[a]Packing Group I or II (other than Packing Group I inhalation hazard).
#Packing Group III.

6. USDOT Hazmat Placards and Labels. *(cont.)*

g. Placard limits.
   1) Multiple and subsidiary hazards.
   2) "Dangerous" placard meaning (Table 1 & 2 commodities).
   3) Compliance and enforcement.

h. When placards are required.
   1) Bulk shipments.
   2) Table 1 commodities (in any amount).
   3) Table 2 commodities (more than 1001 lbs aggregate gross weight loaded at one facility).

i. Placards versus labels.
   1) Placards – affixed to shipping containers. (Railcar, trailer, intermodal container, etc.)
   2) Labels – affixed to shipping packages. (drum, bag, box, etc.)

j. Other transportation-related DOT markings.
   1) Orange panel and hazard codes.
   2) Stenciled railcars.
   3) Package labels (e.g. orientation arrows).
   4) Pipeline markers.
   5) Fumigant.
   6) Hot.
   7) Marine Pollutant.
   8) Orientation markings.
   9) ORM-D marking.

k. Purpose of transportation markings.

   "Placard and labels are a method of communication for ***you***!"

   John Falat, CHP

Placarding Requirements (49 CFR 172)

Other Hazards "Hazardous materials that possess secondary hazards ***may*** exhibit subsidiary placards…" (A commodity may have other hazards that aren't always indicated by placards.)

Dangerous A freight container, unit load device, transport vehicle, or rail car…with two or more categories of hazardous materials that require different placards specified in Table 2 ***may*** be placarded with a DANGEROUS placard ***instead of*** the separate placarding…

Requirement A transport vehicle or freight container that contains less than 454 kg (1001 pounds) aggregate gross weight of hazardous materials covered by Table 2 does ***not*** have to display a placard.

ID Numbers Identification (UN) numbers may be displayed on either a rectangular shaped orange panel or on a plain white placard.

Fumigant Shows when a trailer, railcar or shipping container has been or is being fumigated.

Hot Means what it says. Used to warn responders of elevated-temperature cargoes. (e.g. molten sulfur)

Marine Pollutant Materials toxic to or that can bioaccumulate in aquatic organisms.

Orientation Shows required orientation of a package when the inner packaging contains hazardous liquids.

ORM-D Affixed to packages containing materials, such as consumer commodities, that present a limited hazard.

7. Special Markings.

a. NFPA 704.

1) Scope, applicability, purpose, locations and limitations.

a) Scope: Addresses health, flammability, instability and related hazards presented by short-term exposure.

b) Applicability: Applies to industrial, commercial and institutional facilities (required by California Fire Code).

c) Purpose: Provide basic information to emergency responders.

d) Location(s): Stationary containers, above-ground tanks and at entrances to locations where hazardous materials are stored, dispensed, used or handled. Local fire marshal may specify other required locations.

e) Limitations: Doesn't indicate quantity or specific location(s) of material(s). Doesn't identify material(s).

2) Required marking.

a) Diamond-shaped.

b) Quadrants color-coded by hazard.

c) Numerical rating of hazard (0-4).

3) More details in subsequent chapter.

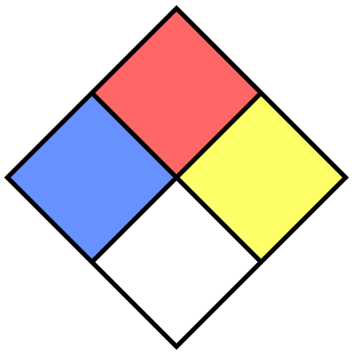
b. Hazard/Product-specific markings.

1) Biohazard. Indicates presence of material or microorganism(s) that pose a threat to the health of living organisms. Required by OSHA on containers of regulated waste, refrigerators and freezers containing blood or other potentially infectious material.

2) PCBs. EPA regulations require label with white or orange background warning of presence of PCBs.

Special Markings

NFPA 704



Biohazard markings

PCB label

7. Special Markings *(contd.)*.

c. Location-specific markings.

1) Industrial pipe markings (ANSI/ASME A13.1).

a) Purpose. Inform workers (and responders) of the contents of pipes and give additional detail if special hazards (such as extreme temperatures or pressures) exist.

b) Colors indicate type of hazard. (See facing page.)

c) Identification markings show contents of pipe and may indicate direction of flow. (See facing page.)

2) Military markings.

a) Fire/Ordnance Hazards.

b) Chemical Hazards.

d. Transportation mode-specific markings.

1) Pipeline markers (USDOT).

2) Railcar stenciling.

e. Hazard communication markings.

1) HMIS®

2) WHMIS

3) ISO-3864

4) GHS

h. Pesticide and consumer product labels.

1) Labels: state active ingredient.

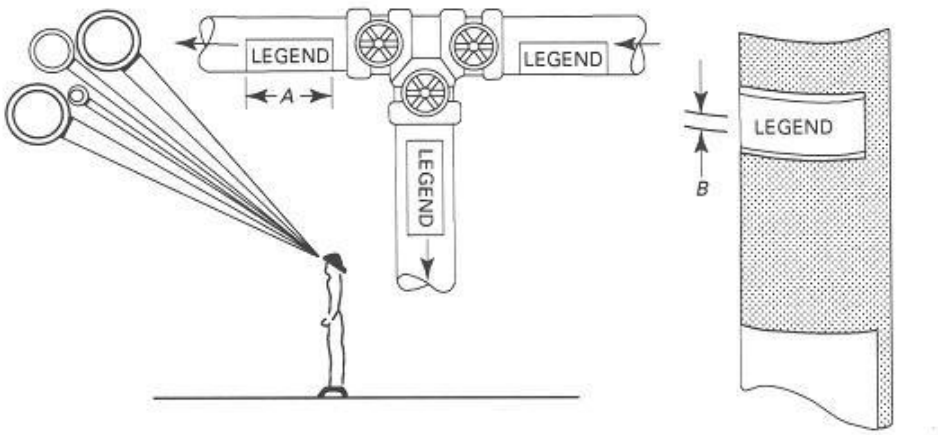
2) Signal Words: Poison (pesticides only) Danger, Warning or Caution.

3) Some pesticides require signage at area of application warning of the presence of the pesticide.

Note: For detailed information on these marking systems see, the pages at the end of this chapter.

Industrial Pipe Markings

Fig. 1 Location of Identification Markers



Designation of Colors	Background Color	Letter Color
Fire Quenching Fluids	Red	White
Toxic & Corrosive Fluids	Orange	Black
Flammable fluids	Yellow	Black
Combustible Fluids	Brown	White
Water	Green	White
Compressed Air	Blue	White

8. Global Harmonization System (GHS).

a. International system for classifying, marking and communicating hazards of materials that meet the GHS definition of hazardous.

b. Communicates hazards via:
   1) Label elements.
      a) Signal words.
      b) Hazard statements.
      c) Precautionary statement and Pictograms.
   2) Safety Data Sheets (more on this later).

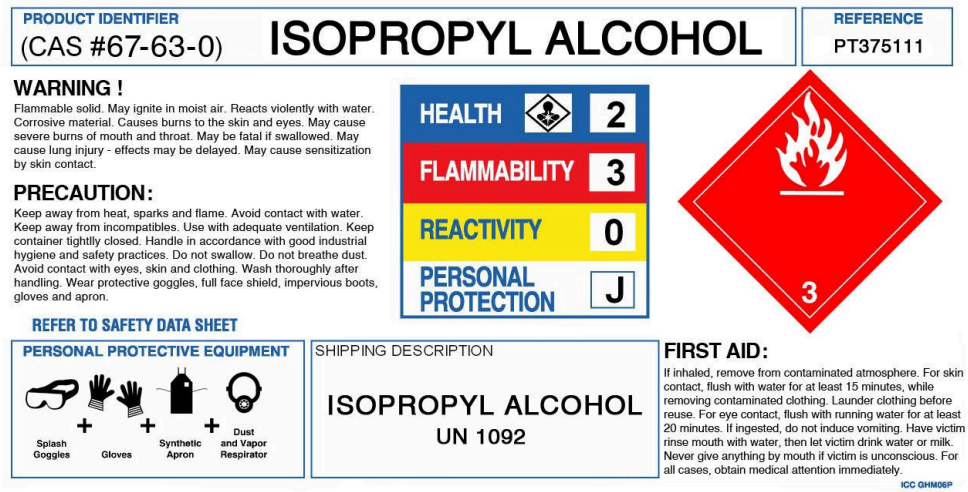
c. Signal words (Indicate severity of hazard).
   1) Danger. (More severe hazards.)
   2) Warning. (Less severe hazards.)

d. Hazard statements.
   1) Standardized phrases.
   2) Assigned to a hazard class & category.
   3) Describes nature of hazard. (e.g. “Fatal If Swallowed”)

e. Pictograms. (Uses graphic elements to convey specific hazards.)
   1) Hazard symbol.
   2) Other graphic elements (border and background).

f. This subject will be covered in more detail in Chapter F.

GHS Label



* Describes recommended measures to minimize or prevent adverse effects of exposure and/or improper storage. GHS standardizes and specifies pictograms, signal words and hazard statements.

9. Shipping Papers and SDSs.

a. Preferred hazmat identification source.

b. Types and location of shipping papers:
   1) Truck: Bill of Lading (In cab near driver seat or with driver),
   2) Air: Air Bill (With pilot in cockpit),
   3) Rail: Waybill and Consist (With conductor),
   4) Vessel: Dangerous Cargo Manifest (On bridge).

c. Shipping papers. "…each person who offers a hazardous material *for transportation* shall describe the hazardous material on the shipping paper…" Shipping papers must include information such as: proper shipping name; hazard class or division; ID number, packing group; subsidiary hazard(s); total quantity and weight; reportable quantity, emergency phone number; etc. If non-hazardous commodities are listed on the shipping papers then the hazardous materials must be clearly indicated (e.g. listed first or in contrasting color). ***BUT shipping papers may not always be accurate, complete or readable, especially if there was an accident.***

d. SDS (Safety Data Sheet). "Employers shall have a safety data sheet *in the workplace* for each hazardous chemical which they use." It provides valuable information such as chemical name, company identification, hazard identification, response information, chemical/physical properties, etc.

Locations of Shipping Papers

General "…each person who offers a hazardous material for transportation shall describe the hazardous material on the shipping paper…" (49 CFR 172.200)

Contents
- Proper shipping name.
- Hazard class or division.
- Identification number (UN number).
- Packing group.
- Total quantity and unit of measure.
- Other information (see DOT regs).

Aircraft "…operator shall provide the pilot-in-command…information in writing… A copy…shall be readily available…during flight." (49 CFR 175.33)

Vessels "This document [Dangerous Cargo Manifest] must be kept in a designated holder on or near the vessel's bridge." (49 CFR 176.30)

Highway "…shipping papers shall be: Within his immediate reach…readily visible to a person entering the driver's compartment or in a holder which is mounted to the inside of the door on the driver's side of the vehicle…The driver shall ensure that the shipping papers are readily available to and recognizable by authorities in the event of accident or inspection." (49 CFR 177.817)

Rail "A member of the crew…must have a copy…" (49 CFR 174.24)

10. *First Operational Thought is Safety.*

a. Think safety with every breath you take — or it may be your last *(Think safety first, last and always)*.

b. Must go *slow* in Hazmat event — A quick vs. go *slow* Hazmat response can kill or injure you and others.

c. Must have "Positive" vs. "Negative" safety attitude.

d. Negative safety attitude.
   1) "I've been handling this stuff for years…"
   2) "This is the way we've always done it. Nothing bad has happened to us yet."
   3) Or, _____

e. Experienced responders have some positive safety attitudes:
   1) Use recognized safety procedures via vigilance and discipline.
   2) Develop awareness of possible secondary and tertiary hazards.
   3) Treat all Hazmat events with respect *and* anticipate problems.
   4) Cross-reference 3 or more sources before action planning.
   5) Ensure back-up plans are in place for failure of safety devices.
   6) Set-up and *use* decon procedures early.

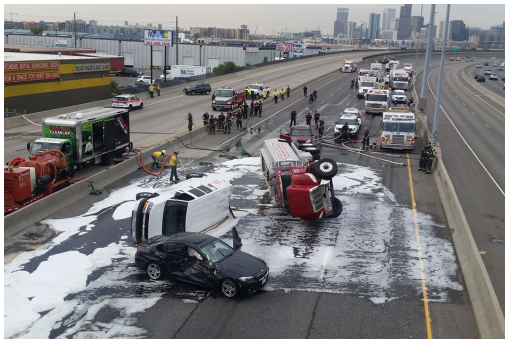
f. Maintain a "Mental Safe Approach Tactic" while on-scene!
   1) Always keep your distance.
   2) Approach Upwind, Upgrade and Upstream.
   3) Be a "responder" not an "indicator".

Mental Safe Approach

Respond at a Safe Distance:

Upwind

Upgrade



Upstream

10.*First Operational Thought is Safety (continued).*

g. Hazmat Death & Injury Due to Lack of Safety.

1) Ways Hazmats can kill you—follow safety guides for *your own safety!*

a) Toxicity

b) Radioactivity

c) Asphyxiation

d) Explosion

e) Flammability

f) Corrosion

2) There's a reason why they call it "hazardous" after all!

3) Remember: *First Operational Thought = Safety!*

Six Ways Hazardous Materials Can Kill You...

Toxicity

Radioactivity

Asphyxiation

Explosion

Fire

Specifications for Placards (49 CFR 172.519).

Placard with no ID number.

Specifications for Placards (49 CFR 172.519)

Placard with ID number.

Retention of DOT Placards and Labels—29 CFR 1910.1201 (effective October 17, 1994)

(a) *Any employer* who receives a package of hazardous material which is required to be marked, labeled or placarded in accordance with the U. S. Department of Transportation's Hazardous Materials Regulations (49 CFR Parts 171 through 180) *shall retain those markings, labels and placards on the package* until the packaging is sufficiently cleaned of residue and purged of vapors to remove any potential hazards.

(b) *Any employer* who receives a freight container, rail freight car, motor vehicle, or transport vehicle that is required to be marked or placarded in accordance with the Hazardous Materials Regulations *shall retain those markings and placards on the freight container, rail freight car, motor vehicle or transport vehicle* until the hazardous materials which require the marking or placarding are sufficiently removed to prevent any potential hazards.

(c) Markings, placards and labels shall be maintained in a manner that ensures that they are readily visible.

(d) For non-bulk packages which will not be reshipped, the provisions of this section are met if a label or other acceptable marking is affixed in accordance with the Hazard Communication Standard (29 CFR 1910.1200).

(e) For the purposes of this section, the term "hazardous material" and any other terms not defined in this section have the same definition as in the Hazardous Materials Regulations (49 CFR Parts 171-180).

Specifications for Pipeline Markers (49 CFR 195.410)

Who Each pipeline "operator shall place and maintain line markers over each buried pipeline…".

Where Markers must be located at each public road crossing, at each railroad crossing, and in sufficient number along the remainder of each buried line so that its location is accurately known. Each operator shall provide line marking at locations where the line is above ground in areas that are accessible to the public.

What The marker must state at least the following on a background of sharply contrasting color: The word "Warning", "Caution", or "Danger" followed by the words "Petroleum (or the name of the hazardous liquid transported) Pipeline", or "Carbon Dioxide Pipeline", all of which… must be in letters at least 1 inch high…; The name of the operator and a telephone number (including area code) where the operator can be reached at all times.

But not here Line markers are not required for buried pipelines located: offshore or at crossings of or under waterways and other bodies of water; in ***heavily developed urban areas such as downtown business centers*** where the placement of markers is impractical and would not serve the purpose for which markers are intended; and the local government maintains current substructure records.

Biohazards Warnings. (CCR 5193)

Labels

Warnings labels required on:
Containers of regulated waste.
Refrigerators and freezers containing blood or other potentially infectious material.
Other containers used to store, transport or ship blood or other potentially infectious materials.
May substitute red bag or red container for label under certain conditions. (Regulated waste must also have a label.)

Signs

Work areas containing infectious materials must have a Biohazard sign posted on every entrance. Must also have the name of the infectious agent, information on special requirements for entering the area and the name and phone number of the responsible person.

Symbol

Lettering

The symbol must have the words “BIOHAZARD” or “BIOHAZARDOUS WASTE” under the symbol.

Hazardous Materials Identification System®

History

The National Paints and Coatings Association (NPCA) developed a voluntary method of hazard communication compliance, called the Hazardous Materials Identification System® (HMIS), and made it available to the coatings industry as a hazard communication compliance tool. J. J. Keller is the exclusive provider of the components of the system (www.jjkeller.com).

System

The system uses color-coded labels with numbers and symbols to present acute and chronic health, flammability, and physical hazard warnings, as well as to designate appropriate personal protective equipment (PPE) and indicate target organs. The color scheme and hazard ranking is similar to NFPA 704. (HMIS® is intended to inform employees of hazards while NFPA 704 is intended to inform responders of hazards.)

DOD Hazard Identification System.

Applicability The Department of Defense (DOD) established a standard firefighting hazard identification system for all DOD facilities. This system classifies fires involving ammunition or explosives into four divisions according to the hazard they present to emergency responders. (Note: Use of these symbols is at the discretion of the facility commander. Under some conditions security considerations may make it undesirable to identify storage locations of munitions.)

Fire Divisions This system uses four symbols to indicate a fire hazard. The symbols are orange and have the Fire Division number in the center.

Fire Division	Hazard	Symbol Shape
1	Mass Explosion	Octagon
2	Explosion with fragment hazard	Cross
3	Mass fire	Inverted triangle
4	Moderate fire	Diamond
5	Mass explosion (blasting agents)	Octagon
6	Nonmass explosion	Cross

Chemical Agents The system uses two symbols to indicate the recommended protective equipment to use when responding to a fire.

Wear full protective clothing. (Color-coded to indicate the degree of hazard.)

Wear breathing apparatus.

"Stenciled" Railcars, 49 CFR 172.330.

General

"A tank car containing any of the following materials must be marked on each side with the key words of the **proper shipping name** specified for the material in the Sec. 172.101 table, or with **a common name authorized** for the material in this subchapter (e.g., 'Refrigerant Gas'):"

Acrolein, stabilized
Ammonia, anhydrous, liquefied
Ammonia solutions (more than 50% ammonia)
Bromine or Bromine solutions
Bromine chloride
Chloroprene, stabilized
Dispersant gas or Refrigerant gas
Division 2.1 materials
Division 2.2 materials (in Class DOT 107 tank cars only)
Division 2.3 materials
Formic acid
Hydrocyanic acid, aqueous solutions
Hydrofluoric acid, solution
Hydrogen cyanide, stabilized (less than 3% water)
Hydrogen fluoride, anhydrous
Hydrogen peroxide, aqueous solutions (greater than 20% hydrogen peroxide)
Hydrogen peroxide, stabilized
Hydrogen peroxide and peroxyacetic acid mixtures
Nitric acid (other than red fuming)
Phosphorus, amorphous
Phosphorus, white dry or…under water or…in solution
Phosphorus white, molten
Potassium nitrate and sodium nitrate mixtures
Potassium permanganate
Sulfur trioxide, stabilized
Sulfur trioxide, uninhibited

Additional DOT Labeling Requirements.

Marine Pollutant "The **MARINE POLLUTANT** mark shall be placed in association with the hazard warning labels required by subpart E of this part or, in the absence of any labels, in association with the marked proper shipping name." 49 CFR 172.322

Biohazard "In addition to other requirements of this subpart, after September 30, 2003, a bulk packaging containing a regulated medical waste, as defined in Sec. 173.134(a)(5) of this subchapter, must be marked with a **BIOHAZARD** marking conforming to 29 CFR 1910.1030(g)(1)(I)." 49 CFR 172.323

Hot "…a bulk packaging containing an elevated temperature material must be marked on two opposing sides with the word **"HOT'** in black or white Gothic lettering on a contrasting background. The marking must be displayed on the packaging itself or in black lettering on a plain white square-on-point configuration having the same outside dimensions as a placard. (See Sec. 172.302(b) for size of markings on bulk packagings.)" 49 CFR 172.325

Orientation "…each non-bulk combination package having inner packagings containing liquid hazardous materials must be… Legibly marked, with **package orientation markings**…with the arrows pointing in the correct upright direction. Depicting a rectangular border around the arrows is optional." 49 CFR 172.312

Pesticide Labels, 40 CFR 156.10.

General "Contents of the label. Every pesticide products shall bear a label containing the information specified by the Act and the regulations in this part. The contents of a label must show clearly and prominently the following:"

Name, brand, or trademark of the pesticide.
Name and address of the producer.
Net contents .
Product registration number.
Producing establishment number.
An ingredient statement. (Specifying active and inert ingredients.)
Hazard and precautionary statements for human and domestic animal hazards and environmental hazards.
The directions for use.
The use classification(s).

Field Postings, Title 3 CCR §6776.

Signs "The operator of the property shall assure that signs are posted around treated fields…The signs shall contain the following: (1) The skull and crossbones symbol near the center of the sign; (2) The words "DANGER" and "PELIGRO" and "PESTICIDES" and "PESTICIDAS" in the upper portion of the sign; (3) The words "KEEP OUT" and "NO ENTRE" in the lower portion on the sign;"

Posting "The signs shall…Be posted before the application begins…Remain posted and clearly legible throughout the application and the restricted entry interval…The signs shall be posted so that they are visible at all usual points of entry to the treated area…"

GHS Pictograms

Health Hazard

- Carcinogen
- Mutagenicity
- Reproductive Toxicity
- Respiratory Sensitizer
- Target Organ Toxicity
- Aspiration Toxicity

Exclamation Point

- Irritant (skin and eye)
- Skin Sensitizer
- Acute Toxicity (harmful)
- Narcotic Effects
- Respiratory Tract Irritant
- Hazardous to Ozone Layer (Non Mandatory)

Flammable

- Flammables
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Self-Reactives
- Organic Peroxides

Gas Cylinder

- Gases under Pressure

Corrosive

- Skin Corrosion/ burns
- Eye Damage
- Corrosive to Metals

GHS Pictograms

Explosive

- Explosives
- Self-Reactives
- Organic Peroxides

Oxidizer

- Oxidizers

Environmental Hazard

- Aquatic Toxicity (non mandatory)

Toxic Hazard

- Acute Toxicity (fatal or toxic)

Module Review – Word Search

Z H U G R N H I P O L L G V R
Z J D C X B X P K C A V Y R S
E D I C I T S E P C B Q R E I
R S L O A P L U I U E G C N I
W L G J J L S G M P L U L I N
A S K N I M O R E A B U K L R
D K M B I L S T E N C I L E D
Q A Y U O K Q P W C S K C P X
S A N I N G R O M Y Y O T I B
W A D G H W H A T P G Y G P L
W A F J E T J E M N S B I R T
R X R E R R W F I B Y E F N K
M K T U T W O Z P L A C A R D
P F C O F Y E U O N P X D Z G
K K O E D K V B S V F M B A G

Find the following words in the word search above.

DANGEROUS
DOT
LABEL
MARKINGS
OCCUPANCY
PESTICIDE
PIPELINE
PLACARD
RADIOLOGICAL
RECOGNIZE
RIBS
SAFETY
STENCILED
TRUCK
WAYBILL

Chapter D

Safety, Isolation and Notifications: (S.I.N.)

Main Points

- Definition of "First Responder" & "SIN"
- The First Operational Thought—Safety
- The First Operational Priority—Isolation
- The First Operational Alert—Notifications

Chapter Outline

1. Definition of First Responder and "SIN".

a. Definition of First Responder Awareness and Operations levels:
   1) First Responder "Awareness": One likely to witness or discover a Hazmat release and can initiate a response by notifying authorities, *taking no further actions* (SIN only). 29 CFR 1910.120(q)(6)(i), Title 8 CCR 5192(q)(6)(A).
   2) First Responder "Operations": One who responds to Hazmat releases for purpose of protecting nearby persons, environment or property — *trained in a defensive fashion without trying to stop the release* (SINCIAPCPDDD). 29 CFR 1910.120(q)(6)(ii), Title 8 CCR 5192(q)(6)(B).

b. Definition of "SIN":
   1) **S**afety.
   2) **I**solation.
   3) **N**otifications.

c. All Hazmat responders should "SIN" as the basic initial on–scene actions at all Hazmat incidents.

Response Levels and Tactical Acronym

Tactic	FRA	FRO	IC	Tech/Spec
Safety	X	X	X	X
Isolation	X	X	X	
Notify	X	X	X	
Command		X	X	
IDHA		X	X	X
Action Plan		X	X	X
Protective Equip.		X	X	X
Countermeasures		X	X	X
Protective Action		X	X	X
Decon		X	X	X
Disposal		X	X	X
Documentation		X	X	X

2. The First Operational Thought — SAFETY

a. The first operational *thought* for everyone = **S**afety!
   1) Safety starts with the first responder on-scene!
   2) Responders must have a "Positive Safety Attitude".

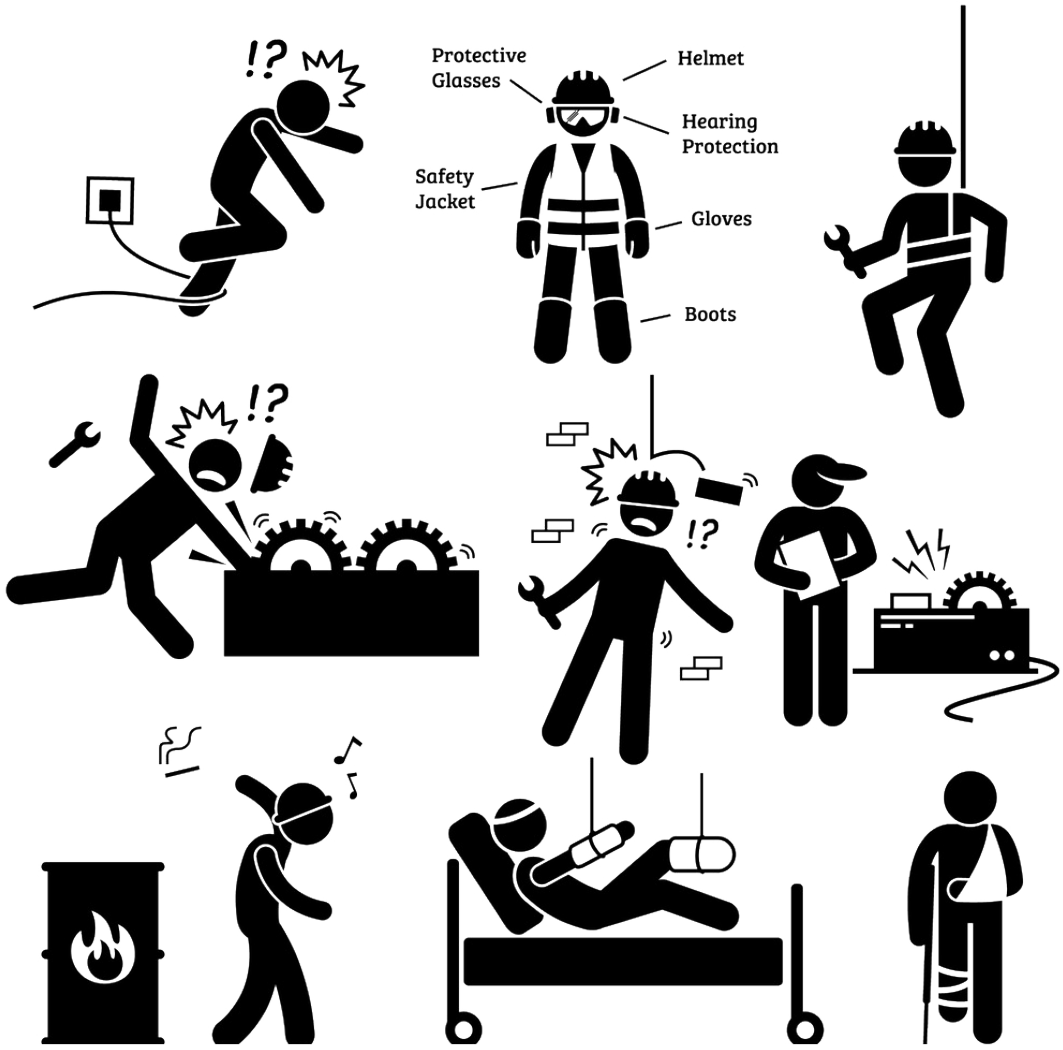
b. Three techniques to ensure safety and a positive safety attitude:
   1) Safe Approach.
   2) Safe Assessment.
   3) Key Safety Guides for all responders to follow.

c. Approach Hazmats from a safe *direction* (Upwind, Upgrade & Upstream), and a safe *distance* (per ERG).
   1) Remember to park vehicles headed away from incident.

d. Conduct a safe assessment/size-up:
   1) Identify the hazards but you may not be safe to get close enough for positive and/or complete identification.
   2) Slow vehicle down, shut off air/ventilation and observe area.
   3) Position vehicles headed away from incident.
   4) Use binoculars to identify/assess incident.

e. Desired First Responder initial actions:
   1) **S**afe approach at a safe distance.
   2) **I**solate and deny entry.
   3) Make initial **N**otifications.
   4) Establish temporary command.

S.I.N.


Protective Glasses
Helmet
Hearing Protection
Safety Jacket
Gloves
Boots

2. The First Operational Thought — SAFETY *(cont.)*

f. Ten key safety guides on-scene:

1) Be cautious; treat materials as hazardous until proven otherwise.
2) Approach upwind, upgrade and upstream.
3) Keep safe distance until IDHA complete and risk is confirmed.
4) Isolate and deny entry (limit numbers of responders).
5) Do not rush to victims without doing a risk assessment (Risk vs. Gain) and wearing proper protective equipment.
6) Do not touch, taste or breath unknown released material (do not assume vapor is harmless just because you can't smell it).
7) Do not eat, drink or smoke in incident area.
8) Eliminate all ignition sources (e.g. flares) near incident area.
9) Establish and observe safety perimeters and control zones.
10) Do not worry about looking foolish (your health and the health of others is at stake). Think safety!

g. OSHA regulations *require* IC to designate a Safety Official/Officer.

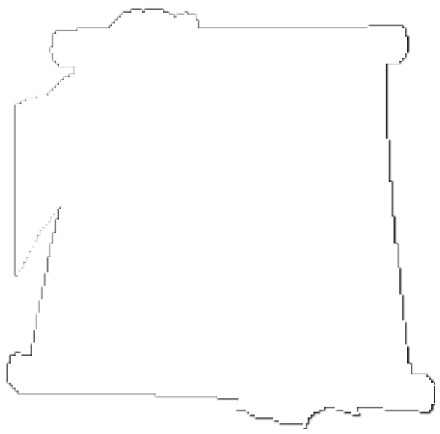
1) Safety Officer ensures safety on-scene by conducting safety related activities—*can suspend any unsafe act.*
2) Every hazmat response should have a Safety Officer assigned and a Site Safety Plan (preferably in writing).
3) You should know who the Safety Officer is and should read (and follow!) the site safety plan.

Safety Official

29 CFR 1910.120(q)(3), Title 8 CCR 5192(q)(3)

"(vii) The individual in charge of the ICS shall designate a safety official, who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of the operations for the emergency at hand.

(viii) When activities are judged by the safety official to be an IDLH and/or to involve an imminent danger condition, the safety officer shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the emergency scene."



3. The First Operational Priority — ISOLATION

a. The first operational *priority* = **I**solate and deny entry!

1) Responders can safely isolate and deny entry by establishing Perimeters & Control Zones using ERG recommendations.

2) The dilemma of distance. Safety vs. isolation (distance is safety's #1 ally, while it is isolation's #1 enemy).

b. Perimeter and Zones.

1) Purpose: ensure safety and isolation, control the scene, limit contamination spread and allow for safe working areas.

2) Main difference: FRAs can be can establish the Perimeter but only FRO or above can establish the Exclusion Zone.

c. Perimeter and Control Zone terminology:

1) **Perimeter** (Outside security line around all Control Zones).

2) **Exclusion**/Hot **Zone** - Area of isolation (only responders with specific task & proper level of protective clothing in this Zone).

3) **Contamination Reduction**/Warm **Zone** - Used to control areas like Safe Refuge and Decontamination (may use a reduced protective clothing level in this Zone).

4) **Support**/Cold **Zone** - Safe area for Command Post, Media, medical aid, etc. (No protective clothing or SCBA required).

5) Exclusion Zone, Contamination Reduction Zone and Support Zone are all within the Perimeter.

Perimeters and Zones

First Operational Priority — ***Isolate & Deny Entry...***

Perimeter Security line surrounding control zones to isolate and deny entry to any unnecessary people, usually established by law enforcement.

Zone Zones to ensure safety, limit spread of the hazard, control hazard area, conduct decon and support emergency operations *as established by Haz Mat Group.*

Examples **Exclusion Zone:** Also called Hot Zone, Red Zone, Inner Perimeter.
Contamination Reduction Zone: Also called Warm Zone, Yellow Zone, Secondary Perimeter.
Support Zone: Also called Cold Zone, Green Zone, Outer Perimeter.

(Control Zone terms from *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH Publication 85-115, October 1985.)

3. The First Operational Priority — ISOLATION *(cont.)*

d. Perimeter Control Objectives:
   1) Control "**Entry Points**" (secure doors, stairways, gates, intersections, on and off ramps, etc.).
   2) Control "**Perimeter**" between all Entry Points.
   3) Control "**Access**" inside Perimeter (including responders).

e. Perimeter Control Tactics:
   1) Determine size and extent of perimeter. Depends on:
      a) Current and expected weather.
      b) Type of terrain.
      c) Potential size of release.
      d) Condition of container (i.e. extent and type of damage).
   2) Identify all entry points.
   3) Control all entry points.
   4) Identify and establish boundaries for perimeter.
      a) Unstaffed barricades usually ineffective.
      b) Be aware of ignition sources from vehicles.
      c) Use existing barriers if possible (e.g. fences).
   5) Control access to the perimeter.
      a) Deny entry to all unauthorized personnel (incl. responders).
      b) Stage all responders without an immediate mission.
      c) Establish emergency exit procedures for all responders.
      d) Hazmat Group will establish Control Zones.
      e) Watch out for wind shifts!

Isolation and Deny Entry Objectives

Entry Points ***Control Entry Points***

•Determine size of Perimeter using ERG recommendations.

•Identify closest entry/control points for Perimeter. (e.g. Doorways, Intersections, Gates, etc.) Others: _____

•Start with most obvious and most commonly used Perimeter entry point. (FEMA studies have showed people will evacuate through exits they are accustomed to using.)

•Make early request for sufficient units to secure entry points. Give incident location and safe routes for ingress.

•Use all available methods of restricting access (e.g. vehicles, barricades, cones, etc.) Others: _____

•Identify staging areas for responders.

Hazard ***Control Area Around Hazard***

•Secure the area around the hazard area.

•Use tape, natural barriers, patrols, etc.

•Remember, it's easier to make a perimeter smaller than to make it bigger after you establish it. Don't be afraid to start big.

Perimeter ***Control Access Inside Perimeters.***

•Keep public and nonessential responders out.

•Maintain patrol of Perimeter area.

•Provide security for Support Zone work areas.

•Provide traffic control as necessary.

•Maintain communications with security group at all times!

•Have an emergency escape route and watch the wind!!

4. The First Operational Alert — NOTIFICATIONS

a. Three types of "Notifications" to alert others of a Hazmat event:
   1) Mandatory Notifications.
   2) Resource requests.
   3) Report of Conditions.

b. Responsible Party must notify authorities of a Hazmat release or potential release. *Legal penalties possible for non-notification.*
   1) Responders should make same notifications as back-up.
   2) Mandatory notifications:
      a) Local dispatch (Local 911).
      b) CUPA/Local Administering Agency (#:_____).
      c) State Warning Center (800-852-7550).
      d) National Response Center (800-424-8802).
   3) Other notifications per specific incident:
      a) Pesticide spill – County Agriculture.
      b) Spill in state waters – CalOES (who must notify RWQCB, OSPR & State Lands Commission).
      c) Spill on state highway/freeway (incl. county roads) – CHP.
      d) Radiological release – DHS (Radiological Branch).
      e) Release impacting state wildlife – Dept. of Fish & Wildlife.
      f) Acutely hazardous material within $^1/_2$ mile of school – School District Superintendent.
      g) Oil spills – CalOES (if responsible party has not done so).
      h) Prop 65 Haz Mats – Board of Supervisors & Health Officer. (For "designated employees" only. If you're not sure if you're a designated employee then you're not one.)
      i) Workplace injury/fatality – CalOSHA.

   Note: Responders must make notifications for f-i.

Legal Requirements for Notifications

NRC	"Notice of an oil discharge or release of a hazardous substance…equal to or **greater than the reportable quantity** must be made immediately…to…NRC…" 40 CFR 300.125(c).
CUPA/AA	"…provide an immediate, verbal report of **any release or threatened release** of a hazardous material to the Administering Agency…" Title 19 CCR 2703.
CalOES	"… immediately report any release or threatened release of a hazardous material to the administering agency and the [CalOES]." §25507, Health & Safety Code.
Transportation	"…each carrier who transports hazardous materials (including hazardous wastes) shall give notice…after each incident…" 49 CFR 171.15, Title 13 CCR 1166 (equivalent California regulation).
Schools	"Emergency rescue personnel…shall immediately advise the superintendent…where the location of the release or threatened release is within one-half mile of a school." §25507.10 Health & Safety Code.
Oil	"Any local or state agency responding to a spill of oil shall notify [CalOES], if notification…has not occurred." §8670.26 California Government Code.
Injury/Fatality	Emergency responders must notify CalOSHA when they are "… called to an accident…in which a serious injury, or illness, or death occurs…" Title 8 CCR §342(b)

4. The First Operational Alert — NOTIFICATIONS *(cont.)*

4) General information needed for mandatory notifications:
   a) Name/Agency of person reporting.
   b) Location of Hazmat release.
   c) Haz Mat involved.
   d) Nature of problem.
   e) Quantity released.
   f) Potential hazards, etc.
5) Key point of notification for state agencies is State Warning Center.
   a) State Warning Center will provide control number (important for mutual aid and funding).

c. Resource Request Notification.
   1) Types of resources:
      a) Agencies/Personnel (Law, Fire, EMS, Health, etc.).
      b) Materials/Equipment (Hazmat Team).
      c) Facilities (ICP, EOC, evacuee shelters, etc.).
      d) Other (Information sources, Hazmat Teams, etc.).
   2) Possible off-site resources (CHEMTREC, CHLOREP, USA and Poison Control Centers). Other: _____
   3) Key question: How do I get help? Who do I call?

Private Sector Assistance

CHEMTREC Provides technical emergency response information concerning the product(s) involved. Information is obtained from several sources, including the manufacturer's product-specific Safety Data Sheet or a product specialist from the manufacturer.

CHEMTEL Provides immediate guidance regarding the incident. Should additional support be required, ChemTel will dispatch Hazmat Response Teams with client authorization.

INFOTRAC INFOTRAC operators will evaluate the chemical emergency and will then disseminate all information necessary, related to evacuation radius, fire-fighting procedures, incompatibility with other products, protective clothing requirements, and any other additional information needed. They will then notify the INFOTRAC member, advise as to the status of the emergency, and if necessary, interlink them with the emergency site location via the Command Center interlink.

Verisk 3E` 3E's HazMat Response Team can deploy ER professionals and equipment. They can also provide immediate access to medical advice related to chemical exposures. Poison control specialists, physicians, and toxicologists provide medical advice related to chemical exposures, including skin/eye contact, inhalation and ingestion.

4. The First Operational Alert — NOTIFICATIONS *(cont.)*

4) Know your local resources for Haz Mat and request early.
5) Give arriving resources a safe route of access.
6) You are not alone (many Hazmat resources are available), *but* you must contact, coordinate and manage resources properly!

d. Report of Conditions Notification.
   1) Report of Conditions includes:
      a) What you see in and around hazard area.
      b) What you want.
      c) What you are doing.
   2) Report of Conditions helps IC assess basic actions, identify needed resources, and begin the IDHA process.

Haz Mat Notification Guide

Agency/Organization	Phone #	Time	Person Notified
Local			
First Responders (Fire, PD, etc.)*	_____	_____	_____
Administering Agency*	_____	_____	_____
County OES	_____	_____	_____
County Agriculture Dept.	_____	_____	_____
County Health	_____	_____	_____
Local Haz Mat Team	_____	_____	_____
Animal Control	_____	_____	_____
Other	_____	_____	_____
State			
CalOES Warning Center*	_____	_____	_____
Highway Patrol	_____	_____	_____
Fish and Wildlife	_____	_____	_____
Dept. of Toxic Substances Control	_____	_____	_____
Other	_____	_____	_____
Federal			
National Response Center*	_____	_____	_____
Coast Guard	_____	_____	_____
EPA Region IX	_____	_____	_____
Other	_____	_____	_____
Private			
CHEMTREC	_____	_____	_____
Local Cleanup Company	_____	_____	_____
Underground Services Alert	_____	_____	_____
Regional Poison Control Center	_____	_____	_____
Hospitals	_____	_____	_____
Other	_____	_____	_____
Special Districts			
Air Quality Mgt. District	_____	_____	_____
Regional Water Quality Cntl. Brd.	_____	_____	_____
Flood Control Districts	_____	_____	_____
School Districts	_____	_____	_____
Sewer Districts	_____	_____	_____
Other	_____	_____	_____

**Mandatory Notifications*

Do This!

DO	think safety and consider it a big deal!!!
DO	report your location.
DO	stay upwind, uphill and upgrade.
DO	isolate and deny entry.
DO	establish perimeters and observe zones.
DO	notify and request assistance early.
DO	establish command & practice unity of command.
DO	complete identification and assessment.
DO	have alternative plans and consider no action.
DO	recognize your limits.
DO	forecast your intervention and expect change.
DO	weigh risk against gain (benefits).
DO	wear protective clothing.
DO	maintain control of the incident.
DO	evacuate and warn public early.
DO	decontaminate & document before demobilization.
DO	communicate & coordinate with other agencies.
DO	ensure the safety of all on-scene personnel!
DO	_____
	(Fill in your recommendation)

Don't Do This!

DON'T	be overly aggressive.
DON'T	have a negative safety attitude.
DON'T	get coaxed into a bad situation.
DON'T	touch, breathe or swallow it.
DON'T	act without a plan.
DON'T	lose sight of your mission.
DON'T	act on emotion.
DON'T	confuse rescue with evacuation.
DON'T	believe everything you're told.
DON'T	intervene unless sure of positive outcome.
DON'T	drive through spills or clouds.
DON'T	pick up or move containers needlessly.
DON'T	key in on only one hazard.
DON'T	take victims to the incident.
DON'T	let small amounts fool you.
DON'T	use flares.
DON'T	be lulled into a false sense of security.
DON'T	fail to competently respond to the event!
DON'T	_____
	(Fill in your recommendation)

California Vehicle Code and Notifications

Public Health

VC §2451 "The Legislature finds and declares that a statewide program for the management of hazardous substances highway spills, under the jurisdiction of the California Highway Patrol, is necessary to protect the public health and environment."

Hazardous Spill Notification System

VC §2453 "The California Highway Patrol shall serve as a statewide information, assistance, and notification coordinator for all hazardous substances spill incidents occurring on highways within the State of California. The California Highway Patrol shall establish a single notification mechanism…"

Incident Command Authority

VC §360 "'Highway' is a way or place of whatever nature, publicly maintained and open to the use of the public for purposes of vehicular travel. *Highway includes street.*" (italics added)

VC §2454 (a) The authority for incident command at the scene of an on-highway hazardous substance spill or disaster shall be vested in the ***appropriate law enforcement agency having primary traffic investigative authority on the highway where the spill or disaster occurs.*** Responsibility for incident command at the scene of an on-highway hazardous substance spill or disaster shall continue until all emergency operations at the scene have been completed and order has been restored.

Module Review – Word Match

Description	Term
Can send you an SDS.	Incident Commander
A mandatory notification.	NRC
The “I” in SIN.	Exclusion
First Operational Thought.	CHEMTREC
A responder who can SIN only.	Fish and Wildlife
Notification contact for federal government	Awareness
OSHA requires this ICS position.	CHLOREP
The zone where the bad stuff is.	State Warning Center
The agency to call if a spill impacts wildlife.	Isolate
Call this organization for chlorine incidents.	Safety

Instructions Match the description with the proper term. Draw a line from the description to the term associated with it.

Chapter E

Introduction to Incident Command: (C.)

Main Points

- Basics of Incident Command
- ICS Organization
- Hazmat and "Who's in Charge"
- Incident Command Post (ICP)
- Agency Coordination at Hazmat Incidents

Chapter Outline

1. Basics of Incident Command.

a. Role of FRO specified in emergency response plan and/or standard operating guidelines. (What does yours say?)
   1) Know your role in the organization.
   2) What position are you assigned to?
   3) Who do you report to?
   4) FRO should assume temporary/initial command until the authorized Incident Commander arrives.

b. Purpose of ICS: Provide effective coordination among local, state, and federal responders at the scene of a hazmat response.

c. Need for ICS.
   1) Need efficient tool to manage emergency response to hazmat
   2) Hazmat incidents often cross-jurisdictional boundaries. incidents, ICS provides tools for managing multi-jurisdictional responses to hazardous substance releases.
   3) CalOSHA regulation requires an IC and use of ICS.

d. Benefits of ICS.
   1) Provides standardized organizational structure and common processes for planning and managing resources.
   2) Enables a coordinated response among various jurisdictions and functional agencies, both public and private.
   1) Provides standardized roles, responsibilities and S.O.P.s to manage and direct emergency responses.

Requirements for using ICS

California Government Code Section 8607

SEMS

"By December 1, 1993, the Office of Emergency Services…shall jointly establish by regulation a standardized emergency management system for use by all emergency response agencies… This system shall be applicable, but not limited to, those emergencies or disasters referenced in the state emergency plan. …state agencies shall use the standardized emergency management system…to coordinate multiple jurisdiction or multiple agency emergency and disaster operations. …each local agency…shall use the standardized emergency management system…to coordinate multiple jurisdiction or multiple agency operations."

29 CFR 1910.120(q)(3)(i)

Fed OSHA

"The senior emergency response official responding to an emergency shall become the individual in charge of a site-specific Incident Command System (ICS). All emergency responders and their communications shall be coordinated and controlled through the individual in charge of the ICS assisted by the senior official present for each employer."

Title 8 CCR Section 5192(q)(3)(A)

State OSHA

"The senior emergency response official who has ultimate site control responsibility shall confirm that the Incident Command System (ICS) is in place and the position of Incident Commander (IC) instituted. All emergency responders and their communications shall be coordinated and controlled through the ICS."

2. ICS Organization.

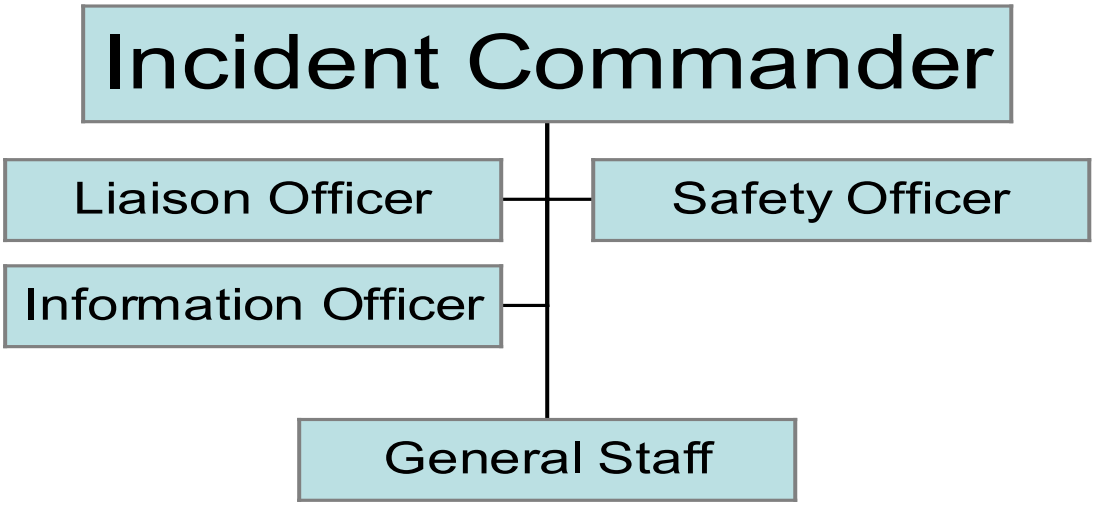
a. Critical components of ICS:
   1) One unified organization.
   2) Clear functional elements (division of labor).
   3) Flexibility and expandability.
   4) Unity of command.
   5) Manageable span of control.
   6) Effective communications and coordination.

b. ICS Organization.
   1) **Incident Commander** (overall management),
   2) General Staff positions (and functions):
      a) **Operations Section** (manages tactical operations).
      b) **Planning/Intel Section** (does incident action planning).
      c) **Logistics Section** (procures incident resource needs).
      d) **Finance/Admin Section** (manages incident financial aspects).
   3) Command Staff Positions.
      a) **Information Officer** (releases incident info).
      b) **Liaison Officer** (POC for assisting/cooperating agencies).
      c) **Safety Officer** (ensures safety of all personnel),

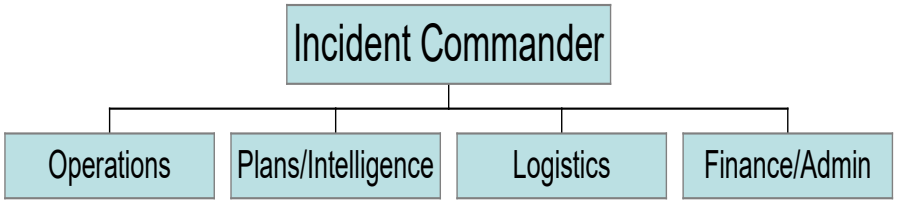
c. Key ICS hazmat positions.
   1) Incident Commander*.
   2) Safety Officer*.
   3) Information Officer.
   4) Hazmat Group Supervisor.

   **Required by OSHA regulations.*

ICS Command Staff



ICS General Staff



2. ICS Organization. *(continued)*

d. Role of the IO in hazmat.
   1) Media is often involved in hazmat incidents.
      a) They often arrive first.
      b) Can be valuable intelligence gathering tool.
      c) Can quickly warn, inform and instruct public of hazards.
      d) They have a legal right of access (PC §409.5)
   2) Things that will attract the media:
      a) Evacuations (actual or potential).
      b) Road closures.
      c) Unusual substances (e.g. radioactives).
      d) Presence of "celebrities" (e.g. politicians, activists, etc.)
      e) Any politically "hot" issue or location.
      f) Obvious indicators (e.g. big orange cloud).
   3) FRO responsibilities.
      a) Know employer policies regarding media.
      b) Know how to contact IO.
      c) Inform Media of facts (only what you know).
      d) Advise them of potential danger and need for decon.
      e) Inform them that designated IO will arrive soon.

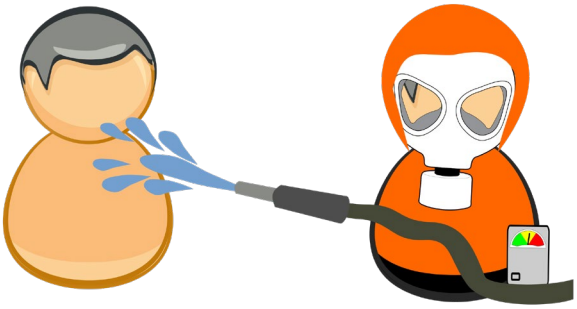
e. Role of the Hazmat Group Supervisor.
   1) Directs operations of Hazmat Group.
   2) Assigns and manages resources in the Hazmat Group.
   3) Reports to Operations Section Chief.

When to Call for an IO

When employer plan says to do so.

When the Media is already there.

When something "newsworthy" is happening.



3. Hazmat and "Who's in Charge".

a. OSHA Hazwoper regulation mandates an "IC".
   1) OSHA regulations don't specify who it should be.
   2) Employer emergency response plan and/or SOGs will.
   3) Some state laws may identify IC for specific locations.

b. VC §2454 designates "Incident Command Authority" for hazmat events on the highway.
   1) The law enforcement agency with primary traffic investigative authority where the spill occurs (state highway or county road: CHP, city street: Police Department).
   2) VC §2454 doesn't apply to Off-Highway hazmat events.

c. Fish and Wildlife.
   1) Hazmat incidents on marine waters.
   2) Hazmat incidents on state waters.

d. Agencies owning or operating government-owned property may be the designated Incident Commander for that property.
   1) Military vessels and facilities.
   2) State buildings.
   3) State universities (UC and Cal State system).
   4) State mental health institutions.
   5) Correctional institutions.

e. If in doubt about who is in charge, ask!

IC Authorities in State Law

General Authority

CGC §8618 "… the responsible local official in whose jurisdiction an incident requiring mutual aid has occurred shall remain in charge at such incident, including the direction of personnel and equipment provided him through mutual aid."

Incident Command Authority

CVC §2454 "The authority for incident command at the scene of an on-highway hazardous substance spill or disaster shall be vested in the *appropriate law enforcement agency having primary traffic investigative authority on the highway where the spill or disaster occurs… Department of the California Highway Patrol is responsible for incident command at the scene of an on-highway hazardous substance spill or disaster on all highways where the department has primary traffic investigative authority***.** Any law enforcement agency having primary traffic investigative authority may enter into written agreements with other public agencies to facilitate incident command…"

What's a "highway"?

CVC §360 "'Highway' is a way or place of whatever nature, publicly maintained and open to the use of the public for purposes of vehicular travel. *Highway includes street.*" (italics added)

Department of Fish and Wildlife

CGC §8670.7 "…has the primary authority to direct prevention, removal, abatement, response, containment, and cleanup efforts with regard to all aspects of any oil spill in the marine waters of the state…"

F&WC §5650 *"*...it is unlawful to deposit in…the waters of this state…Any substance or material deleterious to fish, plant life, or bird life."

4. Incident Command Post (ICP).

a. Purpose of ICP.
   1) Provide location to execute command functions.
   2) ICP is key location for agency coordination.

b. Establishing an ICP.
   1) First arriving unit should set temporary ICP until IC arrives.
   2) Locate ICP upwind, upgrade and upstream from the incident scene (when possible).
   3) ICP location may be pre-determined for many workplaces.
   4) Location should allow IC to effectively manage response (does IC need to see the incident scene?).

c. Info from all responders ultimately goes to IC at Incident CP. Communicate through channels with IC when:
   1) Mission is accomplished,
   2) You need more resources to accomplish your mission,
   3) There is a "Significant Event" the IC needs to know,
   4) Be succinct and use plain English.

5. Agency Coordination at Hazmat Incidents.

a. Typical First Responders.
   1) Fire services (Fire Departments/Districts, CalFire, etc.).
   2) Law enforcement agencies (Police, Sheriff, CHP, etc.).
   3) Emergency medical services (Private or government).
   4) Health agencies (County Health, Environmental Health).
   5) Public Works Departments (CalTrans, etc.).
   6) Responsible party.

First Responder Agencies

Fire	Municipal fire departments, local special district fire departments (paid or volunteer), county fire departments, CalFire, or the U.S. Forest Service. May be responsible for containment of hazardous material releases, and are frequently the best local sources of specialized response capabilities for hazardous material releases. Frequently responsible for decontamination of incident victims. Local plans often designate the fire department as the Incident Commander for hazmat incidents.
Law	City police departments may be the Incident Commander for hazardous material incidents occurring on roadways within their jurisdiction. Some cities have contracted with their local sheriff's department for law enforcement and traffic control rather than establish a police department, making that sheriff the Incident Commander in absence of local codes or ordinances to the contrary.
EMS	Provide care and/or transportation to the sick and injured, including victims of contamination. (No patient contact should be made without adequate decontamination.) May be fire on scene.
Env. Health	Protect the public and environmental health and often coordinate emergency medical services. Have authority to declare hazardous waste-related "health emergencies" in any area within their jurisdiction if there is an immediate threat to human health.
Public Works	May assist in road closures, cleanup, or decontamination.

5. Agency Coordination at Hazmat Incidents. *(continued)*

b. Other Local Hazmat Agencies.
   1) Emergency Services.
   2) County Agriculture.
   3) Air Pollution Control Districts.
   4) Flood Control/Sanitation Districts.
   5) Parks and Recreation Districts.
   6) Port Authorities.
   7) Local agencies are first line of defense for hazmat incidents.

c. Key State Hazmat Agencies.
   1) CHP: Incident Commander (State highways & buildings).
   2) DFW: State trustee for wildlife and their habitat.
   3) OSPR: State IC for oil spills in marine waters.
   4) CalOES: Focal point for notification of state agencies.
   5) Other key state agencies: CalFire, CalTrans, Cal EPA.
   6) Most state agencies have support role to local agencies but some may be first responders.

d. Key Federal Hazmat Agencies.
   1) U. S. Environmental Protection Agency (EPA): Federal OSC—Inland Zone.
   2) U. S. Coast Guard (USCG): Federal OSC—Coastal Zone.
      a) Boundaries of Inland & Coastal Zones specified in Regional Contingency Plans.
   3) Other key federal agencies: DOD, DOE, FEMA, DOJ, etc.
      a) DOD is OSC for hazmat releases on DOD facilities or vessels.
      b) DOD is OSC for incidents involving military munitions.
      c) DOE is OSC for incidents on DOE facilities.
   4) Other federal agencies usually have designated support role as specified by National Contingency Plan (NCP).

Federal Jurisdiction 40 CFR 300.120 (NCP)

OSC	The On-Scene Coordinator "directs response efforts and coordinates all other efforts at the scene of a discharge or release."
USCG	"The USCG shall provide OSCs for oil discharges, including discharges from facilities and vessels under the jurisdiction of another federal agency, within or threatening the coastal zone…"
EPA	"EPA shall provide OSCs for discharges or releases into or threatening the inland zone…" *(Note: this includes navigable waters in the inland zone such as Lake Tahoe.)*
DOD & DOE	"DOD or DOE shall provide OSCs…For releases of hazardous substances, pollutants, or contaminants, when the release is on, or the sole source of the release is from, any facility or vessel…under the jurisdiction, custody, or control of [DOD & DOE]…"
Coastal Zone	"…all United States waters subject to the tide, United States waters of the Great Lakes, specified ports and harbors on inland rivers, waters of the contiguous zone, other waters of the high seas subject to the NCP, and the land surface or land substrata, ground waters, and ambient air proximal to those waters."
Inland Zone	"…the environment inland of the coastal zone excluding the Great Lakes and specified ports and harbors on inland rivers."

5. Agency Coordination at Hazmat Incidents. *(continued)*

e. Private Sector Hazmat Resources.
   1) Responsible Party.
      a) Has financial and legal liability to abate and mitigate the adverse effects of a release.
      b) May have in-depth knowledge of product(s) and processes involved.
      c) May have specialized resources you need.
   2) Who is the "responsible" party?
      a) Owner of product(s).
      b) Owner or operator of facility where incident occurred.
      c) Shipper of product(s) involved.

f. Other resources.
   1) Industry cooperatives (see facing page).
   2) Local private sector expertise (e.g. product specialist).
   3) Volunteer agencies (e.g. American Red Cross).

g. Enhancing Agency Coordination and Communication.
   1) Use Standardized Emergency Management System (SEMS) and Incident Command System (ICS).
   2) Establish one Incident Command Post (ICP).
   3) Others:
      a) Notify all interested parties.
      b) Keep IC informed of who shows up.

Private Sector Response Resources

CHEMNET® A network of for-hire contractors (primarily in the USA) for CHEMTREC registrants. The CHEMNET list is the primary resource for shippers, carriers and others that require the services of a contractor for response to a incident involving hazardous materials. Upon request, CHEMTREC can link the shipper with the CHEMNET contractor closest to the scene.

Mutual Aid Manufacturers of certain basic chemicals and related industry associations have developed Mutual Aid Networks that are available to assist with incidents involving those specific hazardous materials. Products covered by Mutual Aid Networks include chlorine, hydrogen chloride, hydrogen peroxide, phosphorus (through the Phosphorus Emergency Response Team - PERT), and compressed gases. Contact them through CHEMTREC.

CHLOREP Administered and coordinated by The Chlorine Institute. Provides an organized system for responding to chlorine emergencies in the United States and Canada. A CHLOREP team consists of a Team Leader and Assistants to handle the emergency, and a Home Coordinator to provide support at the home location. These resources are supplemented by a network of emergency response contractors.

Module Review – Word Scramble

mmadocn _____

iopelnsersb _____

uogpr _____

neopiarsot _____

drontiraoco _____

ereldaf _____

hyghwia _____

iaonisl _____

geelrna _____

uorsrepivs _____

Instructions The words listed above are scrambled versions of the following words. Unscramble the words above then check with your instructor to see how many you got right.

Command
Coordinator
Supervisor
Highway
Operations
Responsible
Group
Liaison
General
Federal

Chapter F

IDHA and Action Plans: (I.A.)

Main Points

- Identification and Hazard Assessment Process
- Hazard Identification Sources
- Hazard Assessment Sources
- Emergency Response Guidebook
- Container System Stress and Behavior
- Assessing Hazards
- Is The Material Toxic
- How Will the Material Behave
- Managing Risk
- Action Planning

Chapter Outline

1. Identification and Hazard Assessment Process.

a. The most critical aspects of a hazardous materials response is "Identification and Hazard Assessment" (IDHA).
   1) All further decisions flow from this.
   2) OSHA regs require the IC to do IDHA ("identify… all hazardous substances or conditions present…").
   3) Can't protect yourself from a problem if you can't identify ***and*** assess the problem!

b. Hazard assessment starts immediately.
   1) Starts with initial discovery/notification.
   2) Use recognition clues and common sense.
   3) Caution: Initial reports may not be accurate or complete.

c. The basic FRO IDHA process:
   1) Identify material(s) involved.
   2) Consult ERG and/or SDS.
   3) Follow your employer's policies.

d. Basic IDHA questions.
   1) Will something bad happen *right now*?
      a) Is it on fire?
      b) Can it explode or burn?
      c) Is it a gas or vapor that can come after me?
   2) If something bad happens, will it hurt *me*?
      a) Is it toxic?
      b) Is it flammable?
      c) Is it corrosive?
      d) Is it radioactive?

Will it Burn or Blow Up ***Right Now***?

"Explosive" placard visible?

Gas cylinder under stress?

Polymerization hazard? **"POL" "130P"**

Visible gas or vapor?

Bottom line:

Will this happen?

2. Hazard Identification Sources.

a. Safety Data Sheet.*
   1) Required by OSHA Hazard Communication Regulation.
   2) Purpose: Inform employees of "hazardous chemicals" present.
   3) Methods of transmitting information.
      a) Comprehensive hazard communication programs.
      b) Container labeling and other forms of warning.
      c) Material safety data sheets/safety data sheets and.
      d) Employee training.
   4) SDS a major source of hazard information.
   5) SDS can provide information on:
      a) Physical properties.
      b) Hazards of material.
      c) Signs and symptoms of exposure.
      d) Exposure levels.
      e) PPE recommended.
      f) Manufacturer contact information.
      g) See facing page for sections of SDS.
   6) Who can provide an SDS.
      a) Workplace involved in incident.
      b) Manufacturer and/or distributor of product.
      c) CHEMTREC.

* Safety Data Sheets (SDS) were previously called Material Safety Data Sheets (MSDS). The OSHA Hazard Communication regulation was revised and MSDSs were supposed to be converted to Safety Data Sheets prior to 2015. You may still find MSDSs that haven't been converted.

Sections of Safety Data Sheets (SDS).

Format As of 6/1/2015 all Safety Data Sheets must be in a uniform format. They will contain the following information:

Section	Description
1	Identification of the substance/mixture and the company/undertaking
2	Hazards identification (assessment)
3	Composition/information on ingredients
4	First aid measures
5	Fire fighting measures
6	Accidental release measures
7	Handling and storage
8	Exposure controls/personal protection
9	Physical and chemical properties
10	Stability and reactivity
11	Toxicological information
12	Ecological information
13	Disposal considerations
14	Transport information
15	Regulatory information
16	Other information

2. Hazard Identification Sources. *(continued)*

b. DOT placards, labels and markings.
   1) Stenciled railcars.
   2) ID # on placards and orange panels.
   3) Hazard identification code on orange placard.
   4) DOT Radioactive labels.
      a) White-I (lowest level of radiation)
      b) Yellow-II
      c) Yellow-III (highest level of radiation)

c. Shipping papers have following hazard ID info:
   1) Proper shipping name. (Hazmat(s) listed first, shown in a contrasting color or marked with an "X" in the "HM" column.)
   2) Hazard class.
   3) Identification (UN) number.
   4) Packing Group. (Indicates degree of hazard and the degree of protective packaging required.)
      a) Packing Group I. (Great danger.)
      b) Packing Group II. (Moderate danger.)
      c) Packing Group III. (Minor danger.)

d. Pipeline markers have following hazard ID info:
   1) Level of hazard ("Warning," "Caution," or "Danger").
   2) Name of product.

DOT Hazard ID Sources.

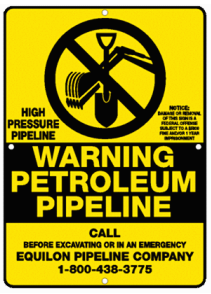
Orange Panels

Hazard Identification Code

DOT/UN Identification Number

Radioactive Labels

Pipeline Markers



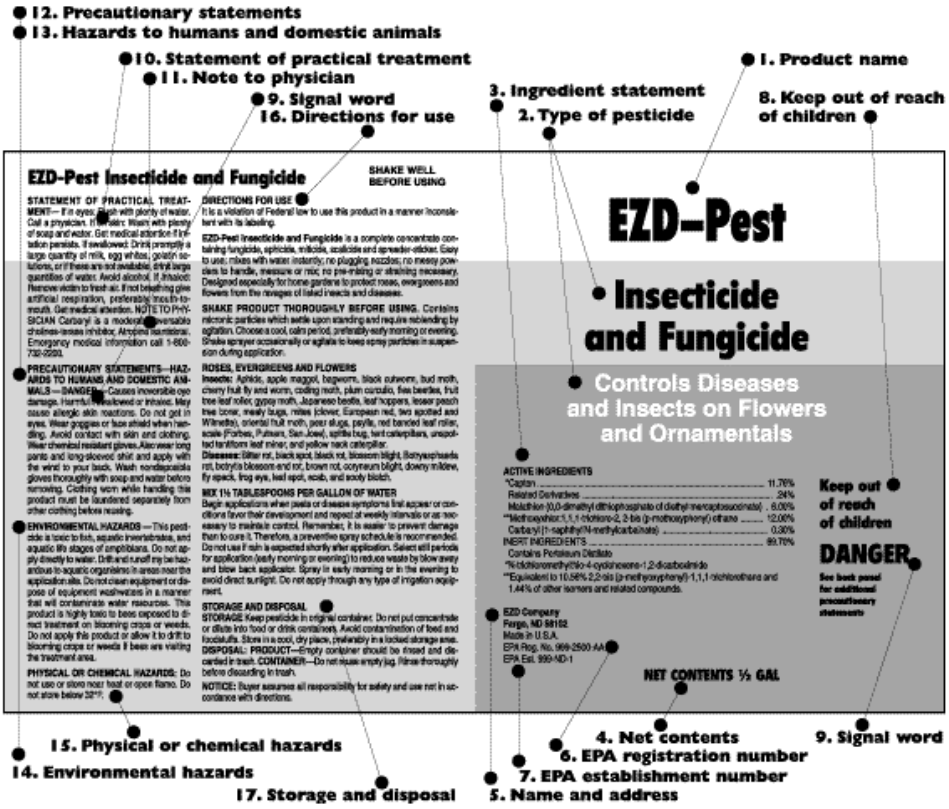
3. Hazard Assessment Sources.

a. NFPA 704 warning system.
   1) Colored quadrants identify type of hazard.
      a) Health (Blue).
      b) Flammability (Red).
      c) Instability (Yellow).
      d) Special Hazards (No special color, usually white).
   2) Numerical rating scale shows degree of severity. "0" = minimal hazard. "4" = severe hazard.
   3) See detailed information at the end of this module.

b. Pesticide and/or consumer product labeling must include:
   1) Common or usual name or the chemical name. (Consumer products.) Ingredient statement (pesticides).
   2) Signal words. (Consumer products & pesticides.)
      a) "Poison" — substances that are highly toxic.
      b) "Danger"— substances which are extremely flammable, corrosive, or highly toxic.
      c) "Warning"—moderate hazard.
      d) "Caution"—lowest hazard.
   3) Statement of the principal hazard or hazards, such as "Flammable", "Combustible", "Vapor Harmful", "Causes Burns", "Absorbed Through Skin", or similar wording describing the hazard. (Consumer products.)
   4) Precautionary statements for human hazards. (Pesticides.)

   (Detailed info at the end of this chapter.)

Pesticide Label. (40 CFR 156)



3. Hazard Assessment Sources. *(continued)*

c. CHEMTREC – Chemical Transportation Emergency Center.
   1) 24 hour technical information center.
   2) Can provide SDS from member companies. Has over 4 million safety data sheets available.
   3) Has database of medical experts and toxicologists who can provide advice and emergency medical treatment assistance to on-scene medical professionals treating victim.
   4) Can put responders in touch with product specialist(s) from the manufacturer or shipper.

d. Other hazard assessment sources.
   1) NIOSH Pocket Guide to Chemical Hazards.
      a) Source of information on several hundred chemicals/classes for workers, employers, and occupational health professionals.
      b) Presents key information and data in abbreviated or tabular form for chemicals or substance groupings (e.g. cyanides, fluorides, manganese compounds) found in the work environment.
      c) Designed to provide chemical-specific data to supplement general industrial hygiene knowledge.
   2) Poison Control System. (See facing page.)
   3) Infotrac™, ChemTel™ and 3E Company™.
      a) 24 hour technical information centers.
      b) Can provide SDSs from member companies.
      c) Can dispatch member company response teams.

Off-Site Information Resources

Chemical Transportation Emergency Center (CHEMTREC)

CHEMTREC serves as a round-the-clock resource for obtaining immediate emergency response information for accidental chemical releases. CHEMTREC is linked to the largest network of chemical and hazardous material experts in the world including chemicals and response specialists, response specialists within the carrier community, public emergency services, and private contractors. Their electronic library has over 4 million SDSs on file.

Shippers of hazardous materials use CHEMTREC to comply with U.S. DOT emergency notification regulation. This regulation requires hazmat shippers to provide a 24-hour emergency telephone number on shipping documents that can be called in the event of an emergency involving the hazardous material that was shipped. (49 CFR §172.604). Phone: 800-262-8200 24 hours a day. www.chemtrec.com

California Poison Control System

The California Poison Control System (CPCS) is the statewide provider of immediate free and expert treatment advice. They provide assistance in case of exposure to poisonous, hazardous or toxic substances. Pharmacists, physicians, nurses, and poison information providers staff all answering sites. Phone: 1-800-222-1222. www.calpoison.org

4. DOT Emergency Response Guidebook (ERG).

a. ERG purpose: *Basic* safety tool for *basic* identification, *basic* assessment and *initial* response (recognized good practice/standard for FROs to follow).
   1) Use current version of ERG for transportation-related incidents!
   2) Use current SDS (if available) for other incidents.

b. ERG page border colors and basic organization:
   1) **White** - Basic information and instructions.
      a) Table of Placards (pages 8-9).
      b) Rail Car Identification Chart (pages 10-12).
      c) Road Trailer Identification Chart (pages 13-15).
      d) Intermodal Container Hazard ID Numbers (pages 18-21).
      e) Pipeline Information (pages 22-27).
   2) **Yellow** – ID number index (materials listed by ID number).
   3) **Blue** - Material name index (materials listed alphabetically).
   4) **Orange** – Numbered guide pages.
   5) **Green** - Initial Isolation & Protective Action Distances.
      a) Table 1, Toxic Inhalation Hazards (pages 290-333)).
      b) Table 2, Water-Reactive Materials (pages 334-339).
      c) Table 3, Six Common TIH Gases (pages 340-343).
   6) **White** - Basic information and instructions (continued).
      a) BLEVE Safety Precautions (pages 357-359).
      b) Glossary (pages 369-379).

Emergency Response Guidebook Exercise.

White Pages (Pages 8-15)

Identify the material(s) and find the proper Guide page for this material.

Recognition Clue	Guide #	Major Hazard
Blue Placard		
Green Placard		
Box Car		
Intermodal Container		

Hazard Identification Numbers (Pages 18-21)

Find the hazards associated with the following numbers.

Number	Hazard(s)
55	
X80	
382	
63	

4. DOT Emergency Response Guidebook (ERG) *(continued)*.

c. ERG is a good user-friendly basic guide *but is limited:*
   1) Classifies by major hazard class or general chemical family.
   2) *Guides are general guidance with specific recommendations for some hazards.*
      a) General: Guide 111.
      b) Specific: "P" – Polymerization hazard.
      c) List of Dangerous Water–Reactive Materials.
   3) Isolation and evacuation distances in back of book are guides.
   4) Use table of placards only if materials cannot be identified.
   5) Intended for use in transportation-related incidents.
   6) Intended only for use in "initial response phase" of incident.

d. Responders should have ready access to an ERG and other guides, and *must know how to efficiently and effectively use it.*

Emergency Response Guidebook Exercise.

ID Number

Use the ERG to identify the material associated with this ID number and find the proper Guide page for this material.

ID #	Name	Guide #	Major Hazard(s)
3065			
1365			
3171			
1356			

Material Name

What is the protective action distance for a large spill that occurs at night (light winds, no fire)? Identify any specials hazards.

Name	Distance/Special Hazards
Ammonia, Anhydrous	
Butyl Acrylate	
Nitric Acid, Red Fuming	
Acetic Anhydride	
Aluminum Phosphide Pesticide	
Sarin	

5. Container System Stress and Behavior.

a. Hazmats are released when their containment system fails.
   1) Container failure can be minor (e.g. leaking can of paint thinner) or catastrophic (e.g. BLEVE).
   2) Nature of failure determines immediate potential harm.
      a) Kingman BLEVE versus Tokyo Sarin release.

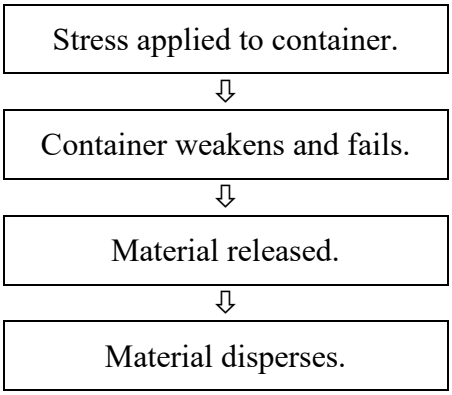
b. Hazmat release process.
   1) Stress on container.
   2) Container weakens and fails.
   3) Material released.
   4) Material disperses.
   5) ***Hazards and risks depend on what step the process is on when you arrive!***

c. Types of container stress. (Can occur individually, in combination or in sequence.)
   1) Thermal (hot or cold).
   2) Mechanical.
   3) Chemical.

d. Evaluating container stress. (If something bad *might* happen, how much time do I have before it *does* happen?)
   1) What type of stress is the container subjected to?
   2) What will the container likely do?
   3) When will it likely do it?

Evaluating Container Stress.

Steps Container failure process.



Hierarchy Evaluating risk from container stresses.

Situation	**Risk to Responders**
Damaged pressurized container with flame impingement, Pressure relief valve is operating.	Immediately Dangerous
Pressurized container with flame impingement.	Immediately Dangerous
Damaged pressurized container.	Dangerous
Pressurized containers that have been stressed but not visibly damaged.	Cause for Concern
Any container exposed to temperature extremes (hot *or* cold).	Cause for Concern
Any container exposed to any other form of stress.	Cause for Concern

5. Container System Stress and Behavior. *(contd.)*

e. Types of container failure.
   1) Catastrophic. (Total loss of container integrity.)
   2) Fracture. (Crack, tear or split seam.)
   3) Puncture. (Hole in container caused by mechanical stress.)
   4) Degradation. (Corrosion from excessive rust or exposure to corrosive substances.)

f. Types of product dispersion.
   1) Instantaneous release.
      a) Gases and liquids will spread rapidly in all directions.
      b) Flammable gases and liquids may ignite immediately.
   2) Rapid release.
      a) Gases will spread rapidly downwind.
      b) Liquids will spread rapidly downgrade.
      b) Flammable gases and liquids may ignite quickly.
   3) Slow release.
      a) Gases will spread slowly downwind.
      b) Liquids will spread slowly downgrade.
      b) Flammable gases and liquids may ignite.

g. Boiling-Liquid Expanding Vapor Explosion (BLEVE).
   1) Cause: Thermal stress on pressure vessel.
      a) Thermal stress weakens container.
      b) Container breaches.
      c) Product released nearly instantaneously.
   2) Hazards: Flying debris from ruptured container. Large fireball when expanding vapor ignites.
   3) Timeframe: Can occur in *less than* 10 minutes.

Special Hazard—BLEVE.

Basics Thermal stress on a container can cause an extremely hazardous event known as a Boiling Liquid Expanding Vapor Explosion (BLEVE). This occurs when a liquid or liquefied gas within a container is heated to a temperature well above its boiling point at atmospheric temperature. The increase in pressure causes the container to rupture catastrophically. When the container breaches the pressure in the container drops suddenly. The sudden drop in pressure inside the container causes the volatile liquid to expand rapidly generating a large amount of vapor. This sometimes happens with tremendous force. A BLEVE can occur when fire impinges on the container at a point or points above the liquid level of the contents of the container. This flame impingement causes the metal to weaken and fail from the internal pressure.

Hazards BLEVE hazards can include fireballs, blast effects, projectiles and possible toxic clouds or vapor cloud explosions. BLEVEs of large containers can cause large pieces of debris to travel nearly one mile. These events have caused deaths hundreds of feet away from the source of the explosion. If the liquid in the container is flammable, the rapid expansion of the vapor can cause a fireball that may be hundreds of feet in diameter. *A BLEVE is one of the most dangerous events an emergency responder can face.*

Cause A BLEVE can occur in a vessel that stores a substance that is usually a gas at atmospheric pressure but is a liquid when pressurized (for example, liquefied petroleum gas). The substance is usually stored partly in liquid form, with a gaseous vapor above the liquid filling the remainder of the container.

ERG **See pages 357-359.**

6. Assessing Hazards.

a. If the container fails what will the material do to you?
   1) Will it explode?
   2) Will it burn?
   3) Will it hurt you some other way (i.e. toxic)?

b. How can you tell?
   1) What are the properties of the material?
   2) Properties determine behavior and hazard of material.
   3) Behavior and hazard of material determine response.

c. What properties tell us it will explode or burn?
   1) BP - Boiling Point. (Temperature at which liquid starts to become a gas.)
   2) FP - Flash Point. (Temperature at which a liquid can vaporize to form an ignitable mixture in air.)
   3) IT - Ignition Temperature. (Minimum temperature at which a substance will continue to burn on its own.)
   4) FR - Flammable Range (Range of a concentration of a gas or vapor that will burn if an ignition source is introduced).
      a) Flammable Range is between the Upper Explosive (UEL) and Lower Explosive Limit (LEL).
      b) If the concentration of the material is within the flammable range the material could easily burn.

When Will It Burn Or Explode?

BP If the boiling point of a material is less than or near the ambient air temperature then the material will be more likely to produce vapors. If the boiling point is well below the ambient air temperature then the material may be a gas. ***Remember: liquids don't burn, gases and vapors do!***

FP If the flash point of a material is less than or near the ambient air temperature then the material could easily begin to burn (if there is a source of ignition). The higher the flash point the less likely the material will burn.

IT If the ignition temperature of a material is less than or near the ambient air temperature then the material could easily begin to burn (if there is a source of ignition) and continue to burn.

FR Flammable range is expressed as a per cent. It tells you how much of the material must be in the air for it to burn. If the lower explosive limit (LEL) is a low number (i.e. single digits) then it is more hazardous than a material with a higher LEL. If the concentration of the material is less than the LEL then it won't burn in a normal atmosphere (but it may burn in an atmosphere that is oxygen-enriched). If the concentration is above the upper explosive limit (UEL) then it won't burn (unless you open the door to the room and let in some fresh air).

6. Assessing Hazards. *(continued)*

d. Will the material be a solid, liquid or gas?
   1) Vapor pressure.
   2) Boiling point.
   3) Freezing/melting point.

e. Will the material float or sink?
   1) VD - Vapor Density (in air).
   2) SG - Specific Gravity (in water).

f. Will the material dissolve in water?
   1) Sol – Solubility.

g. Will the material be acidic, basic or neutral?
   1) pH - Acidity/Alkalinity.

h. How else it can hurt you.
   1) Asphyxiation.
   2) Carcinogenesis.

Physical & Chemical Property Terms.

BP	Boiling Point. Temperature at which a liquid will boil and become a gas or vapor. (Hint: Compare BP with air temp.)
FP	Flash Point. Lowest temperature at which vapors will ignite in air when exposed to a flame. (Hint: Compare FP with air temp.)
IT	Ignition Temperature. Minimum temperature at which the material will ignite without a spark or flame being present. (Hint: Compare the ignition temperature with the air temperature.)
FR/FL	Flammable Range and Flammable Limit. Range of concentration of a flammable gas or vapor at which fire or explosion can occur upon ignition. (Hint: A wider range indicates a greater hazard.)
Sol	Solubility. Amount of a material that will dissolve in water. (Hint: Will this material mix with or dissolve in water?)
SG	Specific Gravity. Ratio of weight of material to weight of an equal volume of water. Greater than 1, it sinks. Less than 1, it floats. (Hint: Oil: less than 1. Pesticides: greater than 1.)
VD	Vapor Density. Ratio of weight of a vapor or gas to weight of an equal volume of dry air at the *same* temperature and pressure. VD less than 1: vapors tend to rise. VD greater than 1: vapors tend to sink. (Hint: Most petroleum vapors sink.)
VP	Vapor Pressure. Pressure exerted by vapor that is in equilibrium with the liquid at a specified temperature. The pressure over a liquid that is confined in a closed container. (Hint: VP varies greatly with temperature.)
pH	Acidity/Alkalinity. Measure of the degree of acidity or alkalinity. pH of less than 7: acid. pH of greater than 7: alkaline substance. (Hint: Get advice from competent sources. Reactions with other materials can vary greatly.)

6. Assessing Hazards. *(continued)*

i. Is the material radioactive?

1) Ionizing radiation. Process in which a charged portion of a molecule (usually an electron) is given enough energy to break away from the atom. Results in the formation of two charged particles or ions: the molecule with a net positive charge, and the free electron with a negative charge.

2) Types of ionizing radiation.

a) Alpha. Large subatomic fragments consisting of two protons and two neutrons. Easily absorbed by most materials, and can travel only a few centimeters in air. Lack the energy to penetrate skin.

b) Beta. Subatomic particles ejected from the nucleus. Equivalent to electrons. Originate in the nucleus (electrons originate outside the nucleus). Can be stopped by clothing or thin sheet of metal.

c) Gamma. A packet of electromagnetic energy (a photon). very penetrating. Several feet of concrete or a few inches of lead may be required to stop gamma rays.

d) Neutron. Energy released from an atom in the form of neutral particles called neutrons. Significant neutron radiation in the human environment is rare.

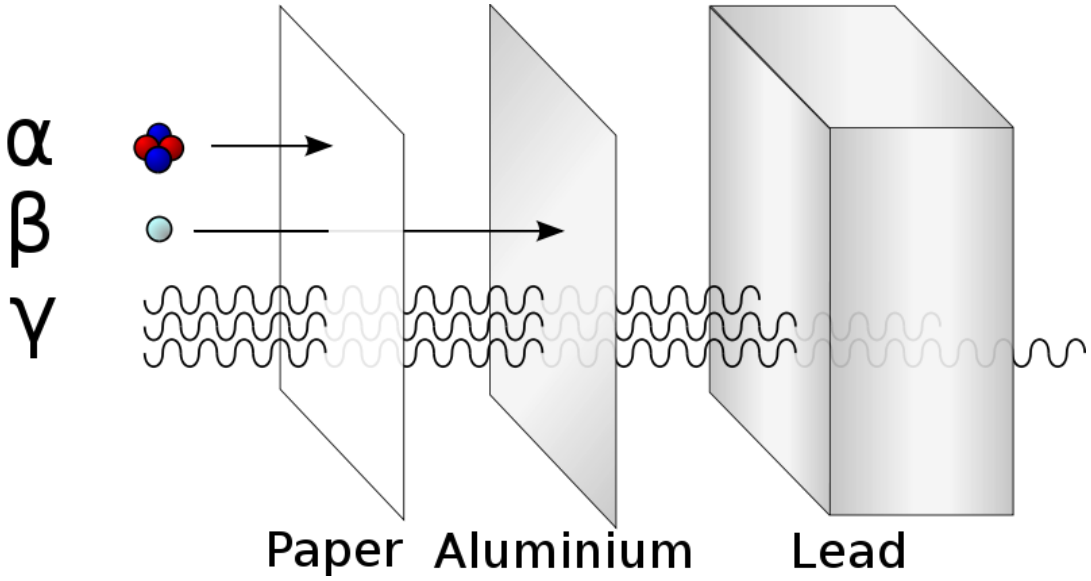
3) Protection against ionizing radiation.

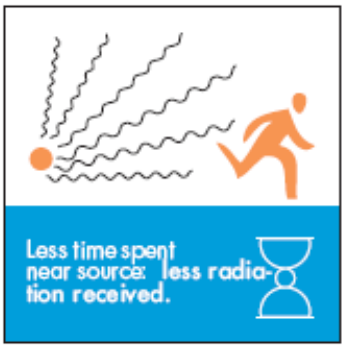
a) Time. (Minimize the amount of time you're exposed.)

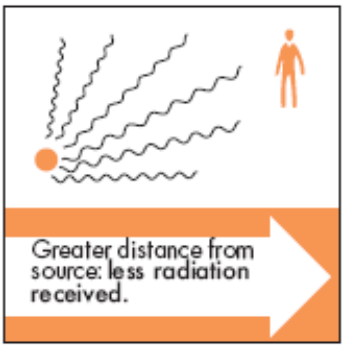
b) Distance. (Stay as far away from the sources as is practical.)

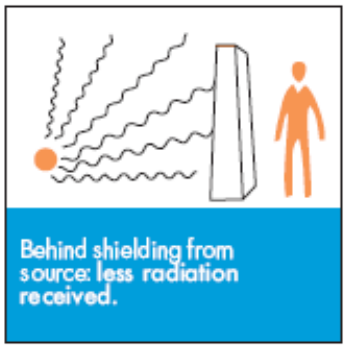
c) Shielding. (Put as much thick stuff as possible between you and the source.)

Protection Against Ionizing Radiation.









7. Is The Material Toxic?

a. Toxicology: The study of adverse systemic effects of chemicals.
   1) Not just the study of poisons. ***Many substances can be toxic even though they aren't classified as poisons!***

b. Toxic: it can hurt you when you eat, drink, breathe or touch it.

c. Poison: Chemical that produces illness or death when taken in very small quantities (DOT: $LD_{50} < 50$ mg per kg of body weight).
   Placards that indicate toxic hazards:
   1) "Poison Gas 2" placard: Gas (compressed or liquid).
   2) "Poison 6.1" placard: Liquid or solid.
   3) "Poison 6.2" placard: Infectious substance or etiological agent.

d. Science of Toxicology has limits — Tests usually done on animals (rats, guinea pigs, etc.), and there are often wide variations of health effects between animals and humans.

e. Assessing toxicity.
   1) Measures of toxicity.
      a) There are many.
      b) More on this later.
   2) Sources of information on toxicity.
      a) NIOSH Pocket Guide.
      b) Safety Data Sheets (SDS).

Toxic? The Details.

U.S. Dept. of Transportation

Division 2.3 "Is known to be so toxic to humans as to pose a hazard to health during transportation, or… when tested on laboratory animals it has an LC50 value of not more than 5000 mL/m3…" 49 CFR 173.115

Division 6.1 "…known to be so toxic to humans as to afford a hazard to health during transportation, or… it falls within any one of the following categories when tested on laboratory animals… Oral Toxicity. A liquid or solid with an LD50 for acute oral toxicity of not more than 300 mg/kg… Dermal Toxicity. A material with an LD50 for acute dermal toxicity of not more than 1000 mg/kg… Inhalation Toxicity. (A) A dust or mist with an LC50 for acute toxicity on inhalation of not more than 4 mg/L…" 49 CFR 173.132

CalOSHA

Poison "A substance which when taken in small quantities or low concentrations by mouth, inhaled, or absorbed through the skin rapidly jeopardizes life by other than mechanical or physical action." Title 8 CCR §5161

Dictionary

Poison Any substance that impairs health or destroys life when ingested, inhaled, or absorbed by the body in relatively small amounts.

7. Is The Material Toxic? *(continued)*

f. Tools for determining relative toxicity and selecting appropriate levels of PPE. Many measure occupational (chronic) exposures and may not apply to emergency (acute) response exposures.
   1) IDLH — Immediately Dangerous to Life and Health.*
   2) TLV™ — Threshold Limit Value (guides).
      a) TLV™-TWA
      b) TLV™-STEL
      c) TLV™-C
   3) STEL — Short Term Exposure Limit.*
   4) PEL — Permissible Exposure Limit (OSHA regulation).
   5) MLD — Minimum Lethal Dose.
   6) LD/LC_{50} — Lethal Dose/Lethal Concentration 50%.
   7) LD_{lo} — Lethal Dose, low.
   8) ERPG — Emergency Response Planning Guide.

      *Indicates an acute hazard.

g. Dose-Response Relationship.
   1) Effect produced depends on the dose you receive.
   2) As dose increases, severity of toxic response increases. (e.g. Exposure to tetrachloroethylene a solvent that is commonly used for dry-cleaning fabrics.)
      a) 100 ppm mild symptoms, such as headache and drowsiness.
      b) 200 ppm loss of motor coordination in some individuals.
      c) 1,500 ppm for 30 minutes, loss of consciousness.
   3) Severity of toxic effect also depends on duration of exposure.

The "Law" (Permissible Exposure Limit—PEL).

The Limit "An employee's exposure to any substance listed in Tables Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section." 29 CFR 1910.1000

Table Z-1 Limits for Air Contaminants. The exposure limit shall at no time exceed the exposure limit given for that substance, or an exposure to any substance in Table Z-1 shall not exceed the 8-hour Time Weighted Average given for that substance in any 8-hour work shift of a 40-hour work week. 29 CFR 1910.1000(a)(1)-(2)

Table Z-2 Toxic and Hazardous Substances. An exposure to any substance listed in Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given or, an exposure shall not exceed at any time during an 8-hour shift the acceptable ceiling concentration limit. 29 CFR 1910.1000(b)(1)-(2)

Table Z-3 Mineral Dusts. An exposure to any substance listed in Table Z-3, in any 8-hour work shift of a 40-hour workweek, shall not exceed the 8-hour time-weighted average limit given for that substance. 29 CFR 1910.1000(c).

7. Is The Material Toxic? *(continued)*

h. Routes of entry and minimizing exposure.

1) Inhalation—Breathing vapors, fumes, gases, etc.
   a) Isolate and deny entry.
   b) Wear SCBAs.
   c) Just stay away!
2) Ingestion—Eating it.
   a) Isolate and deny entry.
   b) Don't eat, smoke or drink near the scene.
3) Absorption—Soaks through your skin.
   a) Isolate and deny entry.
   b) Wear proper PPE.
   c) May absorb hazmats through skin, eyes or wounds.
4) Injection/Physical Contact—Puncture wound.
   a) Isolate and deny entry.
   b) Wear proper PPE (e.g. steel-toed shoes).
   c) Ways this can occur: _____
5) **Remember**: toxic vapors may lack color, odor and/or taste.
   a) You may get exposed before you even know it.
   b) Exposure can occur at anytime from approaching downwind, from wind shifts or not wearing PPE.

Minimizing Toxic Exposure in a Response.

The Law "The individual in charge of the ICS shall limit the number of emergency response personnel at the emergency site, in those areas of potential or actual exposure to incident or site hazards, to those who are actively performing emergency operations." 29 CFR 1910.120(q)(3)(v), Title 8 CCR 5192(q)(3)(E)

Inhalation
Approach the scene from upwind.
Establish control zones.
Require all entry teams to wear SCBAs.
Evaluate potential vapor/gas dispersion.
Consider the possibility of wind shifts.
Decontaminate all exposed personnel and equipment.

Absorption
Require all entry teams to wear proper PPE.
Isolate all sources of potential exposure.
Decontaminate all exposed personnel and equipment.

Ingestion
Forbid eating, drinking and smoking until decon is complete.
Require all responders to thoroughly wash hands, face and hair.
Decontaminate all exposed personnel and equipment.

Injection
Require all responders to wear proper PPE and basic safety equipment (hardhats, steel-toed shoes, gloves, etc.)
Evaluate hazards of debris, wreckage, etc.

7. Is The Material Toxic? *(continued)*

i. Acute vs. Chronic.
   1) Acute — One time, limited or short term exposure.
      a) Acute effects may not manifest themselves immediately. Many substances will cause problems that won't show up for hours or even days after exposure.
   2) Chronic — Continuous, repeated or long term exposure.
      a) Chronic effects: Often not detectable for years—could cause death, injury, birth defects or illness.

j. Toxicology variables—Reactions to exposure may depend on:
   1) Kind/type of Hazardous Material.
   2) Route of exposure.
   3) Dose (concentration) received.
   4) Duration and frequency of exposure.
   5) Personal tolerances and variable sensitivities.
      a) Age, medical history, gender, general state of health, personal habits, medications taken, etc.

Acute vs. Chronic—Not as Simple as it Seems…

Differences	Responders should keep in mind the great differences between the effects of acute exposures and chronic exposures. *The two may bear no relationship whatsoever.*
Endpoints	For example, the target organ for a chronic exposure to carbon tetrachloride is the liver while acute exposures can cause damage to the central nervous system.
Dose	Some substances may be acutely toxic but chronically essential. Vitamin D is a highly toxic material with the same LD_{50} as Parathion yet humans require minute amounts of Vitamin D regularly for good health.
Route of Entry	Other substances such as mercury have effects that vary greatly with the route of entry. If ingested, the body will easily eliminate a large, one time dose with little noticeable ill effects. Inhaling fumes from the same amount of mercury each day for a long period can cause severe health effects.
Source	*The Dose Makes the Poison,* M. Alice Ottoboni, Ph.D.

8. How Will the Material Behave?

a. Many variables will affect hazard assessment and may significantly influence the behavior of the material.
   1) Location will determine how material will disperse and what it will affect.
      a) Liquids and most vapors usually go downhill.
      b) Buildings can trap contaminants and cause unpredictable shifts in wind direction and speed.
   2) Time/date will affect evaporation rate and potential for flammability or reactivity (liquids evaporate faster on hot days/during the day, slower on cold days/at night).
   3) Weather will affect how material will disperse and where it will go (and where it will end up).
      a) Gases and vapors usually travel downwind.
      b) Vapor clouds may take longer to disperse in cold temperatures.
   4) Nature of materials (Bad stuff? How bad?).
   5) Type of release. (Slow leak, large leak or instantaneous release.)
   6) Size of problem (Bad stuff? How much?).
   7) Type, condition, nature and behavior of container.
   8) Reactivity and combustion.
      a) Chemicals can react with each other or burn and produce toxic substances.
      b) This may be difficult or impossible to predict. (Table 2 of ERG green section can help.)

b. The same material with different variables may significantly change the incident and the way you respond to it.

c. You may not find the answer in a book—use your head!

IDHA Complications.

Wind Very low wind speeds can make it difficult to predict where and how far a vapor or gas will spread. Generally, wind direction is least predictable and most variable when wind speed is low.

Stability Atmospheric stability determines how quickly a vapor or gas cloud will disperse. Under the most stable atmospheric conditions (usually at night), there is usually very little wind and almost no mixing of the pollutant cloud with the surrounding air. Gas concentrations within the cloud can remain high far from the source. The cloud spreads slowly, and high gas concentrations may build up in valleys or depressions and remain for long periods of time, even at distances far from the release point.

Terrain The wind typically shifts speed and direction as it flows up or down slopes, between hills or down into valleys, turning where terrain features turn. In urban areas, wind flowing around large buildings forms eddies and changes direction and speed, significantly altering a cloud's shape and movement. Through streets bordered by large buildings can generate a "street canyon" wind pattern that constrains and funnels a dispersing cloud.

Fires/Reactions The smoke from a fire, because it has been heated, rises before it moves downwind carrying contaminants with it. In addition, many chemicals react with dry or humid air, water, other chemicals, or even themselves. Because of these chemical reactions, the chemical that disperses downwind might be very different from the chemical that originally escaped from containment. In some cases, this difference may be substantial enough to make computer dispersion predictions inaccurate.

9. Managing Risk.

a. The IDHA process will help answer the following questions:
   1) What will this stuff do?
   2) Where will it go?
   3) Who will it hurt?

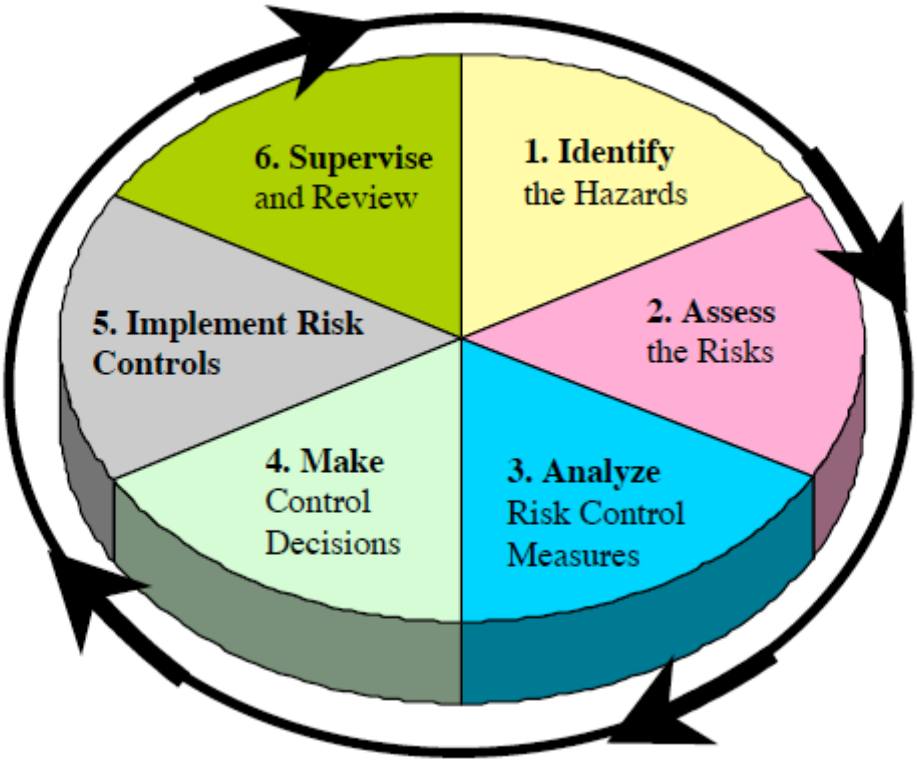
b. Answering above will help answer the basic IDHA questions:
   1) Will something bad happen *right now*?
   2) If something bad happens, will it hurt *me*?

c. If something bad can happen, how do we manage that risk?

d. Risk management process.
   1) ID the hazards.
   2) Assess the risks.
   3) ID your options.
   4) Evaluate risk versus gain.
   5) Monitor and reevaluate the situation.

e. Assessing risks.
   1) What is the potential severity?
   2) What is the probability it will happen?
   3) What is the potential exposure?

Managing Risk.



9. Managing Risk. *(continued)*

f. Rating risks.

1) Low, Moderate, High or Unacceptable.

2) Related to amount of material involved, physical state of material, container stress, properties of material and potential exposures (i.e. people, environment and/or property).

3) Low risks.

a) Small quantities.

b) Inert solid materials.

c) Undamaged container.

4) Moderate risks.

a) Smaller quantities.

b) Low vapor-pressure liquid materials.

c) Undamaged or slightly damaged container.

5) High risks.

a) Larger quantities or multiple containers.

b) Moderate vapor-pressure liquid materials or gases.

c) Slightly or moderately damaged container.

6) Unacceptable risks.

a) Larger quantities and/or gas cylinders involved.

b) High vapor-pressure liquids, gases, explosives and/or reactive materials.

c) Visibly stressed container and/or flame impingement on a gas cylinder.

d) An unacceptable risk where I work is:

_____

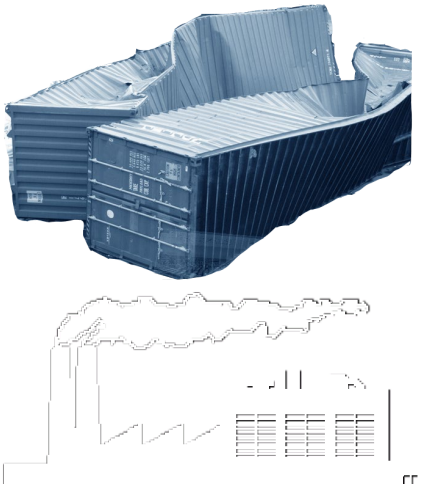
Unacceptable Risks.

Large quantity of gas cylinders

Explosive/reactive materials

Polymerization hazard **"POL" "130P"**

Visibly stressed containers



10. Action Planning.

a. After identifying and assessing hazards FROs should develop (informal) objectives and (unwritten) plans prior to taking action.
   1) As incident progresses responders may develop a written Incident Action Plan (IAP).
   2) IAP will usually include a Site Safety Plan (ICS HM208).
   2) FROs should know and follow IAP and Site Safety Plan.

b. Components of action planning.
   1) Identify the problem.
   2) Assess the problem.
   3) Identify the resources available.
   4) Use available resources to solve the problem.

c. Sources of FRO objectives and action plans.
   1) ERG guides.
   2) SDS recommendations.
   3) Employer standard operating guides.

d. Basic FRO actions.
   1) All incidents: isolate and deny entry.
   2) Acceptable risk present: containment and protective actions.
   3) Unacceptable risk present: isolate and deny entry ***only***.

e. Action planning for rescue.
   1) ID the hazard(s).
   2) Assess risk to responders.
   3) Risk assessment and rescue
      a) Acceptable risk: rescue.
      b) Unacceptable risk: no rescue.

Action Planning—What OSHA Says…

Appendix C to 1910.120 - Compliance guidelines

6. Incident Command System.

FRO "The first responding senior officer would implement and take command of the ICS. That person would size-up the incident and determine if additional personnel and apparatus were necessary; would determine what actions to take to control the leak; and determine the proper level of personal protective equipment." *(In other words, the first responder will develop an action plan.)*

7. Site Safety and Control Plans.

Plans "The safety and security of response personnel and others in the area of an emergency response incident site should be of primary concern to the incident commander. The use of a site safety and control plan could greatly assist those in charge of assuring the safety and health of employees on the site."

Plan Contents "A comprehensive site safety and control plan should include the following: summary analysis of hazards on the site and a risk analysis of those hazards; site map or sketch; site work zones (clean zone, transition or decontamination zone, work or hot zone); use of the buddy system; site communications; command post or command center; standard operating procedures and safe work practices; medical assistance and triage area; hazard monitoring plan (air contaminate monitoring, etc.); decontamination procedures and area; and other relevant areas. This plan should be a part of the employer's emergency response plan or an extension of it to the specific site."

NFPA 704 Warning System.

Background The Standard System for the identification of the fire hazards of materials was first adopted by the NFPA in 1961. The purpose of the standard is to safeguard the lives of those individuals who may be concerned with fires or emergencies occurring in an industrial plant or storage location where the hazards of materials on-site may not be readily apparent.

Applicability Applies to facilities that manufacture, store or use hazardous materials.

Purpose Provides a simple system of readily recognizable and easily understood markings that will give, at a glance, the general idea of the inherent hazards of any hazardous material.

Components Identifies the hazards of a material in terms of three principal categories: Health, Flammability and Instability.

Indicates order of severity numerically by five divisions ranging from four (4), indicating a severe hazard, to zero (0), indicating minimal hazard.

Presents information by a standard pattern of shapes and colors. Health (blue), left; Flammability (red), top; Instability (yellow), right. Note: Yellow was changed from "Reactivity" to "Instability" in 1996.

The bottom space indicates unusual hazards such as reactivity with water, oxidizing properties or radioactivity.

Health Hazard – Blue.

Signal	Type of Possible Injury
4	Materials that, under emergency conditions, can be lethal.
3	Materials that, under emergency conditions, can cause serious or permanent injury.
2	Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.
1	Materials that, under emergency conditions, can cause significant irritation.
0	Materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials.

Flammability – Red.

Signal	Type of Possible Injury
4	Materials that rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and burn readily.
3	Liquids or solids that can be ignited under almost all ambient temperature conditions.
2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.
1	Materials that must be preheated before ignition can occur.
0	Materials that will not burn under typical fire conditions.

Instability – Yellow.

Signal	Type of Possible Injury
4	Materials which are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials which are capable of detonation or explosive decomposition or explosive reaction but that require a strong initiating source of must be heated under confinement before initiation.
2	Materials that readily undergo violent chemical change at elevated temperatures and pressures.
1	Materials which are normally stable but which can become unstable at elevated temperatures and pressures.
0	Materials that in themselves are normally stable, even under fire conditions.

Special Hazards – White.

Signal	Type of Possible Injury
POL	Polymerization hazard.
COR	Corrosive hazard.
W	Materials that react violently or explosively with water.
OX	Materials that possess oxidizing properties.
	Radiation hazard.

Pesticide Label Info.

Availability **"A copy of the registered labeling that allows the manner in which the pesticide is being used shall be available at each use site."** (Title 3 CCR §6602)

Placement "The label shall appear on the pesticide or the immediate container thereof. If the immediate container is enclosed within a wrapper or outside container through which the label cannot be clearly read by a person with normal vision, the label must also appear on such outside wrapper or container if it is a part of the retail package." (Title 3 CCR §6237)

Statements "Warning or caution statements…must appear on the label in a place sufficiently prominent to warn the user, and must state clearly and in nontechnical language the particular hazard involved in the use of the pesticide, e.g., ingestion, skin absorption, inhalation, flammability or explosion, and the precautions to be taken to avoid accident, injury, or damage."
(a) The label of every pesticide shall bear warnings or cautions which are necessary for the protection of the public, including the statement, "Keep out of reach of children," and a signal word such as "Danger," "Warning," or "Caution" as the director may prescribe, on the front panel or that part of the label displayed…
(b) The label of every pesticide which is highly toxic to man shall bear the word "Danger" along with the word "Poison" in red on contrasting background in immediate proximity to the skull and crossbones, and an antidote statement including directions to call a physician immediately on the front panel or that part of the label displayed…"(Title 3 CCR §6242)

Toxicological Terms.

REL	**R**ecommended **E**xposure **L**imit. Developed by NIOSH to reflect exposure limits for hazardous substances or conditions in the workplace. OSHA and MSHA use these recommendations to develop regulatory exposure limits. Time weighted average. Up to a 10 hour workday. 40 hour workweek.
STEL	**S**hort **T**erm **E**xposure **L**imit. Unless otherwise stated, an exposure limit for a short period of time. Can't exceed this level during any part of the work period. (Usually measured over a short period of time because it's often impossible to obtain an instantaneous measurement of an airborne concentration.) Time weighted average. 15 minutes.
PEL	**P**ermissible **E**xposure **L**imit. Legal limit for exposures in the workplace. OSHA/CALOSHA regulation. Majority adopted from TLV's. (CALOSHA PEL's usually more up to date.) Uses time weighted averages, short-term exposure limits and ceilings.
TLV–TWA	**T**hreshold **L**imit **V**alue – **T**ime **W**eighted **A**verage. Exposure limit recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). Level to which nearly all workers may be repeatedly exposed without adverse effect. Time weighted average. 8 hour workday. 40 hour workweek. Derived from data on healthy, adult male workers (levels may not apply to women or children).
TLV®–C	**T**hreshold **L**imit **V**alue – **C**eiling. Workplace exposure limit recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). Ceiling concentration you shouldn't exceed at any time *in the workplace*.

Toxicological Terms. *(continued)*

TLV®–STEL	**T**hreshold **L**imit **V**alue – **S**hort **T**erm **E**xposure **L**imit. Exposure limit recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). All workers should be able to withstand up to four exposures per day at this concentration with no ill effects (if TLV®-TWA not exceeded). Applied to supplement the TLV®-TWA when there are recognized acute effects from a substance whose toxic effects are primarily of a chronic nature. Time weighted average. 15 minutes. 8 hour workday. 40 hour workweek.
IDLH	**I**mmediately **D**angerous to **L**ife and **H**ealth. Maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects. Recommendation from NIOSH. Recommended ceiling for a healthy, adult, male worker. *Values determined only for the purpose of respirator selection.*
Odor Threshold	Level at which most people can detect the odor of a substance. *Great variation in individual response to odors and in data in various reference sources.* Average figure normally based on empirical research. Usually expressed in parts per million.
WEEL	**W**orkplace **E**nvironmental **E**xposure **L**evel. Exposure limits recommended by the American Industrial Hygienists Association. Used in absence of TLV® or PEL. Time weighted average. 8 hour workday.

Toxicological Terms. *(continued)*

EEGL	**E**mergency **E**xposure **G**uidance **L**evel. Concentration of a substance judged acceptable for the performance of specific tasks by military personnel during emergency conditions lasting 1-24 hours. Acceptable only to perform tasks necessary to prevent greater risks. Developed by National Research Council (NRC) for the DOD. Ceiling level for single substances considered acceptable for rare situations. *Acceptable, but not safe, level of exposure.* Acute toxicity is primary concern.
SPEGL	**S**hort–Term **P**ublic **E**xposure **G**uidance **L**evel. Acceptable ceiling concentration for a single, unpredicted short–term exposure to the public. Developed by NRC primarily for materials used as rocket fuels. Usually one tenth to one half of the EEGL. Ceiling level for single substance. Exposure period usually 1 hour or less; never more than 24 hours. Takes into account sensitive subpopulations.
ERPG–1	**E**mergency **R**esponse **P**lanning **G**uide–1. Maximum airborne concentration to which nearly all individuals could be exposed for up to one hour without experiencing or developing health effects more severe than sensory perception or mild irritation. Ceiling recommended by the American Industrial Hygiene Association. Not *intended for repeated exposures.*
ERPG–2	**E**mergency **R**esponse **P**lanning **G**uide–2. Maximum airborne concentration below which, it is believed, nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible adverse or other serious health effects or symptoms which could impair an individual's ability to take protective action. Ceiling recommended by the American Industrial Hygiene Association. Not *intended for repeated exposures.*

Toxicological Terms. *(continued)*

ERPG–3	**E**mergency **R**esponse **P**lanning **G**uide–3. Maximum airborne concentration below which, it is believed, nearly all individuals could be exposed for up to one hour without experiencing or developing life threatening health effects. Ceiling recommended by the American Industrial Hygiene Association. Not *intended for repeated exposures.*
LC_{50}	**L**ethal **C**oncentration, 50%. Concentration level at which 50 percent of the test animals died when exposed by inhalation for a specified time period. Standard measurement used by toxicologists.
LD_{50}	Median **L**ethal **D**ose. Dose at which 50 percent of test animals died following exposure. Standard measurement used by toxicologists. Dose is usually given in milligrams per kilogram of body weight of the test animal.

Module Review – DOT ERG Exercise

Problem #1 The placard on the side of a tank car looks like this:

What Guide # would you choose?

Problem #2 The placards on the side of a tank car look like this:

What Guide # would you choose:

Problem #3 You arrive at the scene of an overturned truck. The placards on the side of the truck look like this:

What Guide # would you choose?

Chapter G

Protective Equipment & First Responder Limitations: (P.)

Main Points

- IDHA and Personal Protective Equipment
- Need for PPE
- Typical Hazards On-Scene
- Protective Clothing
- Criteria for Selecting Protective Clothing Level
- Respiratory Protection
- Environmental Monitoring Devices
- Risks and Limits of Protective Equipment

Chapter Outline

1. IDHA and Personal Protective Equipment (PPE).

a. After IDHA, need to determine protective equipment needs.

b. "Personal Protective Equipment" (PPE) includes:
   1) Protective Clothing (at proper level),
   2) Respiratory Protection (SCBA, APR or SAR) and
   3) Monitoring Devices.

c. Level of PPE determined by:
   1) Physical state of material.
   2) Hazards of material.
   3) Route(s) of entry and potential exposure(s).

d. IDHA process will determine type and level of PPE needed.
   1) OSHA regs ***require*** SCBA for inhalation hazards.
   2) FROs normally lack PPE for hazmat.
   3) FROs are limited to defensive actions because they lack PPE that protects against hazardous materials.

e. Bottomline: PPE keeps responders safe!

PPE Requirements.

PPE "Based on the hazardous substances and/or condition present, the individual in charge…shall…assure that the PPE worn is appropriate for the hazards…" Title 8 CCR §5192(q)(3)(C), 29 CFR 1910.120(q)(3)(iii).

SCBA "Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear [SCBA]…" Title 8 CCR §5192(q)(3)(D), 29 CFR 1910.120(q)(3)(iv).

Monitoring "The individual in charge…shall identify…all hazardous substances or conditions present…" Title 8 CCR §5192(q)(3)(B), 29 CFR 1910.120(q)(3)(ii).
"Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear [SCBA]…until…the individual in charge…determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees." Title 8 CCR §5192(q)(3)(D), 29 CFR 1910.120(q)(3)(iv).

Selection Level B is, "…the minimum level recommended for initial site entries until hazards have been further identified." *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* NIOSH Publication 85-115.

2. Need for Personal Protective Equipment (PPE).

a. Responders may be exposed via inhalation, ingestion, absorption and/or injection.

b. PPE protects you from the bad stuff by getting between the bad stuff and route(s) of entry.

c. Limits of PPE that first responders usually wear.
   1) Firefighter turnouts, proximity suits and entry suites are ***not*** chemical protective clothing (read the label!). Even with SCBA they are *Level D*.
   2) Law enforcement equipment (e.g. leather) may actually absorb hazardous materials.
   3) EMS universal precautions won't protect against inhalation of vapors, gases, fumes, etc. Latex gloves may be ineffective against many common hazardous substances (e.g. gasoline, paint thinner and nail polish remover).

3. Typical Hazards On-Scene.

a. First Responders.
   1) Primary hazard is inhalation exposure.
   2) Others: oxygen deficiency, burns (chemical and thermal), toxicity and radioactivity.

b. Technicians and Specialists.
   1) Primary hazard is heat stress from PPE.
   2) Others: damaged containers, slips, trips and falls.

c. Injuries to responders.
   1) Minor injuries are usually from inhalation exposure.
   2) Major injuries are usually chemical burns from exposure to corrosive materials.

Examples of Level "D" PPE.

Hazard to Responders

FROs

Inhalation

Technicians and Specialists

Heat Stress

3. Typical Hazards On-Scene. *(continued)*

d. Skin contact hazards from common hazmats.

1) Hazard Class 1. Nitroglycerine. Systemic toxin and skin irritant. Readily absorbed by the skin.

2) Hazard Class 2. Diethylamine. Severely corrosive to the skin. Causes severe burns. Toxic in contact with skin.

3) Hazard Class 3. Benzene. Systemic toxin. Known carcinogen. Damages blood, bone marrow & central nervous system.

4) Hazard Class 4. Pentaborane. Can be fatal by skin contact. Dermal exposure can cause chemical burns. Evaporation of pentaborane from the skin may create symptoms of frostbite.

5) Hazard Class 5. Fluorine. Toxic by skin absorption. Contact with skin in lower than lethal concentrations causes chemical burns.

6) Hazard Class 6. Phenol. Hazardous in case of skin contact (sensitizer, permeator). Skin contact can produce inflammation and blistering.

7) Hazard Class 7. Uranium Hexafluoride. Causes severe irritation, possibly burns, to the skin. Absorption through the skin may occur, resulting in toxic effects similar to inhalation.

8) Hazard Class 8. Hydrofluoric Acid. Corrosive and toxic by skin absorption. Can cause deep-seated ulcers.

9) Hazard Class 9. Miscellaneous Dangerous Substances. PCBs. Can be absorbed through intact skin and cause chloracne.

PPE for Common Hazards.

Explosives	None!
Gases	SCBA and fully encapsulated vapor-tight chemical protective clothing (toxic gases).
Flamm. Liquids	Firefighter turnouts (e.g. Nomex™) or proximity suit.
Flamm. Solids	Firefighter turnouts (e.g. Nomex™) or proximity suit
Oxidizers	SCBA & chemical protective clothing.
Toxic Materials	SCBA & chemical protective clothing.
Rad. Materials	NFPA 1994/2007 Class 2 ensemble. (May provide limited protection against gamma radiation.)
Corrosives	SCBA & chemical protective clothing.
Misc. Hazmats	SCBA & chemical protective clothing.

4. Protective Clothing.

a. Levels of Protective Clothing (PC) include:
   1) Level A — Best respiratory and skin protection.
      a) Positive pressure SCBA and
      b) *Fully encapsulated, vapor tight, vapor protective* chemical protective suit.
   2) Level B — High level of respiratory protection but less for skin
      a) Positive pressure SCBA and
      b) Hooded chemical resistive and splash protective clothing.
   3) Level C — Air purifying respirators and modest skin protection
      a) Full or half-mask APR and
      b) Hooded chemical resistive clothing.
   4) Level D — Ordinary work uniform, *Minimal protection*.
      a) No respiratory protection.
      b) Minimal splash and vapor protection.
      c) May actually absorb vapors, gases and liquids.

b. Limitations of PPE levels.
   1) Levels A and B: limited mobility, restricted vision, finite air supply and heat stress.
   2) Level C: limited mobility, restricted vision, difficulty breathing and heat stress.

c. Number 1 responder limitation is lack of Protective Clothing. (i.e. FROs don't usually have *any* PPE.)
   1) First Responders are usually in *Level D*.
   2) Level D provides no respiratory protection and only limited chemical resistance.

Levels of Protective Clothing.

Level A When greatest level of skin, respiratory and eye protection is required; site operations and work functions involve a high potential for splash, immersion or exposure to unexpected vapors, gases or particulates that are harmful to skin or capable of being absorbed through the skin; substances with high degree of hazard to the skin are present; operations being conducted in confined, poorly ventilated areas in the absence of conditions requiring Level A haven't yet been determined.

Level B When highest level of respiratory protection is needed, but a lesser level of skin protection is needed; atmosphere contains less than 19.5% oxygen; presence of vapors indicated but vapors aren't harmful to skin or capable of being absorbed through the skin; no confined space.

Level C When atmospheric contaminants, liquid splashes or direct contact won't adversely affect or be absorbed through any exposed skin; concentrations and types of airborne substances have been identified and measured; appropriate air purifying respirators (APRs) are available. *These criteria make Level C impractical for emergency response.*

Level D When the atmosphere contains no known hazard; work functions preclude splashes, immersion or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals. A work uniform affording minimal protection, used for nuisance contamination only.

NOTE: **Work uniforms and firefighter turnouts are Level D protection! Firefighter turnouts and police uniforms often contain materials that may absorb hazardous materials.**

5. Criteria for Selecting Protective Clothing Level.

a. Selection of Protective Clothing level based on:
   1) Physical form of material (e.g. vapor or splash potential),
   2) Degree of hazard (e.g. length of exposure, dermal hazard),
   3) Other (Oxygen level, PC chemical compatibility, work activity, uncertain/unknown hazards, etc).

b. Criteria for each level:
   1) Level A: Unknown and/or skin absorptive material, high splash hazard, confined space.
   2) Level B: Less than 19.5% O_2, incompletely ID'd gas or vapor.
   3) Level C: No skin hazard, no unknowns, sufficient O_2.
   4) Level D: No Hazard.

c. Control Zones and PPE.
   1) Exclusion Zone: Level A-C.
      a) No PPE? Then stay out of Exclusion Zone!
   2) Contamination Reduction Zone: Level A-C.
   3) Support Zone: None required (no hazard!).

d. The Safety Officer *approves* proper level of PC and submits recommendation to IC for final approval.

Control Zones and Protective Clothing

Exclusion Zone

Requires proper level of protective clothing, including Level A, B or C. (Also called Hot Zone, Red Zone, Inner Perimeter, etc.)

Contamination Reduction Zone

Requires proper level of protective clothing, **usually one level down** from that required in the Exclusion Zone (e.g. Entry to Exclusion Zone requires Level A, entry to CRZ will require at least Level B.) (Also called Warm Zone, Yellow Zone, Secondary Perimeter, etc.)

Support Zone

No special protective clothing required. Level D is acceptable. (Also called Cold Zone, Green Zone, Outer Perimeter, etc.)

6. Respiratory Protection.

a. Respiratory protection helps to prevent you from inhaling dangerous substances.

b. Basic types of respiratory protection:
   1) SCBA (Self-contained breathing apparatus). Used in Level-A and B PPE. Highest level of respiratory protection.
   2) APR (Air purifying respirator). Used in Level-C PPE.
   3) SAR (Supplied Air Respirator.) Rarely used in emergency response due to limit on hose length (300 feet).

c. Components of respiratory protection:
   1) Self-Contained Breathing Apparatus.
      a) Facepiece,
      b) Harness,
      c) Regulator,
      d) Air source.
   2) Air-Purifying Respirators.
      a) Facepiece,
      b) Air-purifying device (hazard-specific).

d. Limitations of respiratory protection.
   1) SCBA: finite supply of air.
   2) SAR: length of hose limited.
   3) ARP/PAPR: filter life limited.
   4) Rebreather/Closed-circuit SCBA: generates heat. Allows for longer time in suit that can cause heat stress. Mechanically more complicated than an SCBA.

Respirators.

Self-Contained Breathing Apparatus (SCBA)

Powered Air-Purifying Respirator (PAPR)

Air-Purifying Respirator (APR)

7. Environmental Monitoring Devices.

a. Purposes of monitoring equipment.
   1) Detect hazardous vapors and gases.
   2) Determine concentration of contaminants.
   3) Estimate size of contaminated area.
   4) Document incident conditions.

b. Common types FROs use:
   1) Combustible Gas Indicators and Oxygen Meters.
   2) Radiation survey instruments.
   3) pH paper.

8. Risks and Limits of Protective Equipment.

a. "Penetration", "Degradation" and "Permeation".

b. All levels of protection have limitations
   1) Heat stress.
      a) CPC interferes with body's ability to dissipate heat.
      b) Core body temperature rises when in CPC.
   2) Impaired vision and mobility.
   3) Incompatibilities with contaminant(s).
   4) CPC damaged by temperature extremes.
   5) CPC has a shelf life.

Limits of Protective Clothing Material.

Penetration The movement of chemicals through zippers, stitched seams or imperfections (e.g. holes) in the clothing material.

Degradation The loss of or change in the fabric's chemical resistance or physical properties due to exposure to chemicals, use (or misuse) or ambient conditions (e.g. sunlight).

Permeation The process by which a chemical dissolves in and/or moves through a protective clothing material on a molecular level.

Chapter H

Hazmat Release Countermeasures: (C.)

Main Points

- Review of the Basics
- Selecting Response Strategy
- Non-intervention Strategy
- Defensive "Containment" Strategy
- Offensive "Control" Strategy
- General Tips and Techniques

Chapter Outline

1. Review of the Basics.

a. Responders' goal: Protect life, environment and property.

b. The role of any Hazmat Responder:
   1) Safely and competently respond within level, resources and capabilities.
   2) Module focus: S.I.N.C.I.A.P.**C**.P.D.D.D.

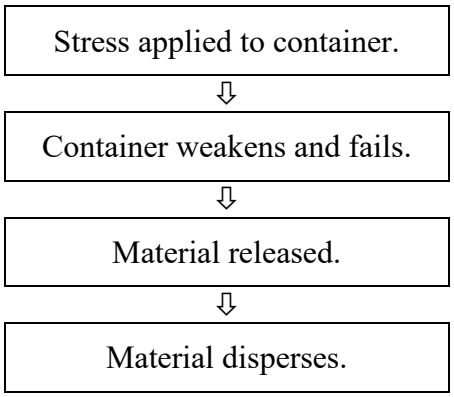
d. Hazmats are released when their containment system fails.
   1) Nature of failure determines how material disperses.
   2) Dispersion determines who/what is affected. (DOT ERG can help estimate extent of area affected.)

e. Hazmat release process.
   1) Stress on container.
   2) Container weakens and fails.
   3) Material released.
   4) Material disperses.

c. Types of dispersion.
   1) Catastrophic failure of container (e.g. BLEVE).
   2) Energetic dispersion.
   3) Rapid flow through visible opening.
   4) Slow leak through crack or small opening.
   5) How much disperses and how fast it disperses determine the countermeasures you can employ.

Evaluating Container Stress.

Container failure process.



Material escapes from container.

Dispersion Type	**Example**
Catastrophic failure.	BLEVE, explosion or polymerization.
Energetic dispersion.	55 gallon drum struck by a moving vehicle or a bottle falling from a shelf.
Rapid flow through visible opening.	55 gallon drum punctured by a forklift.
Slow leak through crack or small opening.	55 gallon drum leaking through a pinhole in a rusted chine.

2. Selecting Response Strategy.

a. Responders should contribute to the solution, not the problem!
   1) The key question: What if I don't intervene?
   2) Next question: Will my intervention help?

b. Three strategies to stabilize a Hazmat event:
   1) Non-Intervention: No direct actions other than S.I.N.
   2) Containment (Defensive): Slow & restrict Hazmat spread.
   3) Control (Offensive): Stop Hazmat release.

c. Response strategy hierarchy. Level of risk determines strategy.
   1) Definitions.
      a) Unacceptable risk: Response actions provide no benefit.
      b) Acceptable risk: Benefits exceed costs.
      c) Calculated risk: Take risk after considering costs.
   2) Non-Intervention: Unacceptable risk. SIN only. Protect life.
   3) Defensive: Acceptable/calculated risk (benefits exceed costs). Protect the environment.
   4) Offensive: Minimal risk. Protect property.

Offensive vs. Defensive Actions (OSHA Regs).

FRA "…trained to initiate an emergency response…by notifying the proper authorities of the release. They would take no further action…" (Non-intervention only!) Title 8 CCR §5192(q)(6)(A) 29 CFR 1910.120(q)(6)(i).

FRO "…trained to respond in a *defensive* fashion without actually trying to stop the release. Their function is to *contain* the release from a safe distance, keep it from spreading, and prevent exposures." (Defensive actions only. Generally, containment only.) Title 8 CCR §5192(q)(6)(B) 29 CFR 1910.120(q)(6)(ii).

Technician "…respond to releases…for the purpose of stopping the release. They assume a more *aggressive* role than a [FRO] in that they will approach the point of release in order to plug, patch or otherwise stop the release…" (Defensive or offensive actions. Containment or control.) Title 8 CCR §5192(q)(6)(C) 29 CFR 1910.120(q)(6)(iii).

Specialist "…respond with and provide support to [technicians]. …require a more directed or specific knowledge of the various substances…also act as the site liaison with federal, state, local, and other government authorities…" (Defensive or offensive actions. Containment or control.) Title 8 CCR §5192(q)(6)(D) 29 CFR 1910.120(q)(6)(iv).

3. Non-intervention Strategy.

a. Non-intervention.
   1) No direct action to stop, slow, contain or restrict the release.
   2) Isolate and deny entry.
   3) May be required by standard operating guides.

b. When to not intervene.
   1) Risk is unacceptable. Examples of unacceptable risks:
      a) Presence of explosives. ("Explosive" placard visible and/or NFPA 704 Instability rating of 4.
      b) Pressure vessels severely damaged and/or subjected to thermal stress (i.e. fire).
      c) Material that may polymerize. ("POL" on white quadrant of NFPA 704 sign. "P" on DOT ERG Guide Number.)
      d) Visible vapor cloud.
      e) Threat of fire.
   2) No threat to life.
   3) Lack necessary response resources.
   4) Lack proper PPE. (No such thing as a BLEVE suit!)

Hazmat Risk Factors.

Lowest to highest risk.

Container Size

Small (consumer quantity)
Less than 55 gallons
More than 55 gallons
Small pressure vessel/gas cylinder
Large pressure vessel/gas cylinder

Material State

Solid
Liquid w/low VP
Liquid w/high VP
Flammable/Toxic Gas
Explosive/Flammable gas w/BLEVE potential

Container Stress

None
Possible mechanical stress
Mechanical stress visible
Thermal or chemical stress
Combined or multiple stresses

Exposures

Vacant land
Some structures nearby, possibly occupied
Many structures nearby, confirmed occupied
People and structures adjacent to scene
People and structures in area affected by spill/release

4. Defensive Containment Strategy.

a. What: Actions to safely restrict, slow or redirect spread of Hazmat.

b. When to contain:
   1) When it's safe and practical.
   2) When benefits exceed costs.

c. Why contain: Limit spread; reduce life and health risks; protect environment and property; reduce cleanup costs; limit liability.

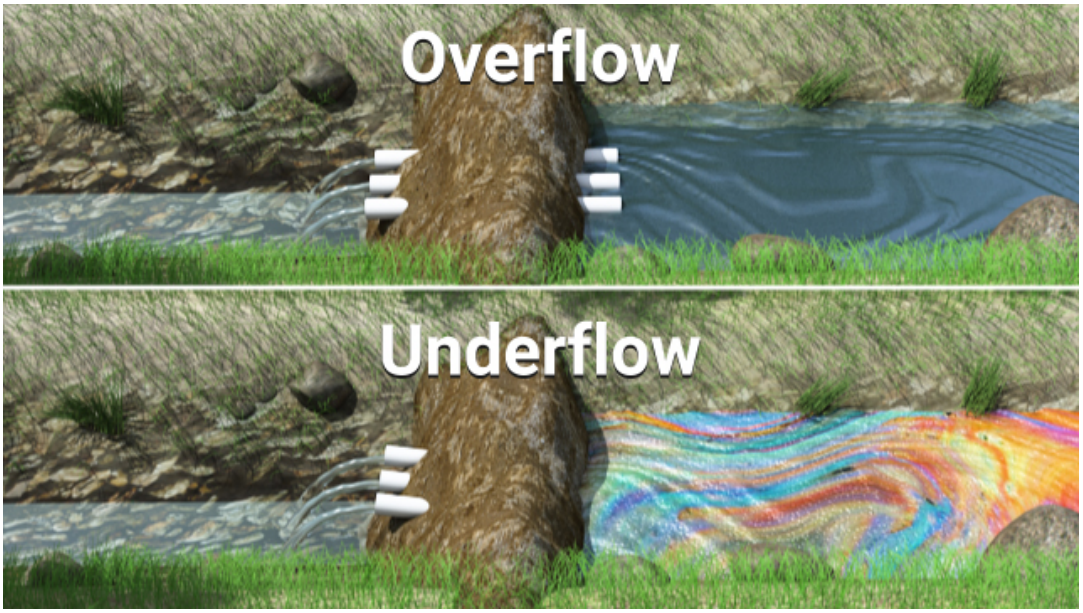
d. Who does containment: FROs usually do containment if they have proper training and equipment.

e. Typical methods of *defensive* containment:
   1) Dike (e.g. make a small curb with dirt around drain).
   2) Dam (e.g. build overflow dam for product that sinks in water).
   3) Divert (e.g. build small dike to change direction of flow).
   4) Disperse (e.g. apply fog spray in chlorine cloud).
   5) Dilute (e.g. apply water to water-soluble material).
   6) Cover (e.g. lay salvage cover over powder spill).
   7) Foam (e.g. apply AFFF to large gasoline spill).
   8) Other: _____

f. Practical containment tools/equipment include:
   1) Shovels, dump trucks, dirt, sand bags, plastic bags, plastic sheet, heavy earth moving equipment, foam, salvage covers, absorbents, firehose, etc.
   2) Presence of flammables may require use of non–sparking or intrinsically safe equipment.
   3) Some Hazmats may react with common containment materials or common substances such as water. Consult ERG, NFPA 704 and SDS (if available).

Containment Methods.

Method **Dams** — barriers across a waterway or between two objects intended to hold back flowing water or material.



Underflow Dam	Used for releases involving materials that float on water (e.g. gasoline).
Overflow Dam	Used for releases involving materials that sink in water (e.g. PCB's)

5. Offensive "Control" Strategy.

a. What: Safe acts to actually stop, control or stabilize the release.

b. When to control: When it's safe and practical.

c. Why control: Stop release; reduce life and health risks; protect environment and property; start cleanup; limit liability.

d. Who does control: *Usually* technicians and specialists.

e. Typical methods of offensive control:
   1) Plug and patch (e.g. fix faulty valve or hole in drum).
   2) Absorb/Adsorb (e.g. apply pads to oil spill).
   3) Transfer (e.g. remove product to waste vacuum truck).
   4) Containerize (e.g. put leaking drum into overpack drum).
   5) Stop (e.g. simply reposition drum or shut off valve).
   6) Other _____

f. Selection considerations for control method based on: Physical state of material (solid, liquid or gas); physical & chemical properties; amount & rate of release; topography & terrain; time available; resources & tools; risk vs. gain.

g. Practical containment tools/equipment include: Shovels, dump trucks, dirt, sand bags, plastic bags, plastic sheet, heavy earth moving equipment, foam, salvage covers, absorbents, hose, redwood plugs, etc. *Note: presence of flammables will require use of non–sparking or intrinsically safe equipment.*

Control of Hazardous Materials

Method **Absorption** — To take in and make part of or to take up and hold. Can use natural materials (e.g. dirt, sand, sawdust, diatomaceous earth, vermiculite, etc.) or materials specifically made for this purpose.

Caution ***Some sorbents (either natural or man-made) may react with certain hazardous substances.***

Method **Isolation/Diverting** — Diverting material to less environmentally sensitive area and isolating the area. Effective tactic for incidents involving slowly leaking liquids that have low volatility. Can create an area to isolate the material with dikes and dams.

Method **Covering** — Something placed over or about another thing, an overlay. Cover the spilled material with plastic sheeting, tarpaulin, foam, water, etc. to prevent powders from becoming airborne or to slow down evaporation of liquids.

Method **Containerizing** — To pack in containers. Place leaking drums into overpack drums, put plastic bucket under leaking pipe or valve, etc. Usually done by technicians or specialists.

Method **Plugging and Patching** — A piece used to fill a hole/material used to cover a hole. Use available material or prepared tools to stop leaks from containers or pipes. Note: Closing existing valves is a method of plugging and patching. Many piping systems and cargo containers may have such systems — look for them before trying something complex.

6. General Tips and Techniques.

a. Selection of strategies and methods.
   1) Identify hazards.
   2) Evaluate risks of those hazards.
   3) Analyze strategy.
   4) Implement strategy.

b. Relationship of strategy and risks.
   1) Unacceptable risk: non-intervention.
   2) Acceptable risk: defensive response strategy.
   3) Little or no risk: offensive response strategy.

c. Who does what.
   1) FRA & FRO: non-intervention.
   2) FRO: defensive response strategy.
   3) Technician/Specialist: offensive response strategy.

Containment and Control Methods Worksheet

Determine if the following methods are:

No Action (non intervention)
Containment (defensive action)
Control (offensive action)

		Method*
Isolate	To deny entry or prevent access...	_____
Plug & Patch	A piece used to fill a hole/material used to cover a hole...	_____
Retain	To hold back, hold secure or intact (in natural low area)...	_____
Dike	A bank constructed to control or confine a liquid...	_____
Absorb/Adsorb	To take in and make part of/to take up and hold...	_____
Dam	A barrier built across a watercourse for impounding liquids...	_____
Divert	To turn aside, to turn from one course to another...	_____
Containerize	To pack in containers...	_____
Disperse	To break up, spread widely, from a fixed source evaporate...	_____
Dilute	To diminish strength by admixture...	_____
Cover	Something placed over or about another thing, an overlay...	_____
Transfer	To move to a different place or situation...	_____
Foam	A stabilized froth produced chemically or mechanically...	_____

Be prepared to defend your selection!

Offensive vs. Defensive Actions.

OSHA CPL 02-02-073

Fires First Responder Operations Level. Fire fighters responding to propane and gasoline fires.

Propane Fire fighters trained to the operations level, who are also trained in the hazards of propane, may enter the danger area to shut off the valves that will starve the fire and thus extinguish it. Normally, employees trained to the operations level would be restricted from taking aggressive action. This is considered to be a special case. The principal hazards from propane are fire and explosion, not toxicity. Because propane fires are common, most fire fighters are fully trained and equipped to respond to propane fires, including taking aggressive action by shutting off the valves in the danger area.

Policy If fire fighters are fully trained and equipped (which is a high degree of training), and have also received first responder operations level training, OSHA believes they have sufficient training to take aggressive action due to propane's relatively low toxicity.

Violation? It would be only a technical violation of 29 CFR 1910.120(q)(6) for not having the additional training required of a HAZMAT technician if a fire fighter took aggressive action in the danger area during a propane fire or leak, was fully trained and equipped to handle the fire and had first responder operations level training. In this circumstance OSHA would not issue a citation.

Offensive vs. Defensive Actions. *(continued)*

Gasoline

Releases of gasoline similar to the example involving propane discussed above may be addressed by operations level emergency responders if they have the required PPE, emergency response equipment, and specific training in the safety and health hazards associated with gasoline.

Employers who expect fire fighters to shut off a gasoline valve in the danger area, and who can show that employees are trained to the operations level and adequately trained in the hazards of gasoline, have committed a technical violation of 1910.120(q)(6)(iii) for such employees not having the training required of a HAZMAT technician.

NOTE: The fire and explosion hazards of propane and gasoline are very substantial. The interpretations herein are applicable only when fire fighters are fully trained and equipped to handle the explosion and fire hazards of propane, gasoline, or similar flammable gases and liquids.

Facilities

Process Operators responding within a facility.

Criteria

Process operators who have (1) informed the incident command structure of an emergency (defined in the facility's emergency response plan), (2) adequate PPE (3) adequate training in the procedures they are to perform, and (4) employed the buddy system, may take limited action in the danger area (e.g., turning a valve) before the emergency response team arrives. The limited action taken by process operators must be addressed in the emergency response plan. *Once the emergency response team arrives, these employees would be restricted to the actions that their training level allows.*

Module Review – Remember the Quote

There's no such thing as a (blank) suit!

Responders should contribute to the (blank), not the problem!

Protect (blank), (blank)and (blank).

The key question: What if I don't (blank)?

This module focuses on the (blank) in SINCIAPCPDDD.

Don't risk (blank) to protect environment or property.

Chapter I

Protective Actions: (P.)

Main Points

- Protective Actions
- Authorities for Protective Actions
- Protective Action Considerations
- DOT ERG and Protective Actions
- Summary

Chapter Outline

1. Protective Actions.

a. Two key "Protective Actions" — "Evacuation" & "In-Place Protection/Sheltering in Place".

b. Evacuation.
   1) Purpose of Evacuation: to remove people from threatened area of hazard to safe area of refuge (e.g. evacuation shelter).
      a) Evacuation may be the preferred protective action,
      b) But, can be logistically and operationally difficult to execute for large evacuation area.

c. Shelter in Place/In-Place Protection.
   1) Purpose of "Sheltering in Place" (In-Place Protection): keep threatened people inside a protective structure:
   2) May be the only practical protective action (especially in congested urban areas or with special populations).
      a) Evacuations take time and resources.
      b) Gases/vapors may dissipate before evacuation is completed.

d. Decision regarding protective action will be one of the most important and difficult decisions. (Often there is no right answer.)

Protective Action Options.

Options Two (2) protective action options:

1) Evacuation — Removing public from areas at risk to areas of safety/refuge (*most common protective action*).

2) In-Place Protection/Sheltering in Place — Keeping public inside structures and having them close doors, windows, ventilation systems, etc., to make structure as air-tight as possible.

2. Authorities for Protective Actions.

a. Basic authorities.
   1) Police power of the state. (Authority to restrict movement of people and property in an emergency.)
   2) PC §409.5 — allows peace officers to close or restrict access to a specific area (i.e. disaster scene).
   3) Emergency Services Act. Authorizes local government to issue orders and regulations necessary to provide for the protection of life and property. (Government Code §8634.)

b. Specific areas and locations.
   1) Highways.
      a) CalTrans — can restrict traffic or close any state highway for the protection of the public. Streets & Highway Code §124.
      b) Highway Patrol — can close any highway if there is a threat to public health or safety caused by hazardous materials. Vehicle Code §2812.
   2) Waterways.
      a) Dept. of Boating and Waterways — has basic police authority to close waterways during emergencies.
      b) Dept. of Water Resources — can close waterways under their jurisdiction to protect health, safety, convenience and welfare of the public. Water Code §128.
      c) U.S. Coast Guard — can close navigable waterways and adjacent shorelines. 33 CFR 147.

Authorities for Protective Actions.

ESA

"A local emergency may be proclaimed only by the governing body of a city, county, or city and county, or by an official designated by ordinance…" Gov't Code §8630(a).

"During a local emergency the governing body of a political subdivision, or officials designated thereby, may promulgate orders and regulations necessary to provide for the protection of life and property, including orders or regulations imposing a curfew within designated boundaries where necessary to preserve the public order and safety. Such orders and regulations and amendments and rescissions thereof shall be in writing and shall be given widespread publicity and notice." Gov't Code §8634.

Peace Officers

"Whenever a menace to the public health or safety is created by a calamity…[peace officers] may close the area where the menace exists… If the calamity creates an immediate menace to the public health, the local health officer may close the area where the menace exists…" Penal Code §409.5.

Highways

"The department may restrict the use of, or close, any State highway whenever the department considers such closing or restriction of use necessary: (a) For the protection of the public." Streets and Highway Code §124.

"Whenever poisonous gas, explosives, dust, smoke, or other similar substances, or fire exist upon or so near a public highway as to create a menace to public health or safety, members of the California Highway Patrol, police departments, or sheriff's office may close any highway to traffic…" Vehicle Code §2812.

3. Protective Action Considerations.

a. Basic considerations*:*

1) Materials involved.
   a) Physical state.
   b) Physical properties.
   c) Toxicity.
2) Population threatened. (Who are they and can they leave?)
3) Responder resources and capabilities.
   a) Amount of people and equipment.
   b) Command and control resources available.
4) Time factors involved.
   a) Time of day. (Gases/vapors disperse differently in daytime versus night. See ERG page 287 and 357.)
   b) Expected duration of incident.
5) Current *and* predicted weather.
6) Ability to communicate with public.

See end of this chapter for detailed discuss of basic considerations.

b. Workplace considerations.

1) In many workplaces Emergency Response Plan or Emergency Action Plan will specify protective actions to use.
2) Workplace employees will react the way they are trained and are trained according to employer plans. (See above.)

Evacuation? Material Involved. Yes or No?

Material Involved	Yes	No	Maybe
			
			
			
			
			

3. Protective Actions Considerations. *(continued)*

c. Evacuation messages.
   1) Must be clear and concise.
      a) Specify area to be evacuated.
      b) State evacuation routes to use.
   2) Speak with one voice.
      a) Mixed messages confuse the public.
      b) Confused public won't take action.

d. Traffic control.
   1) People tend to exit the way they entered.
   2) Evacuees tend to follow familiar routes.
   3) Respond accordingly!

e. Special Populations. (Hospitals, prisons and institutions.)
   1) Population may not be able to help themselves. (Evacuation may not be practical.)
      a) Need assistance to move.
      b) Incapable of being moved due to security or health concerns.
   2) May need to use Sheltering-in-Place/In-Place Protection.

Special Populations.

Hospitals

Correctional Facilities

Rest Homes

Others? _____

4. DOT ERG and Protective Actions.

a. Orange-bordered pages all provide recommendations for isolation and evacuation distances.

b. Green-bordered pages provide recommendations for isolation and evacuation distances for materials that are Toxic by Inhalation (TIH).
   1) Table 1: Initial & Protective Action Distances for TIH Materials.
   2) Table 2: Water-Reactive Materials Which Produce TIH Gases.
   3) Table 3: Initial & Protective Action Distances for the six most common gases.
   4) Different distances for day and night.
      a) Day: Atmosphere is more active. Material disperses more quickly than at night.
      b) Night: Atmosphere more stable. Material doesn't disperse as quickly as it would in daytime.

5. Summary.

a. Selecting the best Protective Action is only half the job; Implementing the action will present many problems to solve!

b. No choice will be easy or obviously correct. Expect problems!

Overview of "Shelter-in-Place" Concepts.

Introduction

There are two ways to protect the public from toxic gas/vapor discharges into the atmosphere. One of these methods is evacuation and involves relocation of threatened populations to shelters in safer areas. The other is in-place protection and involves giving instructions to people to remain inside their homes or places of business until the danger passes.

Evacuation

Evacuation is generally safer with respect to the specific hazards posed by a toxic gas or vapor release but has certain limitations and may pose new problems. A major evacuation takes time and may not be feasible once large amounts of toxic gases or vapors have entered the atmosphere. If people in the path of a toxic cloud or plume leave their homes they may be exposed to the material released. This may cause greater harm than good. Large-scale evacuations in response to toxic gas or vapor hazards are best considered when:

1. The discharge has not yet taken place and there appears to be time available to safely relocate people.

2. The discharge has taken place but people are sufficiently far downwind to permit time for evacuation.

3. People not yet in the direct path of a cloud or plume are threatened by a future shift in the wind direction.

4. The risks of evacuation are outweighed by benefits of the action.

5. In-Place Protection might not fully protect threatened populations from serious consequences of a release.

Evacuation vs. Shelter in Place.

Considerations Six (6) basic considerations:

1) Materials involved;
2) Population threatened;
3) Capability of emergency responders;
4) Time factors involved;
5) Current & predicted weather;
6) Ability to communicate with public.

Materials When evaluating the materials involved, responders should consider the physical/chemical characteristics, condition and location of the material.

Physical/chemical characteristics: Is it solid, liquid or gas? If it's a solid, is it powdered or crushed so it can give off dust particles? If it's a liquid, will it give off flammable, explosive and/or toxic vapors? Will the material rise or sink in air/water? Is it flammable, explosive or unstable? Are the characteristics unknown?

Toxicity: Is the material toxic or irritating to human tissues? What is the route of entry? If the material burns, will it give off toxic byproducts?

Amount and Condition: Is there a potential for a large spill? Is the material presently contained? Is the container exposed to flame impingement? Is the container damaged?

Location: Is the container/spill near a populated area? Is it near sensitive populations or special facilities? Are there areas where the vapors will collect? Are there things such as waterways or storm drains that may trap the material or transport it to another location?

Evacuation vs. Shelter in Place. *(continued)*

Population

The number and status of the people potentially affected will have a major impact on a decision involving protective actions.

Location: How far away are the people from the incident? Are they downstream, downwind and downgrade? If not, and if the wind shifts, is this location at risk.

Characteristics: What type of area is at risk? Residential, commercial or industrial? Is it a densely populated area? What language do the residents speak? Will the number of people in the area vary with the time of day? What structural protection is available? Can the potentially affected population help themselves?

Responders

The capabilities and resources of available response organizations will determine the Incident Commander's ability to implement and control any protective actions.

Mobilization: Can responders deploy their resources quickly? What specialized resources do they have available immediately? What specialized resources do they have available under mutual aid?

Operations: Can responders control or contain the spill? Can responders transport special populations? Can they control expected traffic? Can responders set up and manage shelters?

Time

The time of day the incident occurs and how long it may last will largely determine what type of protective action to select. What day of the week is it? How long will the release last? How long will it take vapors/gases to reach populations at risk? How long will it take to deploy responders? How long will it take to set up environmental monitoring?

Evacuation vs. Shelter in Place. *(continued)*

Weather

The existing and predicted weather will affect both the dispersion of the material and the ability of people to evacuate.

Dispersion: How will the weather affect the movement of the vapors/gases? Which way is the wind blowing? How strong? Is there any rain, snow, hail, etc. (or any chance of any)? What are the normal weather patterns for the area? What is the expected weather for the next operational period?

Movement: Will bad weather block escape routes? Will the weather slow down evacuation? Will high air temperatures/humidity reduce the ability of people to remain in shelters?

Communication

The ability to communicate with the public will impact the Incident Commander's ability to notify people of protective action plans and the ability to communicate with responders will impact the Incident Commander's ability to manage the operations.

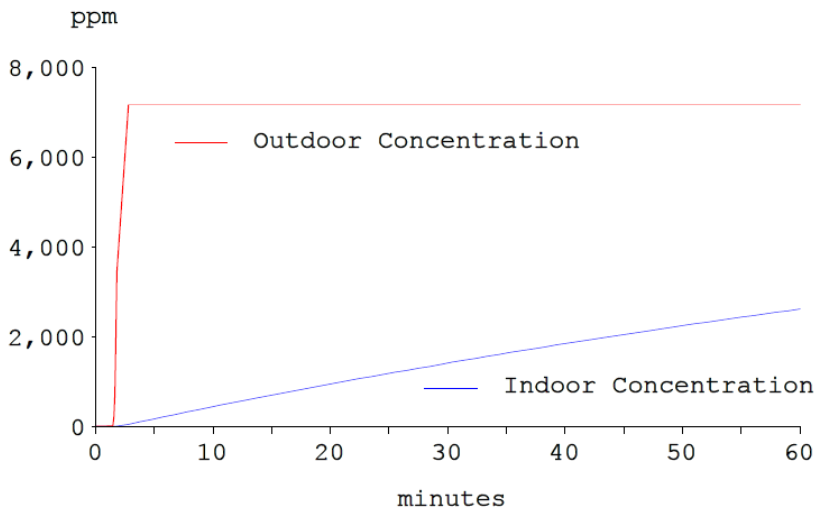
Public: Can you quickly warn the public? Can you clearly (in their own language) communicate protective action instructions?

Responders: Can you notify and deploy responders? Can responders communicate with each other? Can you access mutual aid?

Evacuation vs. Shelter in Place. *(continued)*

Education Prior public planning and education efforts through such vehicles as the CMA Community Awareness & Emergency Response (CAER) programs can greatly increase the effectiveness of protective actions.

Dose The dose a person would receive in a structure is usually less than what they would receive in an unprotected location. The following graph from the CAMEO Air Model shows the difference between doses for a person about 200 yards downwind from a chlorine release.



At Point: Downwind: 200 yards Off Centerline: 0 yards

Chapter J

Decontamination, Disposal & Documentation: (D.D.D.)

Main Points

- Primary FRO Actions
- Decontamination Terms
- Why, When, Who/What and How of Decon
- Emergency Decontamination
- Decon Team Personnel, Roles and Responsibilities
- Disposal Requirements
- Funding Requirements
- Hazmat Documentation and Reporting
- Chemical Exposure Records

Chapter Outline

1. Primary FRO Actions.

a. Conduct **D**econ as needed.

b. Ensure clean-up and proper **D**isposal.

c. Keep **D**ocumentation for later records and reports.

2. Decontamination Terms.

a. Decontamination: process of removing or neutralizing contaminants from personnel and/or equipment.

b. Responder Decontamination. (Also called "technical" decon.)
   1) Provided to personnel working in Exclusion Zone and/or Contamination Reduction Zone.
   2) Normally done by Hazmat Group.

c. Emergency Decontamination.
   1) Urgent, field expedient process.
   2) Use any available water source.
   3) Intended for exposed persons displaying symptoms.
   4) Normally done by first responders.

d. Secondary Contamination.
   1) Results from hazmat(s) on people or things being transported off site.
   2) This is why we need to perform decon.

Decontamination

Purpose **To prevent spread of contamination.**

When Anytime contamination is suspected.

What People (victims and responders), equipment, etc.

How Only general *guides* based on needs of the event.

Decon Tips/Guides

Initial planning, training and SOGs are important.
Establish contamination reduction zone/corridor.
Use decon set-up/stations as per SOG.
Establish a decon team under a decon leader.
Ensure that decon team has the proper tools.
Observe standard safety guides.
Use proper PPE level.
For medical emergency decon prior to transport.
Decon equipment & retain run-off.

3. Why, When, Who/What and How of Decon.

a. Why: Prevent spread of contamination.
   1) Exposure vs. contamination.
      a) Exposure: it ***might*** be on you.
      b) Contamination: it ***is*** on you.
   2) How contamination can occur.
      a) Physical contact with material. (Touch, step in, walk through, pick up, etc.)
      b) Physical contact with runoff from incident.
      c) Breathing smoke and/or vapors from the incident.
      d) Physical contact with contaminant on victims, responders, equipment, vehicles, animals, etc.
   3) Factors affecting degree of exposure/contamination:
      a) Amount of material on you.
      b) Length of time material is on you.
      c) Concentration of stuff you're exposed to.
      d) Physical state of material.
      e) Ambient temperature.

b. When to decontaminate.
   1) Anytime you suspect contamination.
   2) Indications of contamination:
      a) Material is visible.
      b) Victim(s) complains of pain, odor, etc.
      c) Victim(s) was/were in area of a known release.
      d) Warning: many hazardous materials are odorless, colorless, tasteless and their acute effects may not show up immediately. You may not be able to confirm contamination. If in doubt, decon!

Exposure vs. Contamination.

Exposure

Contamination

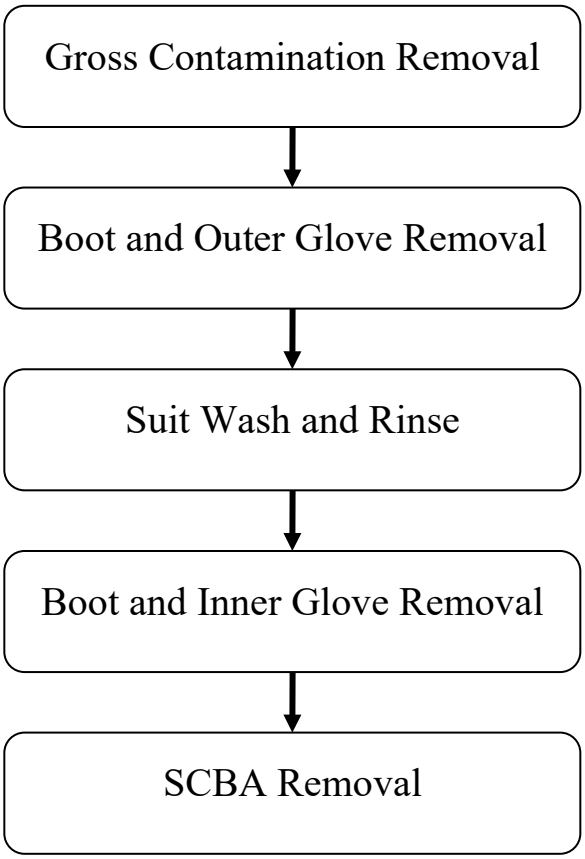
3. Why, When, Who/What and How of Decon. *(cont.)*

c. Who/What should you decon?
   1) Victims (decon prior to EMS treatment/transport.)
   2) Responders.
   3) Equipment.
   4) Animals. (e.g. Pets or working animals.)

d. How to perform decon.
   1) No absolute methods. *Only general guides.*
      a) Physical removal.
      b) Chemical removal.
      c) Emergency decon.
   2) Procedures follow a logical order of going from "dirty" (i.e. contaminated) to "clean" (i.e. uncontaminated).
   3) Protective clothing for planned decon.
      a) Same level as entry team or one level below entry team.
      c) Level of PPE depends on degree of hazard, amount of contamination and potential time of exposure.
   4) Limitations.
      a) Small particles or colorless liquids may not be visible. (Can't decon what you can't see.)
      b) Many substances cause immediate damage (corrosives or skin absorptive materials). Decon may be too late.
      c) Some contaminants may be imbedded in skin.

e. Consequences of no decon/improper decon.
   1) Acute/Chronic health effects.
   2) Contaminant(s) spread beyond the scene.
   3) Others are affected (e.g. emergency room staff).

Typical Contamination Reduction Corridor Stations.



4. Emergency Decontamination.

a. Definition: Urgent and field expedient method of decon primarily for individuals who have known exposure. Usually performed prior to setting up formal decontamination corridor.

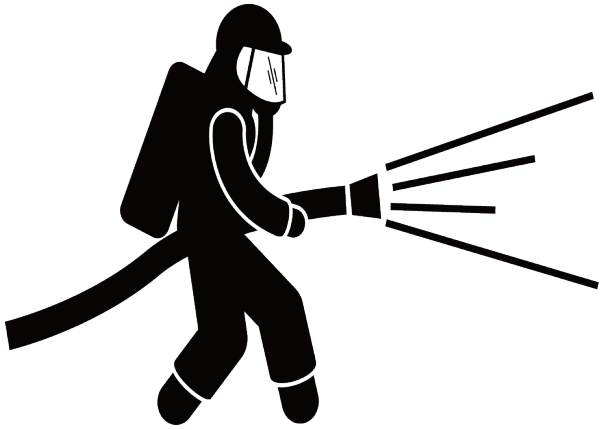
b. Purpose: Remove and/or dilute material that is immediately harmful to exposed individuals. Intended to prevent secondary contamination and minimize adverse effects of exposure.

c. Guidelines for emergency decon.
   1) Move victim to least environmentally sensitive area.
   2) Water on, clothes off.
      a) Order depends on type and degree of contamination.
      b) Water may make some things worse.
      c) Clothing removal may be sufficient decon.
   3) Flush with *copious* amount of water.
      a) More water = more dilution = less contamination.
      b) Adding small amounts of water to some substances (e.g. corrosives) may make the situation worse.
   4) Remove contaminated clothing (including underwear) and continue flushing with water. (May have to remove only contaminated clothing.)
   5) Avoid the following:
      a) Brushes and abrasives: can produce skin lesions that allow further contamination.
      b) Hot water: promotes peripheral vasodilation and can increase absorption of toxins.
      c) Decon solutions: can cause drastic changes in pH. Dilute bleach can damage body tissues (e.g. eyes or wounds).

Emergency Decon Procedures.

1. Move victim(s) to least environmentally sensitive area.

2. Flush victim(s) with water (low pressure!).



3. Remove clothing (all!).

(Sorry, no more room on the page for illustrations!)

4. Emergency Decontamination. *(continued)*

d. Precautions in emergency decon.
   1) Remove victim's clothing (may have to cut it off).
   2) Minimize contact with contaminated clothing.
   3) Segregate/isolate removed clothing.
   4) Ensure modesty of anyone decontaminated.
      a) Provide barriers to shield victims from spectators.
      b) Provide temporary garments or covering.
      c) Segregate sexes.

e. Emergency decon and emergency medical treatment.
   1) Decon contaminated victims prior to transporting.
   2) Protect EMS personnel, equipment and vehicles from contamination. (EMS personnel may have no PPE.)

f Factors to consider in emergency decon.
   1) Amount of material on victims.
   2) Length of time material was on victims.
   3) Concentration of material.
   4) Physical state of material.
   5) Ambient temperature.
   6) Type of adverse effects material can cause.
   7) Ability to remove contaminant.

Hospitals and Emergency Decon.

Why it's important to decon patients *prior* to transport.

California

The emergency department at Valley Medical Center in San Jose, CA was shut down for five hours by a hazmat release on 12 February 2009. 93 people at the scene, including patients and staff, were decontaminated.

The incident started when a person was found unconscious in his home. His mother called 911 and responders transported him to Valley Medical Center. After he arrived it was determined that he was exposed to hydrogen sulfide. The hospital immediately segregated and decontaminated everyone who may have been exposed.

New York

On 16 November 2011 the Southampton, NY Hospital Emergency Department entrance was shut down for several hours when a man attempted to commit suicide by mixing various hazardous materials in his car. The resulting gases filled his car and incapacitated him after he drove to the hospital and parked near the entrance to the emergency department. A local fire department hazmat team was called in to decontaminate the hospital emergency department and the victim's car. The individual survived.

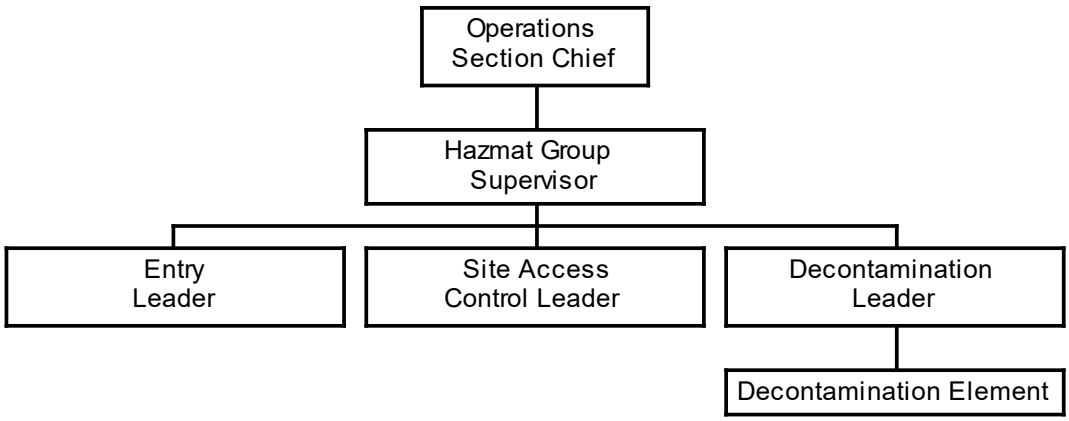
5. Decon Team Personnel, Roles and Responsibilities.

a. Emergency response plan must include provisions for decon.
   1) Know required equipment & procedures.
   2) Know location of emergency showers & eyewash stations.

b. Incident Command System roles.
   1) Hazmat Group Supervisor (under Operations). Manages all tactical operations carried out in the Exclusion Zone.
      a) Entry Team.
      b) Site Access Control.
      c) Decon Leader (responsible for all decon operations).
   2) Decon Leader (under Hazmat Group Supervisor). Responsible for operations of Decontamination elements.
      a) Establish Contamination Reduction Corridor (CRZ).
      a) Identify contaminated people and equipment.
      a) Supervise decon unit.
      a) Control of movement within CRZ.
      a) Coordinate transfer of contaminated patients.
      b) FROs may be trained to fill Decon roles.

c. Training levels.
   1) Decon Leader – Hazmat Technician or Specialist
   2) Decon element – Hazmat Technician, Specialist or FRO.
      a) FRO training minimum level for Decon element.
      b) FRO will require additional training in decon procedures.

Hazardous Materials Group.



Training A person trained to the FRO level must have training in the procedures of responder decontamination, respiratory protection, donning & doffing PPE and safety issues involved in wearing Level-B/C PPE before being assigned to a Decontamination element.

6. Disposal Requirements.

a. A Hazmat incident almost always creates Hazardous Waste.
   1) Hazardous Waste is any Hazmat that can't be reused.
   2) Hazardous Waste possesses one or more characteristics:
      a) Toxic.
      b) Reactive.
      c) Ignitable (Flash Point of 141 degrees or less).
      d) Corrosive (pH of 2 or less/12.5 or more).

b. Federal and State Governments have hazardous waste disposal requirements—You must know them and follow them.
   1) Hazardous Waste must legally be tracked from "Cradle to Grave" (i.e. Generator → Transporter → Treatment, Storage & Disposal Facility).
      a) Disposing of hazardous waste has strict requirements for documentation that apply to all generators (including government agencies).
      b) "Flushing Hazmats Away" harms the environment, is no longer acceptable, *and is often a violation of the law!*
   c. Bottom-line: don't walk off and leave it. It may come back to haunt you.

Hazardous Waste.

For Hazardous Waste to be ***"Hazardous"*** it must be…

Toxic

Reactive

Ignitable

Corrosive

…as per the definitions in Title 22, CCR §66261.

7. Funding Requirements.

a. Funding for Hazmat emergencies and clean-up should start and end with "Responsible Party" provided:
   1) Responsible party accepts clean-up duty.
   2) Conducts clean-up adequately and safely.

b. Local agencies have clean-up funding responsibility if:
   1) No responsible party identified.
   2) Responsible party refuses or does inadequate clean-up.
   3) State may provide funding if there is no responsible party or local funding, *and there is a threat to life.*
   4) Call State Warning Center at (800) 852-7550 to obtain funding from state agencies.
   5) Don't spend money until you get authorization.

c. Main state funding agencies:
   1) Department of Toxic Substances Control (DTSC).
   2) Dept. of Fish and Wildlife (DFW or OSPR).
   3) Others (RWQCB, CalTrans, State Lands, etc.)

d. Federal Funds — access via the Federal On-Scene Coordinator (FOSC) — call (800) 424-8802.
   1) "Superfund" (CERCLA).
   2) Oil Spill Liability Trust Fund (OSLTF).

e. Bottom-line: Help (i.e. money) is available. Don't be afraid to ask.

Funding Sources.

Agency	**U. S. Coast Guard, Oil Spill Liability Trust Fund.**
Criteria	The discharge must involve "oil" (Includes animal, mineral or vegetable oils.) and must be in or threaten a "navigable waterway". (Includes tributaries thereof and adjoining shorelines.)
Max. Amount	$250,000.00 per incident.
Contact	State OES Warning Center 800-852-7550.
Agency	**U. S. EPA, CERCLA (i.e. "Superfund")**
Criteria	Release of a hazardous substance into the environment.
Max. Amount	$25,000.00 per incident. (Reimbursement)
Criteria	Access via FOSC: 1-800-424-9346.
Agency	**CAL/EPA, Emergency Reserve Account.**
Criteria	No responsible party. No alternate funding available.
Max. Amount	$20,000.00 per incident.
Contact	State Warning Center 800-852-7550.
Agency	**Dept. of Fish and Wildlife, Cleanup and Abatement Account**
Criteria	Discharges/releases that threaten wildlife or their habitat.
Max. Amount	$5,000.00 immediately available (more with approval).
Contact	State Warning Center 800-852-7550.

8. Hazmat Documentation.

a. Documentation needed in hazmat incidents for:
   1) Cost recovery.
   2) Exposure records.
   3) Training records.
   4) Investigations and other legal proceedings.

b. Role of FRO in hazmat investigations.
   1) Capture key info in initial stages of incident.
   2) Preserve evidence. (See facing page.)
      a) Secure scene and enforce perimeter.
      b) Identify potential items of evidence.
      c) Photograph and video scene.

c. Evidence collection.
   1) Leave this to professionals.
   2) If necessary, begin and maintain chain of custody.
   3) Record name of anyone handling evidence.

d. Key information to capture.
   1) Date, time and location.
   2) Names of all response personnel and witnesses.
   3) Incident conditions (hazardous materials involved, weather conditions, release factors).
   4) Statements of witnesses (if any).
   5) Diagrams, photos, video, samples, etc.

Preservation of Evidence.

Evidence	"Evidence" means testimony, writings, material objects, or other things presented to the senses that are offered to prove the existence or nonexistence of a fact. §140 Evidence Code …"direct evidence" means evidence that directly proves a fact, without an inference or presumption, and which in itself, if true, conclusively establishes that fact. §410 Evidence Code
Crime Scene	Location where any part of criminal act was committed and all entry/exit routes from area where crime was committed.
Procedures	Preserve anything that may be "evidence" (see above). Safeguard the scene. (Don't disturb scene any more than necessary.) Record names of all people who come into contact with scene. Identify witnesses. Do not let evidence leave your custody until it passes directly to an appropriate investigator. If you, or anyone else, handles evidence note in your report that you handled the evidence and to whom you gave it. (If the chain of custody on piece of evidence is broken, it becomes inadmissible in court!) Provide the names of all responders to investigator to include in his/her report.
If in Doubt	Call investigators and ask them what they need and what you need to preserve and how to do it.

9. Chemical Exposure Records.

a. Employer shall keep exposure records for employees (and retain them for 30 years *after termination of employment*).

b. All responders should also keep their own exposure records.

c. Exposure Records should include:
   1) Date, time, location and incident number,
   2) Responder's name,
   3) Chemical name,
   4) Type and concentration/duration of exposure,
   5) Decon and medical aid given, etc.

Exposure Records

Chemical Exposure Records Should Include:

Dates, Time, Location & Incident/Event Number

Names of Material(s) & Responder

Type, Concentration & Duration of Exposure

Decon, Medical Treatment, Related Circumstances, etc.

Employer must retain exposure records for at least 30 years after the employee retires, quits, gets fired, dies, disappears, etc.

Title 8 CCR 3204(d)(1)(A) Employee Medical Records

Title 8 CCR 3204(d)(1)(B) Employee Exposure Records

29 CFR 1910.1020(d)(1)(i) Employee Medical Records

29 CFR 1910.1020(d)(1)(i)(C)(ii) Employee Exposure Records

Decontamination Liability—Emergency Decon.

Federal Way, WA 1996

Drug Lab

On April 15, 1996 police officers raided a clandestine methamphetamine lab in an apartment house. They arrested two suspects. Shortly thereafter, the local fire department directed seven of the officers to undergo emergency decontamination. Two of the officers were women. The women later filed a complaint against the fire district alleging the firefighters (all male) forced them to take off all of their clothes behind a makeshift shelter. They alleged the male firefighters "peered at them and made degrading remarks about their figures…" during the decontamination process. A mediator agreed with them and awarded each of the female police officers $105,000.00. The fire district had to pay $100,000.00 to each woman and the county had to pay $5,000.00. (Source: Seattle Times, July 11, 1996, page B1)

Earlimart, CA 1999

Pesticides

On November 13, 1999 farm workers applied a soil fumigant (Sectagon 42) to a 75-acre potato field. A noticeable odor from the product later drifted into a residential area. Emergency responders arrived and found the substance contained metam sodium. They began emergency decontamination procedures for everyone who had been exposed. Although the responders provided temporary shelters, the residents felt this was inadequate and objected to having to remove their clothes in the presence of emergency response personnel, spectators and the media. They later voiced their objections to the County Board of Supervisors and a member of the California Assembly. (Source: Fresno Bee, December 9, 1999 and Associated Press, December 9, 1999)

Module Review – Wheel of Fortune

Basic method of emergency decon.

Position in charge of responder decon.

Employer keeps these for 30 years.

Chapter K

Exercises & FRO Exercise Briefing

Main Points

- Exercise Definition
- Four Types of Exercises
- Instructions for FRO Exercise

Block Outline

1. Exercise Definition.

a. Training tool to improve performance.

b. An activity to promote preparedness, test plans, operations, SOGs or facilities, and train personnel in proper response.

2. Four Types of Exercises.

a. Orientation Seminar — "Tell Me" exercise/discussion.

b. Tabletop Exercise — "Talk Me Thru It" exercise/discussion.

c. Functional Exercise — "Partial Practice" exercise.

d. Full Scale Exercise — "Full Practice" exercise.

3. Instructions for First Responder Exercise.

a. What we will do.

b. Where we'll do it.

c. Who will do what.

d. Safety briefing.

Chapter L

Putting it all Together and Graduation

Main Points

- Course Purpose & Content
- How This Fits Together
- Know Your Limitations
- Course Critique
- Concluding Remarks

Block Outline

1. Course Purpose and Key Course Content.

a. Course Purpose: Be a safe & competent responder within your appropriate level, resources and capabilities!

b. Key course content: Review performance objectives.

c. Know Dos for FROs. (See facing page.)

d. Review final exam (as needed).

2. How This All Fits Together.

a. First Responder "Awareness": **S.I.N.**

b. First Responder "Operations": S.I.N.C.I.A.P.C.P.D.D.D.

c. **F**aithfully **R**espond to any Hazmat event with **S**afety and **C**ompetence. (FRSC — the final acronym in this class!)

3. Know Your Limitations.

a. You are at the First Responder Operations level:
   1) Know your real resources and capabilities.

b. You are not a Technician or Specialist:
   1) "A little bit of knowledge can be more dangerous than none."

First Responder Course Key Points.

DO	Recognize your level and role in a hazmat response.
DO	Understand the capabilities and limits of responders.
DO	Make proper notifications and requests for aid.
DO	Understand hazmat is a multi-agency response.
DO	Understand need to coordinate with those agencies.
DO	Appreciate need for pre-event & event planning.
DO	Recognize that toxicology is deadly important.
DO	Demand response is safe via isolation & perimeters.
DO	Assume command, set unified CP & use ICS.
DO	A complete identification and hazard assessment.
DO	Ensure proper safety equipment for responders.
DO	Try for safe containment and protective actions.
DO	Proper decon, clean-up and disposal.
DO	Maintain good documentation and reporting.
DO	Know the hazmat laws and points of liability.
DO	Recognize the need for investigations during response.
DO	Strive for increased competence and safety.
DO	Use the tools of training, exercising and critiques.
DO	Be careful and competent out there!

4. Complete Verbal and Written Class Critique.

a. Please candidly identify what was positive about class, and more importantly what we can do to better meet your training needs.

b. We want your constructive comments.

5. Concluding Remarks.

a. Make a positive difference in responding to Hazmat events!

b. Be part of the solution — Not part of the problem!

c. And don't forget: ***Let's be careful and competent out there!!!***

Congratulations!