Unit III
Decision Making in Emergencies

At the end of this unit the student will be able to:

- List in order and describe Benner's D E.C.I.D.E. steps.

UNIT III—DECISION MAKING IN EMERGENCIES

TOTAL TIME REQUIRED FOR THIS UNIT: 35 *minutes*

METHODOLOGY OUTLINE:

Step 1.	Interactive Discussion with slides Review outcomes. Review purpose of emergency response effort.	5 minutes
Step 2.	Lecture with slides D.E.C.I.D.E. process steps.	30 minutes
Step 3.	Interactive Discussion Similarity between D.E.C.I.D.E. and other analysis processes.	

INSTRUCTIONAL MATERIALS

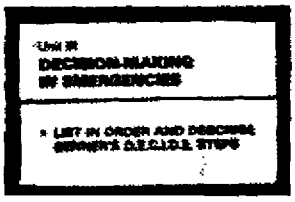
1. Slides 161–167 (Step 1)
2. Slides 168–176 (Step 2)

REFERENCE

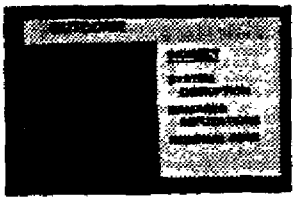
Benner, L., D.E.C.I.D.E. in Hazardous Materials Emergencies, *Fire Journal*, July 1975.

TIME	CONTENT/METHODOLOGY	MATERIALS
5 min	**STEP 1**—Interactive Discussion— Introduce Decision making at Emergencies	Slide 161
	• *Review the definition of the term "outcome"*	Slide 162
	Outcome—State or condition at the end of an emergency.	
	Direct outcomes—Fatalities, injuries, property damage, and environmental damage	
	Indirect outcomes—System disruption, damaged reputations, and residual fear of hazardous materials.	
	It is these outcomes that are unsatisfactory to us when it comes to emergencies, and **because of these potential negative outcomes we become involved in emergencies.**	Slide 163
	• *Review the purpose of an emergency response effort.*	
	Purpose of an emergency response effort—favorably change or influence the outcome of an emergency.	Slide 164
	Become part of the solution, not part of the problem.	Slide 165
	Instructor may want to elicit this answer from the students to see if they understand.	

Slide 161

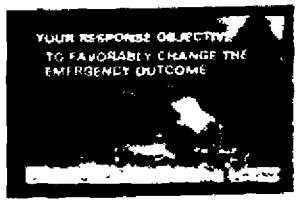


Slide 162



Slide 163

Slide 164



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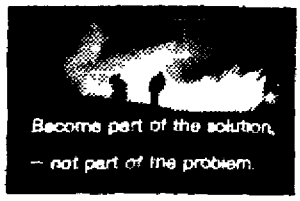
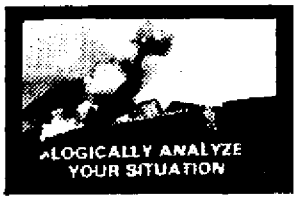


TIME	CONTENT/METHODOLOGY	MATERIALS
	• *Introduce the concept of decisionmaking as a means of becoming part of the solution and not part of the problem.*	
	Question to students—**How do we go about handling these emergencies involving hazardous materials so that we become part of the solution, and not part of the problem?**	
	The key is in a **logical process of analyzing and/or understanding the situation**, including the realization that the problem exists, defining that problem and identifying the likely harm associated with that problem, and then **making decisions based on that understanding** of the problem and its potential.	Slide 166
	A problem well-defined is half solved.	Slide 167
	• *Identify the Topics for the Unit.*	
	This unit will:	
	Introduce a logical decisionmaking process for hazardous material emergencies.	
	We will discuss the similarity between the D.E.C.I.D.E. process and your normal decision making process or size-up process.	
	• *Identify the Objectives for the Unit.*	
	By the end of this unit, you will be able to:	
	List in order and describe the six steps in the D.E.C.I.D.E. process.	

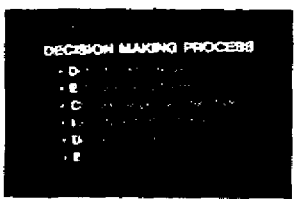
Slide 166



Slide 167

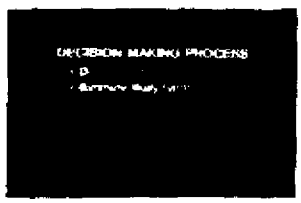
TIME	CONTENT/METHODOLOGY	MATERIALS
30 min.	**STEP 2**—Lecture with Slides— Present the D.E.C.I.D.E. Process	
	• *Introduce and List the D.E.C.I.D.E. Steps.*	
	Decisionmaking for emergencies involving hazardous materials calls for emergency response personnel to:	Slide 168
	Detect hazardous material presence.	
	Estimate likely harm without intervention.	
	Choose response objectives.	
	Identify action options.	
	Do the best option.	
	Evaluate progress.	
	Make note of the acronym, D.E.C.I.D.E.	
	• *Discuss the D.E.C.I.D.E. Steps in Detail.*	
	• **Detect hazardous material presence.**	Slide 169
	• Critical in any emergency!	
	• If you are not aware that a hazardous material is present, how can you respond positively to that emergency?	
	• Various clues are available to assist you in detecting the presence of hazardous materials (we will discuss them in the next unit).	
	• **Estimate likely harm without intervention.**	Slide 170
	• A difficult but indispensible step.	
	• If you don't know what is likely to happen, how can you figure out what it is you need to do?	

Slide 168



Slide 169

Slide 170



TIME	CONTENT/METHODOLOGY	MATERIALS

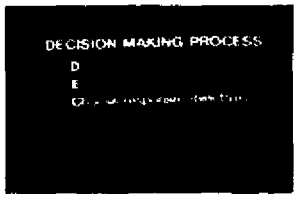
	• This step includes:
	  • **Visualizing** what is likely to happen in the emergency, and then . . .
	  • **Describing the likely outcome of that emergency.**	

	• **Choose response objectives.**	Slide 171
	• After estimating the likely harm without intervention, you should have some idea of what it is that you want to save or protect. With that in mind, you should set your strategical objectives. • Your strategical objectives identify the goals of your response activities—the people or things you want to save or protect.	
	• **Identify action options.**	Slide 172

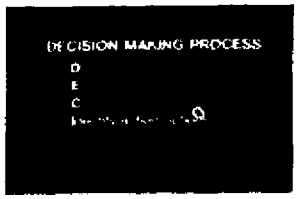
	• With your strategical objectives in mind, you must look at the tactical options and resources available to help you accomplish or meet those objectives.
	• You must consider all *practical* options before you act:
	  • Response times
	  • Equipment available to do the job required	

	• **Do the best option.**	Slide 173
	• When multiple options exist, you must implement the option that provides a solution to your problem. • The solution implemented should be the one with the greatest gain and the least loss when it comes to a tally of the outcome.	

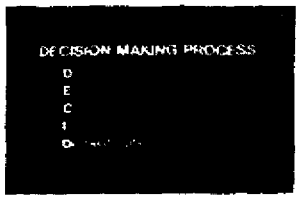
Slide 171



Slide 172

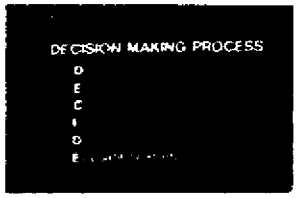


Slide 173

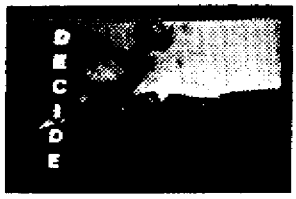


TIME	CONTENT/METHODOLOGY	MATERIALS
	• **Evaluate progress.**	Slide 174
	• After implementing the best option, you have to be sure that what you expected to happen is actually happening.	
	• If not, you must review the problem and select another option to lead to the desired results (your objective).	
	• *Review the D.E.C.I.D.E. Steps.*	Slide 175
	• **D.E.C.I.D.E. steps:**	
	Detect hazardous material presence.	
	Estimate likely harm without intervention.	
	Choose response objectives.	
	Identify action options.	
	Do the best option.	
	Evaluate progress.	
	• **These steps will guide your decisionmaking at emergencies involving hazardous materials.**	
	• **These steps will help to minimize confusion, guesswork, mistakes, delays, unnecessary harm, and loss of control at an emergency.**	
	• **The first two steps, Detecting Hazardous Materials Presence and Estimating Likely Harm Without Intervention, form an approach to hazardous materials size-up, which is what this course is all about. The strategy and tactics portions of the D.E.C.I.D.E. model are addressed in other programs.**	
	Ask the students: **Any questions?**	

Slide 174



Slide 175



TIME	CONTENT/METHODOLOGY	MATERIALS
	• *Discuss the Similarities Between D.E.C.I.D.E. Steps and Other Decisionmaking or Analysis Processes*	Slide 176 (Blank)
	• **Relate the D.E.C.I.D.E. steps to the size-up process or other processes used by the students.** Ask students to suggest similar or related processes.	
	• D.E.C.I.D.E. is very similar conceptually.	
	• D.E.C.I.D.E. uses some different terminology.	
	• Students must realize similarity so that they will "buy into" the process.	
	Ask the students: **Any questions?**	

Slide 176

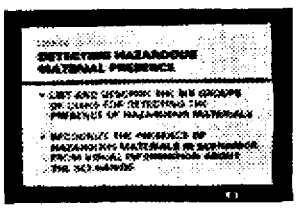
Unit IV
Detecting Hazardous Material Presence

At the end of this unit the student will be able to:

- List and describe the six groups of clues for detecting the presence of hazardous materials.
- Recognize the presence of hazardous materials in scenarios from visual information about the scenarios.

TIME	CONTENT/METHODOLOGY	MATERIALS
10 min.	**STEP 1**—Interactive Discussion—Introduce "Detecting Hazardous Material Presence"	Slide 177
	• **Present unit objectives.**	
	• **Present Milliken Crossing Incident.**	Slide 178
	Present slide of Milliken Crossing incident to students.	
	Pose the following questions to the students, one at a time, to generate discussion:	
	Look at this slide. Do you see a problem? Discussion	
	If so, what is the problem? Discussion	
	Are hazardous materials involved? Discussion	
	If so, what was it that made you think hazardous materials are involved? Discussion of importance of prompt detection of hazardous materials.	
	• *Provide background information about the incident.* Four railroad employees were injured, one permanently disabled, because they did not realize that a hazardous material was present. Not realizing that hazardous materials were present, they did not protect themselves.	
	Key points to indicate (if not already brought out):	
	Methyl bromide in one-pound aerosol cans.	
	Train hit rear of trailer and mechanical damage opened up the cans.	
	Wetness in grass is methyl bromide (dark areas in grass).	
	Cans strewn all around.	
	Clean-up contractor with full protective equipment.	
	Policeman with no protective equipment	
	Methyl bromide absorbed through skin on contact.	

Slide 177



Slide 178

TIME	CONTENT/METHODOLOGY	MATERIALS
	• *Review purpose of this unit.* This unit is designed to develop the skills needed to detect hazardous material presence: **This unit will present skills for detecting hazardous material presence.** **During this unit, you will be able to practice your detection skills on a recognition exercise.**	Slide 179
20 min.	**STEP 2**—Present Slide/Tape • *Introduce Slide Tape: "Detecting Hazardous Materials Presence."* NOTE: If this slide/tape is in two carousel trays, slides 180–230 should be in the first tray, and slides 231–272 should be in the second tray. Instructor should manually stop the tape when slide 230 is showing. **This slide tape presents a useful method for detecting hazardous material presence during pre-emergency planning activities or at an actual scene. It focuses on six types of clues:** **1. Occupancy and location** **2. Container shapes** **3. Markings and colors** **4. Placards and labels** **5. Shipping papers and other documents** **6. Senses** • ***Point out material in Student Manual.***	SM IV-3 to IV-7
	• **Present slide tape.** Be sure that Slide #180 is showing and that tape is fully rewound, before starting slide tape:	Slides 180–272
20 min.	**STEP 3**—Practical Exercise and Discussion (Recognition Exercise) • *Explain purpose of exercise.* The purpose of this exercise is to have the students practice the detection skills just presented on the slide tape.	SM IV-7

Slide 179

TIME	CONTENT/METHODOLOGY	MATERIALS

- *Provide instructions to recognition exercise.*

  Turn to Page IV-7 in the student manual. A series of 10 slides will be presented to you visually. Look at each slide carefully. If you detect the presence of a hazardous material from the image on the slide, circle the word "Yes."

  - **Note the clue or clues that helped you detect the presence of the hazardous material.**
- **Write those clues in the space provided.**

  Review the Clues:

  - Occupancy/location
  - Container shapes
  - Markings and colors
  - Placards and labels
  - Shipping papers and other documents
  - Senses

If you do not detect the presence of a hazardous material in the slide, circle the word "No."

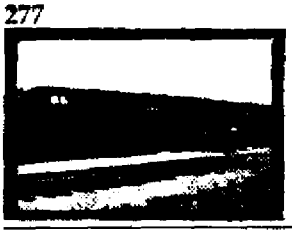
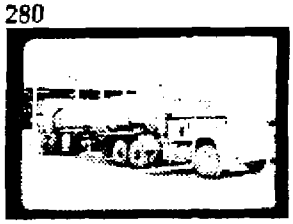
You will be given a brief period for each slide. Any questions before we start?

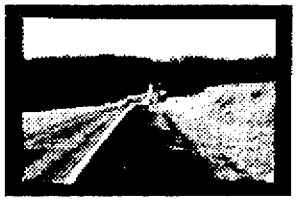
- **Present recognition exercise.** Slides 273–282

  Show the first slide while reviewing instructions.

NOTE: You may put in either additional slides or replacement slides in order to tailor program to your specific area.

Slide No.	Hazardous Material	Means of Detection	Points to be Made
273 	**Yes**	Container shapes	Spherical tanks. Other tanks.
		Occupancy/ location	Pre-emergency planning and inspections. Cracking tower—indication of petro-chemical operations.
274 	**Yes**	Container shapes	Rounded ends. Unenclosed dome area.
		Markings and colors	*Chlorine* wording—4" letters. CHEMTREC marking. Identification number—1017.
		Placard	Poison placard with UN Hazard Class Number 2 at bottom. What does "2" mean?

275 	**Yes**	Container shapes Markings and colors	Compressed gas indications. Discoloration at dome covers may indicate corrosive products. Red strips on white car for *hydrocyanic acid*.
276 	**Yes**	Occupancy/ location Labels Container shapes	Combination of drums and processing units. Blue unit in the background is a *phosgene gas* processing unit used in formulating dyes. Pre-emergency planning and inspections. 55-gallon drums.
277 	**No** But there could be— see 1,000 pound rule	Container shapes Placards	Box cars. *1,000-pound rule*—Could have less than 1,000 pounds and not be placarded.
278 	**Yes**	Container shapes Placard	*Calcium carbide* in special watertight, sift-proof containers. Flammable solid, water reactive placard. Calcium carbide + Water = Acetylene Gas
279 	**Yes**	Container shapes Marking and colors	Liquid type containers—tanks. 704 Markings. *Oleum* wording in red band. Emphasize that it is not hydrocyanic acid despite the red stripe.
280 	**Yes**	Container shapes Placard	Corrosive tanker appearance—note ribbed construction (indicates heavy load), splash protector at rear, overflow hose.
281 	**Yes**	Labels	Etiologic agent label—biomedical symbol, address for Center for Disease Control, phone number for CDC in Atlanta. Emphasize that this label will only be found on the individual package; there are no placards.

TIME	CONTENT/METHODOLOGY		MATERIALS
282 	Yes	Senses	Release of contents under pressure; could be gas or liquid. Fire. Actually, this is the relief valve in operation on an LP gas delivery truck.

STEP 4—Introduce summary of detection clues in relation to response — SM IV-14

- Have students turn to page IV-14 in the Student Manual:

  This is a summary of the information sources available to you when responding to an emergency.

- **Walk through the information on the sheet if time allows. Otherwise have the students review the sheet. They can add additional sources as necessary.**

5 min. STEP 5—SUMMARY

- **When responding to an incident, you need to be prepared to determine if hazardous materials are present.**
- **Six types of clues can help you detect hazardous materials presence. They are:**

  1. **Occupancy and location**
  2. **Container shapes**
  3. **Marking and colors**
  4. **Placards and labels**
  5. **Shipping papers and other documents**
  6. **Senses**

Remember, these six clues are in the order of your proximity to the incident and therefore in the order of increasing danger level.

- **There are a great deal of helpful sources of information associated with each of these clues. We have discussed a few of these sources in this unit and later in the course we will work with a few more. But remember—the ultimate responsibility for seeking out and finding the information you need, rests solely and completely with you.**
- **Any questions?**

Slide 283
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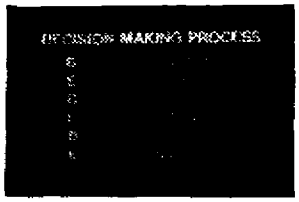
DETECTING HAZARDOUS MATERIALS PRESENCE
Slide/Tape Script

Slide 180

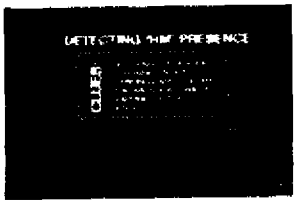


While all the steps in the D.E.C.I.D.E. model are important, it should be apparent that the first—detecting hazardous materials presence—and the second—estimating likely harm without intervention—are the two upon which all others depend.

Slide 181

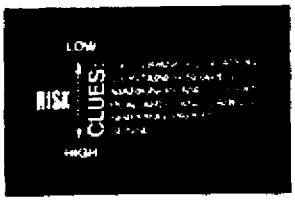
Detecting hazardous material presence.
Emergency response personnel must recognize that a hazardous materials problem exists before proceeding to Step 2.

Slide 182



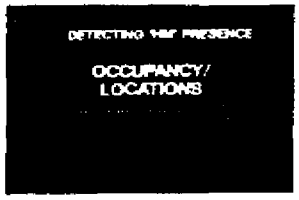
Six kinds of clues may be present to assist emergency response personnel in detecting hazardous material presence: Occupancy and locations; container shapes; markings and colors; placards and labels; shipping papers and other documents; and senses.

Slide 183



These clues are listed on the basis of distance from the emergency—the closer one gets to the emergency, the greater the chance of becoming part of the problem, not part of the solution.

Slide 184

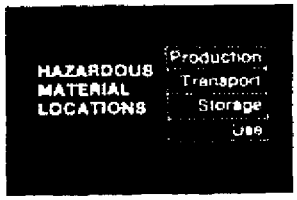


First, *Occupancy and Location*. Again, all emergency response personnel should be aware of hazardous material locations in their community through pre-emergency planning and inspection.

Slide 185

When dispatched to an industrial plant, emergency response personnel expect to find hazardous materials because of their prior knowledge of the operations of the plant. This prior knowledge also pinpoints where these potentially dangerous materials will be found. Once pinpointed, the materials can be identified as to hazards and response guidelines.

Slide 186

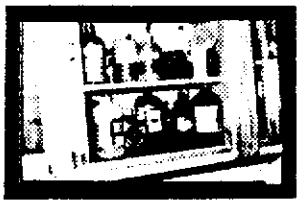


In addition to production and storage locations, hazardous materials are used in many locations in the community.

Slide 187

Farmers use herbicides, pesticides, and fertilizers on their fields.

Slide 188



Local health departments often have poisons and flammable materials on the shelves.

Slide 189

High school chemistry labs have a wide range of hazardous materials.

Slide 190

Construction sites may use blasting agents or explosives.

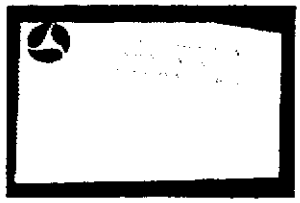
Slide 191

This is why pre-emergency planning is important. Emergency response personnel should know their community—including the transportation facilities that serve it—well enough to know where hazardous materials are likely to be found.

Slide 192

Secondly, you can use *Container Shapes*.

Slide 193

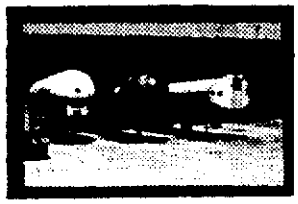


The Department of Transportation regulates the packaging used in the transportation of hazardous materials. Other nationally recognized codes include safety standards for bulk storage containers.

Slide 194

Packaging for hazardous materials can be divided into three categories: bulk storage containers; bulk transport vehicles; and small packages such as drums, cartons, and cylinders.

Slide 195

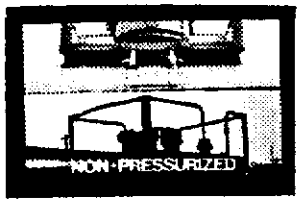


By noting container shapes and relating that shape to known contents in planning and inspection activities, emergency response personnel can have another clue to the presence of hazardous materials.

Slide 196

Stationary storage tanks in a variety of sizes and shapes are found throughout the community.

Slide 197

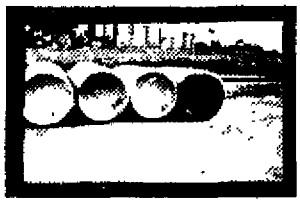


Rail tank cars can be pressurized or non-pressurized. For pressurized tank cars, the fittings on the manway are totally enclosed. On nonpressurized tank cars, the fittings and emergency relief devices are visible.

Slide 198

Pressurized tank trucks have visibly rounded ends. Nonpressurized tank trucks have flat or nearly flat ends.

Slide 199



One-ton containers of compressed gases (so named because they hold one ton of chlorine) are found at many sewage treatment plants.

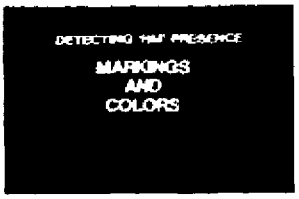
Slide 200

Compressed gas cylinders are found in many industrial situations, homes, laboratories, garages, and even large swimming pools.

Slide 201

Sometimes fiberboard boxes can contain hazardous materials.

Slide 202



Third, certain *Markings and Colors* may indicate the presence of hazardous materials.

Slide 203

Most of you have seen these words on various retail packages of pesticides, household cleaners, medicines, etc. These words are called "markings," and indicate the presence of certain hazards

Slide 204

Transportation markings are regulated by the Department of Transportation, also called the D.O.T.

D.O.T. requires the specific name of some 40 or so hazardous materials to be stenciled in four-inch letters on both sides of rail tank cars.

Slide 205

Many shippers stencil commodity names, other than those required, on tank cars for their own benefit.

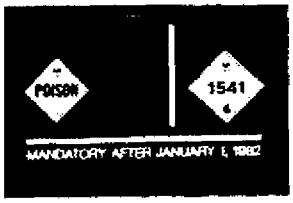
Slide 206

Identification numbers are required on certain packages of hazardous materials—next to the shipping name.

Slide 207

D.O.T. regulations require the display of a four-digit identification number on tank trucks, portable tanks, and rail tank cars carrying hazardous materials. In addition, these identification numbers can be displayed on other bulk hazardous material containers, such as vans and hopper cars. Except for portable tanks, identification numbers must be displayed on both sides and both ends of the container.

Slide 208



This four-digit identification number will be displayed in either of two ways:

1. In 4-inch numerals on an orange panel—approximately 6 inches by 16 inches—near the appropriate placards; *or*
2. In 3½-inch numerals in the center of the hazardous material placard.

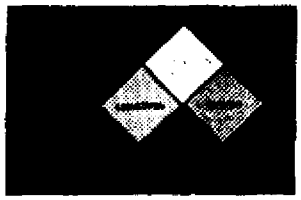
Slide 209

Identification numbers are not authorized on the standard placard for explosives, poison gas, and radioactive shipments. If identification numbers are used on one of these shipments, they must be displayed on the orange panel.

Slide 210

The National Fire Protection Association has developed the NFPA 704 marking system for hazardous materials in stationary tanks and facilities. The NFPA system is not used in transportation.

Slide 211



The NFPA 704 marker is diamond shaped and has four quadrants. The blue quadrant refers to health hazards; the red, to flammability hazards; and the yellow, to reactivity hazards. The white quadrant carries special information. Examples: the propeller for radioactive materials; "-O-X-Y-" for oxidizers; and a "W" with a slash—indicating that water should not be used.

Slide 212

Each of the other quadrants bears a number from zero through four. The zero indicates minimum hazard, while the four indicates a maximum hazard.

Slide 213

Look at this marking. The NFPA 704 marking is *two/three/two* indicating health, flammability, and reactivity hazards.

Slide 214

Other clues to the presence of hazardous materials may include company names on containers, or logos and slogans of known hazardous material producers or carriers.

Slide 215

Fourth, *placards and labels* can indicate hazardous material presence.

Slide 216

Labels and placards are designed to alert people to the presence of hazardous materials. The proper placard or label for a hazardous material shipment is determined by the hazard class of that product.

Slide 217

A 4- by 4-inch label is found on small packages. It should be located close to the name of the commodity and the identification number

Slide 218

Multiple labels, indicating more than one hazard, are required on some packages.

Slide 219

Like chlorine, which carries nonflammable gas and chlorine labels

Slide 220

Labels for "dangerous when wet" and "spontaneously combustible" flammable solids are found in special situations.

Slide 221

Etiologic or disease agent shipments display this unique label. Labels are not used on bulk packages such as tank trucks and tank cars—a placard will be used.

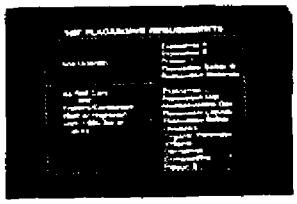
Slide 222

When small packages or bulk products are loaded into highway or rail vehicles,

Slide 223

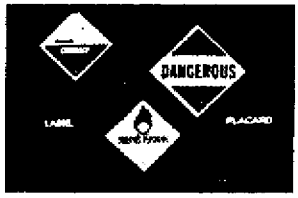
A 10-¾- by 10-¾-inch diamond placard is applied to both ends and both sides of the vehicle. The package labels and quantity determine the placard to be applied.

Slide 224



Placards are not required for some highway shipments carrying less than 1,000 pounds of the hazardous material. No placards are required for shipments such as charcoal.

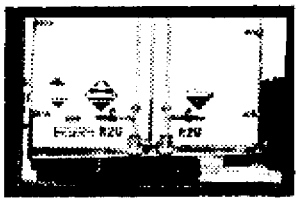
Slide 225



When several classes of hazardous materials are being shipped in the same vehicle, the "dangerous" placard is applied, subject to the weight and the hazard class of the contents. It can indicate that multiple hazards, as well as multiple materials, are present in the vehicle.

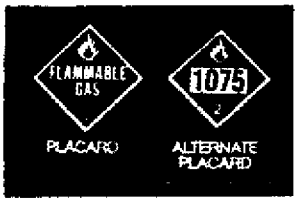
Remember, the "Dangerous" placard is also used for Class "C" explosives and "irritant" shipments. So be very careful to identify the contents.

Slide 226



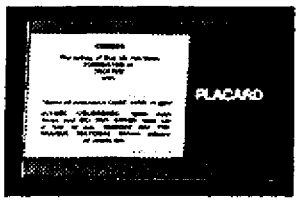
Vehicles carrying multiple commodities may display a placard for each hazard class in a quantity of more than 5,000 pounds, in addition to any other required placarding.

Slide 227



Both the placard and the label convey information by their color, symbol, United Nations hazard class number, and the hazard class wording, or identification number in the case of alternate placards.

Slide 228

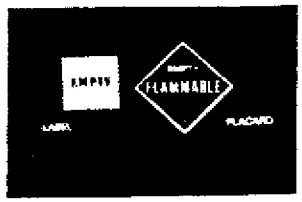


A fumigation placard is found on both doors of rail cars that have been treated with methyl bromide or some other fumigant that may be harmful to people.

Slide 229

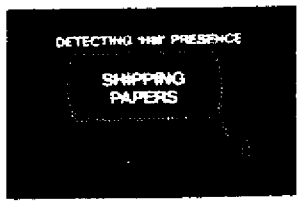
Placards with square white backgrounds indicate rail shipments that require special handling. These shipments include: explosive "A", poisonous gas, and poison gas-empty shipments.

Slide 230



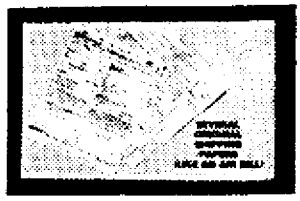
When the hazardous materials contents are removed from a tank, a hazardous residue will remain unless the tank is cleaned. By rail, empty placards are used to indicate this residual hazard. Note the black triangle with the word "empty" in white. Tank trucks display the loaded placard whether loaded or empty.

Slide 231



Fifth, *Shipping Papers* help emergency response personnel detect hazardous materials presence. Shipping papers, accompanying a hazardous material shipment, are required—

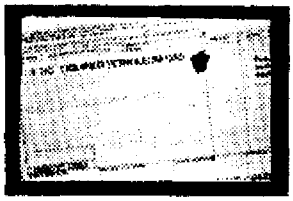
Slide 232



To describe the commodity in a specific way. Emergency response personnel should become familiar with the shipping papers used in various modes of transportation within the community. Examples are found in the Student Manual.

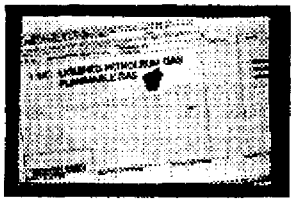
All shipping papers must contain the following basic shipping description entries:

Slide 233



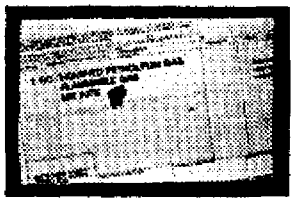
Proper shipping name;

Slide 234



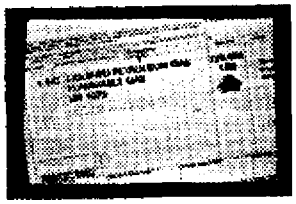
Hazard class;

Slide 235



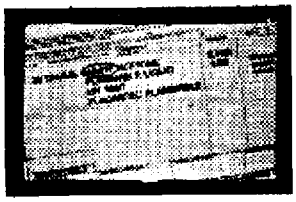
Identification number—preceded by the letters "UN" or "NA" as appropriate. NA stands for "North America" identification number;

Slide 236



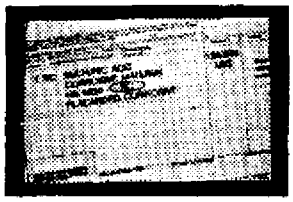
Total quantity by weight, volume, and/or packaging. With several commodities, additional entries are required.

Slide 237



If the lading is a hazardous *waste*, the word "waste" will generally precede the proper shipping name.

Slide 238

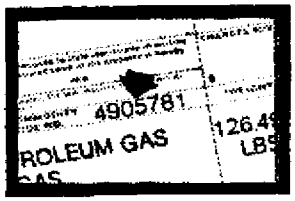


If the lading is a hazardous substance in a quantity that must be reported if there is a leak, the letters "RQ" which stand for Reportable Quantity must be shown before or after the basic shipping description entries.

Slide 239

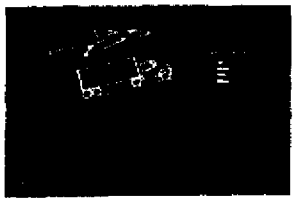
If the lading is a poison and that fact is not obvious by the proper shipping name, the word "poison" and/or the technical name of the poison must be shown near the proper shipping name.

Slide 240



A seven-digit, 49-series standard transportation commodity code number is found on shipping papers accompanying rail shipments of hazardous materials.

Slide 241

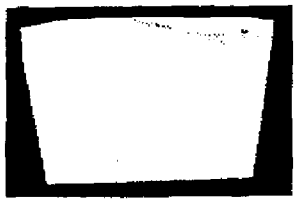


Let's look briefly at shipping papers used in the different modes of transportation.

Slide 242

In rail transportation, two types of shipping papers with hazardous materials information are generally present:

Slide 243



The waybill and the consist.

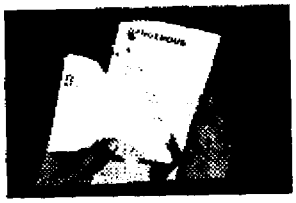
Slide 244

The waybill contains the required information about the contents of each car in the train. It accompanies the shipment throughout its rail transportation "life."

Slide 245

The waybills for a train are bundled together in the order the railcars appear on the train and are usually in a packet containing the consist, also called "wheel report."

Slide 246



While thumbing through the packet, waybills for hazardous shipments are easily recognized by the placard endorsement stamp in the upper left-hand corner.

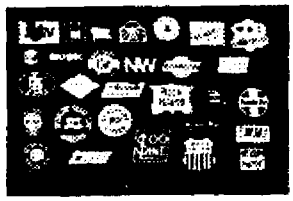
Slide 247

The consist, or wheel report, is a sequential list of the position of cars in the train.

Slide 248

Some wheel reports may include a printout of the emergency hazard and response data for each of the commodities on the train.

Slide 249



Become familiar with the procedures used on the railroads in your community.

Slide 250

Rail shipping papers are the responsibility of, and are kept by, the conductor, who usually, but not always, rides in the caboose.

Slide 251

A member of the train crew is instructed to take the shipping papers and locate the emergency responder.

Slide 252

When an accident occurs, these documents should provide emergency response personnel with information on the car's location and contents.

Check the shipping papers to see if any of the cars involved contain hazardous materials.

Slide 253

If the conductor or the shipping papers are not readily located, contact the railroad train dispatcher through the radio on either the engine or caboose *or* a public telephone. Waybill and consist information should be available through these contacts.

Slide 254

If an incident occurs in a classification yard, contact the yardmaster, the trainmaster, or other operations personnel to obtain the waybill information.

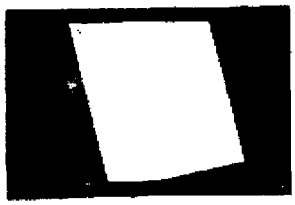
Slide 255

These people are generally found in the yard office.

Slide 256

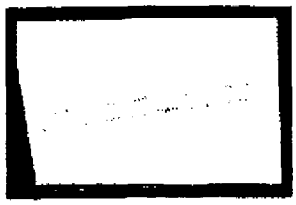
For highway transportation, the shipping paper is generally called—

Slide 257



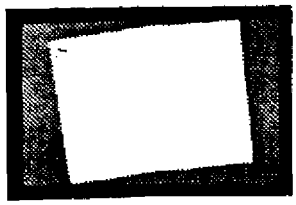
The "bill of lading." The driver of the vehicle is responsible for carrying this shipping paper on the truck. It should be available in the cab of the truck, either in a pouch on the door, or on the driver's seat.

Slide 258



Each shipment of a hazardous material must be described in the shipping papers.

Slide 259

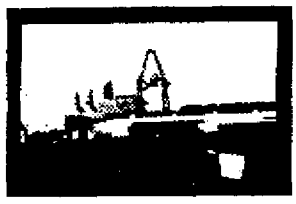


For some bulk and truckload shipments, a manufacturer's data sheet will be attached to the bill of lading to identify hazards and characteristics of the material.

Slide 260

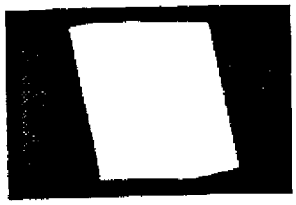
If the bill of lading is unavailable, the dispatcher for the trucking company should be contacted.

Slide 261



For water transportation,

Slide 262



The "dangerous cargo manifest" is the shipping paper. The master of the vessel will have the shipping papers in his possession in the wheelhouse.

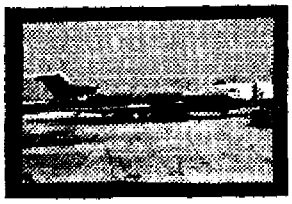
Slide 263

For barge traffic, the captain of the tow will know the contents of his barges. In many cases, the "dangerous cargo manifest" will be kept.

Slide 264

In a small pipe-like container used as a mailbox on the barge. Coast Guard regulations require that the shipping papers remain with the barge until it is emptied.

Slide 265



For air transportation, the shipping paper is called an "airbill."

Slide 266

For hazardous materials, the "shipper's certification for restricted articles" is used. This shipping paper may be identified by the distinctive striped border or other conspicuous marking.

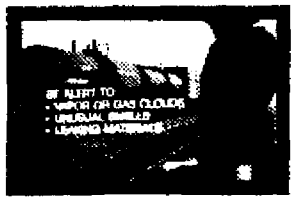
Slide 267

Airbills are the responsibility of the pilot and are generally kept in the cockpit.

Slide 268

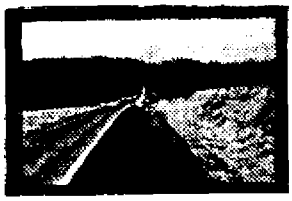
Sixth, your *Senses* can provide clues to the presence of hazardous materials in an emergency. Any physical sensation of contact with a hazardous material should alert you to immediately protect yourself and your fellow responders.

Slide 269



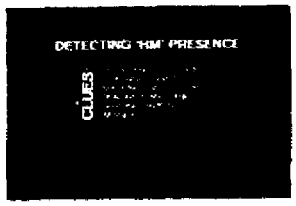
It is important to recognize that an unusual odor may indicate the presence of a hazardous material. Any irritation to the eyes or skin is also a signal that you are being exposed and that you should leave the area.

Slide 270



With some hazardous materials, seeing dead animals or fish, feeling powdery or slippery deposits on things, or hearing faint crackling noises, may indicate the presence of hazardous materials problems.

Slide 271



In review, six categories of clues are used to detect hazardous materials:

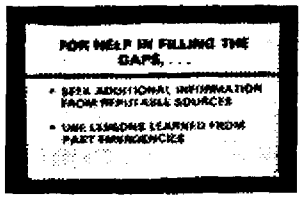
1. Occupancy and Location
2. Container Shapes
3. Markings and Colors
4. Placards and Labels
5. Shipping Papers and Other Documents
6. Senses

Slide 272 (Blank)

Emergency response personnel must be alert to these clues as they approach any emergency scene.

TIME	CONTENT/METHODOLOGY	MATERIALS
	• If you cannot visualize what is likely to happen from the information available, you should seek additional information from a reputable source to fill the gap.	Slide 303
	• If you cannot get additional information to complete your understanding, you can use your understanding of past emergencies to fill that gap.	
	Past experience is critical in visualizing events.	Slide 304
	Past experience is available from:	
	• **Being there and experiencing the emergency first-hand.**	
	• **From the experience of others** through the trade journals, accident reports, training, etc.	Slide 305
	• **Your experience can be used to fill the gaps in your visualization of the events.**	Slide 306
10 min.	**STEP 4**—Lecture and Group Discussion— Discuss describing the likely outcome in an emergency	
	• **We have been discussing estimating likely harm without intervention. This is because of the potential high cost of intervening. So, let's look at the kind of harm that can result:**	Slide 307
	For example, what kind of harm would you anticipate when the tank car violently ruptured?	Slide 308

Slide 303



Slide 304

Slide 305

Slide 306

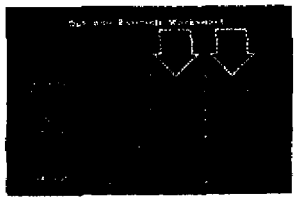
Slide 307

Slide 308

TIME	CONTENT/METHODOLOGY	MATERIALS
	Answers you should get from the students include:	
	• Death within the fireball.	
	• Injuries from the radiant heat	
	• Death or injury from getting hit by a piece of tank car.	
	• Property damage	
	• Environmental damage.	
	You should describe the likely outcome in terms of:	Slide 309
	• **Fatalities**	
	• **Injuries**	
	• **Property damage.**	
	• **Critical systems disruption** (such as hospitals, utilities, communications, etc.)	
	• **Environmental damage**	
	A format is provided on page V-7 of your Student Manual to guide your description of the outcome.	Slide 310 SM V-7
	You should try to identify whether or not the incident itself (without your intervention) will give you a problem in each area. Then you can decide whether you can effect this problem through intervention.	
	To be able to describe the outcome, you must understand how the hazardous material and its container will behave, and the exposures involved.	Slide 311
	Outcome estimates begin when you arrive, and may be modified as additional information becomes available.	

Slide 309

Slide 310



Slide 311

Remember, in describing your outcome, you can only prevent the harm that is going to happen You cannot prevent harm that has already occurred before you got to the scene.

- *Comment on the problems of uncertainty in decisionmaking at emergencies.*

  In the past, emergency response personnel have responded to many emergencies with little help in making the estimates discussed in this unit. They improvised as well as possible, and frequently succeeded in quelling the problem before it cascaded the harm, often through sheer determination and reasonable luck.

  The main thrust of this course is to show you how you can improve the degree of certainty in making these estimates. You should recognize that the greater the uncertainty, the greater the need for expert assistance to help you make the estimates discussed in a specific emergency.

  Any questions?

  Slide 312 (Blank)

  Optional: Show film "Closed Containers and Fire," if available.

Slide 312

EVENTS ANALYSIS EXERCISE

WHAT HAS ALREADY HAPPENED:

* Derailment

* Puncture of tank of flammable material

* Ignition of released material

* Impingement of flame on tank

Who or what is involved?

1. Burning fuel from breached container.

2. Tank car.

3. Product in tank car.

What is happening now?

1. Burning fuel is heating tank car.

2. Burning fuel is heating contents within tank car.

3. Tank car is absorbing heat and transmitting it to the contents.

Contents are absorbing heat from the tank car.

What is likely to happen?

What will the burning fuel do?

Fuel spill will keep burning until the fuel is consumed.

How will the tank car behave under this impingement:

Tank car will absorb more and more heat.

Tank car, as it absorbs heat, will heat the contents.

As the heat is transferred to the contents, what will the contents do?

Contents will expand and undergo a change of physical state.

Content expansion will raise pressure in the tank car.

Internal pressure will stress tank car from within.

What will happen to the tank car?

Tank car will not pressure through the relief valve.

What will happen to the contents?

Vapor will escape.

Cooling will be limited.

If thermal stressing continues, what will the tank car do?

Tank car will crack and separate rapidly due to weakening of the tank car shell and the pressure build-up in the tank.

When the tank car separates, what will the contents do?

The heated contents will start to expand and flow out through the breach.

Contents will flash vaporize.

Escaping contents will produce a propulsive effect.

Vapored contents will ignite, forming a fireball

When the tank car opens up, what happens to the tank shell?

Tank car pieces could fly.

Contents may fall along the flight path.

Unit V
Estimating Likely Harm Without Intervention

At the end of this unit the student will be able to:

- Describe the two parts of "estimating likely harm without intervention."
- Explain how events analysis can be used to estimate likely harm without intervention.
- Identify the significant events in a given scenario, and then place those events in sequence.
- Explain the format for describing likely outcomes in emergencies.

UNIT V—ESTIMATING LIKELY HARM WITHOUT INTERVENTION

TOTAL TIME REQUIRED FOR THIS UNIT: *60 minutes*

METHODOLOGY OUTLINE:

Step 1.	Interactive Lecture Introduce "Estimating Likely Harm Without Intervention." Introduce unit content.	5 minutes
Step 2.	Lecture Present the concept of events analysis.	15 minutes
Step 3.	Group Discussion Provide practice in events analysis.	30 minutes
Step 4.	Lecture and Group Discussion Discuss describing the likely outcome in emergencies.	10 minutes

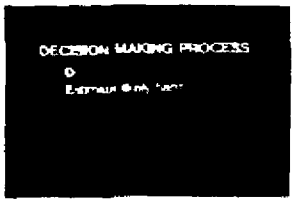
NOTE: The exercise in Step 3 of the unit should be tailored by the instructor to the level of students in the audience. The exercise in the lesson plan guides the students through a simple and somewhat obvious analysis of a potential BLEVE. For more advanced students, instructors may want to prepare a less obvious example for the exercise. Extra blank forms have been provided in the Student Manual for this purpose.

INSTRUCTIONAL MATERIALS

1. Slides 284–286 (Step 1 lecture)
2. Slides 287–294 (Step 2 lecture)
3. Slides 295–306 (Step 3 group discussion)
4. Slides 307–312 (Step 4 lecture and group discussion)

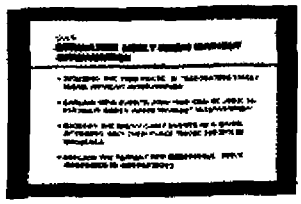
TIME	CONTENT/METHODOLOGY	MATERIALS
5 min.	**STEP 1**—Interactive Lecture— Introduce "Estimating Likely Harm Without Intervention"	
	• *Announce the title of this unit.*	
	This unit is entitled "**Estimating Likely Harm Without Intervention.**"	Slide 284
	This unit will discuss this most critical step in the D.E.C.I.D.E. process—often the least understood step in the process	
	This is the step where we define the problem that exists.	
	There are two activities in "estimating likely harm without intervention":	
	• **Visualizing (or predicting) what is likely to happen** in an emergency if nothing at all is done—visualize the behavior of the hazardous material.	Slide 285
	• **Describing the likely outcome** in the emergency based on the predicted behavior.	
	• *Identify the topics for the unit.*	
	This unit will:	
	• **Discuss the concept of events analysis**—a process which helps us visualize the behavior of the hazardous material—including:	
	• **Thinking in terms of events.**	
	• **Visualizing those events** in their logical sequence.	
	• **Practice the process of events analysis.**	
	• **Discuss the process for estimating (describing) outcomes.**	
	• *Identify the objectives for the unit*	Slide 286
	By the end of this unit, you will be able to:	

Slide 284



Slide 285

Slide 286



TIME	CONTENT/METHODOLOGY	MATERIALS

1. **Describe the two parts of "estimating likely harm without intervention."**
2. **Explain how events analysis can be used to estimate likely harm without intervention.**
3. **Identify the significant events in a given scenario, and then place those events in sequence.**
4. **Explain the format for describing likely outcomes in emergencies.**

- **Any questions?**

15 min. **STEP 2**—Interactive Lecture—
Discussion of Events Analysis

- *Discuss the concept of "Estimating Likely Harm Without Intervention."*

The concept of "estimating likely harm without intervention" covers two parts: Slide 287

- **Visualizing (or predicting) what is likely to happen in an emergency.**
- **Describing the likely outcome in the emergency.**

- *Introduce and discuss the process of "events analysis."*

Events analysis is the process used to help you "visualize what is likely to happen in an emergency." Slide 288

- **A process of breaking down complex actions (such as an emergency), into smaller, more easily understandable parts.** Slide 289

Slide 287

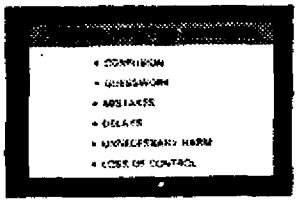
Slide 288

Slide 289

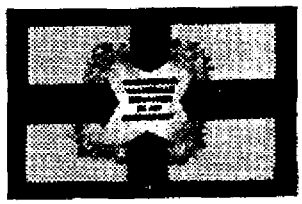
TIME	CONTENT/METHODOLOGY	MATERIALS
	Events analysis should help you:	
	• **Understand, track, and predict a given sequence of events.**	Slide 290
	• **Decide when and how to change that sequence of events.**	
	• **The concept of events analysis helps define your problems in a sequential and logical way, thus minimizing confusion, guesswork, mistakes, delays, unnecessary harm, and loss of control at an emergency.**	Slide 291
	• **There are four factors affecting the behavior of hazardous materials in an emergency:**	Slide 292
	• **Inherent properties and quantity of the hazardous material;**	
	• **Built-in characteristics of the container;**	
	• **Natural laws of physics and chemistry;**	
	• **Environment, including exposures, the physical surroundings (terrain) and the conditions (weather).**	
	Determining the interrelationship among these factors can help considerably in visualizing what is likely to happen in the emergency.	
	• *Review the steps in events analysis.*	Slide 293

Slide 290

Slide 291



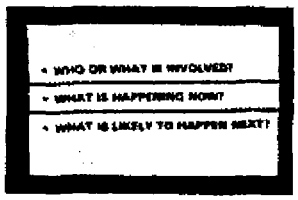
Slide 292



Slide 293

TIME	CONTENT/METHODOLOGY	MATERIALS
	Remember, **events analysis** is a process of systematically breaking down a happening, in the case of an emergency, into smaller, more understandable components (or events).	
	To use events analysis, you must describe or visualize the following:	Slide 294
	• **Who or what is involved?**	
	• **What is happening?** (What is happening now with the people or things involved?)	
	• **What is likely to happen next?** (What do you predict these people/things are likely to do as the emergency progresses?	
	How will these actions affect the sequence of events in the emergency?)	
	As we discuss emergencies, keep one thing in mind, always name the person/thing doing something first, then indicate what the person/thing is doing.	
	• **Any questions?**	
	This concept is best learned in practice. Therefore, let's try an exercise to see how it helps us estimate likely harm without intervention.	
30 min.	**STEP 3**—Interactive Discussion— Practice in Events Analysis	
	• *Introduce events analysis exercise.*	
	Have students turn to page V-4. Ask them to note analysis information on V-4–V-6 as the discussion proceeds. (A correctly filled-in form is included at the end of this Lesson Plan).	SM V-4–V-6 Answer Key
	Let's use this situation to practice the process of events analysis. The tanks contain a flammable compressed gas. The tanks, as you can see, are exposed to a fire created by the release of product from another tank.	Slide 295

Slide 294



Slide 295

TIME	CONTENT/METHODOLOGY	MATERIALS

Use a questioning technique to generate the discussion:

What is likely to happen in this situation?

Let students discuss this question in their normal "illogical" manner for a short time. Matter of fact, you might even want to list the points that the students make as they make them—illogical as they may be.

In any case, let the students verbalize their thoughts before you cut them off. Use these thoughts when you need to bring them back on track.

- *Use the events analysis steps to define the situation systematically. For the purposes of this exercise, we will use the diagram pictured.* Slide 296

Note what has already happened:

- **Derailment**
- **Puncture of tank of flammable material**
- **Ignition of released material**
- **Impingement of flame on tank**

Now, try to get the students to look at the emergency in a more systematic manner.

1 **The first step in events analysis is: <u>Identify who or what is involved at this time.</u>** Slide 297

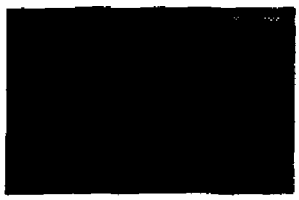
Remember, significant people/things—those that will have an effect on the sequence of events and the outcome.

Answers you should get from the students include the following. Have the students note these answers on page V-4:

- **Burning fuel from breached container**
- **Tank car**

Slide 296

Slide 297



- **Product in tank car** (cannot see, but must assume it's there)

NOTE: Make sure you differentiate between tank car and product contained therein.

Try to relate other answers to process if significant; disregard insignificant people/things.

2 **The second step in events analysis is:** Slide 298

<u>Determine what is happening with the people/things involved at present.</u> What is happening now with the flame (fire), tank car and product contained in the tank car?

Answers you should get from the students include the following. Have the students note these answers on page V-4:

- **Burning fuel is heating tank car.**
- **Burning fuel is heating contents within tank car.**
- **Tank car is absorbing heat and transmitting it to the contents.**
- **Contents are absorbing heat from the tank car.**

3 **The third step in events analysis is: <u>Determine what is likely to happen</u> with each person/thing involved.** Slide 299

Predict the behavior of the people/things involved as the emergency progresses without intervention. Do this with each separate person/thing involved.

Answers to the following questions should be noted on page V-5: SM V-9

IG Answer Key

<u>What will the burning fuel do?</u>

Answers you should get from the students include:

Slide 298

Slide 299

TIME	CONTENT/METHODOLOGY	MATERIALS

- **Fuel spill will keep burning until the fuel is consumed.** If no one does anything, the burning fuel will continue to surround and heat the tank car.
- **The burning fuel will heat the tank car** at the point of impingement, weakening the strength of the metal.

Leave Slide #299 up

How will the tank car behave under this impingement?

Answers you should get from the students include:

- **Tank car will absorb more and more heat.**
- **Tank car, as it absorbs heat, will heat the contents.**

As the heat is transferred to the contents, what will the contents do?

Answers you should get from the students include:

- **Contents will expand** and undergo a change of physical state (liquid to gas).
- **Content expansion will raise pressure in the tank car.**
- **Internal pressure will stress tank car from within.**

Leave slide #299 up

What will happen to the tank car?

Answer you should get from the students:

Tank car will vent pressure through the relief valve (if the tank car shell is stronger than the relief valve setting).

What will happen to the contents?

Answers you should get from the students include:

- **Vapor will escape** from the relief valve opening initiating an auto-refrigeration process in the tank and lowering the pressure inside the tank.
- **Cooling will be limited** due to continued heating from fire outside tank.

TIME	CONTENT/METHODOLOGY	MATERIALS

<u>If thermal stressing continues, what will the tank car do?</u>

Answer you should get from the students include:

Tank car will crack and separate rapidly due to weakening of the tank car shell and the pressure build-up in the tank.

<u>When the tank car separates, what will the contents do?</u>

Answers you should get from the students include:

- As the pressure is relieved through the breach in the tank car, **the heated contents will start to expand and flow out through the breach** (opening).

- **Contents will flash vaporize** as they reach the unpressurized atmosphere outside the tank car changing the form of the contents to a vapor (in this case a flammable vapor).

Leave slide #299 up

- **Escaping contents will produce a propulsive effect** on the tank car pieces, propelling them like rockets.

- If the tank car is still surrounded by the burning fuel, the **vaporized contents will ignite forming a fireball** and cascading the problem.

When the tank car opens up, what happens to the tank shell?

Answers you should get from the students include:

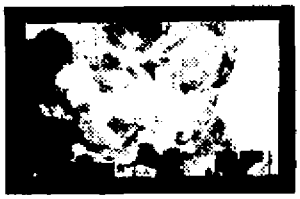
- **Tank car pieces could fly** along one of several trajectories depending on where the tank car was heated (tank car pieces are propelled by the vaporization of the escaping contents) and obstructions could cause a change in direction.

- **Contents may fall along the flight path** of the tank car shell, leaving a trail of burning material on the ground.

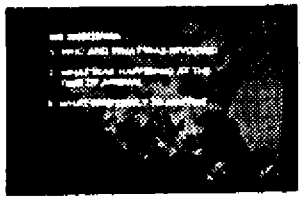
NOTE: Discussions at this point often focus on record distances of rocketing and the "size" of safe areas. Prior to Labor Day, 1983, 2,260 feet was the longest trajectory on record for an LP gas tank car. On Labor Day, a tank car in Murdock,

TIME	CONTENT/METHODOLOGY	MATERIALS
	IL, rocketed 3,200 feet. A piece of an ethylene oxide tank was reported to have traveled 4,900 feet.	
	We could continue to track the burning fuel, the tank car parts and the contents. However, we have tracked the example far enough to show you the events analysis method.	
	Let's summarize the incident thus far by looking at the number and complexity of predicted events that you have noted on your worksheet.	
	When these events interact, the result is this:	Slide 300
	Does this interaction help you understand the incident more fully?	
	• *Review the events analysis process.*	
	In this scenario discussion, **we applied three important steps** to help us understand what was likely to happen in the situation given:	
	• **We identified who and what was involved.**	Slide 301
	• **We identified the actions of each person/thing at the time of arrival.**	
	• **We then predicted what each person/thing would likely do in the emergency and their effect on the total emergency.**	
	The process of visualizing likely events helps you identify gaps in your understanding of a problem.	Slide 302

Slide 300



Slide 301



Slide 302