Hazardous Materials Officer and Hazardous Materials Safety Officer

HMOHMSO-Student Manual

2nd Edition, 4th Printing-November 2024

FEMA

FEMA/USFA/NFA
HMOHMSO-SM
November 2024
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ACKNOWLEDGMENTS

The development of any National Fire Academy (NFA) course is a complex process aimed at providing students the best possible learning opportunity we can deliver.

There are many players in the course development, each of whom plays an equally important part in its success. We want to acknowledge their participation and contribution to this effort and extend our heartfelt thanks for making this quality product.

The following people participated in the creation of this course:

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COURSE DESCRIPTION

This nine-day course will enable emergency responders and allied professionals to direct and coordinate hazardous materials/weapons of mass destruction (WMD) incident response from a hazardous materials officer's and a hazardous materials safety officer's perspective. These skills are essential in implementing a safe and effective risk-based response for hazardous materials/WMD incidents, as well as conveying the information to team members and the public.

COURSE GOAL

Prepare hazardous materials response personnel and allied professionals operating at technician and specialist levels to be able to utilize a risk-based approach to directing and coordinating hazardous materials/WMD incident response using applicable regulations, policies and standards for a safe incident environment.

AUDIENCE, SCOPE AND COURSE PURPOSE

The target audience for this course includes personnel with hazardous materials response and mitigation functions including:

- Members of hazardous materials response teams including:
  - Hazardous materials officers or potential hazardous materials officers.
  - Hazardous materials safety officers or potential hazardous materials safety officers.
- Allied professionals associated with hazardous materials response.
- Training officers with responsibility for hazardous materials training.

Applicants to this course should be emergency response personnel or allied professionals having hazardous materials response or training responsibility certified at the technician/specialist level as referenced in Title 29 of the Code of Federal Regulations (CFR) Section 1910.120 or 40 CFR 311 and National Fire Protection Association (NFPA) standards.

In addition, students should have completed the following prerequisite courses or equivalent prior to enrollment:

- "ICS-100: An Introduction to the Incident Command System" (Q0462).
- "ICS-200: Basic Incident Command System for Initial Response" (Q0463).
- "ICS-300: Intermediate All-Hazard NIMS ICS Review for Expanding Incidents" (Q0464) or "Hazardous Materials Incident Management" (HMIM) (R0243).

It is also strongly recommended that students complete the "Chemistry for Emergency Response" (CER) (R0233) course or possess equivalent knowledge.

This course is intended to prepare hazardous materials response personnel and allied professionals operating at technician and specialist levels to be able to utilize a risk-based approach to directing and coordinating hazardous materials/WMD incident response using applicable regulations, policies and standards for a safe incident environment.

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GRADING METHODOLOGY

The students' final grades will be computed using the final exam. The final exam will include 50 multiple-choice questions (25% of the total grade). The exam covers all the information in the Student Manual (SM), as well as the concepts presented during presentations and class discussions. In addition, Activity 9.1: Team Project (50% of the total grade) and Activity 9.3: The Way Forward: Presentation (25% of the total grade) will be evaluated for contribution to the final grade.

Grade		Percentage range
A	=	90-100
B	=	80-89
C	=	70-79
F	=	69 or less

Passing is a C (70%).

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GRADING RUBRICS

ACTIVITY 9.1

Team Project Grading Rubric

Assignment: Working in your small group, implement, evaluate and terminate the incident based on the provided scenario.

Each small group member receives 5 points for participation (0 points for nonparticipation). The table below details the remaining point distribution for Activity 9.1. (Maximum points total: 25)

Element of performance	**No effort:** **0 points**	**Deficient:** **1-2 points**	**Developing:** **3-4 points**	**Acceptable:** **5-6 points**	**Proficient:** **7-8 points**	**Exemplary:** **9-10 points**
ICS forms. (10 pts. max)	No ICS forms are completed.	Less than 50% of the forms are complete. Of the completed portions, less than 20% of the information is accurate. The written information lacks clarity and organization.	Approximately 50% of the forms are complete. Of the completed portions, more than 20% but less than 50% of the information is accurate. The written information shows minimal clarity and organization; organization needs improvement.	Approximately 75% of the forms are complete. Of the completed portions, more than 50% but less than 75% of the information is accurate. The written information is mostly clear and organized.	More than 75% of the forms are complete. Of the completed portions, more than 75% but less than 90% of the information is accurate. The written information is very clear and well organized.	More than 90% of the forms are complete. Of the completed portions, more than 90% of the information is accurate. Written information is very clear and well organized.

Element of performance	No effort: 0 points	Deficient: 1-2 points	Developing: 3-4 points	Acceptable: 5-6 points	Proficient: 7-8 points	Exemplary: 9-10 points
Communication of information by conducting a pre-entry briefings. (5 pts. max) Communication of information by conducting an incident termination briefing. (5 pts. max)	No effort presented.	The briefing includes one or two required elements; no briefing structure apparent. Technical recommended topics for briefing not applied. Information communicated with difficulty without appropriate hazardous materials response team assigned. Group members are not able to respond to any of the clarifying questions from peers and instructors.	The briefing includes less than half of the required elements. Information is communicated with little clarity without appropriate hazardous materials response team members assigned. Group members are not able to respond to most of the clarifying questions from peers and instructors.	The briefing includes more than half of the required elements with no more than two elements missing. Information is communicated with clarity by appropriate hazardous materials response team members. Group members can respond to approximately half of the clarifying questions from peers and instructors. Group applies the use of the ICS Form 208HM to facilitate the organized brief.	The briefing includes required elements except for one or two missing elements. Information is communicated clearly by appropriate hazardous materials response team members. Group members can respond to most of the clarifying questions from peers and instructors. Group applies the use of the ICS Form 208HM to facilitate the organized brief.	T The briefing includes all required elements. Information is communicated clearly by appropriate hazardous materials response team members. Group members can respond to clarifying questions from peers and instructors. Group applies the use of the ICS Form 208HM to facilitate the organized brief.

ACTIVITY 9.3

The Way Forward: Presentation Grading Rubric

Assignment: Working in your assigned group from Activity 3.6, research the approved topic related to hazardous materials/WMD and prepare and present your findings to the larger class using the skills you learned about delivering effective briefings.

The table below details the point distribution for Activity 9.3 (maximum points total: 25).

Element of performance	No effort: 0 points	Deficient: 1-3 points	Developing: 4-6 points	Proficient: 7-9 points	Exemplary: 10-15 points
Clarity, conciseness, accuracy and preparedness in presenting information and fielding questions on the approved topic. (15 pts. max)	No presentation provided.	Information provided in the presentation and the summary handout was unclear, unorganized and poorly planned. The audience was disengaged. Group members were unable to answer questions asked by their peers and/or instructors.	Information provided in the presentation and the summary handout was organized but contained some inaccuracies and/or excessive technical jargon, making details of the presentation unrelatable to their audience. Group members were able to answer some questions asked by their peers and/or instructors.	Information provided in the presentation and the summary handout was very well organized. The audience was engaged and the presentation created lively discussions around the presented topic. Group members were able to answer most questions asked by their peers and/or instructors.	Information provided in the presentation and the summary handout was extremely well organized, easy to follow, and presented in a professional, engaging and innovative way that created lively discussions around the presented topic. Group members were able to answer and provide detailed justifications for all questions asked by their peers and/or instructors.

Element of performance	**No effort:** **0 points**	**Deficient:** **1-2 points**	**Developing:** **3-4 points**	**Proficient:** **5-6 points**	**Exemplary:** **7-10 points**
Collaboration and contribution. (10 pts. max)	No effort presented to collaborate among the group members.	More than 50% of the group members did not contribute to the research, preparation and delivery of the presentation.	More than 50% of the group contributed to the delivery of the presentation, but only one or two members contributed to the research and preparation activities.	All group members contributed individually to equally divided assignments for research, preparation and delivery of the presentation. The group had some communication during research and preparation, but mostly worked individually.	All group members contributed individually to equally divided assignments for research, preparation and delivery of the presentation. The group collaborated frequently to establish clear connection and communication among the group members.

SCHEDULE

TIME	DAY 1	DAY 2
8:00 - 10:00	Unit 1: Introduction Unit 2: Risk-Based Response Process and Standard of Care	Recap of Day 1 Unit 3: Hazardous Materials Response Team Organization and Incident Command System Activity 3.1: Emergency Response Guidebook Knowledge Check
10:00 - 10:15	*Break*	*Break*
10:15 - 12:00	Unit 2: Risk-Based Response Process and Standard of Care (cont'd) Activity 2.1: Standard of Care — Federal Laws and Regulations	Unit 3: Hazardous Materials Response Team Organization and Incident Command System (cont'd) Activity 3.2 Hazardous Materials Terminology Matching Activity 3.3: Hazardous Materials Certification and Competency
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:00	Unit 2: Risk-Based Response Process and Standard of Care (cont'd) Activity 2.2: Hazardous Waste Operations and Emergency Response 29 Code of Federal Regulations 1910.120	Unit 3: Hazardous Materials Response Team Organization and Incident Command System (cont'd) Activity 3.4: Typing Hazardous Materials Response Teams
2:00 - 2:15	*Break*	*Break*
2:15 - 3:15	Unit 2: Risk-Based Response Process and Standard of Care (cont'd)	Unit 3: Hazardous Materials Response Team Organization and Incident Command System (cont'd)
3:15 - 3:30	*Break*	*Break*
3:30 - 5:00	Unit 2: Risk-Based Response Process and Standard of Care (cont'd) Activity 2.3: Risk-Based Response Unit 2: Risk-Based Response Process and Standard of Care (cont'd)	Unit 3: Hazardous Materials Response Team Organization and Incident Command System (cont'd) Activity 3.5: Hazardous Materials Response Team Positions — Knowledge, Skills and Abilities Activity 3.6: The Way Forward Research Group Activity 3.7: Who Am I?: Hazardous Materials Roles and Responsibilities

Note: This schedule is subject to modification by the instructors and approved by the training specialist.

TIME	DAY 3	DAY 4
8:00 - 10:00	Recap of Day 2 Unit 4: Developing the Plan of Action	Recap of Day 3 Unit 5: Communicating the Plan
10:00 - 10:15	*Break*	*Break*
10:15 - 12:00	Unit 4: Developing the Plan of Action (cont'd) Activity 4.1: Determining Operational Modes	Unit 5: Communicating the Plan (cont'd) Activity 5.1: Delivering the Pre-entry Briefing
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:00	Unit 4: Developing the Plan of Action (cont'd)	Unit 5: Communicating the Plan (cont'd) Activity 5.1: Delivering the Pre-entry Briefing (cont'd)
2:00 - 2:15	*Break*	*Break*
2:15 - 3:15	Unit 4: Developing the Plan of Action (cont'd) Activity 4.2: Completing Incident Command System Form 208 HM, Site Safety and Control Plan	Unit 5: Communicating the Plan (cont'd) Activity 5.1: Delivering the Pre-entry Briefing (cont'd)
3:15 - 3:30	*Break*	*Break*
3:30 - 5:00	Unit 4: Developing the Plan of Action (cont'd) Activity 4.2: Completing Incident Command System Form 208 HM, Site Safety and Control Plan (cont'd)	The Way Forward Project Preparation

TIME	DAY 5	DAY 6
8:00 - 10:00	Recap of Day 4 Unit 6: Implementing the Plan	Recap of Day 5 Unit 7: Evaluating the Progress of the Response Activity 7.1: Methods for Evaluating Incident Progress Activity 7.2: Best Practices for Evaluating Incident Progress
10:00 - 10:15	*Break*	*Break*
10:15 - 12:00	Unit 6: Implementing the Plan (cont'd) Activity 6.1: Implementing the Plan	Unit 7: Evaluating the Progress of the Response (cont'd) Activity 7.2: Best Practices for Evaluating Incident Progress (cont'd) Activity 7.3: Changes to the Plan of Action
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:00	Unit 6: Implementing the Plan (cont'd) Activity 6.1: Implementing the Plan (cont'd)	Unit 7: Evaluating the Progress of the Response (cont'd) Activity 7.3: Changes to the Plan of Action (cont'd)
2:00 - 2:15	*Break*	*Break*
2:15 - 3:15	Unit 6: Implementing the Plan (cont'd) Activity 6.1: Implementing the Plan (cont'd)	Unit 7: Evaluating the Progress of the Response (cont'd) Activity 7.3: Changes to the Plan of Action (cont'd)
3:15 - 3:30	*Break*	*Break*
3:30 - 5:00	The Way Forward Project Preparation	The Way Forward Project Preparation

TIME	DAY 7	DAY 8
8:00 - 10:00	Recap of Day 6 Unit 8: Terminating the Response	Recap of Day 7 Unit 9: Assessment Activity 9.1: Team Project
10:00 - 10:15	*Break*	*Break*
10:15 - 12:00	Unit 8: Terminating the Response (cont'd)	Unit 9: Assessment (cont'd) Activity 9.1: Team Project (cont'd)
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:00	Unit 8: Terminating the Response (cont'd) Activity 8.1: Incident Debrief	Unit 9: Assessment (cont'd) Activity 9.1: Team Project (cont'd)
2:00 - 2:15	*Break*	*Break*
2:15 - 3:15	Unit 8: Terminating the Response (cont'd) Activity 8.1: Incident Debrief (cont'd)	Unit 9: Assessment (cont'd) Activity 9.1: Team Project (cont'd)
3:15 - 3:30	*Break*	*Break*
3:30 - 5:00	Unit 8: Terminating the Response (cont'd) Activity 8.2: Cost Recovery Analysis	Unit 9: Assessment (cont'd) Activity 9.1: Team Project (cont'd)

TIME	DAY 9
8:00 - 10:00	Recap of Day 8 Unit 9: Assessment (cont'd) Activity 9.2: Final Exam
10:00 - 10:15	*Break*
10:15 - 12:00	Unit 9: Assessment (cont'd) Activity 9.3: The Way Forward: Presentation
12:00 - 1:00	*Break*
1:00 - 2:00	Unit 9: Assessment (cont'd) Activity 9.3: The Way Forward: Presentation (cont'd)
2:00 - 2:15	*Lunch Break*
2:15 - 3:15	Unit 9: Assessment (cont'd) Activity 9.3: The Way Forward: Presentation (cont'd)
3:15 - 3:30	*Break*
3:30 - 5:00	Course Evaluation Graduation

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Firefighter Code of Ethics

Background

The Fire Service is a noble calling, one which is founded on mutual respect and trust between firefighters and the citizens they serve. To ensure the continuing integrity of the Fire Service, the highest standards of ethical conduct must be maintained at all times.

Developed in response to the publication of the Fire Service Reputation Management White Paper, the purpose of this National Firefighter Code of Ethics is to establish criteria that encourages fire service personnel to promote a culture of ethical integrity and high standards of professionalism in our field. The broad scope of this recommended Code of Ethics is intended to mitigate and negate situations that may result in embarrassment and waning of public support for what has historically been a highly respected profession.

Ethics comes from the Greek word ethos, meaning character. Character is not necessarily defined by how a person behaves when conditions are optimal and life is good. It is easy to take the high road when the path is paved and obstacles are few or non-existent. Character is also defined by decisions made under pressure, when no one is looking, when the road contains land mines, and the way is obscured. As members of the Fire Service, we share a responsibility to project an ethical character of professionalism, integrity, compassion, loyalty and honesty in all that we do, all of the time.

We need to accept this ethics challenge and be truly willing to maintain a culture that is consistent with the expectations outlined in this document. By doing so, we can create a legacy that validates and sustains the distinguished Fire Service institution, and at the same time ensure that we leave the Fire Service in better condition than when we arrived.

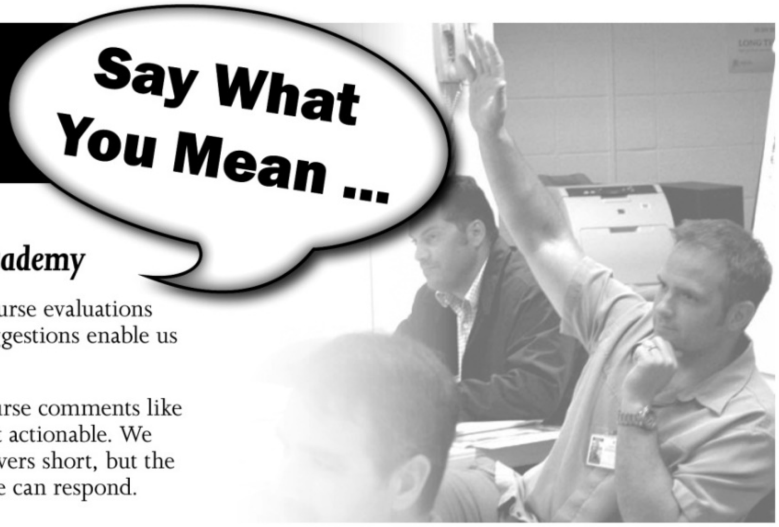
FIREFIGHTER CODE OF ETHICS

I understand that I have the responsibility to conduct myself in a manner that reflects proper ethical behavior and integrity. In so doing, I will help foster a continuing positive public perception of the fire service. Therefore, I pledge the following…

- Always conduct myself, on and off duty, in a manner that reflects positively on myself, my department and the fire service in general.
- Accept responsibility for my actions and for the consequences of my actions.
- Support the concept of fairness and the value of diverse thoughts and opinions.
- Avoid situations that would adversely affect the credibility or public perception of the fire service profession.
- Be truthful and honest at all times and report instances of cheating or other dishonest acts that compromise the integrity of the fire service.
- Conduct my personal affairs in a manner that does not improperly influence the performance of my duties, or bring discredit to my organization.
- Be respectful and conscious of each member's safety and welfare.
- Recognize that I serve in a position of public trust that requires stewardship in the honest and efficient use of publicly owned resources, including uniforms, facilities, vehicles and equipment and that these are protected from misuse and theft.
- Exercise professionalism, competence, respect and loyalty in the performance of my duties and use information, confidential or otherwise, gained by virtue of my position, only to benefit those I am entrusted to serve.
- Avoid financial investments, outside employment, outside business interests or activities that conflict with or are enhanced by my official position or have the potential to create the perception of impropriety.
- Never propose or accept personal rewards, special privileges, benefits, advancement, honors or gifts that may create a conflict of interest, or the appearance thereof.
- Never engage in activities involving alcohol or other substance use or abuse that can impair my mental state or the performance of my duties and compromise safety.
- Never discriminate on the basis of race, religion, color, creed, age, marital status, national origin, ancestry, gender, sexual preference, medical condition or handicap.
- Never harass, intimidate or threaten fellow members of the service or the public and stop or report the actions of other firefighters who engage in such behaviors.
- Responsibly use social networking, electronic communications, or other media technology opportunities in a manner that does not discredit, dishonor or embarrass my organization, the fire service and the public. I also understand that failure to resolve or report inappropriate use of this media equates to condoning this behavior.

Developed by the National Society of Executive Fire Officers

A Student Guide to End-of-course Evaluations



Ten Things You Can Do to Improve the National Fire Academy

The National Fire Academy takes its course evaluations very seriously. Your comments and suggestions enable us to improve your learning experience.

Unfortunately, we often get end-of-course comments like these that are vague and, therefore, not actionable. We know you are trying to keep your answers short, but the more specific you can be, the better we can respond.

Actual quotes from student evaluations:	Examples of specific, actionable comments that would help us improve the course:
1 "Update the materials."	• The (ABC) fire video is out-of-date because of the dangerous tactics it demonstrates. The available (XYZ) video shows current practices. • The student manual references building codes that are 12 years old.
2 "We want an advanced class in (fill in the blank)."	• We would like a class that enables us to calculate energy transfer rates resulting from exposure fires. • We would like a class that provides one-on-one workplace harassment counseling practice exercises.
3 "More activities."	• An activity where students can physically measure the area of sprinkler coverage would improve understanding of the concept. • Not all students were able to fill all ICS positions in the exercises. Add more exercises so all students can participate.
4 "A longer course."	• The class should be increased by one hour per day to enable all students to participate in exercises. • The class should be increased by two days so that all group presentations can be peer evaluated and have written abstracts.
5 "Readable plans."	• The plans should be enlarged to 11 by 17 and provided with an accurate scale. • My plan set was blurry, which caused the dotted lines to be interpreted as solid lines.
6 "Better student guide organization," "manual did not coincide with slides."	• The slide sequence in Unit 4 did not align with the content in the student manual from slides 4-16 through 4-21. • The instructor added slides in Unit 4 that were not in my student manual.
7 "Dry in spots."	• The instructor/activity should have used student group activities rather than lecture to explain Maslow's Hierarchy. • Create a pre-course reading on symbiotic personal relationships rather than trying to lecture on them in class.
8 "More visual aids."	• The text description of V-patterns did not provide three-dimensional views. More photographs or drawings would help me imagine the pattern. • There was a video clip on NBC News (date) that summarized the topic very well.
9 "Re-evaluate pre-course assignments."	• The pre-course assignments were not discussed or referenced in class. Either connect them to the course content or delete them. • The pre-course assignments on ICS could be reduced to a one-page job aid rather than a 25-page reading.
10 "A better understanding of NIMS."	• The instructor did not explain the connection between NIMS and ICS. • The student manual needs an illustrated guide to NIMS.

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UNIT 1: INTRODUCTION

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HAZARDOUS MATERIALS OFFICER AND HAZARDOUS MATERIALS SAFETY OFFICER

Slide 1-2

I. WELCOME

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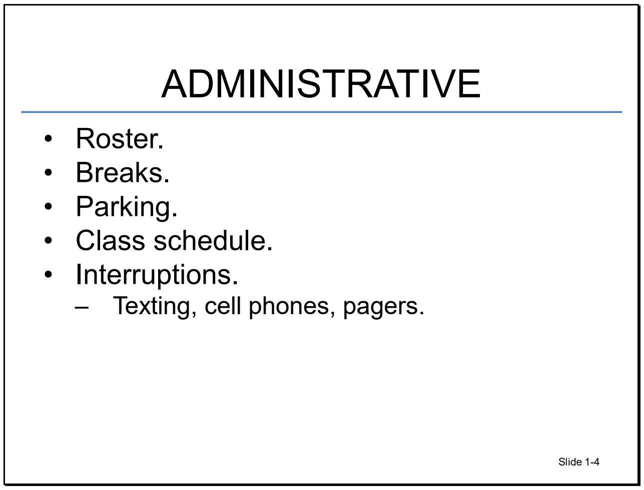
UNIT 1: INTRODUCTION

Slide 1-3

A. Instructor introduction.



B. Administrative matters.

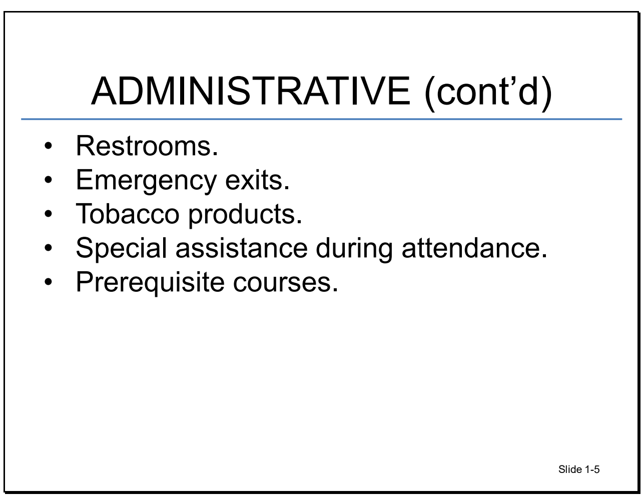
1. Roster.

2. Breaks: held in mornings and afternoons as needed.

3. Parking: The instructor or the local program sponsor will provide any necessary parking information.

4. Class schedule: Classes begin at 8 a.m. and end at approximately 5 p.m.

5. Interruptions: Please do not use mobile phones or texting devices while in class. This includes any venues used for class activities.



6. Restroom locations: The instructor or the local program sponsor will provide information on restroom locations.

7. Emergency exits: The instructor or the local program sponsor will provide information on emergency exits.

8. Tobacco products: No tobacco products are allowed in class.

9. Please let the instructors know of any required special assistance or health concerns experienced during attendance (e.g., symptoms of an illness, special allergies, medical, learning disabilities to include dyscalculia (math deficiency), dysgraphia (impaired fine motor skills, e.g., handwriting), dyslexia (reading impairments), etc.).

10. This course is appropriate for emergency response personnel and allied professionals having hazardous materials response or training responsibility certified at the technician/specialist level as referenced in Title 29 of the Code of Federal Regulations (CFR) Section 1910.120 or 40 CFR 311 and National Fire Protection Association (NFPA) standards.

    a. The students should have completed the following courses:

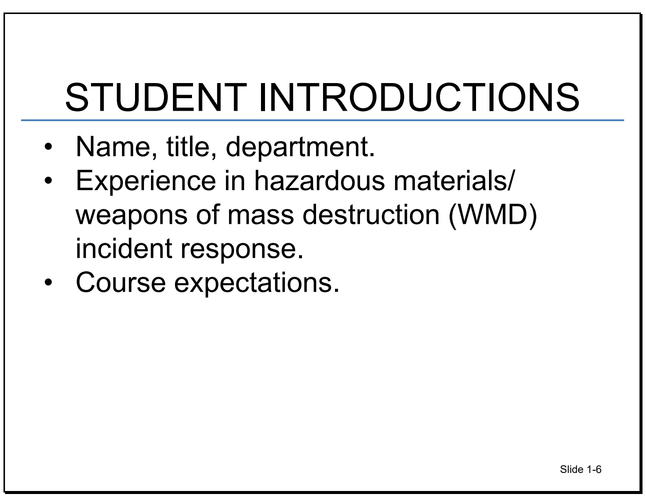
        - "ICS-100: An Introduction to the Incident Command System" (Q0462).

        - "ICS-200: Basic Incident Command System for Initial Response" (Q0463).

        - "ICS-300: Intermediate All-Hazard NIMS ICS Review for Expanding Incidents" (Q0464) or "Hazardous Materials Incident Management" (HMIM) (R0243).

    b. It is strongly recommended that students complete the "Chemistry for Emergency Response" (CER) (R0233) course or possess equivalent knowledge.

II. STUDENT INTRODUCTIONS

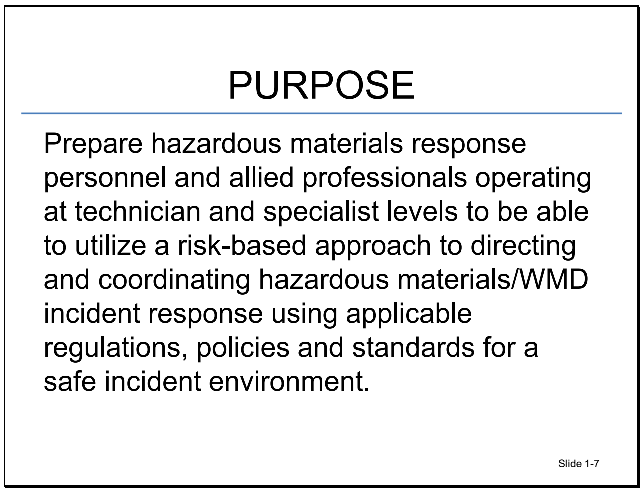


A. Name, title, department.

B. Experience in hazardous materials/weapons of mass destruction (WMD) incident response.

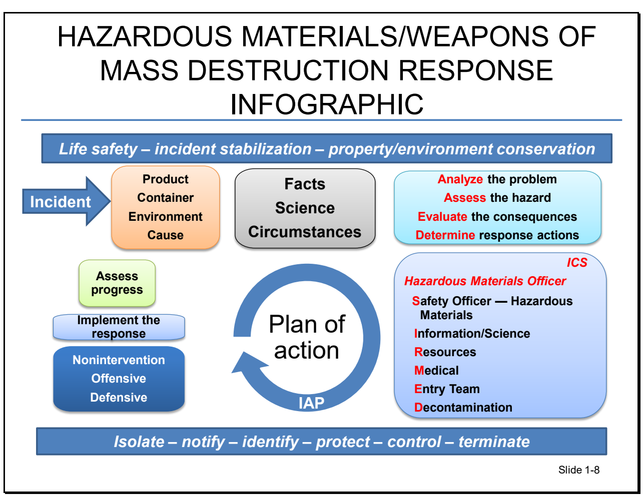
C. Course expectations.

III. COURSE INTRODUCTION



A. Course purpose.

1. This course is intended to prepare hazardous materials response personnel and allied professionals operating at technician and specialist levels to be able to utilize a risk-based approach to directing and coordinating hazardous materials/WMD incident response using applicable regulations, policies and standards for a safe incident environment.



2. Hazardous materials/WMD response infographic.

   The infographic starts when the incident begins. The thought process goes in a clockwise direction generally, understanding that some decision-making processes occur simultaneously and are ongoing.

   a. In the upper-left side of the graphic, you see the “Incident” arrow. This is where the process begins.

   b. The first arriving responders would then consider the state of the product, the container, the environment and the apparent cause.

   c. Based on the incident’s facts, science and circumstances, the responder can more effectively analyze the problem, assess the hazards, evaluate the consequences and determine response actions.

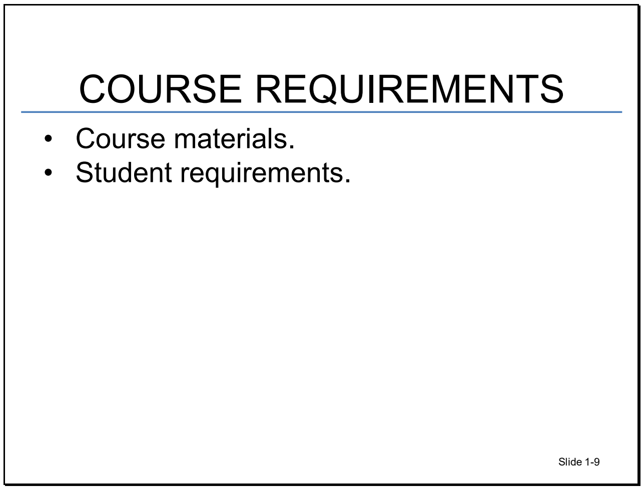
   d. Once the initial site assessment is completed (a through c) and a general picture of what is needed is determined, the organization can then be established: hazardous materials officer and SIRMED (Safety Officer — Hazardous Materials, Information/Science, Resources, Medical, Entry Team, Decontamination).

   e. A plan of action (Incident Command System (ICS) Forms 202, 204 and 208 HM) is established based on one of three operational modes: offensive, defensive or nonintervention.

   f. The hazardous materials branch/group executes the plan and implements the response.

   g. The safety and progress of the plan are then evaluated, and if any changes need to be implemented, those changes need to be communicated, and the cycle starts over again with a new direction, new data or new objectives based on the progress evaluation.

   h. The process follows the general decision model used in NFPA 470, *Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders*: Analyze, Plan, Implement, and Evaluate (APIE).



B. Course requirements.

Course materials.

1. Student Manual (SM).

   a. Instructional objectives are stated at the beginning of each unit in the SM.

      - Terminal objectives describe the on-the-job performance expected by the student after completing this course.

      - Enabling objectives specify what the student is to accomplish at any point in the course after receiving appropriate training.

   b. Activities are found within the SM where planned.

2. In the back of each unit, students will find a “Supplemental Materials” section pertinent to that specific unit.

3. The back of the SM contains appendices to use as references for the overall course.

4. Identification Data books containing data pertinent to activities will be provided to each table.

5. Additional handout materials will be provided during the course.

C. Student/course requirements.

1. Participation in class.

a. Attendance is required each day.

b. Participation is expected during all activities.

c. It is the student's responsibility to read the SM and associated materials in preparation for the course and final exam.

The final grade for this course consists of:

- Team Project (Activity 9.1): 25%.
- Final Exam (Activity 9.2): 50%.
- The Way Forward: Presentation (Activity 9.3): 25%.

d. Class seating and organization.

2. Respect the opinions of others.

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UNIT 2: RISK-BASED RESPONSE PROCESS AND STANDARD OF CARE

TERMINAL OBJECTIVE

The students will be able to:

2.1 Describe the risk-based response process within the standard of care, given a hazardous materials/weapons of mass destruction (WMD) scenario.

ENABLING OBJECTIVES

The students will be able to:

2.1 Describe the analysis process of risk-based response according to the standard of care.

2.2 Describe hazard assessment methods.

2.3 Describe methods for evaluating consequences.

2.4 Determine safe response actions using a risk-based response process.

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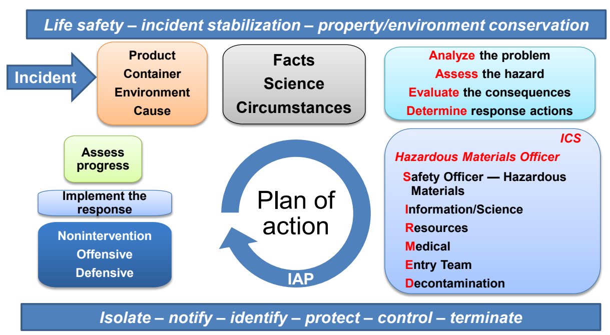
UNIT 2: RISK-BASED RESPONSE PROCESS AND STANDARD OF CARE

Slide 2-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



Slide 2-2

TERMINAL OBJECTIVE

Describe the risk-based response process within the standard of care, given a hazardous materials/weapons of mass destruction (WMD) scenario.

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ENABLING OBJECTIVES

- Describe the analysis process of risk-based response according to the standard of care.
- Describe hazard assessment methods.
- Describe methods for evaluating consequences.
- Determine safe response actions using a risk-based response process.

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I. STANDARD OF CARE

DEFINITION

The standard of care for a hazardous materials/WMD response is the expected level of response that a professional response team should follow given similar circumstances in a similar community.

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A. Definition.

1. The standard of care for a hazardous materials/weapons of mass destruction (WMD) response is the expected level of response that a professional response team should follow given similar circumstances in a similar community.

2. The standard of care is influenced by laws, regulations, standards, agency policies and guidelines, and leadership support for equipment, training, staffing and mission.

3. Agencies typically affected by this standard of care are fire department-based hazardous materials response teams, law enforcement teams, military domestic response teams, government environmental and public health response teams, industrial emergency response teams, and private spill response contractors.

INFLUENCES ON THE STANDARD OF CARE

- Laws, regulations, rules and standards.
- Agency specific.
  - Standard operating procedures (SOPs).
  - Standard operating guidelines (SOGs).
- Administrative support level.
  - Mission (response level) and capabilities.
  - Training, staffing and equipment.
  - Budget.

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B. Influences on the standard of care.

1. Laws, regulations, rules and standards.

2. Agency specific.

   a. Standard operating procedures (SOPs).

   b. Standard operating guidelines (SOGs).

3. Administrative support level.

   a. Mission (response level) and capabilities.

   b. Training, staffing and equipment.

   c. Budget.

LAWS — FEDERAL AND STATE

- Clean Water Act (CWA).
- Resource Conservation and Recovery Act (RCRA).
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- Superfund Amendments and Reauthorization Act (SARA).

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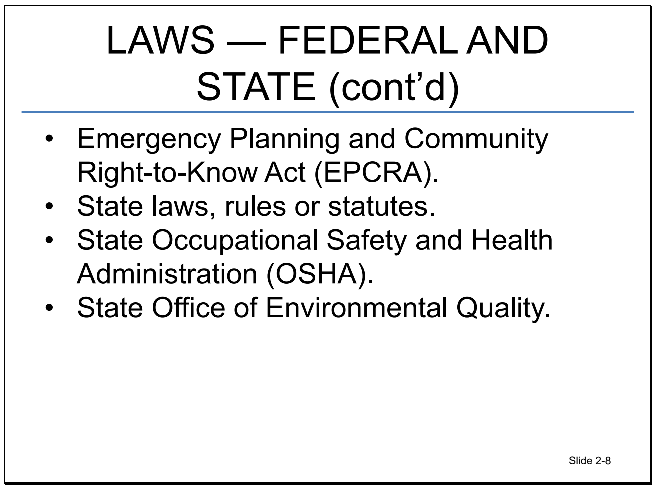
C. Laws — federal and state.

1. Clean Water Act (CWA) of 1972.

2. Resource Conservation and Recovery Act (RCRA) of 1976.

3. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

4. Superfund Amendments and Reauthorization Act (SARA) of 1986.



5. Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986.

6. State laws, rules or statutes.

   States have environmental enforcement and regulating agencies and associated statutes that provide regulating authority at a state level.

7. State Occupational Safety and Health Administration (OSHA).

   a. The following 22 states or territories have OSHA-approved state plans that cover both private and state and local government workers:

      - Alaska.

      - Arizona.

      - California.

      - Hawaii.

- Indiana.
- Iowa.
- Kentucky.
- Maryland.
- Michigan.
- Minnesota.
- Nevada.
- New Mexico.
- North Carolina.
- Oregon.
- Puerto Rico.
- South Carolina.
- Tennessee.
- Utah.
- Vermont.
- Virginia.
- Washington.
- Wyoming.

b. Connecticut, Illinois, Maine, New Jersey, New York and U.S. Virgin Islands have OSHA-approved state plans that cover only local government workers.

8. State Office of Environmental Quality.

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ACTIVITY 2.1

Standard of Care — Federal Laws and Regulations

Purpose

Research and learn about federal laws that impact standard of care for a hazardous materials/ WMD response.

Directions

1. The instructor will assign a federal law for each small group from the following list:

    a. CWA.

    b. CERCLA.

    c. SARA.

    d. EPCRA.

    e. RCRA.

2. In your small group, research the assigned federal law and prepare to briefly present the following information to the rest of the class.

    a. What the law states.

    b. How the law may impact standard of care for hazardous materials/WMD response.

3. The instructor will ask each group to present their researched federal law.

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I. STANDARD OF CARE (cont'd)

HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE 29 CODE OF FEDERAL REGULATIONS 1910.120

- Established and maintained by OSHA.
- Establishes health and safety requirements for employers engaged in these operations, as well as responses to emergencies involving releases of hazardous substances.

Slide 2-10

D. Hazardous Waste Operations and Emergency Response (HAZWOPER) 29 Code of Federal Regulations (CFR) 1910.120.

1. Established and maintained by OSHA.

2. Establishes health and safety requirements for employers engaged in these operations, as well as responses to emergencies involving releases of hazardous substances.

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ACTIVITY 2.2

Hazardous Waste Operations and Emergency Response 29 Code of Federal Regulations 1910.120

Purpose

Research and learn about HAZWOPER 29 CFR 1910.120.

Directions

1. Using OSHA's HAZWOPER Standard (29 CFR 1910.120), identify the sections and contents that apply to the following components of the hazardous materials response:

   a. Pre-incident requirements.

   ____

   ____

   ____

   b. Training requirements.

   ____

   ____

   ____

   c. Personal protective equipment (PPE) requirements.

   ____

   ____

   ____

   d. Position requirements.

   ____

   ____

   ____

2. Be prepared to share your responses with the larger group.

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I. STANDARD OF CARE (cont'd)

STANDARDS

- National Fire Protection Association (NFPA) — consensus and all hazards.
- Nongovernmental organizations (NGOs)
  – American Conference of Governmental Industrial Hygienists Inc. (ACGIH).
  – ASTM International.
  – American National Standards Institute (ANSI).

Slide 2-12

E. Standards.

1. National Fire Protection Association (NFPA) — consensus and all hazards.

2. Nongovernmental organizations (NGOs): Any nonprofit, citizen-based or faith-based group that functions independently from government control. They can have social, scientific or philanthropic missions for assistance.

   a. American Conference of Governmental Industrial Hygienists Inc. (ACGIH).

      - Occupational/environmental health and safety.

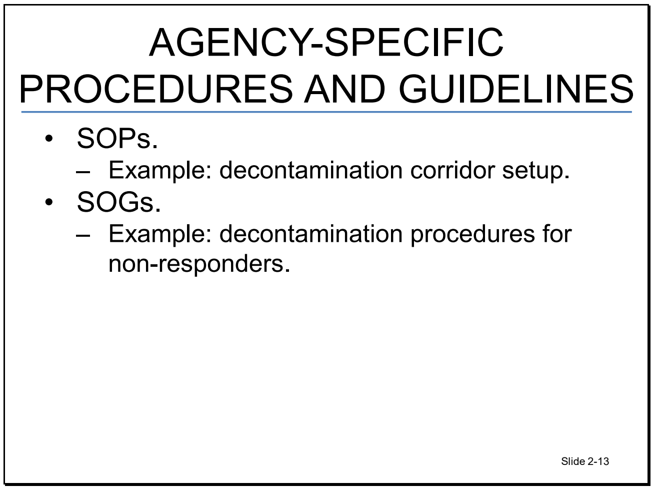
   b. ASTM International.

      - Research and production safety standards.

   c. American National Standards Institute (ANSI).

      - Technical/scientific standards.

      - A consensus standard.



F. Agency specific.

1. SOPs provide users with a step-by-step approach to a procedure.

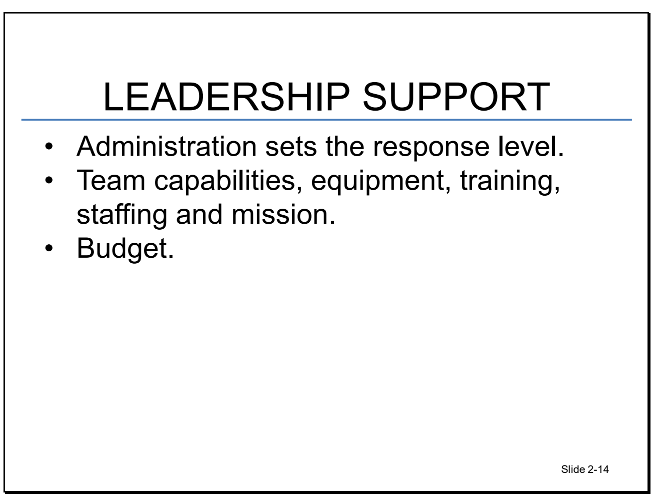
   a. Must do’s.

   b. Example: decontamination corridor setup.

2. SOGs provide a guideline for generalized direction. It is up to the user’s discretion whether to follow the guidelines completely. Deviations are due to changes driven by facts, science and circumstances of the incident and within the expertise of the user.

   a. May do’s.

   b. Example: decontamination procedures for non-responders.



G. Leadership support.

1. Administration sets the response level based on elements such as the community needs and expectations.

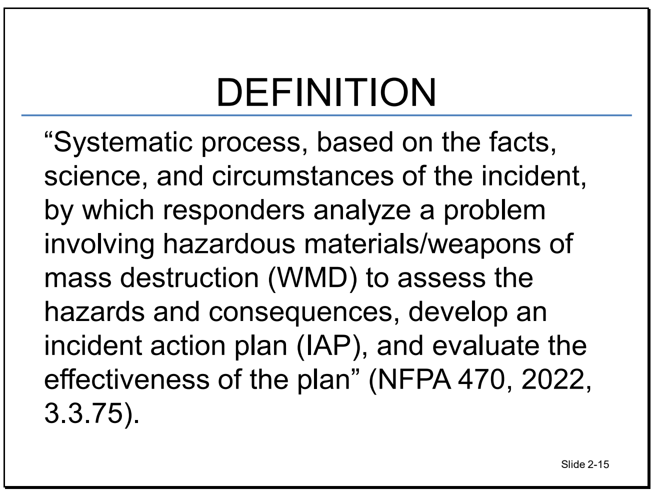
2. Team capabilities, equipment, training, staffing and mission.

   The capabilities of any agency depend on the quality and capacity of the equipment they carry, the caliber and frequency of the training they receive, and the number of personnel assigned to carry out a specific and well-defined mission.

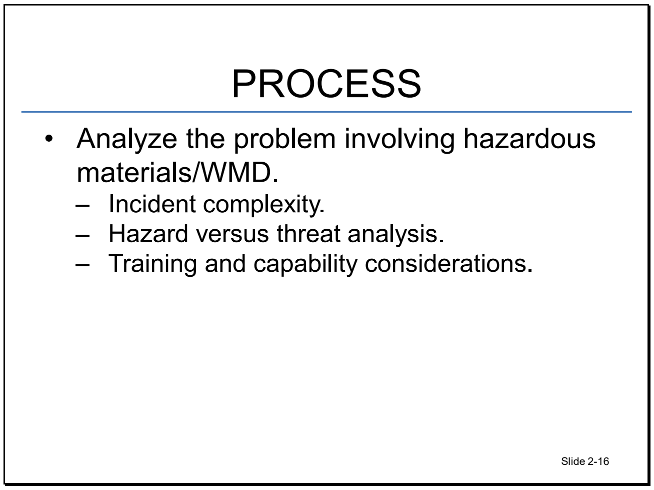
3. Budget.

   The measure of any agency administrator's support for a department's capabilities ultimately lies in how much of their operating budget they allocate to keep the mission viable. The budget has a direct impact to the team capabilities.

II. RISK-BASED RESPONSE



A. Definition: "Systematic process, based on the facts, science, and circumstances of the incident, by which responders analyze a problem involving hazardous materials/WMD to assess the hazards and consequences, develop an incident action plan (IAP), and evaluate the effectiveness of the plan" (NFPA 470, 2022, 3.3.75).



B. Process: All decisions made on scene will be made after considering the facts, science and circumstances of the incident at each phase of the process. The process begins with analysis.

1. Analyze the problem involving hazardous materials/WMD.

   Definition of “analyze”: “To identify a hazardous materials/WMD problem and determining likely behavior and harm within the training and capabilities of the emergency responder” (NFPA 470, 2022, 3.3.3).

   a. Incident complexity.

   b. Hazard versus threat analysis.

      - Hazard.

        -- Primary and subsequent potential.

        -- Containers, Safety Data Sheet (SDS), metering, detection, sampling, analysis of data.

        -- Likely behavior and harm.

        -- Classification versus identification of materials.

      - Threat.

        -- Human — force protection considerations.

        -- Natural.

-- Terrorism: law enforcement intelligence and partnerships; intelligence and investigation section/ staffing.

c. Training and capability considerations.

- Vulnerabilities.

  -- We are vulnerable to what we cannot respond to because of a lack of support, resources, training or personnel. These all make us vulnerable to a hazard or threat.

  -- For example, without body armor, tactical medics should not enter an active shooter incident.

- Impact on the hazard or threat.

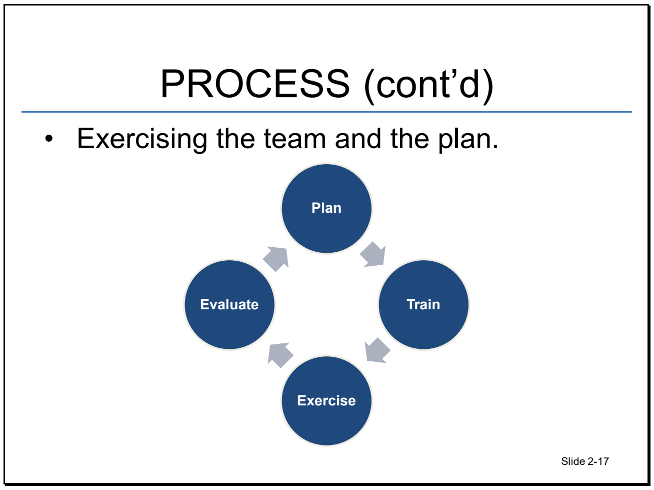
  -- Hazards and threats can be managed effectively with the proper training and capabilities. Without these, they cannot be managed.

- Certifications, re-certifications and credentialing.

  -- Personnel prove their value to the response by producing credentials that reflect their level of training and that their certifications and qualifications are current. Without credentialing, supervisors and unit leaders have no idea of the capabilities of any individual.

- Caliber and frequency of training.

  -- Instructors and programs should be researched, vetted and relevant to the mission before any training is scheduled.



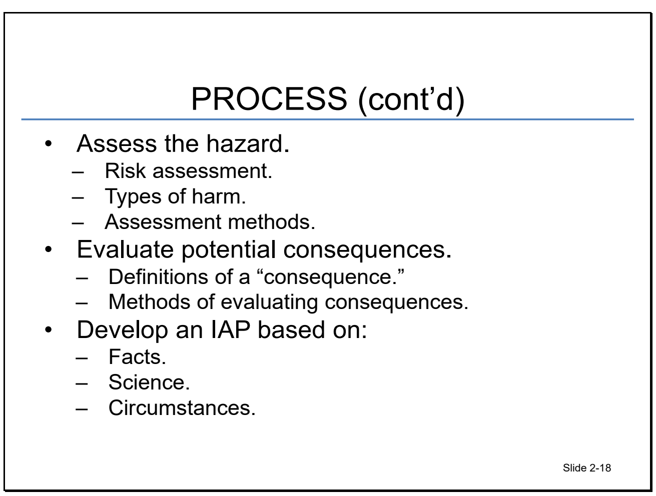
- Exercising the team and the plan.

  -- Having a written response plan, such as SOPs and SOGs, requires a team to exercise those plans. Exercising the response plan makes a proficient team.

- Support from leadership.

  -- Agency administrators and team leadership must provide the team with the capabilities to execute the mission.

  -- Without the proper support for the delivery of quality training, equipment and exercises, the trust of leadership will weaken and pose a danger to responders who are called into service unprepared. Support is critical to success, and success is a safely executed mission.



2. Assess the hazard.

   a. Risk assessment.

      - Definitions of "risk."

        -- "The probability that a substance or situation will produce harm under specified conditions, determined by a combination of two factors: (1) the probability that an adverse event will occur, and (2) the severity of the consequences of the adverse event" (NFPA, 2021).

        -- "Possibility of loss or injury" (Merriam-Webster, n.d.).

        -- Synonyms include danger, hazard, menace, peril, threat, trouble and pitfall.

      - Probability or possibility of harm is based on the quality of the assessment.

      - Judgement is based on as much information as a responder can safely gather.

   b. Types of harm (not an all-inclusive list).

      - Thermal.

      - Radiological.

      - Asphyxiation.

      - Chemical.

      - Etiological.

      - Mechanical.

   c. Assessment methods.

      - Monitoring and detection technologies.

        -- Classification technologies.

        -- Identification technologies.

-- Interpretation of data (good and bad data).

- Documentation and referencing.

  -- Shipping papers.

  -- SDSs and printed books/pamphlets.

  -- E-databases (e.g., mobile apps, computer databases).

- Direct human information.

  -- Technical specialists.

  -- Product specialists.

  -- Facility personnel.

  -- Interrogation and/or interviews.

- Experience backed by science.

  -- Avoiding group think.

  -- Combined experience is much more reliable than individual experience.

- Product, container, environment.

3. Evaluate potential consequences.

   a. Definitions of a "consequence."

      - "Something produced by a cause or necessarily following from a set of conditions" (Merriam-Webster, n.d.).

      - The results or the effect of an incident, impacting community, personnel, resources and response.

   b. Methods for evaluating consequences.

      - Based on known vulnerabilities of the community and agency and the capabilities of the agency.

        -- Analyze data.

        -- Research hazards.

-- Estimate harm.

-- If you increase capabilities and reduce vulnerabilities, you minimize the consequences.

- Value of pre-incident planning and emergency response plans.

-- Specific facilities.

-- Community and agency.

-- Local Emergency Planning Committee (LEPC) and Emergency Operations Center (EOC).

4. Develop an IAP.

a. After analysis and assessment, a plan can be developed and an operational mode established.

- Making the decision to move forward with one of three operational modes based on all available incident data and "appropriate" response actions.

b. The Incident Commander (IC) establishes the incident objectives, and the hazardous materials officer establishes the strategies and tactics to accomplish the objectives.

c. Important elements of good decision-making.

- Understanding the standard of care.

- Knowing the vulnerabilities and capabilities of the response agency.

- Gathering as much data as can be safely gathered.

-- Analyzing the problem.

-- Assessing the hazard or threat.

- Interpreting the incident data correctly and completely considering:

-- Facts.

-- Science.

-- Circumstances.

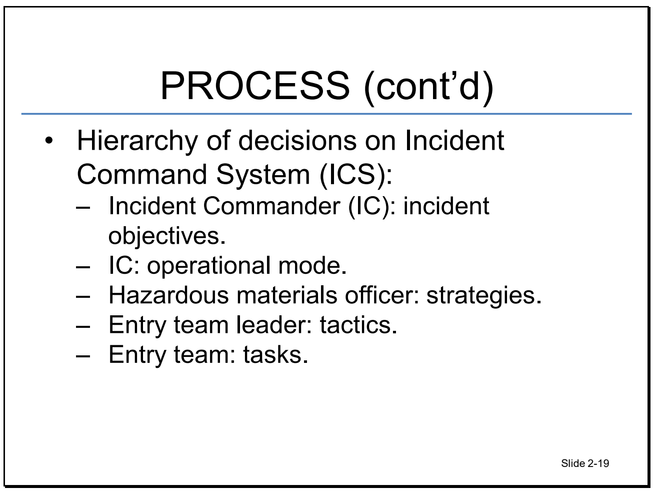
- Implementing the plan — response actions put into action.

d. All decisions are based on facts, science and circumstances with incident priorities in mind:

- Life safety.

- Incident stabilization.

- Protection of property and environment.



e. Hierarchy of decisions in the Incident Command System (ICS) based on NFPA:

- IC: incident objectives.

- IC: operational mode.

- Hazardous materials officer: strategies.

- Entry team leader: tactics.

- Entry team: tasks.

PROCESS (cont'd)

- Evaluate the effectiveness of the plan.
  - Observable results.
  - New facts or circumstances.
  - Are we making progress?

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5. Evaluate the effectiveness of the plan.

   a. Make the appropriate adjustments based on additional and/or new facts or circumstances.

   b. Are we making progress toward achieving the IC's objectives?

   c. Correct the plan if necessary.

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ACTIVITY 2.3

Risk-Based Response

Purpose

Practice applying the risk-based process to real-life situations.

Directions

1. The instructor will assign a scenario to each small group.
2. In your small group, review the assigned scenario.
3. Apply the risk-based process to the assigned scenario.
    a. Analyze the problem involving hazardous materials/WMD.
    b. Assess the hazard.
    c. Evaluate potential consequences.
    d. Determine appropriate response actions.
4. Be prepared to share your group work with the class.

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ACTIVITY 2.3 (cont'd)

Scenarios

Scenario 1 — Unknown Powder

- Product: white powder.
- Container: inside a coffee filter, as well as some spilled residue.
- Environment: basement of a residential apartment building — 62 F, 77% relative humidity (RH).
  - Work bench area in a furnace room.
  - Various homemade containers, glass jars filled with cloudy liquids, petri dishes, hotplates, multiple refrigerators — warm.
- FBI arrested the building superintendent and requested your support for an assessment of the area.
- Detection and metering: lower explosive limit (LEL), O_2, H_2S, normal, CO 2 parts per million (ppm); photoionization detector (PID) – 210 ppm; protein kit – positive; pH – neutral, F – negative, KI – negative.

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Scenario 2 — Unknown Gas

- Product: unknown gas.
- Container: yellow, 1-ton cylinder.
- Environment: metal salvage yard — 89 F, 87% RH, 1-4 miles per hour (mph) wind.
- Heavy machinery operator punctures a yellow, 1-ton cylinder and is overcome by a strong odor of “burning matches.” Supervisor calls 911 to report the exposure and is also overcome by the gas along with three customers dropping off metal for recycling. All complain of difficulty breathing and severe eye and throat irritation.
- Detection and metering: LEL 0%, O_2 20.9%, H_2S 20 ppm, CO 0 ppm; PID – 778 parts per billion (ppb); wetted pH – red; F – negative, KI – negative.

Scenario 3 — Liquid Spill

- Product: liquid pool.
- Container: MC306 — Placard reads 3475 (E85); spilled around fuel pumps at a gas station; approximate dimensions of the spill are 40 x 60 feet.
- Environment: gas station/convenience store — 91 F, 68% RH, 10 mph wind.
- Detection and metering: LEL 9%, O_2 20.9%, H_2S 0 ppm, CO 1 ppm; PID-440 ppm with a conversion factor of 10.

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Scenario 4 — Propane Tanker Rollover

- Product: propane.
- Container: MC 331.
- Environment: 29 F, 78% RH, 4-8 mph wind; off the shoulder of the freeway in deep snow; low-speed rollover after trying to avoid a collision on snowy roads; 50 feet from residential homes along the freeway.
- Detection and metering: LEL, O_2, H_2S, CO normal; PID – 19 ppm upwind.

Scenario 5 – Cold Storage

- Product: ammonia.
- Container: piping — union leak in piping.
- Environment: inside an insulated cold-storage warehouse; pipe is running through the roof trusses; 10 feet off the floor; inside a 40,000 square foot freezer area.
- Detection and metering: LEL 9%, O_2 18.9%, H_2S 0 ppm, CO 0 ppm; PID – 10,110 ppm, NH_3 sensor – 200 ppm; wetted pH – blue.

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III. SUMMARY

FEMA

SUMMARY

U.S. Fire Administration

- Standard of care.
- Risk-based response.

Slide 2-22

- What have you learned in this unit?
- Do you have any questions?

Slide 2-23

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SUPPLEMENTAL MATERIAL

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Hazardous Waste Operations and Emergency Response (HAZWOPER) 29 CFR 1910.120

1910.120(a)
Scope, application, and definitions. --
1910.120(a)(1)
Scope. This section covers the following operations, unless the employer can demonstrate that the operation does not involve employee exposure or the reasonable possibility for employee exposure to safety or health hazards:
1910.120(a)(1)(i)
Clean-up operations required by a governmental body, whether Federal, state local or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority Site List (NPL), state priority site lists, sites recommended for the EPA NPL, and initial investigations of government identified sites which are conducted before the presence or absence of hazardous substances has been ascertained);
1910.120(a)(1)(ii)
Corrective actions involving clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 *et seq*);
1910.120(a)(1)(iii)
Voluntary clean-up operations at sites recognized by Federal, state, local or other governmental bodies as uncontrolled hazardous waste sites;
1910.120(a)(1)(iv)
Operations involving hazardous waste that are conducted at treatment, storage, disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA; or by agencies under agreement with U.S.E.P.A. to implement RCRA regulations; and
1910.120(a)(1)(v)
Emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.
1910.120(a)(2)
Application.
1910.120(a)(2)(i)
All requirements of Part 1910 and Part 1926 of Title 29 of the Code of Federal Regulations apply pursuant to their terms to hazardous waste and emergency response operations whether covered by this section or not. If there is a conflict or overlap, the provision more protective of employee safety and health shall apply without regard to 29 CFR 1910.5(c)(1).
1910.120(a)(2)(ii)
Hazardous substance clean-up operations within the scope of paragraphs (a)(1)(i) through (a)(1)(iii) of this section must comply with all paragraphs of this section except paragraphs (p) and (q).
1910.120(a)(2)(iii)
Operations within the scope of paragraph (a)(1)(iv) of this section must comply only with the requirements of paragraph (p) of this section.

Notes and Exceptions:
1910.120(a)(2)(iii)(A)
All provisions of paragraph (p) of this section cover any treatment, storage or disposal (TSD) operation regulated by 40 CFR parts 264 and 265 or by state law authorized under RCRA, and required to have a permit or interim status from EPA pursuant to 40 CFR 270.1 or from a state agency pursuant to RCRA.
1910.120(a)(2)(iii)(B)

Employers who are not required to have a permit or interim status because they are conditionally exempt small quantity generators under 40 CFR 261.5 or are generators who qualify under 40 CFR 262.34 for exemptions from regulation under 40 CFR parts 264, 265 and 270 ("excepted employers") are not covered by paragraphs (p)(1) through (p)(7) of this section. Excepted employers who are required by the EPA or state agency to have their employees engage in emergency response or who direct their employees to engage in emergency response are covered by paragraph (p)(8) of this section, and cannot be exempted by (p)(8)(i) of this section.

1910.120(a)(2)(iii)(C)
If an area is used primarily for treatment, storage or disposal, any emergency response operations in that area shall comply with paragraph (p) (8) of this section. In other areas not used primarily for treatment, storage, or disposal, any emergency response operations shall comply with paragraph (q) of this section. Compliance with the requirements of paragraph (q) of this section shall be deemed to be in compliance with the requirements of paragraph (p)(8) of this section.
1910.120(a)(2)(iv)
Emergency response operations for releases of, or substantial threats of releases of, hazardous substances which are not covered by paragraphs (a)(1)(i) through (a)(1)(iv) of this section must only comply with the requirements of paragraph (q) of this section.
1910.120(a)(3)
Definitions --

Buddy system means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

Clean-up operation means an operation where hazardous substances are removed, contained, incinerated, neutralized,d stabilized, cleared-up, or in any other manner processed or handled with the ultimate goal of making the site safer for people or the environment.

Decontamination means the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

Emergency response or *responding to emergencies* means a response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

Facility means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any water-borne vessel.

Hazardous materials response (HAZMAT) team means an organized group of employees, designated by the employer, who are expected to perform work to handle and control actual or potential leaks or spills of hazardous substances requiring possible close approach to the substance. The team members perform responses to releases or potential releases of hazardous substances for the purpose of control or stabilization of the incident. A HAZMAT team is not a fire brigade nor is a typical fire brigade a HAZMAT team. A HAZMAT team, however, may be a separate component of a fire brigade or fire department.

Hazardous substance means any substance designated or listed under (A) through (D) of this definition, exposure to which results or may result in adverse effects on the health or safety of employees:

[A] Any substance defined under section 103(14) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (42 U.S.C. 9601).

[B] Any biologic agent and other disease causing agent which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such persons or their offspring.

[C] Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices; and

[D] Hazardous waste as herein defined.

Hazardous waste means --

[A] A waste or combination of wastes as defined in 40 CFR 261.3, or

[B] Those substances defined as hazardous wastes in 49 CFR 171.8.

Hazardous waste operation means any operation conducted within the scope of this standard.

Hazardous waste site or *Site* means any facility or location within the scope of this standard at which hazardous waste operations take place.

Health hazard means a chemical or a pathogen where acute or chronic health effects may occur in exposed employees. It also includes stress due to temperature extremes. The term *health hazard* includes chemicals that are classified in accordance with the Hazard Communication Standard, 29 CFR 1910.1200, as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration toxicity or simple asphyxiant. (*See* Appendix A to § 1910.1200—Health Hazard Criteria (Mandatory) for the criteria for determining whether a chemical is classified as a health hazard.)

IDLH or *Immediately dangerous to life or health* means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape from a dangerous atmosphere.

Oxygen deficiency means that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

Permissible exposure limit means the exposure, inhalation or dermal permissible exposure limit specified in 29 CFR Part 1910, Subparts G and Z.

Published exposure level means the exposure limits published in "NIOSH Recommendations for Occupational Health Standards" dated 1986, which is incorporated by reference as specified in § 1910.6, or if none is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1987-88" dated 1987, which is incorporated by reference as specified in § 1910.6.

Post emergency response means that portion of an emergency response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the site has begun. If post emergency response is performed by an employer's own employees who were part of the initial emergency response, it is considered to be part of the initial response and not post emergency response. However, if a group of an employer's own employees, separate from the group providing initial response, performs the clean-up operation, then the separate group of employees would be considered to be performing post-emergency response and subject to paragraph (q)(11) of this section.

Qualified person means a person with specific training, knowledge and experience in the area for which the person has the responsibility and the authority to control.

Site safety and health supervisor (or official) means the individual located on a hazardous waste site who is responsible to the employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

Small quantity generator means a generator of hazardous wastes who in any calendar month generates no more than 1,000 kilograms (2,205) pounds of hazardous waste in that month.

Uncontrolled hazardous waste site means an area identified as an uncontrolled hazardous waste site by a governmental body, whether Federal, state, local or other where an accumulation of hazardous substances creates a threat to the health and safety of individuals or the environment or both. Some sites are found on public lands such as those created by former municipal, county or state landfills where illegal or poorly managed waste disposal has taken place. Other sites are found on private property, often belonging to generators or former generators of hazardous substance wastes. Examples of such sites include, but are not limited to, surface impoundments, landfills, dumps, and tank or drum farms. Normal operations at TSD sites are not covered by this definition.

1910.120(b)
Safety and health program.

NOTE TO (b): Safety and health programs developed and implemented to meet other federal, state, or local regulations are considered acceptable in meeting this requirement if they cover or are modified to cover the topics required in this paragraph. An additional or separate safety and health program is not required by this paragraph.
1910.120(b)(1)
General.
1910.120(b)(1)(i)
Employers shall develop and implement a written safety and health program for their employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations.
1910.120(b)(1)(ii)
The written safety and health program shall incorporate the following:
1910.120(b)(1)(ii)(A)
An organizational structure;
1910.120(b)(1)(ii)(B)
A comprehensive workplan;
1910.120(b)(1)(ii)(C)
A site-specific safety and health plan which need not repeat the employer's standard operating procedures required in paragraph (b)(1)(ii)(F) of this section;
1910.120(b)(1)(ii)(D)
The safety and health training program;
1910.120(b)(1)(ii)(E)
The medical surveillance program;
1910.120(b)(1)(ii)(F)
The employer's standard operating procedures for safety and health; and
1910.120(b)(1)(ii)(G)
Any necessary interface between general program and site specific activities.

1910.120(b)(1)(iii)
Site excavation. Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped as appropriate to prevent accidental collapse in accordance with Subpart P of 29 CFR Part 1926.
1910.120(b)(1)(iv)
Contractors and sub-contractors. An employer who retains contractor or sub-contractor services for work in hazardous waste operations shall inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by the employer's information program.
1910.120(b)(1)(v)
Program availability. The written safety and health program shall be made available to any contractor or subcontractor or their representative who will be involved with the hazardous waste operation; to employees; to employee designated representatives; to OSHA personnel, and to personnel of other Federal, state, or local agencies with regulatory authority over the site.
1910.120(b)(2)
Organizational structure part of the site program. --
1910.120(b)(2)(i)
The organizational structure part of the program shall establish the specific chain of command and specify the overall responsibilities of supervisors and employees. It shall include, at a minimum, the following elements:
1910.120(b)(2)(i)(A)
A general supervisor who has the responsibility and authority to direct all hazardous waste operations.
1910.120(b)(2)(i)(B)
A site safety and health supervisor who has the responsibility and authority to develop and implement the site safety and health plan and verify compliance.
1910.120(b)(2)(i)(C)
All other personnel needed for hazardous waste site operations and emergency response and their general functions and responsibilities.
1910.120(b)(2)(i)(D)
The lines of authority, responsibility, and communication.
1910.120(b)(2)(ii)
The organizational structure shall be reviewed and updated as necessary to reflect the current status of waste site operations.
1910.120(b)(3)
Comprehensive workplan part of the site program. The comprehensive workplan part of the program shall address the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives.
1910.120(b)(3)(i)
The comprehensive workplan shall address anticipated clean-up activities as well as normal operating procedures which need not repeat the employer's procedures available elsewhere.
1910.120(b)(3)(ii)
The comprehensive workplan shall define work tasks and objectives and identify the methods for accomplishing those tasks and objectives.
1910.120(b)(3)(iii)
The comprehensive workplan shall establish personnel requirements for implementing the plan.
1910.120(b)(3)(iv)
The comprehensive workplan shall provide for the implementation of the training required in paragraph (e) of this section.
1910.120(b)(3)(v)
The comprehensive workplan shall provide for the implementation of the required informational programs required in paragraph (i) of this section.
1910.120(b)(3)(vi)
The comprehensive workplan shall provide for the implementation of the medical surveillance program described in paragraph (f) if this section.
1910.120(b)(4)
Site-specific safety and health plan part of the program. --

1910.120(b)(4)(i)
General. The site safety and health plan, which must be kept on site, shall address the safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection.
1910.120(b)(4)(ii)
Elements. The site safety and health plan, as a minimum, shall address the following:
1910.120(b)(4)(ii)(A)
A safety and health risk or hazard analysis for each site task and operation found in the workplan.
1910.120(b)(4)(ii)(B)
Employee training assignments to assure compliance with paragraph (e) of this section.
1910.120(b)(4)(ii)(C)
Personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program in paragraph (g)(5) of this section.
1910.120(b)(4)(ii)(D)
Medical surveillance requirements in accordance with the program in paragraph (f) of this section.
1910.120(b)(4)(ii)(E)
Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.
1910.120(b)(4)(ii)(F)
Site control measures in accordance with the site control program required in paragraph (d) of this section.
1910.120(b)(4)(ii)(G)
Decontamination procedures in accordance with paragraph (k) of this section.
1910.120(b)(4)(ii)(H)
An emergency response plan meeting the requirements of paragraph (l) of this section for safe and effective responses to emergencies, including the necessary PPE and other equipment.
1910.120(b)(4)(ii)(I)
Confined space entry procedures.
1910.120(b)(4)(ii)(J)
A spill containment program meeting the requirements of paragraph (j) of this section.
1910.120(b)(4)(iii)
Pre-entry briefing. The site specific safety and health plan shall provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that this plan is being followed. The information and data obtained from site characterization and analysis work required in paragraph (c) of this section shall be used to prepare and update the site safety and health plan.
1910.120(b)(4)(iv)
Effectiveness of site safety and health plan. Inspections shall be conducted by the site safety and health supervisor or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health, acting on behalf of the employer as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by the employer.
1910.120(c)
Site characterization and analysis --
1910.120(c)(1)
General. Hazardous waste sites shall be evaluated in accordance with this paragraph to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards.
1910.120(c)(2)
Preliminary evaluation. A preliminary evaluation of a site's characteristics shall be performed prior to site entry by a qualified person in order to aid in the selection of appropriate employee protection methods prior to site entry. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed by a qualified person in order to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

1910.120(c)(3)
Hazard identification. All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that may cause death or serious harm shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.
1910.120(c)(4)
Required information. The following information to the extent available shall be obtained by the employer prior to allowing employees to enter a site:
1910.120(c)(4)(i)
Location and approximate size of the site.
1910.120(c)(4)(ii)
Description of the response activity and/or the job task to be performed.
1910.120(c)(4)(iii)
Duration of the planned employee activity.
1910.120(c)(4)(iv)
Site topography and accessibility by air and roads.
1910.120(c)(4)(v)
Safety and health hazards expected at the site.
1910.120(c)(4)(vi)
Pathways for hazardous substance dispersion.
1910.120(c)(4)(vii)
Present status and capabilities of emergency response teams that would provide assistance to on-site employees at the time of an emergency.
1910.120(c)(4)(viii)
Hazardous substances and health hazards involved or expected at the site and their chemical and physical properties.
1910.120(c)(5)
Personal protective equipment. Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:
1910.120(c)(5)(i)
Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no permissible exposure limit or published exposure level, the employer may use other published studies and information as a guide to appropriate personal protective equipment.
1910.120(c)(5)(ii)
If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least five minute's duration shall be carried by employees during initial site entry.
1910.120(c)(5)(iii)
If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site an ensemble providing equivalent to Level B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions. (See Appendix B for guidelines on Level B protective equipment.)
1910.120(c)(5)(iv)
Once the hazards of the site have been identified, the appropriate PPE shall be selected and used in accordance with paragraph (g) of this section.
1910.120(c)(6)
Monitoring. The following monitoring shall be conducted during initial site entry when the site evaluation produces information which shows the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient reasonably to eliminate these possible conditions:

1910.120(c)(6)(i)
Monitoring with direct reading instruments for hazardous levels of ionizing radiation.
1910.120(c)(6)(ii)
Monitoring the air with appropriate direct reading test equipment for (i.e., combustible gas meters, detector tubes) for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances.)
1910.120(c)(6)(iii)
Visually observing for signs of actual or potential IDLH or other dangerous conditions.
1910.120(c)(6)(iv)
An ongoing air monitoring program in accordance with paragraph (h) of this section shall be implemented after site characterization has determined the site is safe for the start-up of operations.
1910.120(c)(7)
Risk identification. Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified. In situations covered by the Hazard Communication Standard, 29 CFR 1910.1200, training required by that standard need not be duplicated.

NOTE TO PARAGRAPH (c)(7). - Risks to consider include, but are not limited to:

[a] Exposures exceeding the permissible exposure limits and published exposure levels.
[b] IDLH Concentrations.
[c] Potential Skin Absorption and Irritation Sources.
[d] Potential Eye Irritation Sources.
[e] Explosion Sensitivity and Flammability Ranges.
[f] Oxygen deficiency.
1910.120(c)(8)
Employee notification. Any information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees prior to the commencement of their work activities. The employer may utilize information developed for the hazard communication standard for this purpose.
1910.120(d)
Site control. --
1910.120(d)(1)
General. Appropriate site control procedures shall be implemented to control employee exposure to hazardous substances before clean-up work begins.
1910.120(d)(2)
Site control program. A site control program for protecting employees which is part of the employer's site safety and health program required in paragraph (b) of this section shall be developed during the planning stages of a hazardous waste clean-up operation and modified as necessary as new information becomes available.
1910.120(d)(3)
Elements of the site control program. The site control program shall, as a minimum, include: A site map; site work zones; the use of a "buddy system"; site communications including alerting means for emergencies; the standard operating procedures or safe work practices; and, identification of the nearest medical assistance. Where these requirements are covered elsewhere they need not be repeated.

1910.120(e)
Training. --
1910.120(e)(1)
General.
1910.120(e)(1)(i)
All employees working on site (such as but not limited to equipment operators, general laborers and others) exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the site shall receive training meeting the requirements of this paragraph

before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards, and they shall receive review training as specified in this paragraph.
1910.120(e)(1)(ii)
Employees shall not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility.
1910.120(e)(2)
Elements to be covered. The training shall thoroughly cover the following:
1910.120(e)(2)(i)
Names of personnel and alternates responsible for site safety and health;
1910.120(e)(2)(ii)
Safety, health and other hazards present on the site;
1910.120(e)(2)(iii)
Use of personal protective equipment;
1910.120(e)(2)(iv)
Work practices by which the employee can minimize risks from hazards;
1910.120(e)(2)(v)
Safe use of engineering controls and equipment on the site;
1910.120(e)(2)(vi)
Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards; and
1910.120(e)(2)(vii)
The contents of paragraphs (G) through (J) of the site safety and health plan set forth in paragraph (b)(4)(ii) of this section.
1910.120(e)(3)
Initial training.
1910.120(e)(3)(i)
General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off the site, and a minimum of three days actual field experience under the direct supervision of a trained experienced supervisor.
1910.120(e)(3)(ii)
Workers on site only occasionally for a specific limited task (such as, but not limited to, ground water monitoring, land surveying, or geophysical surveying) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of instruction off the site, and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.
1910.120(e)(3)(iii)
Workers regularly on site who work in areas which have been monitored and fully characterized indicating that exposures are under permissible exposure limits and published exposure limits where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site, and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.
1910.120(e)(3)(iv)
Workers with 24 hours of training who are covered by paragraphs (e)(3)(ii) and (e)(3)(iii) of this section, and who become general site workers or who are required to wear respirators, shall have the additional 16 hours and two days of training necessary to total the training specified in paragraph (e)(3)(i).
1910.120(e)(4)
Management and supervisor training. On-site management and supervisors directly responsible for, or who supervise employees engaged in, hazardous waste operations shall receive 40 hours initial training, and three days of supervised field experience (the training may be reduced to 24 hours and one day if the only area of their responsibility is employees covered by paragraphs (e)(3)(ii) and (e)(3)(iii)) and at least eight additional hours of specialized training at the time of job assignment on such topics as, but not limited to, the employer's safety and health program and the associated employee training program,

personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques.
1910.120(e)(5)
Qualifications for trainers. Trainers shall be qualified to instruct employees about the subject matter that is being presented in training. Such trainers shall have satisfactorily completed a training program for teaching the subjects they are expected to teach, or they shall have the academic credentials and instructional experience necessary for teaching the subjects. Instructors shall demonstrate competent instructional skills and knowledge of the applicable subject matter.
1910.120(e)(6)
Training certification. Employees and supervisors that have received and successfully completed the training and field experience specified in paragraphs (e)(1) through (e)(4) of this section shall be certified by their instructor or the head instructor and trained supervisor as having completed the necessary training. A written certificate shall be given to each person so certified. Any person who has not been so certified or who does not meet the requirements of paragraph (e)(9) of this section shall be prohibited from engaging in hazardous waste operations.
1910.120(e)(7)
Emergency response. Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances shall be trained in how to respond to such expected emergencies.
1910.120(e)(8)
Refresher training. Employees specified in paragraph (e)(1) of this section, and managers and supervisors specified in paragraph (e)(4) of this section, shall receive eight hours of refresher training annually on the items specified in paragraph (e)(2) and/or (e)(4) of this section, any critique of incidents that have occurred in the past year that can serve as training examples of related work, and other relevant topics.
1910.120(e)(9)
Equivalent training. Employers who can show by documentation or certification that an employee's work experience and/or training has resulted in training equivalent to that training required in paragraphs (e)(1) through (e)(4) of this section shall not be required to provide the initial training requirements of those paragraphs to such employees and shall provide a copy of the certification or documentation to the employee upon request. However, certified employees or employees with equivalent training new to a site shall receive appropriate, site specific training before site entry and have appropriate supervised field experience at the new site. Equivalent training includes any academic training or the training that existing employees might have already received from actual hazardous waste site experience.
1910.120(f)
Medical surveillance --
1910.120(f)(1)
General. Employees engaged in operations specified in paragraphs (a)(1)(i) through (a)(1)(iv) of this section and not covered by (a)(2)(iii) exceptions and employers of employees specified in paragraph (q)(9) shall institute a medical surveillance program in accordance with this paragraph.
1910.120(f)(2)
Employees covered. The medical surveillance program shall be instituted by the employer for the following employees:
1910.120(f)(2)(i)
All employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year;
1910.120(f)(2)(ii)
All employees who wear a respirator for 30 days or more a year or as required by § 1910.134;
1910.120(f)(2)(iii)
All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation; and
1910.120(f)(2)(iv)
Members of HAZMAT teams.
1910.120(f)(3)

Frequency of medical examinations and consultations. Medical examinations and consultations shall be made available by the employer to each employee covered under paragraph (f)(2) of this section on the following schedules:
1910.120(f)(3)(i)
For employees covered under paragraphs (f)(2)(i), (f)(2)(ii), and (f)(2)(iv);
1910.120(f)(3)(i)(A)
Prior to assignment;
1910.120(f)(3)(i)(B)
At least once every twelve months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is appropriate;
1910.120(f)(3)(i)(C)
At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.
1910.120(f)(3)(i)(D)
As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation;
1910.120(f)(3)(i)(E)
At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.
1910.120(f)(3)(ii)
For employees covered under paragraph (f)(2)(iii) and for all employees including of employers covered by paragraph (a)(1)(iv) who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used:
1910.120(f)(3)(ii)(A)
As soon as possible following the emergency incident or development of signs or symptoms;
1910.120(f)(3)(ii)(B)
At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.
1910.120(f)(4)
Content of medical examinations and consultations.
1910.120(f)(4)(i)
Medical examinations required by paragraph (f)(3) of this section shall include a medical and work history (or updated history if one is in the employee's file) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.
1910.120(f)(4)(ii)
The content of medical examinations or consultations made available to employees pursuant to paragraph (f) shall be determined by the attending physician. The guidelines in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (See Appendix D, reference # 10) should be consulted.
1910.120(f)(5)
Examination by a physician and costs. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.
1910.120(f)(6)
Information provided to the physician. The employer shall provide one copy of this standard and its appendices to the attending physician and in addition the following for each employee:
1910.120(f)(6)(i)
A description of the employee's duties as they relate to the employee's exposures,
1910.120(f)(6)(ii)

The employee's exposure levels or anticipated exposure levels.
1910.120(f)(6)(iii)
A description of any personal protective equipment used or to be used.
1910.120(f)(6)(iv)
Information from previous medical examinations of the employee which is not readily available to the examining physician.
1910.120(f)(6)(v)
Information required by §1910.134.
1910.120(f)(7)
Physician's written opinion.
1910.120(f)(7)(i)
The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:
1910.120(f)(7)(i)(A)
The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.
1910.120(f)(7)(i)(B)
The physician's recommended limitations upon the employees assigned work.
1910.120(f)(7)(i)(C)
The results of the medical examination and tests if requested by the employee.
1910.120(f)(7)(i)(D)
A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.
1910.120(f)(7)(ii)
The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposure.
1910.120(f)(8)
Recordkeeping.
1910.120(f)(8)(i)
An accurate record of the medical surveillance required by paragraph (f) of this section shall be retained. This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.1020.
1910.120(f)(8)(ii)
The record required in paragraph (f)(8)(i) of this section shall include at least the following information:
1910.120(f)(8)(ii)(A)
The name of the employee;

1910.120(f)(8)(ii)(B)
Physicians' written opinions, recommended limitations and results of examinations and tests;
1910.120(f)(8)(ii)(C)
Any employee medical complaints related to exposure to hazardous substances;
1910.120(f)(8)(ii)(D)
A copy of the information provided to the examining physician by the employer, with the exception of the standard and its appendices.
1910.120(g)
Engineering controls, work practices, and personal protective equipment for employee protection. Engineering controls, work practices and PPE for substances regulated in Subpart Z. (i) Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with this paragraph to protect employees from exposure to hazardous substances and safety and health hazards.
1910.120(g)(1)
Engineering controls, work practices and PPE for substances regulated in Subparts G and Z.
1910.120(g)(1)(i)
Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to or below the permissible exposure limits for substances regulated by 29 CFR Part 1910, to the extent required by Subpart Z, except to the extent that such controls and practices are not feasible.

NOTE TO PARAGRAPH (g)(1)(i): Engineering controls which may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices which may be feasible are removing all non-essential employees from potential exposure during opening of drums, wetting down dusty operations and locating employees upwind of possible hazards.

1910.120(g)(1)(ii)

Whenever engineering controls and work practices are not feasible, or not required, any reasonable combination of engineering controls, work practices and PPE shall be used to reduce and maintain to or below the permissible exposure limits or dose limits for substances regulated by 29 CFR Part 1910, Subpart Z.

1910.120(g)(1)(iii)

The employer shall not implement a schedule of employee rotation as a means of compliance with permissible exposure limits or dose limits except when there is no other feasible way of complying with the airborne or dermal dose limits for ionizing radiation.

1910.120(g)(1)(iv)

The provisions of 29 CFR, subpart G, shall be followed.

1910.120(g)(2)

Engineering controls, work practices, and PPE for substances not regulated in Subparts G and Z. An appropriate combination of engineering controls, work practices, and personal protective equipment shall be used to reduce and maintain employee exposure to or below published exposure levels for hazardous substances and health hazards not regulated by 29 CFR Part 1910, Subparts G and Z. The employer may use the published literature and SDS as a guide in making the employer's determination as to what level of protection the employer believes is appropriate for hazardous substances and health hazards for which there is no permissible exposure limit or published exposure limit.

1910.120(g)(3)

Personal protective equipment selection.

1910.120(g)(3)(i)

Personal protective equipment (PPE) shall be selected and used which will protect employees from the hazards and potential hazards they are likely to encounter as identified during the site characterization and analysis.

1910.120(g)(3)(ii)

Personal protective equipment selection shall be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and duration, and the hazards and potential hazards identified at the site.

1910.120(g)(3)(iii)

Positive pressure self-contained breathing apparatus, or positive pressure air-line respirators equipped with an escape air supply shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

1910.120(g)(3)(iv)

Totally-encapsulating chemical protective suits (protection equivalent to Level A protection as recommended in Appendix B) shall be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

1910.120(g)(3)(v)

The level of protection provided by PPE selection shall be increased when additional informationor site conditions show that increased protection is necessary to reduce employee exposures below permissible exposure limits and published exposure levels for hazardous substances and health hazards. (See Appendix B for guidance on selecting PPE ensembles.)

NOTE TO PARAGRAPH (g)(3): The level of employee protection provided may be decreased when additional information or site conditions show that decreased protection will not result in hazardous exposures to employees.

1910.120(g)(3)(vi)

Personal protective equipment shall be selected and used to meet the requirements of 29 CFR Part 1910, Subpart I, and additional requirements specified in this section.

1910.120(g)(4)
Totally-encapsulating chemical protective suits.
1910.120(g)(4)(i)
Totally-encapsulating suits shall protect employees from the particular hazards which are identified during site characterization and analysis.
1910.120(g)(4)(ii)
Totally-encapsulating suits shall be capable of maintaining positive air pressure. (See Appendix A for a test method which may be used to evaluate this requirement.)
1910.120(g)(4)(iii)
Totally-encapsulating suits shall be capable of preventing inward test gas leakage of more than 0.5 percent. (See Appendix A for a test method which may be used to evaluate this requirement.)
1910.120(g)(5)
Personal protective equipment (PPE) program. A personal protective equipment program, which is part of the employer's safety and health program required in paragraph (b) of this section or required in paragraph (p)(1) of this section and which is also a part of the site-specific safety and health plan shall be established. The PPE program shall address the elements listed below. When elements, such as donning and doffing procedures, are provided by the manufacturer of a piece of equipment and are attached to the plan, they need not be rewritten into the plan as long as they adequately address the procedure or element.
1910.120(g)(5)(i)
PPE selection based upon site hazards,
1910.120(g)(5)(ii)
PPE use and limitations of the equipment,
1910.120(g)(5)(iii)
Work mission duration,
1910.120(g)(5)(iv)
PPE maintenance and storage,
1910.120(g)(5)(v)
PPE decontamination and disposal,
1910.120(g)(5)(vi)
PPE training and proper fitting,
1910.120(g)(5)(vii)
PPE donning and doffing procedures,
1910.120(g)(5)(viii)
PPE inspection procedures prior to, during, and after use,
1910.120(g)(5)(ix)
Evaluation of the effectiveness of the PPE program, and
1910.120(g)(5)(x)
Limitations during temperature extremes, heat stress, and other appropriate medical considerations.
1910.120(h)
Monitoring. --
1910.120(h)(1)
General.
1910.120(h)(1)(i)
Monitoring shall be performed in accordance with this paragraph where there may be a question of employee exposure to hazardous concentrations of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment so that employees are not exposed to levels which exceed permissible exposure limits, or published exposure levels if there are no permissible exposure limits, for hazardous substances.
1910.120(h)(1)(ii)
Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of employee protection needed on site.
1910.120(h)(2)
Initial entry. Upon initial entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure over permissible exposure limits or published exposure levels, exposure over a

radioactive material's dose limits or other dangerous condition such as the presence of flammable atmospheres, oxygen-deficient environments.
1910.120(h)(3)
Periodic monitoring. Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:
1910.120(h)(3)(i)
When work begins on a different portion of the site.
1910.120(h)(3)(ii)
When contaminants other than those previously identified are being handled.
1910.120(h)(3)(iii)
When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.)
1910.120(h)(3)(iv)
When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon.)
1910.120(h)(4)
Monitoring of high-risk employees. After the actual clean-up phase of any hazardous waste operation commences; for example, when soil, surface water or containers are moved or disturbed; the employer shall monitor those employees likely to have the highest exposures to those hazardous substances and health hazards likely to be present above permissible exposure limits or published exposure levels by using personal sampling frequently enough to characterize employee exposures. The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated in the first sentence of this paragraph. If the employees likely to have the highest exposure are over permissible exposure limits or published exposure limits, then monitoring shall continue to determine all employees likely to be above those limits. The employer may utilize a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated above.

NOTE TO PARAGRAPH (h): It is not required to monitor employees engaged in site characterization operations covered by paragraph (c) of this section.
1910.120(i)
Informational programs. Employers shall develop and implement a program which is part of the employer's safety and health program required in paragraph (b) of this section to inform employees, contractors, and subcontractors (or their representative) actually engaged in hazardous waste operations of the nature, level and degree of exposure likely as a result of participation in such hazardous waste operations. Employees, contractors and subcontractors working outside of the operations part of a site are not covered by this standard.

1910.120(j)
Handling drums and containers --
1910.120(j)(1)
General.
1910.120(j)(1)(i)
Hazardous substances and contaminated, liquids and other residues shall be handled, transported, labeled, and disposed of in accordance with this paragraph.
1910.120(j)(1)(ii)
Drums and containers used during the clean-up shall meet the appropriate DOT, OSHA, and EPA regulations for the wastes that they contain.
1910.120(j)(1)(iii)
When practical, drums and containers shall be inspected and their integrity shall be assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.) shall be moved to an accessible location and inspected prior to further handling.
1910.120(j)(1)(iv)

Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.
1910.120(j)(1)(v)
Site operations shall be organized to minimize the amount of drum or container movement.
1910.120(j)(1)(vi)
Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers.
1910.120(j)(1)(vii)
U.S. Department of Transportation specified salvage drums or containers and suitable quantities of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.
1910.120(j)(1)(viii)
Where major spills may occur, a spill containment program, which is part of the employer's safety and health program required in paragraph (b) of this section, shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred.
1910.120(j)(1)(ix)
Drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.
1910.120(j)(1)(x)
A ground-penetrating system or other type of detection system or device shall be used to estimate the location and depth of buried drums or containers.
1910.120(j)(1)(xi)
Soil or covering material shall be removed with caution to prevent drum or container rupture.
1910.120(j)(1)(xii)
Fire extinguishing equipment meeting the requirements of 29 CFR Part 1910, Subpart L, shall be on hand and ready for use to control incipient fires.
1910.120(j)(2)
Opening drums and containers. The following procedures shall be followed in areas where drums or containers are being opened:
1910.120(j)(2)(i)
Where an airline respirator system is used, connections to the source of air supply shall be protected from contamination and the entire system shall be protected from physical damage.
1910.120(j)(2)(ii)
Employees not actually involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.
1910.120(j)(2)(iii)
If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employee in case of accidental explosion.
1910.120(j)(2)(iv)
Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.
1910.120(j)(2)(v)
When there is a reasonable possibility of flammable atmospheres being present, material handling equipment and hand tools shall be of the type to prevent sources of ignition.
1910.120(j)(2)(vi)
Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved. If pressure cannot be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.
1910.120(j)(2)(vii)
Employees shall not stand upon or work from drums or containers.
1910.120(j)(3)
Material handling equipment. Material handling equipment used to transfer drums and containers shall be selected, positioned and operated to minimize sources of ignition related to the equipment from igniting vapors released from ruptured drums or containers.
1910.120(j)(4)

Radioactive wastes. Drums and containers containing radioactive wastes shall not be handled until such time as their hazard to employees is properly assessed.
1910.120(j)(5)
Shock sensitive wastes. As a minimum, the following special precautions shall be taken when drums and containers containing or suspected of containing shock-sensitive wastes are handled:
1910.120(j)(5)(i)
All non-essential employees shall be evacuated from the area of transfer.
1910.120(j)(5)(ii)
Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.
1910.120(j)(5)(iii)
An employee alarm system capable of being perceived above surrounding light and noise conditions shall be used to signal the commencement and completion of explosive waste handling activities.
1910.120(j)(5)(iv)
Continuous communications (i.e., portable radios, hand signals, telephones, as appropriate) shall be maintained between the employee-in-charge of the immediate handling area and both the site safety and health supervisor and the command post until such time as the handling operation is completed. Communication equipment or methods that could cause shock sensitive materials to explode shall not be used.
1910.120(j)(5)(v)
Drums and containers under pressure, as evidenced by bulging or swelling, shall not be moved until such time as the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.
1910.120(j)(5)(vi)
Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized.

Caution: Shipping of shock sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Employers and their shippers should refer to 49 CFR 173.21 and 173.50.
1910.120(j)(6)
Laboratory waste packs. In addition to the requirements of paragraph (j)(5) of this section, the following precautions shall be taken, as a minimum, in handling laboratory waste packs (lab packs):
1910.120(j)(6)(i)
Lab packs shall be opened only when necessary and then only by an individual knowledgeable in the inspection, classification, and segregation of the containers within the pack according to the hazards of the wastes.
1910.120(j)(6)(ii)
If crystalline material is noted on any container, the contents shall be handled as a shock-sensitive waste until the contents are identified.
1910.120(j)(7)
Sampling of drum and container contents. Sampling of containers and drums shall be done in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.
1910.120(j)(8)
Shipping and transport.
1910.120(j)(8)(i)
Drums and containers shall be identified and classified prior to packaging for shipment.
1910.120(j)(8)(ii)
Drum or container staging areas shall be kept to the minimum number necessary to safely identify and classify materials and prepare them for transport.
1910.120(j)(8)(iii)
Staging areas shall be provided with adequate access and egress routes.
1910.120(j)(8)(iv)
Bulking of hazardous wastes shall be permitted only after a thorough characterization of the materials has been completed.
1910.120(j)(9)

Tank and vault procedures.
1910.120(j)(9)(i)
Tanks and vaults containing hazardous substances shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.
1910.120(j)(9)(ii)
Appropriate tank or vault entry procedures as described in the employer's safety and health plan shall be followed whenever employees must enter a tank or vault.
1910.120(k)
Decontamination --
1910.120(k)(1)
General. Procedures for all phases of decontamination shall be developed and implemented in accordance with this paragraph.
1910.120(k)(2)
Decontamination procedures.
1910.120(k)(2)(i)
A decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment may enter areas on site where potential for exposure to hazardous substances exists.
1910.120(k)(2)(ii)
Standard operating procedures shall be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.
1910.120(k)(2)(iii)
All employees leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.
1910.120(k)(2)(iv)
Decontamination procedures shall be monitored by the site safety and health supervisor to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies.
1910.120(k)(3)
Location. Decontamination shall be performed in geographical areas that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment.
1910.120(k)(4)
Equipment and solvents. All equipment and solvents used for decontamination shall be decontaminated or disposed of properly.
1910.120(k)(5)
Personal protective clothing and equipment.
1910.120(k)(5)(i)
Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.
1910.120(k)(5)(ii)
Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed of or decontaminated before it is removed from the work zone.
1910.120(k)(6)
Unauthorized employees. Unauthorized employees shall not remove protective clothing or equipment from change rooms.
1910.120(k)(7)
Commercial laundries or cleaning establishments. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances.
1910.120(k)(8)
Showers and change rooms. Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, they shall be provided and meet the requirements of 29 CFR 1910.141. If temperature conditions prevent the effective use of water, then other effective means for cleansing shall be provided and used.

1910.120(l)
Emergency response by employees at uncontrolled hazardous waste sites --
1910.120(l)(1)
Emergency response plan.
1910.120(l)(1)(i)
An emergency response plan shall be developed and implemented by all employers within the scope of paragraphs (a)(1)(i) through (ii) of this section to handle anticipated emergencies prior to the commencement of hazardous waste operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, OSHA personnel and other governmental agencies with relevant responsibilities.
1910.120(l)(1)(ii)
Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an emergency action plan complying with 29 CFR 1910.38.
1910.120(l)(2)
Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following:
1910.120(l)(2)(i)
Pre-emergency planning.
1910.120(l)(2)(ii)
Personnel roles, lines of authority, training, and communication.
1910.120(l)(2)(iii)
Emergency recognition and prevention.
1910.120(l)(2)(iv)
Safe distances and places of refuge.
1910.120(l)(2)(v)
Site security and control.
1910.120(l)(2)(vi)
Evacuation routes and procedures.
1910.120(l)(2)(vii)
Decontamination procedures which are not covered by the site safety and health plan.
1910.120(l)(2)(viii)
Emergency medical treatment and first aid.
1910.120(l)(2)(ix)
Emergency alerting and response procedures.
1910.120(l)(2)(x)
Critique of response and follow-up.
1910.120(l)(2)(xi)
PPE and emergency equipment.
1910.120(l)(3)
Procedures for handling emergency incidents.
1910.120(l)(3)(i)
In addition to the elements for the emergency response plan required in paragraph (l)(2) of this section, the following elements shall be included for emergency response plans:
1910.120(l)(3)(i)(A)
Site topography, layout, and prevailing weather conditions.
1910.120(l)(3)(i)(B)
Procedures for reporting incidents to local, state, and federal governmental agencies.
1910.120(l)(3)(ii)
The emergency response plan shall be a separate section of the Site Safety and Health Plan.
1910.120(l)(3)(iii)
The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.
1910.120(l)(3)(iv)
The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.

1910.120(l)(3)(v)
The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.
1910.120(l)(3)(vi)
An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication, and to begin emergency procedures.
1910.120(l)(3)(vii)
Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.
1910.120(m)
Illumination. Areas accessible to employees shall be lighted to not less than the minimum illumination intensities listed in the following Table H-120.1 while any work is in progress:

TABLE H-120.1. -- MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-candles	Area or operations
5	General site areas.
3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways.
5	Tunnels, shafts, and general underground work areas; (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading.
10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.
30	First aid stations, infirmaries, and offices.

1910.120(n)
Sanitation at temporary workplaces --
1910.120(n)(1)
Potable water.
1910.120(n)(1)(i)
An adequate supply of potable water shall be provided on the site.
1910.120(n)(1)(ii)
Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers.
1910.120(n)(1)(iii)
Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and not used for any other purpose.
1910.120(n)(1)(iv)
Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.
1910.120(n)(2)
Nonpotable water.
1910.120(n)(2)(i)

Outlets for nonpotable water, such as water for firefighting purposes shall be identified to indicate clearly that the water is unsafe and is not to be used for drinking, washing, or cooking purposes.
1910.120(n)(2)(ii)
There shall be no cross-connection, open or potential, between a system furnishing potable water and a system furnishing nonpotable water.
1910.120(n)(3)
Toilet facilities.
1910.120(n)(3)(i)
Toilets shall be provided for employees according to Table H-120.2.

TABLE H-120.2. -- TOILET FACILITIES

Number of employees	Minimum number of facilities
20 or fewer	One.
More than 20, fewer than 200	One toilet seat and 1 urinal per 40 employees.
More than 200	One toilet seat and 1 urinal per 50 employees.

1910.120(n)(3)(ii)
Under temporary field conditions, provisions shall be made to assure not less than one toilet facility is available.
1910.120(n)(3)(iii)
Hazardous waste sites, not provided with a sanitary sewer, shall be provided with the following toilet facilities unless prohibited by local codes:
1910.120(n)(3)(iii)(A)
Chemical toilets;
1910.120(n)(3)(iii)(B)
Recirculating toilets;
1910.120(n)(3)(iii)(C)
Combustion toilets; or
1910.120(n)(3)(iii)(D)
Flush toilets.
1910.120(n)(3)(iv)
The requirements of this paragraph for sanitation facilities shall not apply to mobile crews having transportation readily available to nearby toilet facilities.
1910.120(n)(3)(v)
Doors entering toilet facilities shall be provided with entrance locks controlled from inside the facility.
1910.120(n)(4)
Food handling. All food service facilities and operations for employees shall meet the applicable laws, ordinances, and regulations of the jurisdictions in which they are located.
1910.120(n)(5)
Temporary sleeping quarters. When temporary sleeping quarters are provided, they shall be heated, ventilated, and lighted.
1910.120(n)(6)
Washing facilities. The employer shall provide adequate washing facilities for employees engaged in operations where hazardous substances may be harmful to employees. Such facilities shall be in near proximity to the worksite; in areas where exposures are below permissible exposure limits and which are under the controls of the employer; and shall be so equipped as to enable employees to remove hazardous substances from themselves.
1910.120(n)(7)
Showers and change rooms. When hazardous waste clean-up or removal operations commence on a site and the duration of the work will require six months or greater time to complete, the employer shall provide showers and change rooms for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations.
1910.120(n)(7)(i)

Showers shall be provided and shall meet the requirements of 29 CFR 1910.141(d)(3).
1910.120(n)(7)(ii)
Change rooms shall be provided and shall meet the requirements of 29 CFR 1910.141(e). Change rooms shall consist of two separate change areas separated by the shower area required in paragraph (n)(7)(i) of this section. One change area, with an exit leading off the worksite, shall provide employees with a clean area where they can remove, store, and put on street clothing. The second area, with an exit to the worksite, shall provide employees with an area where they can put on, remove and store work clothing and personal protective equipment.
1910.120(n)(7)(iii)
Showers and change rooms shall be located in areas where exposures are below the permissible exposure limits and published exposure levels. If this cannot be accomplished, then a ventilation system shall be provided that will supply air that is below the permissible exposure limits and published exposure levels.
1910.120(n)(7)(iv)
Employers shall assure that employees shower at the end of their work shift and when leaving the hazardous waste site.
1910.120(o)
New technology programs.
1910.120(o)(1)
The employer shall develop and implement procedures for the introduction of effective new technologies and equipment developed for the improved protection of employees working with hazardous waste clean-up operations, and the same shall be implemented as part of the site safety and health program to assure that employee protection is being maintained.
1910.120(o)(2)
New technologies, equipment or control measures available to the industry, such as the use of foams, absorbents, absorbents, neutralizers, or other means to suppress the level of air contaminants while excavating the site or for spill control, shall be evaluated by employers or their representatives. Such an evaluation shall be done to determine the effectiveness of the new methods, materials, or equipment before implementing their use on a large scale for enhancing employee protection. Information and data from manufacturers or suppliers may be used as part of the employer's evaluation effort. Such evaluations shall be made available to OSHA upon request.
1910.120(p)
Certain Operations Conducted Under the Resource Conservation and Recovery Act of 1976 (RCRA). Employers conducting operations at treatment, storage and disposal (TSD) facilities specified in paragraph (a)(1)(iv) of this section shall provide and implement the programs specified in this paragraph. See the "Notes and Exceptions" to paragraph (a)(2)(iii) of this section for employers not covered.

1910.120(p)(1)
Safety and health program. The employer shall develop and implement a written safety and health program for employees involved in hazardous waste operations that shall be available for inspection by employees, their representatives and OSHA personnel. The program shall be designed to identify, evaluate and control safety and health hazards in their facilities for the purpose of employee protection, to provide for emergency response meeting the requirements of paragraph (p)(8) of this section and to address as appropriate site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures and uses of new technologies.
1910.120(p)(2)
Hazard communication program. The employer shall implement a hazard communication program meeting the requirements of 29 CFR 1910.1200 as part of the employer's safety and program.

NOTE TO §1910.120 - The exemption for hazardous waste provided in 1910.1200 is applicable to this section.
1910.120(p)(3)
Medical surveillance program. The employer shall develop and implement a medical surveillance program meeting the requirements of paragraph (f) of this section.
1910.120(p)(4)

Decontamination program. The employer shall develop and implement a decontamination procedure meeting the requirements of paragraph (k) of this section.
1910.120(p)(5)
New technology program. The employer shall develop and implement procedures meeting the requirements of paragraph (o) of this section for introducing new and innovative equipment into the workplace.
1910.120(p)(6)
Material handling program. Where employees will be handling drums or containers, the employer shall develop and implement procedures meeting the requirements of paragraphs (j)(1)(ii) through (viii) and (xi) of this section, as well as (j)(3) and (j)(8) of this section prior to starting such work.
1910.120(p)(7)
Training program --
1910.120(p)(7)(i)
New employees. The employer shall develop and implement a training program which is part of the employer's safety and health program, for employees exposed to health hazards or hazardous substances at TSD operations to enable the employees to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees. The initial training shall be for 24 hours and refresher training shall be for eight hours annually. Employees who have received the initial training required by this paragraph shall be given a written certificate attesting that they have successfully completed the necessary training.
1910.120(p)(7)(ii)
Current employees. Employers who can show by an employee's previous work experience and/or training that the employee has had training equivalent to the initial training required by this paragraph, shall be considered as meeting the initial training requirements of this paragraph as to that employee. Equivalent training includes the training that existing employees might have already received from actual site work experience. Current employees shall receive eight hours of refresher training annually.
1910.120(p)(7)(iii)
Trainers. Trainers who teach initial training shall have satisfactorily completed a training course for teaching the subjects they are expected to teach or they shall have the academic credentials and instruction experience necessary to demonstrate a good command of the subject matter of the courses and competent instructional skills.
1910.120(p)(8)
Emergency response program --
1910.120(p)(8)(i)
Emergency response plan. An emergency response plan shall be developed and implemented by all employers. Such plans need not duplicate any of the subjects fully addressed in the employer's contingency planning required by permits, such as those issued by the U.S. Environmental Protection Agency, provided that the contingency plan is made part of the emergency response plan. The emergency response plan shall be a written portion of the employer's safety and health program required in paragraph (p)(1) of this section. Employers who will evacuate their employees from the worksite location when an emergency occurs and who do not permit any of their employees to assist in handling the emergency are exempt from the requirements of paragraph (p)(8) if they provide an emergency action plan complying with 29 CFR 1910.38.
1910.120(p)(8)(ii)
Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following areas to the extent that they are not addressed in any specific program required in this paragraph:
1910.120(p)(8)(ii)(A)
Pre-emergency planning and coordination with outside parties.
1910.120(p)(8)(ii)(B)
Personnel roles, lines of authority, training, and communication.
1910.120(p)(8)(ii)(C)
Emergency recognition and prevention.
1910.120(p)(8)(ii)(D)
Safe distances and places of refuge.
1910.120(p)(8)(ii)(E)

Site security and control.
1910.120(p)(8)(ii)(F)
Evacuation routes and procedures.
1910.120(p)(8)(ii)(G)
Decontamination procedures.
1910.120(p)(8)(ii)(H)
Emergency medical treatment and first aid.
1910.120(p)(8)(ii)(I)
Emergency alerting and response procedures.
1910.120(p)(8)(ii)(J)
Critique of response and follow-up.
1910.120(p)(8)(ii)(K)
PPE and emergency equipment.
1910.120(p)(8)(iii)
Training.
1910.120(p)(8)(iii)(A)
Training for emergency response employees shall be completed before they are called upon to perform in real emergencies. Such training shall include the elements of the emergency response plan, standard operating procedures the employer has established for the job, the personal protective equipment to be worn and procedures for handling emergency incidents.

Exception #1: an employer need not train all employees to the degree specified if the employer divides the work force in a manner such that a sufficient number of employees who have responsibility to control emergencies have the training specified, and all other employees, who may first respond to an emergency incident, have sufficient awareness training to recognize that an emergency response situation exists and that they are instructed in that case to summon the fully trained employees and not attempt control activities for which they are not trained.

Exception #2: An employer need not train all employees to the degree specified if arrangements have been made in advance for an outside fully-trained emergency response team to respond in a reasonable period and all employees, who may come to the incident first, have sufficient awareness training to recognize that an emergency response situation exists and they have been instructed to call the designated outside fully-trained emergency response team for assistance.
1910.120(p)(8)(iii)(B)
Employee members of TSD facility emergency response organizations shall be trained to a level of competence in the recognition of health and safety hazards to protect themselves and other employees. This would include training in the methods used to minimize the risk from safety and health hazards; in the safe use of control equipment; in the selection and use of appropriate personal protective equipment; in the safe operating procedures to be used at the incident scene; in the techniques of coordination with other employees to minimize risks; in the appropriate response to over exposure from health hazards or injury to themselves and other employees; and in the recognition of subsequent symptoms which may result from over exposures.
1910.120(p)(8)(iii)(C)
The employer shall certify that each covered employee has attended and successfully completed the training required in paragraph (p)(8)(iii) of this section, or shall certify the employee's competency for certification of training shall be recorded and maintained by the employer.
1910.120(p)(8)(iv)
Procedures for handling emergency incidents.
1910.120(p)(8)(iv)(A)
In addition to the elements for the emergency response plan required in paragraph (p)(8)(ii) of this section, the following elements shall be included for emergency response plans to the extent that they do not repeat any information already contained in the emergency response plan:
1910.120(p)(8)(iv)(A)(1)
Site topography, layout, and prevailing weather conditions.
1910.120(p)(8)(iv)(A)(2)
Procedures for reporting incidents to local, state, and federal governmental agencies.

1910.120(p)(8)(iv)(B)
The emergency response plan shall be compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and federal agencies.
1910.120(p)(8)(iv)(C)
The emergency response plan shall be rehearsed regularly as part of the overall training program for site operations.
1910.120(p)(8)(iv)(D)
The site emergency response plan shall be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.
1910.120(p)(8)(iv)(E)
An employee alarm system shall be installed in accordance with 29 CFR 1910.165 to notify employees of an emergency situation, to stop work activities if necessary, to lower background noise in order to speed communication; and to begin emergency procedures.
1910.120(p)(8)(iv)(F)
Based upon the information available at time of the emergency, the employer shall evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.
1910.120(q)
Emergency response program to hazardous substance releases. This paragraph covers employers whose employees are engaged in emergency response no matter where it occurs except that it does not cover employees engaged in operations specified in paragraphs (a)(1)(i) through (a)(1)(iv) of this section. Those emergency response organizations who have developed and implemented programs equivalent to this paragraph for handling releases of hazardous substances pursuant to section 303 of the Superfund Amendments and Reauthorization Act of 1986 (Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. 11003) shall be deemed to have met the requirements of this paragraph.
1910.120(q)(1)
Emergency response plan. An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives and OSHA personnel. Employers who will evacuate their employees from the danger area when an emergency occurs, and who do not permit any of their employees to assist in handling the emergency, are exempt from the requirements of this paragraph if they provide an emergency action plan in accordance with 29 CFR 1910.38.
1910.120(q)(2)
Elements of an emergency response plan. The employer shall develop an emergency response plan for emergencies which shall address, as a minimum, the following areas to the extent that they are not addressed in any specific program required in this paragraph:
1910.120(q)(2)(i)
Pre-emergency planning and coordination with outside parties..
1910.120(q)(2)(ii)
Personnel roles, lines of authority, training, and communication.
1910.120(q)(2)(iii)
Emergency recognition and prevention.
1910.120(q)(2)(iv)
Safe distances and places of refuge.
1910.120(q)(2)(v)
Site security and control.
1910.120(q)(2)(vi)
Evacuation routes and procedures.
1910.120(q)(2)(vii)
Decontamination.
1910.120(q)(2)(viii)
Emergency medical treatment and first aid.
1910.120(q)(2)(ix)
Emergency alerting and response procedures.
1910.120(q)(2)(x)

Critique of response and follow-up.
1910.120(q)(2)(xi)
PPE and emergency equipment.
1910.120(q)(2)(xii)
Emergency response organizations may use the local emergency response plan or the state emergency response plan or both, as part of their emergency response plan to avoid duplication. Those items of the emergency response plan that are being properly addressed by the SARA Title III plans may be substituted into their emergency plan or otherwise kept together for the employer and employee's use.
1910.120(q)(3)
Procedures for handling emergency response.
1910.120(q)(3)(i)
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.

NOTE TO PARAGRAPH (q)(3)(i). - The "senior official" at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially it is the senior officer on the first-due piece of responding emergency apparatus to arrive on the incident scene. As more senior officers arrive (i.e. , battalion chief, fire chief, state law enforcement official, site coordinator, etc.) the position is passed up the line of authority which has been previously established.

1910.120(q)(3)(ii)
The individual in charge of the ICS shall identify, to the extent possible, all hazardous substances or conditions present and shall address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance handling procedures, and use of any new technologies.
1910.120(q)(3)(iii)
Based on the hazardous substances and/or conditions present, the individual in charge of the ICS shall implement appropriate emergency operations, and assure that the personal protective equipment worn is appropriate for the hazards to be encountered. However, personal protective equipment shall meet, at a minimum, the criteria contained in 29 CFR 1910.156(e) when worn while performing fire fighting operations beyond the incipient stage for any incident.
1910.120(q)(3)(iv)
Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.
1910.120(q)(3)(v)
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. However, operations in hazardous areas shall be performed using the buddy system in groups of two or more.
1910.120(q)(3)(vi)
Back-up personnel shall be standing by with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also be standing by with medical equipment and transportation capability.
1910.120(q)(3)(vii)
The individual in charge of the ICS shall designate a safety officer, 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 operations for the emergency at hand.
1910.120(q)(3)(viii)
When activities are judged by the safety officer 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.
1910.120(q)(3)(ix)
After emergency operations have terminated, the individual in charge of the ICS shall implement appropriate decontamination procedures.
1910.120(q)(3)(x)
When deemed necessary for meeting the tasks at hand, approved self-contained compressed air breathing apparatus may be used with approved cylinders from other approved self-contained compressed air breathing apparatus provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatus shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.
1910.120(q)(4)
Skilled support personnel. Personnel, not necessarily an employer's own employees, who are 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 that cannot reasonably be performed in a timely fashion by an employer's own employees, and who will be or may be exposed to the hazards at an emergency response scene, are not required to meet the training required in this paragraph for the employer's regular employees. However, these personnel shall be given an initial briefing at the site prior to their participation in any emergency response. The initial briefing shall include instruction in the wearing of appropriate personal protective equipment, what chemical hazards are involved, and what duties are to be performed. All other appropriate safety and health precautions provided to the employer's own employees shall be used to assure the safety and health of these personnel.
1910.120(q)(5)
Specialist employees. Employees who, in the course of their regular job duties, work with and are trained in the hazards of specific hazardous substances, and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge, shall receive training or demonstrate competency in the area of their specialization annually.
1910.120(q)(6)
Training. Training shall be 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, those hired after the effective date of this standard, 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:
1910.120(q)(6)(i)
First responder awareness level. First responders at the awareness level are 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 proper authorities of the release. They would take no further action beyond 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:
1910.120(q)(6)(i)(A)
An understanding of what hazardous substances are, and the risks associated with them in an incident.
1910.120(q)(6)(i)(B)
An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.
1910.120(q)(6)(i)(C)
The ability to recognize the presence of hazardous substances in an emergency.
1910.120(q)(6)(i)(D)
The ability to identify the hazardous substances, if possible.
1910.120(q)(6)(i)(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 U.S. Department of Transportation's Emergency Response Guidebook.
1910.120(q)(6)(i)(F)

The ability to realize the need for additional resources, and to make appropriate notifications to the communication center.
1910.120(q)(6)(ii)
First responder operations level. First responders at the operations level are 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:
1910.120(q)(6)(ii)(A)
Knowledge of the basic hazard and risk assessment techniques.
1910.120(q)(6)(ii)(B)
Know how to select and use proper personal protective equipment provided to the first responder operational level.
1910.120(q)(6)(ii)(C)
An understanding of basic hazardous materials terms.
1910.120(q)(6)(ii)(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.
1910.120(q)(6)(ii)(E)
Know how to implement basic decontamination procedures.
1910.120(q)(6)(ii)(F)
An understanding of the relevant standard operating procedures and termination procedures.
1910.120(q)(6)(iii)
Hazardous materials technician. Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance. Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:
1910.120(q)(6)(iii)(A)
Know how to implement the employer's emergency response plan.
1910.120(q)(6)(iii)(B)
Know the classification, identification and verification of known and unknown materials by using field survey instruments and equipment.
1910.120(q)(6)(iii)(C)
Be able to function within an assigned role in the Incident Command System.
1910.120(q)(6)(iii)(D)
Know how to select and use proper specialized chemical personal protective equipment provided to the hazardous materials technician.
1910.120(q)(6)(iii)(E)
Understand hazard and risk assessment techniques.
1910.120(q)(6)(iii)(F)
Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
1910.120(q)(6)(iii)(G)
Understand and implement decontamination procedures.
1910.120(q)(6)(iii)(H)
Understand termination procedures.
1910.120(q)(6)(iii)(I)
Understand basic chemical and toxicological terminology and behavior.
1910.120(q)(6)(iv)
Hazardous materials specialist. Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials

technician, however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with Federal, state, local and other government authorities in regards to site activities. Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:
1910.120(q)(6)(iv)(A)
Know how to implement the local emergency response plan.
1910.120(q)(6)(iv)(B)
Understand classification, identification and verification of known and unknown materials by using advanced survey instruments and equipment.
1910.120(q)(6)(iv)(C)
Know the state emergency response plan.
1910.120(q)(6)(iv)(D)
Be able to select and use proper specialized chemical personal protective equipment provided to the hazardous materials specialist.
1910.120(q)(6)(iv)(E)
Understand in-depth hazard and risk techniques.
1910.120(q)(6)(iv)(F)
Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.
1910.120(q)(6)(iv)(G)
Be able to determine and implement decontamination procedures.
1910.120(q)(6)(iv)(H)
Have the ability to develop a site safety and control plan.
1910.120(q)(6)(iv)(I)
Understand chemical, radiological and toxicological terminology and behavior.
1910.120(q)(6)(v)
On scene incident commander. Incident commanders, who will assume control of the incident scene beyond the first responder awareness level, shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:
1910.120(q)(6)(v)(A)
Know and be able to implement the employer's incident command system.
1910.120(q)(6)(v)(B)
Know how to implement the employer's emergency response plan.
1910.120(q)(6)(v)(C)
Know and understand the hazards and risks associated with employees working in chemical protective clothing.
1910.120(q)(6)(v)(D)
Know how to implement the local emergency response plan.
1910.120(q)(6)(v)(E)
Know of the state emergency response plan and of the Federal Regional Response Team.
1910.120(q)(6)(v)(F)
Know and understand the importance of decontamination procedures.
1910.120(q)(7)
Trainers. Trainers who teach any of the above training subjects shall have satisfactorily completed a training course for teaching the subjects they are expected to teach, such as the courses offered by the U.S. National Fire Academy, or they shall have the training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach.
1910.120(q)(8)
Refresher training.
1910.120(q)(8)(i)
Those employees who are trained in accordance with paragraph (q)(6) of this section shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.

1910.120(q)(8)(ii)
A statement shall be made of the training or competency, and if a statement of competency is made, the employer shall keep a record of the methodology used to demonstrate competency.
1910.120(q)(9)
Medical surveillance and consultation.
1910.120(q)(9)(i)
Members of an organized and designated HAZMAT team and hazardous materials specialist shall receive a baseline physical examination and be provided with medical surveillance as required in paragraph (f) of this section.
1910.120(q)(9)(ii)
Any emergency response employees who exhibit signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident either immediately or subsequently, shall be provided with medical consultation as required in paragraph (f)(3)(ii) of this section.
1910.120(q)(10)
Chemical protective clothing. Chemical protective clothing and equipment to be used by organized and designated HAZMAT team members, or to be used by hazardous materials specialists, shall meet the requirements of paragraphs (g)(3) through (5) of this section.
1910.120(q)(11)
Post-emergency response operations. Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards and materials contaminated with them (such as contaminated soil or other elements of the natural environment) from the site of the incident, the employer conducting the clean-up shall comply with one of the following:
1910.120(q)(11)(i)
Meet all the requirements of paragraphs (b) through (o) of this section; or
1910.120(q)(11)(ii)
Where the clean-up is done on plant property using plant or workplace employees, such employees shall have completed the training requirements of the following: 29 CFR 1910.38, 1910.134, 1910.1200, and other appropriate safety and health training made necessary by the tasks they are expected to perform such as personal protective equipment and decontamination procedures.

APPENDICES TO §1910.120 - HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

NOTE: The following appendices serve as non-mandatory guidelines to assist employees and employers in complying with the appropriate requirements of this section. However paragraph 1910.120(g) makes mandatory in certain circumstances the use of Level A and Level B PPE protection.

UNIT 3: HAZARDOUS MATERIALS RESPONSE TEAM ORGANIZATION AND INCIDENT COMMAND SYSTEM

TERMINAL OBJECTIVE

The students will be able to:

3.1 Use risk-based response to analyze the incident, determine the needs of the response and organize the hazardous materials response team, given the Incident Commander's (IC's) objectives.

ENABLING OBJECTIVES

The students will be able to:

3.1 Define the levels of hazardous materials training and certifications.

3.2 Analyze the relationship between competency and certification.

3.3 Identify resource typing and credentialing related to hazardous materials response.

3.4 Describe the needs of the response based on facts, science and circumstances.

3.5 Describe the roles and responsibilities of the hazardous materials response team members.

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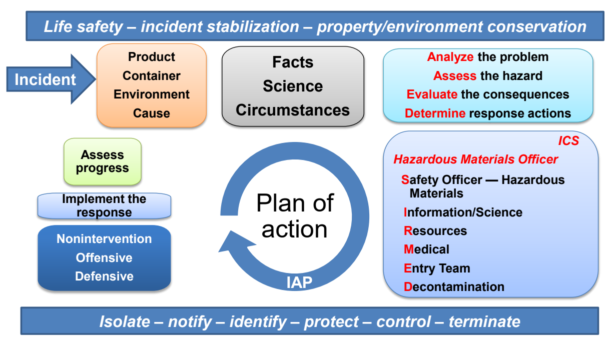
FEMA

U.S. Fire Administration

UNIT 3: HAZARDOUS MATERIALS RESPONSE TEAM ORGANIZATION AND INCIDENT COMMAND SYSTEM

Slide 3-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



Slide 3-2

TERMINAL OBJECTIVE

Use risk-based response to analyze the incident, determine the needs of the response and organize the hazardous materials response team, given the Incident Commander's (IC's) objectives.

Slide 3-3

ENABLING OBJECTIVES

- Define the levels of hazardous materials training and certifications.
- Analyze the relationship between competency and certification.
- Identify resource typing and credentialing related to hazardous materials response.

Slide 3-4

ENABLING OBJECTIVES (cont'd)

- Describe the needs of the response based on facts, science and circumstances.
- Describe the roles and responsibilities of the hazardous materials response team members.

Slide 3-5

I. HAVING THE RIGHT RESOURCES

ACTIVITY 3.1

Emergency Response Guidebook Knowledge Check

Purpose

Assess students' knowledge on the contents of the Emergency Response Guidebook (ERG).

Directions

1. This is an individual activity. The instructor will provide knowledge check handouts.

2. Record your responses on the knowledge check handout.

3. After 20 minutes, the instructor will review the answers with the class. Check your own responses and ask questions as necessary. This knowledge check is not graded.

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I. HAVING THE RIGHT RESOURCES (cont'd)

A. Training is the education, instruction or discipline of a person. We do not train until we get it right; we train until we cannot get it wrong. When something goes wrong, we fail to the level of our training. Initial training, continuing education and competency training are of vital importance.

TRAINING — OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION LEVELS

- Awareness.
- Operations.
- Technician.
- Specialist.
- Hazardous materials IC.

Slide 3-7

1. Occupational Safety and Health Administration (OSHA) levels of training.

   a. Awareness.

   b. Operations.

   c. Technician.

   d. Specialist.

   e. Hazardous materials Incident Commander (IC).

TRAINING — NATIONAL FIRE PROTECTION ASSOCIATION LEVELS

- Awareness (core).
- Operations (core).
- Operations mission-specific (11 missions).
- Technician (core).
- Technician specialties (13 specialties).
- Hazardous materials IC.
- Hazardous materials officer.
- Hazardous materials safety officer.

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2. National Fire Protection Association (NFPA) levels of training.

   a. Awareness (core).

   b. Operations (core).

   c. Operations mission-specific (11 missions).

      - Personal protective equipment (PPE).
      - Mass decontamination.
      - Technical decontamination.
      - Evidence preservation and sampling.
      - Product control.
      - Detection, monitoring and sampling.
      - Victim rescue and recovery.
      - Response to illicit laboratory incidents.
      - Disablement/disruption of improvised explosive devices (IEDs), improvised weapons of mass destruction (WMD) dispersal devices and operations at improvised explosives laboratories.
      - Diving in contaminated water environments.
      - Evidence collection.

   d. Technician (core).

      - Analyzing the incident.
      - Planning the response.
      - Implementing the planned response.
      - Evaluating progress.
      - Terminating the incident.

e. Technician specialties (13 specialties).

- Tank car.
- Cargo tank.
- Intermodal tank.
- Marine tank and non-tank vessel.
- Flammable liquids bulk storage.
- Flammable gases bulk storage.
- Radiological hazards.
- Advanced monitoring and detection.
- Consequence analysis and planning.
- Advanced chemical risk assessment and analysis.
- Advanced product control.
- WMD.
- Advanced decontamination.

f. Hazardous materials IC.

g. Hazardous materials officer.

h. Hazardous materials safety officer.

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ACTIVITY 3.2

Hazardous Materials Terminology Matching

Purpose

Self-evaluate one's understanding of terms related to hazardous materials.

Directions

1. Working in your small group, match the assigned terms to the listed definitions by placing the letter of the definition next to the correct term.

2. The instructor will lead a review of the answers with the class.

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ACTIVITY 3.2 (cont'd)

Terms

Group 1

1. Catalyst ____________
2. Absorption ____________
3. Hazard ____________
4. Active ingredient ____________
5. Penetration ____________
6. Dosage/dose ____________
7. TLV-TWA ____________
8. Inhibitor ____________
9. Ionizing radiation ____________
10. Sensitizer ____________

Group 2

1. LC_{50} ____________
2. Degradation ____________
3. Exposure ____________
4. Acute effect ____________
5. Heat exhaustion ____________
6. Hydrophilic ____________
7. Acid ____________
8. $LD_{50/30}$ ____________
9. Breakthrough time ____________
10. Chronic exposure ____________

Group 3

1. Mutagen ____________
2. Permeation ____________
3. C or Ceiling ____________
4. IDLH ____________
5. PEL ____________
6. Contaminant ____________
7. TLV-STEL ____________
8. Half-life ____________
9. Adsorption ____________

Group 4

1. Hypergolic ____________
2. Poison ____________
3. LD_{50} ____________
4. Reportable quantity ____________
5. Alkali ____________
6. Risk ____________
7. Contamination ____________
8. Aerosol ____________
9. Teratogen ____________
10. Maximum safe storage temperature ____________

Group 5

1. Self-accelerating decomposition temperature ____________
2. Non-ionizing radiation ____________
3. Organophosphate ____________
4. Flammable range ____________
5. Flashpoint ____________
6. Hydrophobic ____________
7. Sublimation ____________
8. Ignition temperature ____________
9. Physical state ____________
10. Polymerization ____________

ACTIVITY 3.2 (cont'd)

Definitions

a. The bonding of chemicals to soil particles or other surfaces.

b. The process of reacting monomer molecules together in a chemical reaction to form polymer chains or three-dimensional networks.

c. An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

d. Exposure expected to kill, within 30 days, half of the population exposed to radiation or radioactive material. The dose of radiation expected to cause death to 50% of an exposed population within 30 days.

e. A material capable of posing an unreasonable risk to health, safety or the environment, or capable of causing harm.

f. A material that produces a physical defect in a developing embryo.

g. The designated amount of a specific material that, if spilled or released, requires immediate notification to the National Response Center (NRC).

h. A substance that changes the speed or yield of a chemical reaction without being consumed or chemically changed by the chemical reaction.

i. Describes the minimum and maximum concentrations at which a given vaporous substance will ignite or combust when mixed with air.

j. The indication that a chemical form is solid, liquid or gas.

k. Introduction into water, air and soil of microorganisms, chemicals, toxic substances, wastes or wastewater in a concentration that makes the medium unfit for its next intended use.

l. The penetration of atoms, ions or molecules into the bulk mass of a substance.

m. Radiation that can strip electrons from atoms, i.e., alpha, beta and gamma radiation.

n. A chemical that, in relatively small amounts, can cause injury by chemical action when it comes in contact with a susceptible tissue.

o. Having an affinity for water, or capable of dissolving in water; soluble or miscible in water.

p. The process by which people, animals, the environment and equipment are subjected to or come in contact with a hazardous material.

q. Any kind of radiation in the electromagnetic spectrum that does not have enough energy to remove an electron from an atom and turn it into an ion.

r. The transition of a substance directly from the solid to the gas state without passing through the liquid state.

s. An agent that causes a permanent genetic change in a cell other than that which occurs during normal genetic recombination.

t. An adverse effect on a human or animal which has severe symptoms developing rapidly and coming quickly to a crisis.

u. The average concentration of a chemical or mixture in air as a gas, vapor, mist, fume or dust capable of killing half of the test animals exposed by inhalation under specific conditions.

v. The minimum temperature at which a volatile material will vaporize into a gas and ignite without help from an external fire source.

w. A measure of the probability that damage to life, health, property and/or the environment will occur as a result of a given hazard.

x. The time required for a pollutant to lose half its effect on the environment.

y. The actual quantity of a chemical administered to an organism or to which the organism is exposed.

z. A mild form of shock caused by overheating when the body cannot dissipate heat.

aa. The average amount of a drug, toxin, chemical substance/mixture or microorganism capable of killing half of the test animals exposed under specific test conditions.

bb. Permissible exposure limits set by OSHA as a guide to acceptable levels of chemical exposure.

cc. The lowest temperature at which an organic peroxide in a typical vessel or shipping package will undergo a self-accelerating decomposition within one week.

dd. The maximum allowable human exposure limit for an airborne substance which is not to be exceeded even momentarily.

ee. The flow or movement of a hazardous chemical through closures, seams, porous materials, pinholes or other imperfections.

ff. The temperature at which a particular organic compound gives off sufficient vapor to ignite in air.

gg. In any pesticide product, the component that kills, or otherwise controls, target pests.

hh. The process by which small amounts of toxic substances are taken into the body over an extended period.

ii. Any organic compound whose molecule contains one or more phosphate ester groups, especially a pesticide of this kind.

jj. A solid particle or liquid droplet suspended in air.

kk. The process by which a hazardous chemical moves through a material at the molecular level.

ll. Two chemical substances that spontaneously ignite upon mixing.

mm. Any physical, chemical, biological or radiological substance or matter that has an adverse effect on air, water or soil.

nn. Tending to repel or fail to mix with water.

oo. The physical destruction or decomposition of a material due to chemical exposure, general use or ambient conditions.

pp. A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

qq. The elapsed time between initial contact of the hazardous chemical with the outside surface of a barrier such as protective clothing material, and the time at which the chemical can be detected at the inside surface of the material.

rr. Short-term exposure limit or maximum concentration for a brief specified period of time, depending on a specific chemical.

ss. A hydrogen-containing corrosive material that reacts with water to produce hydrogen ions.

tt. A hydroxide-containing (-OH) corrosive material, which is soluble in water, neutralizes acids, and is irritating or destructive to tissue.

uu. The time weighted average, based on an allowable exposure averaged over a normal 8-hour workday or 40-hour workweek.

vv. A substance which slows down or prevents a particular chemical reaction or other process, or which reduces the activity of a particular reactant, catalyst or enzyme.

ww. Highest temperature to store a chemical (like an organic peroxide) above which slow decomposition and explosion may occur.

I. HAVING THE RIGHT RESOURCES (cont'd)

COMPETENCE, PROFICIENCY, CERTIFICATION AND CREDENTIALING

Differences among:

- Competence.
- Proficiency.
- Certification.
- Credentialing.

Slide 3-10

B. Competence, proficiency, certification and credentialing.

1. Competence: the set of demonstrable characteristics and skills that enable and improve the efficiency and performance of a job.

2. Proficiency: a high degree of competence; being an expert or highly skilled.

3. Certification: the confirmation of certain characteristics of an object, person or organization. This confirmation is often, but not always, provided by some form of external review, education, assessment or audit.

4. Credentialing: The terms "credentialed" and "credentialing" mean having provided, or providing, respectively, documentation that identifies personnel and authenticates and verifies the qualifications of such personnel by ensuring that such personnel possess a minimum common level of training, experience, physical and medical fitness, and capability appropriate for a particular position.

LEADERSHIP SUPPORT

- Team capabilities, equipment, training, staffing and mission.
- Budget.

Slide 3-11

C. Leadership support.

1. Team capabilities, equipment, training, staffing and mission.

a. Does your departmental or jurisdictional leadership actively support your hazardous materials program, or is it ineffectual?

b. Who determines exactly what your team capabilities should be?

c. Do you have the equipment, training and staffing that you need? If not, why not? Who determines what equipment, training and staffing you need?

d. Does your hazardous materials response team have a mission statement? Does it agree with your department's mission statement? Does your team (or your leadership) know what the hazardous materials response team is supposed to do or what it is capable of doing?

2. Budget.

a. Source of budget.

- Tax revenue.
- User fees.
- Cost recovery.
- Grants.
- Fundraising and donations.
- Corporate/private sponsorships.

b. Recognize that your budget will not stay the same from year to year.

- Some years have more incidents than others.
- Some years will have more equipment that needs to be replaced than others.
- One major incident could use most of your equipment.

ACTIVITY 3.3

Hazardous Materials Certification and Competency

Purpose

Share and analyze certification and competency requirements of various jurisdictions.

Directions

1. In your small group, share your department's or state's requirements relating to hazardous materials on technician and specialist certification, continuing education and credentialing.

2. Use the questions below to guide your discussion.

3. Be prepared to share your responses with the class.

Questions

1. What are the certification and competency requirements in your own department?

 ____

 ____

 ____

2. What certification and competency requirement(s) do you and at least one other jurisdiction in your small group share?

 ____

 ____

 ____

3. What are some certification and competency requirements that are different from your own department? Are there new requirements that will apply well to your own department? If not, why not?

II. RESOURCE TYPING

FEDERAL EMERGENCY MANAGEMENT AGENCY RESOURCE TYPING FOR HAZARDOUS MATERIALS RESPONSE TEAM

- Minimum number of personnel.
- Number of team management personnel.
- Number of support personnel.
- Capabilities.
- Decontamination equipment.
- Communication equipment.

Slide 3-13

A. Federal Emergency Management Agency (FEMA) resource typing specifies the following for hazardous materials response teams:

1. Minimum number of personnel.

2. Number of team management personnel.

3. Number of support personnel.

4. Capabilities (testing, air monitoring, sampling, substance detection, radiological, PPE, technical reference, intervention, decontamination).

5. Decontamination equipment.

6. Communication equipment.

TYPE 4 HAZARDOUS MATERIALS RESPONSE TEAM

Currently not applicable.

Slide 3-14

B. Type 4 hazardous materials response team.

Currently not applicable.

TYPE 3 HAZARDOUS MATERIALS RESPONSE TEAM

- Minimum eight personnel.
- Can only deal with known chemicals:
  - Presumptive testing, identification and classification.
  - Monitoring.
  - Sampling, collection, containerizing, labeling and preparation for transport.
- Basic monitoring equipment.

Slide 3-15

C. Type 3 hazardous materials response team requirements for resources and capabilities include:

1. Minimum of eight personnel trained to the hazardous materials technician level.

2. Can only deal with known chemicals.

   a. Capable of presumptive testing, identification and classification of known chemicals.

   b. Ability to monitor for known chemicals.

   c. Ability to sample, collect, containerize, label and prepare for transport of known chemicals.

3. Access to basic monitoring equipment such as four-gas, photoionization detectors (PIDs) and radiation monitors.

TYPE 3 HAZARDOUS MATERIALS RESPONSE TEAM (cont'd)

- Interpret readings from radiation detection devices for beta and gamma.
- Complete Level B ensemble.
- Print and electronic databases.
- Mechanical means of product control.
- Portable radios, smart phones, laptops and printers.
- Support all decontamination needs.

Slide 3-16

4. Ability to interpret readings from radiation detection devices for beta and gamma.

5. Access to complete Level B ensemble.

6. Access to print and electronic databases.

7. Ability to use mechanical means of product control.

8. Communications equipment to include portable radios, smart phones, laptops and printers.

9. Ability to support all decontamination needs.

TYPE 2 HAZARDOUS MATERIALS RESPONSE TEAM

- All requirements of Type 3 hazardous materials response team.
- Can deal with known and unknown chemicals.
- Classification of unknown chemicals using advanced detection devices.
- Differentiate between two or more hazardous vapors.

Slide 3-17

D. Type 2 hazardous materials response team meets all requirements of a Type 3 hazardous materials response team in addition to the following:

1. Can deal with known and unknown chemicals.

2. Identification and classification of unknown chemicals using advanced detection devices.

3. Ability to differentiate between two or more hazardous vapors.

TYPE 2 HAZARDOUS MATERIALS RESPONSE TEAM (cont'd)

- Collect, handle and track samples for evidence.
- Intermediate monitoring equipment.
- Level A chemical protective clothing.
- Air modeling and air monitoring.
- Neutralization and encapsulation.
- Wireless data communications, multiple laptops, long-range optics and a portable weather station.

Slide 3-18

4. Ability to collect, handle and track samples to be used as evidence.

5. Access to intermediate monitoring equipment.

6. Chemical protective clothing to include Level A capability, Level A with flash-fire protection capability and WMD-compliant capability.

7. Capabilities for air modeling with map overlay and air monitoring with reach-back.

8. Capability for neutralization and encapsulation.

9. Access to wireless data communications, multiple laptops, long-range optics and a portable weather station.

TYPE 1 HAZARDOUS MATERIALS RESPONSE TEAM

- All requirements of Type 2 hazardous materials response team.
- Can deal with all hazards, including weapons of mass destruction (WMD).
- Specialized detection equipment.
- Special resources that may be required for dealing with biological materials.
- Advanced monitoring equipment.

Slide 3-19

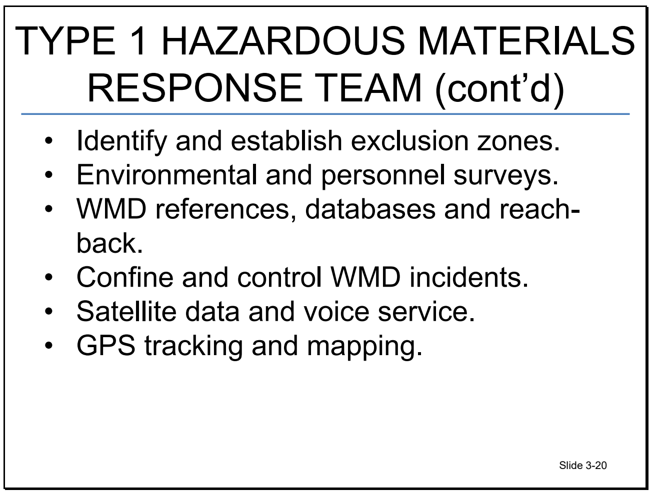
E. Type 1 hazardous materials response team meets all requirements of a Type 2 hazardous materials response team in addition to the following:

1. Can deal with all hazards, including WMDs.

2. Access to specialized detection equipment.

3. Ability to use special resources that may be required for dealing with biological materials.

4. Access to advanced monitoring equipment.



5. Ability to identify and establish exclusion zones.

6. Ability to conduct environmental and personnel surveys.

7. Access to WMD references, databases and reach-back.

8. Ability to confine and control WMD incidents.

9. Access to satellite data and voice service.

10. Capability for GPS tracking and mapping.

NATIONAL GUARD WEAPONS OF MASS DESTRUCTION CIVIL SUPPORT TEAM

- 57 teams nationwide.
- Made up of 22 personnel and six sections.
- Deployment time:
  - Advance team — within 90 minutes.
  - Main team — within three hours.
- Federally resourced, trained and funded, but state controlled.

Slide 3-21

F. National Guard Weapons of Mass Destruction Civil Support Team (WMD-CST): Emergency response organizations should establish relationships with the WMD-CST before an event. WMD-CSTs will also participate in training exercises.

1. There are currently 57 teams in the U.S. Each state, U.S. territory, and Washington, D.C., have one team each; California, Florida and New York each have two teams.

2. A WMD-CST team includes 22 full-time personnel and is structured by six sections (Command, Operations, Communications, Administration/ Logistics, Medical/Analytical and Survey).

3. Advance team deploys within 90 minutes; the main team deploys in three hours.

4. CSTs are federally resourced, trained and funded but are state controlled.

ACTIVITY 3.4

Typing Hazardous Materials Response Teams

Purpose

Research and discuss the requirements of various hazardous materials response teams.

Directions

1. Individually and in your small group, use the Resource Typing Definition for Environmental Response/Health and Safety Fire/Hazardous Materials and Position Qualification for Environmental Response/Health and Safety Fire/Hazardous Materials documents found in the Supplemental Materials section and/or other online sources to research the requirements of various hazardous materials.

2. Answer the questions listed and be prepared to share your group work with the class using the easel pad or the whiteboard.

Individual Questions

1. Based on the staffing and equipment available to your jurisdiction, what FEMA designation (Type 1, Type 2 or Type 3) would your hazardous materials response team be classified as?

2. Based on the hazards found within your jurisdiction (fixed facilities, transportation corridors, chemicals present, etc.) what FEMA designation (Type 1, Type 2 or Type 3) hazardous materials response team does your jurisdiction need?

3. Given the mandate from your fire chief and your jurisdiction's governing body, how difficult would it be for your hazardous materials response team to achieve the next highest-level designation (e.g., moving from a Type 3 to a Type 2 team)? What would be required in terms of additional staffing, training and equipment?

___

___

___

Small Group Assignment

Utilizing the Resource Typing Definition for Environmental Response/Health and Safety Fire/Hazardous Materials document in the Supplemental Materials section, research the components as assigned below for Type 1, Type 2 and Type 3 hazardous materials response teams.

Group 1

- Capability per team.
- Field presumptive testing and public safety screening capabilities.

Group 2

- Atmospheric air monitoring capabilities.
- Sampling capabilities.

Group 3

- Substance detection and monitoring equipment.
- Radiation detection and monitoring capabilities.

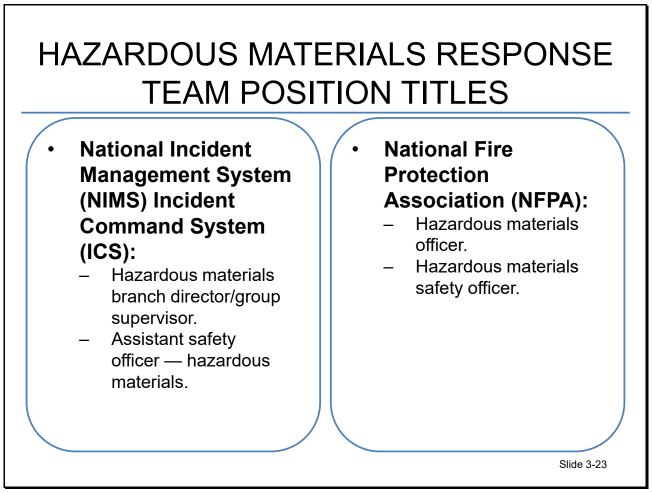
Group 4

- PPE.
- Technical reference capabilities.

Group 5

- Incident intervention capabilities.
- Communications equipment.

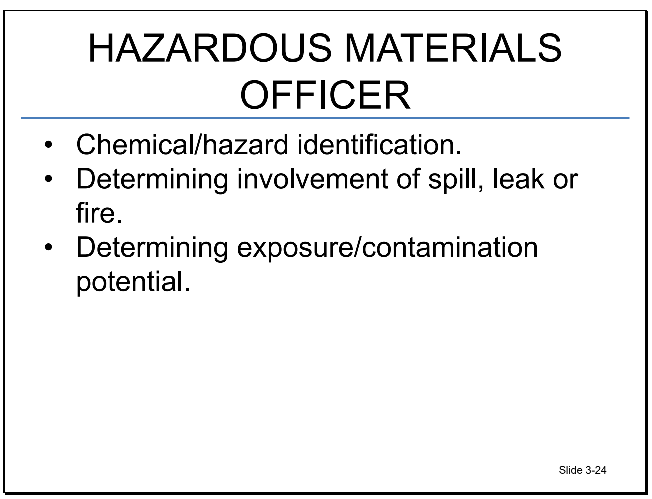
III. ORGANIZATION OF THE HAZARDOUS MATERIALS RESPONSE TEAM



A. Hazardous materials response team position titles.

1. Hazardous materials branch director or group supervisor (National Incident Management System (NIMS) Incident Command System (ICS)); hazardous materials officer (NFPA).

2. Assistant safety officer — hazardous materials (NIMS ICS); hazardous materials safety officer (NFPA).



B. Hazardous materials officer is responsible for:

1. Chemical/hazard identification.

2. Determining involvement of spill, leak or fire.

3. Determining exposure/contamination potential.

HAZARDOUS MATERIALS SAFETY OFFICER

- Completion of ICS Form 208 HM, Site Safety and Control Plan.
- Identification and selection of proper personal protective equipment (PPE), decontamination, tools and monitors.
- Verification of emergency medical services (EMS) transport on scene.
- Establishing medical/rehabilitation.
- Identification of backup team and Rapid Intervention Team (RIT).

Slide 3-25

C. Hazardous materials safety officer handles:

1. Completion of ICS Form 208 HM, Site Safety and Control Plan.

2. Identification and selection of proper PPE, decontamination, tools and monitors.

3. Verification of emergency medical services (EMS) transport on scene.

4. Establishing medical/rehabilitation.

5. Identification of backup team and Rapid Intervention Team (RIT).

INFORMATION/SCIENCE OFFICER

- Chemical information.
- Container information.
- Weather information.
- PPE selection and verification.
- Evacuation versus shelter-in-place.
- Evacuation distances.
- Reportable quantity.
- Medical treatment information.
- Reactivity information.

Slide 3-26

D. Information/science officer handles:

1. Chemical information.

2. Container information.

3. Weather information.

4. PPE selection and verification.

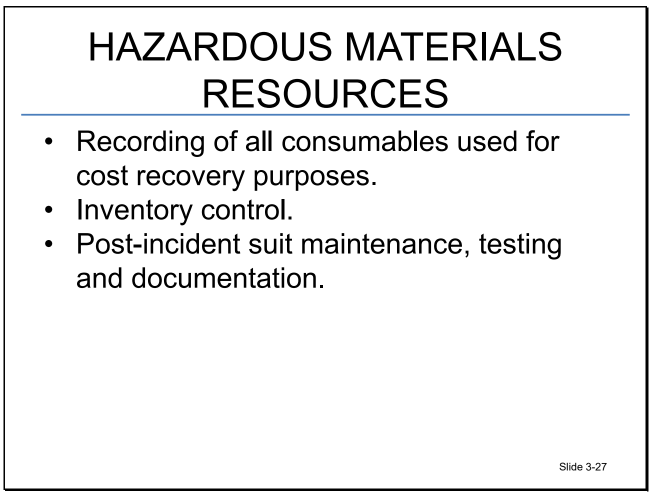
5. Evacuation versus shelter-in-place.

6. Evacuation distances.

7. Reportable quantity.

8. Medical treatment information.

9. Reactivity information.



E. Hazardous materials resources personnel handle:

1. Recording of all consumables used for cost recovery purposes.

2. Inventory control.

3. Post-incident suit maintenance, testing and documentation.

HAZARDOUS MATERIALS MEDICAL

- Pre- and post-entry vital signs.
- Rehabilitation.
- Medical treatment/signs and symptoms.
- ICS Form 206, Medical Plan.

Slide 3-28

F. Hazardous materials medical personnel handle:

1. Pre-entry vital signs.
2. Post-entry vital signs.
3. Rehabilitation.
4. Liaison with EMS.
5. Medical treatment information.
6. Signs and symptoms of chemical exposure.
7. ICS Form 206, Medical Plan.

ENTRY TEAM LEADER

- Selection of entry team personnel based on needs of incident and training/specialties.
- Radio check with entry team.
- Constant contact with entry team.
- Ensuring the status of backup team and RIT.

Slide 3-29

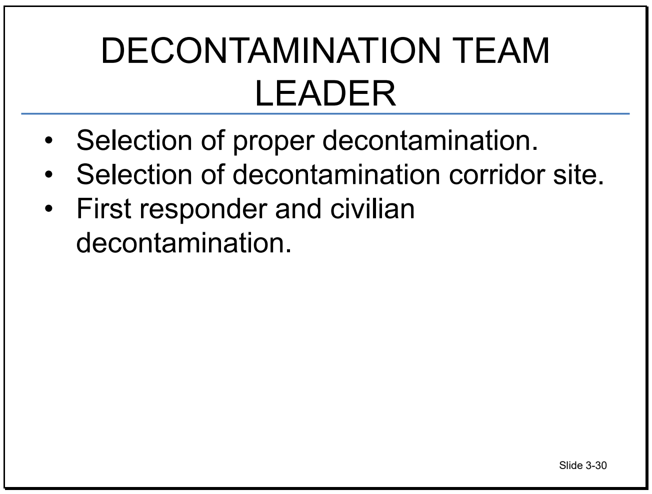
G. Entry team leader handles:

1. Selection of entry team personnel based on needs of incident and training/ specialties.

2. Radio check with entry team.

3. Constant contact with entry team.

4. Ensuring the status of backup team and RIT.



H. Decontamination team leader handles:

1. Selection of proper decontamination.

2. Selection of decontamination corridor site.

3. First responder and civilian decontamination.

I. Other positions impacting hazardous materials response team.

1. IC.

2. Public Information Officer (PIO).

3. Liaison officer.

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ACTIVITY 3.5

Hazardous Materials Response Team Positions — Knowledge, Skills and Abilities

Purpose

Share the knowledge, skills and abilities (KSAs) requirements for each of the hazardous materials response team positions in various jurisdictions.

Directions

1. Working in small groups, discuss the KSAs required to qualify for hazardous materials response team positions in your department or state.
   a. Hazardous materials officer.
   b. Hazardous materials safety officer.
   c. Information/science officer.
   d. Hazardous materials resources.
   e. Hazardous materials medical.
   f. Entry team leader.
   g. Decontamination team leader.
2. Working in the same small group, develop a typed job description for one of the hazardous materials positions assigned to your group. Include the following information in the job description:
   a. Position title and description.
   b. Knowledge.
   c. Skills.
   d. Abilities.
   e. Education.
   f. Years of service/time in grade.
   g. Officer/firefighter.
3. Be prepared to share your group's responses with the class.

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ACTIVITY 3.6

The Way Forward Research Group

Purpose

Meet with assigned groups for the Unit 9: Assessment research project and begin discussing the project topic.

Directions

1. The instructor will assign groups of three for The Way Forward research project and presentation in Unit 9. Gather with your assigned project group.

   The objective of the research project is for you to apply your hazardous materials research, knowledge and experiences in a synergistic approach for you and your peers to return home with "takeaways" that may potentially be used to positively impact your community, organization or agency.

   The Way Forward project is worth 25% of your grade. Please refer to the grading rubric in your Student Manual (SM) to review how the research and presentation will be evaluated.

2. Review and discuss potential project topics. You may select from the list of potential topics or come up with a new topic. If electing to research a new topic not on the list, please discuss with the instructor first.

3. A group representative will provide the selected topic by the next day for the instructor's awareness and approval.

4. Each group will present their research on the last day of the course. Each group has approximately 20 minutes to present, and an additional five to 10 minutes for peer/instructor questions and answers. All members of the team must contribute during the presentation.

   a. Electronic presentations are encouraged but not required. Whiteboards, easel pads and/or other methods for presenting information may be used.

   b. Video(s) must be approved by instructors prior to the presentation.

   c. A one-page summary handout outlining the points of your project topic must be developed and distributed to the class.

Potential Topics

1. Anatomy of a hazardous materials call — tell the story.

   a. Details about the product, container, environment and cause.
   b. Lessons learned.
   c. Video, audio, Incident Action Plan (IAP) documentation, etc.

2. Any issue related specifically to assisting in the management or operations in one of the hazardous materials group tasks (SIRMED (Safety Officer — Hazardous Materials, Information/Science, Resources, Medical, Entry Team, Decontamination)).

3. Specific data on any hazardous material or WMD threat agent.

   a. Historical data about the material.
   b. Common uses today.
   c. Chemical and physical properties.
   d. Detection technology.
   e. Example of a release or use.

4. Specific data on any hazardous materials container.

   a. Historical data about the container.
   b. Common materials contained.
   c. Construction, safety devices, pressures, capacities, markings.
   d. Example of an incident or event involving this container.

5. Information regarding a new tool, technique, technology, procedure or PPE.

   a. Related to any segment of SIRMED.
   b. Example of its use — demonstration (video or actual).
   c. How to get further information about it.

6. Example of a standard operating guideline (SOG) or standard operating procedure (SOP) that had or has a positive impact on your team.

   a. Provide example SOG or SOP.
   b. Tactical worksheet, initial arrival checklists, etc.; demonstrate their use.

7. Topics regarding issues that would improve the health and safety of responders (hazardous materials response related).

8. Other topics approved by the instructor(s).

ACTIVITY 3.7

Who Am I?: Hazardous Materials Roles and Responsibilities

Purpose

Review the roles and responsibilities of a hazardous materials response team.

Directions

1. One representative from each small group will take turns drawing.

2. Each small group representative will choose a random card (provided by the instructor) with one of the following hazardous materials response team positions:

   a. Hazardous materials officer.

   b. Hazardous materials safety officer.

   c. Information/science officer.

   d. Hazardous materials resources.

   e. Hazardous materials medical.

   f. Entry team leader.

   g. Decontamination team leader.

   h. IC.

   i. PIO.

   j. Liaison officer.

   The drawing representative cannot speak or gesture to their group.

3. The small group representative will use the easel pad to draw clues about the selected position. The instructor will start the timer as soon as the group representative starts drawing.

4. Remaining small group members will discuss within the group and call out "**stop**" when they agree on a final answer, at which point the group representative will stop drawing and the instructor will stop the timer. Groups are only allowed to present one final answer.

5. At the end of the activity, the instructor will announce the group that guessed the correct position in the least amount of time.

IV. SUMMARY

FEMA

U.S. Fire Administration

SUMMARY

- Having the right resources.
- Resource typing.
- Organization of the hazardous materials response team.

Slide 3-34

- What have you learned in this unit?
- Do you have any questions?

Slide 3-35

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SUPPLEMENTAL MATERIALS

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Unit 3 Supplemental Materials

Table of Contents

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Available Hazardous Materials Technician Specialty Training Information

Please note that not all technician specialties have established training courses.

Tank Car

Tank Car Specialist
https://sertc.org/courses/tcs/

Tank Car Specialist — Advanced
https://sertc.org/courses/tcs-a/

Crude Oil/Class 3 Flammable Liquid Emergencies Transported by Rail
https://sertc.org/courses/crude-by-rail-emergency-response-cbr/

Security and Emergency Response Training Center
Pueblo, Colorado

Cargo Tank

Highway Emergency Response Specialist
https://sertc.org/courses/hers/

Highway Emergency Response Specialist — Advanced
https://sertc.org/courses/hers-a/

Security and Emergency Response Training Center
Pueblo, Colorado

Intermodal Tank

Intermodal Specialist
https://sertc.org/courses/ims/

Security and Emergency Response Training Center
Pueblo, Colorado

Flammable Liquids Bulk Storage

Xtreme Industrial Fire & Hazard Training
https://www.williamsfire.com/training/xtreme-industrial-fire-hazard-training

Williams Fire and Hazard Control
College Station, Texas

Radiological Hazards

Response to Radiological/Nuclear Weapons of Mass Destruction Incidents
http://www.ctosnnsa.org/pages/courses/courses_resident.htm#course1

Center for Radiological Nuclear Training
Mercury, Nevada

Radiological Emergency Response Operations
https://cdp.dhs.gov/training/course/PER-904

Advanced Radiological Incident Operations
https://cdp.dhs.gov/training/course/PER-905

Center for Domestic Preparedness
Anniston, Alabama

Advanced Monitoring and Detection

Hazardous Materials Technologies: Sampling, Monitoring and Detection
https://cdp.dhs.gov/training/course/PER-261

Center for Domestic Preparedness
Anniston, Alabama

Weapons of Mass Destruction

Response to Radiological/Nuclear Weapons of Mass Destruction Incidents
http://www.ctosnnsa.org/pages/courses/courses_resident.htm#course1

Center for Radiological Nuclear Training
Mercury, Nevada

Incident Response to Terrorist Bombings
http://www.emrtc.nmt.edu/training/irtb.php

Prevention of and Response to Suicide Bombing Incidents
http://www.emrtc.nmt.edu/training/prsbi.php

Energetic Materials Research and Testing Center
Socorro, New Mexico

Hands-On Training for CBRNE Incidents
https://cdp.dhs.gov/training/course/PER-262

Center for Domestic Preparedness
Anniston, Alabama

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Resource Typing Definition for Environmental Response/Health and Safety Fire/Hazardous Materials

FEMA

Resource Typing Definition for Environmental Response/Health and Safety
Fire/Hazardous Materials

HAZARDOUS MATERIALS RESPONSE TEAM

DESCRIPTION	A Hazardous Materials Response Team is an organized group of hazardous materials (HAZMAT) technicians who respond to HAZMAT incidents, including those involving Weapons of Mass Destruction (WMD). Additional personnel trained in HAZMAT operations may assist the Hazardous Materials Response Team in performing low-risk tasks that do not bring them into contact with hazardous materials or substances, at the team leader's discretion.
RESOURCE CATEGORY	Fire/Hazardous Materials
RESOURCE KIND	Team
OVERALL FUNCTION	The Hazardous Materials Response Team: 1. Detects the presence of, and identifies associated chemical and physical properties of, HAZMAT and WMD substances 2. Identifies and establishes control zones 3. Contains and mitigates solid, liquid, gas, and vapor leaks through interventions such as neutralization, plugging, and patching 4. Uses standard protocols to collect and label substances and evidence in preparation for transportation 5. Interprets readings from radiation detection devices and conducts geographical surveys to search for suspected contamination or radiological sources 6. Takes action to limit exposure and contain the spread of contamination 7. Conducts research related to HAZMAT and WMD to contribute to the Incident Action Plan (IAP) 8. Develops predictive models to inform protective actions and support the IAP
COMPOSITION AND ORDERING SPECIFICATIONS	1. Discuss logistics for deploying this team, such as working conditions, length of deployment, security, lodging, transportation, and meals, prior to deployment 2. Teams deploy with their own vehicle(s), equipment, and supplies 3. Type 1 teams support multiple entries into HAZMAT/WMD environments requiring protective ensembles consistent with the following National Fire Protection Association (NFPA) standards: a. 1991: Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents b. 1992: Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies c. 1994: Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents 4. Type 2 teams support entries into environments with unknown/known and classified hazards requiring protective ensembles consistent with NFPA 1991, 1992, or 1994 standards 5. Type 3 teams support entries into environments with known and classified hazards requiring protective ensembles consistent with NFPA standards 1992 or 1994 6. Teams work in accordance with the protocols and regulations concerning work/rest ratios, exposure times, and exposure limits specified in mutual aid agreements 7. Requestor and provider discuss: a. Level of capability necessary for detection, monitoring, sampling, substance identification, and intervention b. Need for and availability of additional consumable supplies such as damming/diking materials and showers c. Need for specialized equipment such as secure radios d. Mission-specific capabilities such as tank car, railcar, cargo tank trucks, intermodal tanks, marine tanks, non-tank vessels, radioactive materials, and bulk storage for flammable liquids and gases e. Coordination with local, state, and Federal agencies–such as Local Emergency Planning Committee (LEPC), State Emergency Response Commission (SERC), and Environmental Protection Agency (EPA)

Each type of resource builds on the qualifications of the type below it. For example, Type 1 qualifications include the qualifications in Type 2, plus an increase in capability. Type 1 is the highest qualification level.

FEMA

Resource Typing Definition for Environmental Response/Health and Safety
Fire/Hazardous Materials

COMPONENT	TYPE 1	TYPE 2	TYPE 3	NOTES
MINIMUM PERSONNEL PER TEAM	8	8	8	Not Specified
MANAGEMENT AND OVERSIGHT PERSONNEL PER TEAM	Same as Type 2	Same as Type 3	1 - National Incident Management System (NIMS) Hazardous Materials Technician	This NIMS Hazardous Materials Technician functions as team leader.
SUPPORT PERSONNEL PER TEAM	Same as Type 2	Same as Type 3	7 - NIMS Hazardous Materials Technician	Team members function in the following roles, as necessary: 1. Hazardous Materials Technician 2. Assistant Safety Officer - Hazardous Materials 3. Hazardous Materials Technical Reference Specialist
CAPABILITY PER TEAM	All hazards, including WMD	Unknown and known chemicals	Known chemicals	A "known chemicals" Type 3 team, for example, would be similar to a facility response team.
FIELD PRESUMPTIVE TESTING AND PUBLIC SAFETY SCREENING CAPABILITIES PER TEAM	Same as Type 2, PLUS: Responds to unknown or suspected WMD materials and substances using specialized detection equipment	Same as Type 3, PLUS: Identification and classification of unknown substances using a variety of advanced chemical and radiological detection devices	Capable of presumptive testing, identification, and classification of known chemical substances using a variety of sources to identify associated chemical and physical properties	Tools include printed and electronic reference resources, safety data sheets, field testing kits, specific chemical testing kits, chemical testing strips, data derived from detection devices, and air monitoring instruments.
ATMOSPHERIC AIR MONITORING CAPABILITIES PER TEAM	Same as Type 2, PLUS: Advanced detection and monitoring capabilities, including ability to use WMD detection instruments	Same as Type 3, PLUS: Ability to use advanced detection equipment to detect the presence of known or unknown gases or vapors; advanced detection and monitoring may incorporate sophisticated instruments that can differentiate between two or more hazardous vapors and that may identify by name a specific hazardous or toxic vapor	Ability to use devices to detect the presence of known gases or vapors, including the ability to monitor for oxygen deficiency percentage, flammable atmosphere lower explosive limit (LEL), carbon monoxide, and hydrogen sulfide	Not Specified
SAMPLING CAPABILITIES PER TEAM	Same as Type 2, PLUS: Same as Type 2, PLUS: Ability to use special resources that may be required for collecting air samples and handling biological materials	Same as Type 3, PLUS: 1. Ability to sample, collect, containerize, label, and prepare to transport unknown toxic industrial chemicals or toxic industrial materials–both liquid and solid–in accordance with standard collection and chain of custody protocols 2. Ability to collect, handle, and track samples to be used as evidence	Ability to perform the following activities with known toxic industrial chemicals or toxic industrial materials, according to established protocols: standard sampling, collection, containerizing, labeling, and preparation for transportation and distribution, including standard environmental sampling procedures for lab analysis	Not Specified

FEMA

Resource Typing Definition for Environmental Response/Health and Safety
Fire/Hazardous Materials

	TYPE 1	TYPE 2	TYPE 3	NOTES
	Same as Type 2, PLUS: 1. Advanced testing instruments, such as gas chromatography and mass spectrometry devices 2. Advanced direct-reading instruments for perimeter air monitoring, such as surface acoustic wave (SAW) or nanotechnology devices 3. Advanced radiological detection instruments, such as x-ray and neutron detection monitors and isotope identification instruments	Same as Type 3, PLUS: 1. Intermediate testing equipment, such as Fourier transform infrared (FTIR) spectroscopy or Raman spectroscopy devices 2. Intermediate direct-reading instruments, such as flame ionization detectors (FID) 3. Intermediate radiological detection instruments, such as alpha radiation detection monitors with survey capabilities	Tools for testing chemical substances to identify chemical and physical properties, including: 1. Basic testing instruments, such as chemical testing kits and testing strips 2. Basic direct-reading instruments, such as multi-gas meters and photoionization detectors (PID)–O2, LEL, H2S, and CO at minimum 3. Basic radiological detection instruments, such as beta and gamma radiation detection and survey monitors 4. Printed and electronic reference resources 5. Safety data sheets 6. Personal dosimeter (for each team member)	Not Specified
	Same as Type 2, PLUS: 1. Ability to identify and establish exclusion zones 2. Ability to identify some but not all radionuclides, including neutron detection 3. Ability to conduct environmental and personnel surveys 4. Possession of accumulative self-reading dosimetry (for each survey team member)	Same as Type 3, PLUS: 1. Ability to detect and survey for alpha, beta, and gamma radiation	1. Ability to accurately interpret readings from beta and gamma radiation detection devices 2. Ability to conduct a geographical survey search for suspected radiological sources or contamination spread	Not Specified
	Same as Type 2	Same as Type 3, PLUS: 1. Vapor-protective chemical protective clothing (CPC) 2. Flash-fire vapor- protective CPC, including a flash-fire protective option for vapor-protective CPC 3. WMD-compliant CPC	1. Complete CPC ensembles, including: a. Suit (encapsulating or non-encapsulating jumpsuit, multipiece; specifications depend on level of protection required) b. Boots c. Gloves 2. Liquid splash protection 3. Self-contained breathing apparatus (SCBA) or other respiratory protection, as appropriate	1. Liquid splash protection must comply with NFPA 1992 standards. 2. Vapor-protective CPC and flash-fire vapor-protective CPC must comply with NFPA 1991. 3. Protective ensembles for first responders to WMD terrorism incidents must comply with NFPA 1994. 4. Respiratory protection, including SCBA or air purifying respirator (APR), complies with Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) Part 1910.120: Hazardous Waste Operations and Emergency Response, and Part 1910.134: Respiratory Protection.

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Resource Typing Definition for Environmental Response/Health and Safety
Fire/Hazardous Materials

COMPONENT	TYPE 1	TYPE 2	TYPE 3	NOTES
TECHNICAL REFERENCE CAPABILITIES PER TEAM	Same as Type 2, PLUS: Access to WMD references, databases, or reach-back assistance	Same as Type 3, PLUS: At minimum, access to technical references or outsourced reach-back capabilities and at least one source of air modeling with map overlay capabilities	1. Ability to access and use various databases, chemical substance data repositories, other guidelines and safety data sheets (print or electronic), standalone computer programs, and data available via telecommunications 2. Ability to interpret data collected from electronic devices and chemical testing procedures and select a response option	Not Specified
INCIDENT INTERVENTION CAPABILITIES PER TEAM	Same as Type 2, PLUS: Advanced capabilities, including the ability to intervene and confine/control incidents involving WMD materials	Same as Type 3, PLUS: Ability to use a chemical means such as neutralization and encapsulation of known and unknown chemicals, along with mechanical means (pneumatic and standard patching systems)–including specially designed kits for controlling leaks in large atmospheric or pressurized containers	1. Ability to use a mechanical means of intervention and product control, such as plugging, patching, off-loading, and tank stabilization, along with environmental means such as adsorption, absorption, dams, dikes, and booms 2. Access to an assortment of hand tools	Hand tools may include hammers, wrenches, pliers, screwdrivers, bung wrenches, shovels, wrecking bars, drum upenders, chisels, punches, and so on.
COMMUNICATIONS EQUIPMENT PER TEAM	Same as Type 2, PLUS: 1. Satellite data and voice service 2. GPS tracking and mapping	Same as Type 3, PLUS: 1. Wireless data communications with stand-off 2. 2 laptop computers 3. Long-range optics 4. Portable weather station	1. 8 handheld two-way portable radios 2. 2 smartphones 3. Laptop computer 4. Color printer	Personnel using CPC must be able to communicate appropriately and safely with each other.
DECON CAPABILITIES PER TEAM	Same as Type 2	Same as Type 3	Ability to support all team decontamination needs	Local first responder operations (FRO) personnel augment this team's decontamination capabilities, if necessary.
DECONTAMINATION SUPPLIES PER TEAM	Same as Type 2	Same as Type 3	Range of supplies and equipment for conducting decontamination, commensurate with the mission assignment	Not Specified

NOTES

Nationally typed resources represent the minimum criteria for the associated component and capability.

REFERENCES

1. FEMA, NIMS 509: Hazardous Materials Technician
2. FEMA, National Incident Management System (NIMS), October 2017
3. FEMA, National Response Framework, June 2016
4. National Fire Protection Association (NFPA) 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, latest edition adopted
5. NFPA 475: Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program, latest edition adopted
6. NFPA 1072: Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications, latest edition adopted
7. NFPA 1991: Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents, latest edition adopted
8. NFPA 1992: Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies, latest edition adopted
9. NFPA 1994: Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents, latest edition adopted
10. Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) Part 1910.120: Hazardous Waste Operations and Emergency Response, latest edition adopted
11. OSHA 29 CFR Part 1910.134: Respiratory Protection, latest edition adopted
12. U.S. Fire Administration (USFA)/National Fire Academy (NFA): Field Operations Guide ICS 420-1, latest edition adopted

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Position Qualification for Environmental Response/Health and Safety Fire/Hazardous Materials

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Position Qualification for Environmental Response/Health and Safety
Fire/Hazardous Materials

HAZARDOUS MATERIALS TECHNICIAN

RESOURCE CATEGORY	Fire/Hazardous Materials
RESOURCE KIND	Personnel
OVERALL FUNCTION	The Hazardous Materials Technician responds to hazardous materials (HAZMAT) incidents, including those involving Weapons of Mass Destruction (WMD). When serving as part of a response team, the Hazardous Materials Technician may also function in one or more of the following roles, as necessary: 1. Team Leader 2. Assistant Safety Officer - Hazardous Materials 3. Hazardous Materials Technical Reference Specialist
COMPOSITION AND ORDERING SPECIFICATIONS	1. This position can be ordered as a single resource or in conjunction with a NIMS typed team (Hazardous Materials Response Team). 2. Discuss logistics for deploying this position, such as working conditions, length of deployment, security, lodging, transportation, and meals, prior to deployment 3. Requestor and provider discuss necessary mission-specific capabilities, such as tank car, railcar, cargo tank trucks, intermodal tanks, marine tanks, non-tank vessels, radioactive materials, and bulk storage for flammable liquids and gases 4. Requestor and provider discuss team oversight and incorporation of this team into the larger response structure

Each type of resource builds on the qualifications of the type below it. For example, Type 1 qualifications include the qualifications in Type 2, plus an increase in capability. Type 1 is the highest qualification level.

COMPONENT	SINGLE TYPE	NOTES
DESCRIPTION	The Hazardous Materials Technician: 1. Responds to HAZMAT incidents, including those involving WMD 2. Uses a risk-based response process to analyze problems 3. Selects applicable detection and monitoring equipment, Personal Protective Equipment (PPE), decontamination procedures, and control equipment	When part of a response team, this position may also function in one or more of the following roles, as necessary, in accordance with National Fire Protection Association (NFPA) 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents and NFPA 1072: Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications 1. Team Leader 2. Assistant Safety Officer - Hazardous Materials 3. Hazardous Materials Technical Reference Specialist
EDUCATION	Not Specified	Not Specified
TRAINING	Completion of the following: 1. IS-100: Introduction to the Incident Command System, ICS-100 2. IS-200: Basic Incident Command System for Initial Response, ICS-200 3. IS-700: National Incident Management System, An Introduction 4. IS-800: National Response Framework, An Introduction 5. Training in accordance with Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) Part 1910.120: Hazardous Materials Technician Level, and NFPA 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents 6. Training in accordance with OSHA 29 CFR Part 1910.134(k): Respiratory Protection	Technicians may complete additional training in HAZMAT specialties in accordance with OSHA 29 CFR Part 1910.120(q)(6)(iv) or NFPA 472, such as one or more of the following specialty areas: 1. Cargo tank 2. Tank car 3. Marine tank and non-tank vessel 4. Intermodal tank 5. Flammable gas bulk storage 6. Flammable liquid bulk storage 7. Railcar 8. Radioactive materials 9. Clandestine manufacturing labs 10. Explosive manufacturing labs

FEMA

Position Qualification for Environmental Response/Health and Safety
Fire/Hazardous Materials

COMPONENT	SINGLE TYPE	NOTES
EXPERIENCE	Knowledge, Skills, and Abilities: 1. Knowledge of relevant terminology and behavior 2. Ability to perform advanced hazard and risk assessment 3. Ability to perform advanced control, containment, and confinement techniques 4. Ability to select and use specialized PPE 5. Ability to implement decontamination procedures 6. Knowledge of radiological dosimeter tracking and recording procedures Experience: One year of work experience in HAZMAT response	Hazardous Materials Technicians serving as Team Leaders, Assistant Safety Officers, or Technical Reference Specialists should have prior experience in those roles.
PHYSICAL/MEDICAL FITNESS	1. Moderate 2. Maintains compliance with OSHA 29 CFR Part 1910.120(f)(3): Frequency of medical examinations and consultations, and OSHA 29 CFR Part 1910.134: Respiratory Protection 3. Maintains Authority Having Jurisdiction (AHJ)-determined physical fitness standards suitable for the environment and typing; for example, the NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments and the National Wildfire Coordinating Group (NWCG) Fitness and Work Capacity meet or exceed this physical fitness standard	The NIMS Guideline for the National Qualification System (NQS) defines Physical/Medical Fitness levels for NIMS positions.
CURRENCY	1. Functions in this position during an operational incident, planned event, exercise, drill, or simulation at least once every year 2. Completes annual refresher training in accordance with OSHA 29 CFR Part 1910.120 or in accordance with AHJ requirements	Not Specified
PROFESSIONAL AND TECHNICAL LICENSES AND CERTIFICATIONS	Maintains AHJ-determined certification or documentation indicating completion of training, consistent with OSHA 29 CFR Part 1910.120(q)(6)(iii), NFPA 472, and NFPA 1072	Not Specified

NOTES

Nationally typed resources represent the minimum criteria for the associated component and capability.

REFERENCES

1. FEMA, NIMS 508: Hazardous Materials Response Team
2. FEMA, National Incident Management System (NIMS), October 2017
3. FEMA, NIMS Guideline for the National Qualification System, November 2017
4. FEMA, National Response Framework, June 2016
5. National Fire Protection Association (NFPA) 472: Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, latest edition adopted
6. NFPA 475: Recommended Practice for Organizing, Managing, and Sustaining a Hazardous Materials/Weapons of Mass Destruction Response Program, latest edition adopted
7. NFPA 1072: Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications, latest edition adopted
8. NFPA 1582: Standard on Comprehensive Occupational Medical Program for Fire Departments, latest edition adopted
9. Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) Part 1910.120: Hazardous Waste Operations and Emergency Response, latest edition adoptedadopted
10. OSHA 29 CFR Part 1910.134: Respiratory Protection, latest edition adopted
11. National Wildfire Coordinating Group (NWCG), PMS 307: Work Capacity Test, latest edition adopted
12. U.S. Fire Administration (USFA)/National Fire Academy (NFA): Field Operations Guide ICS 420-1, latest edition adopted

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UNIT 4: DEVELOPING THE PLAN OF ACTION

TERMINAL OBJECTIVE

The students will be able to:

4.1 Plan a response within the capabilities and competencies of available personnel, personal protective equipment (PPE) and response equipment, given the Incident Commander's (IC's) objectives.

ENABLING OBJECTIVES

The students will be able to:

4.1 Analyze the principles of incident management in order to accomplish the IC's objectives.

4.2 Explain the Incident Action Plan (IAP) development process.

4.3 Develop and complete an Incident Command System (ICS) Form 208 HM, Site Safety and Control Plan and 215A-CG, Incident Action Plan Safety Analysis.

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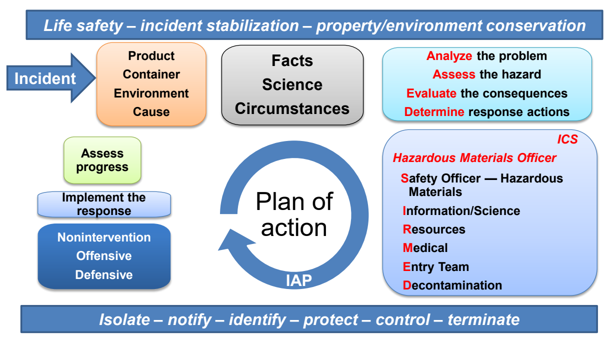
U.S. Fire Administration

UNIT 4: DEVELOPING THE PLAN OF ACTION

Slide 4-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC

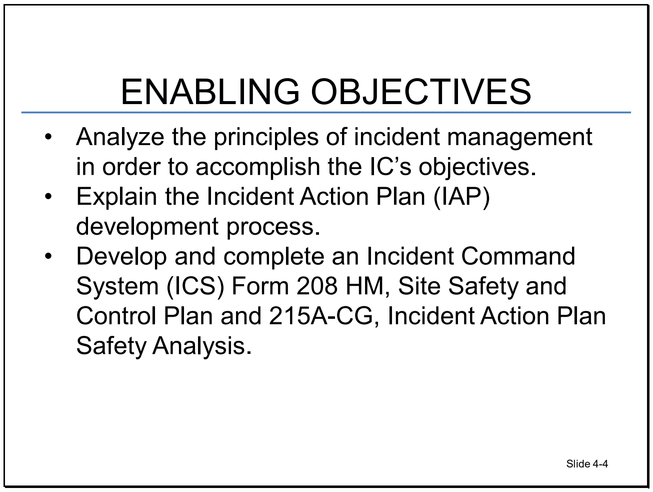


Slide 4-2

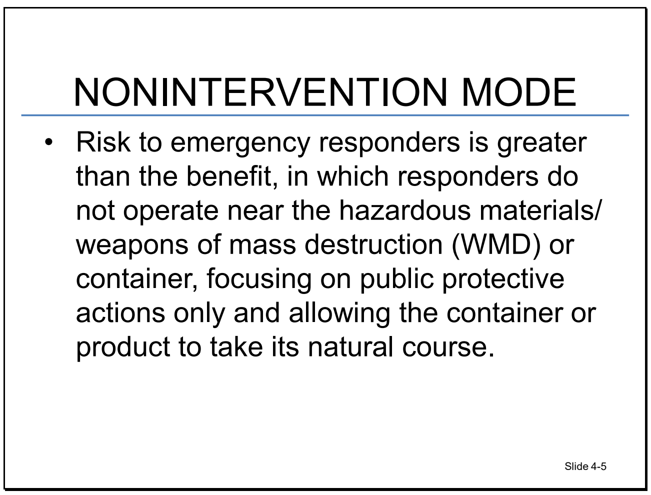
TERMINAL OBJECTIVE

Plan a response within the capabilities and competencies of available personnel, personal protective equipment (PPE) and response equipment, given the Incident Commander's (IC's) objectives.

Slide 4-3



I. OPERATIONAL MODES



A. Nonintervention operational mode.

1. An operational mode used where the risk to emergency responders is greater than the benefit, in which responders do not operate near the hazardous materials/weapons of mass destruction (WMD) or container, focusing on public protective actions only and allowing the container or product to take its natural course.

2. This operational mode is typically employed after a risk-based analysis determines that the risk to emergency responders is greater than the benefit of operating in a defensive or offensive mode.

NONINTERVENTION MODE (cont'd)

- Pros:
  - Highest degree of personnel safety.
  - Can be easily accomplished with limited training and resources required.
- Cons:
  - May negatively alter public image.
  - May require the sacrifice of property or increasing environmental damage.

Slide 4-6

a. Pros:

- Highest degree of personnel safety.

- Can be easily accomplished with limited training and resources required.

b. Cons:

- May negatively alter public image.

- May require the sacrifice of property or increasing environmental damage.

NONINTERVENTION MODE (cont'd)

- When to use:
  - Nonintervention operation is used when the incident is unsafe based on facts, science and circumstances, or based on inadequate resources.
  - May be required until the scene stabilizes.

Slide 4-7

c. When to select this type of response objective:

- Nonintervention operations are used when the risks are unacceptable as compared to allowing a natural resolution to the problem.

- Nonintervention operations are used when the incident is unsafe based on facts, science and circumstances, or based on inadequate personnel, training, equipment and/or resources.

- Operations in this mode may be required until the scene stabilizes and transition to another operational mode becomes possible.

DEFENSIVE MODE

- Medium risk to emergency responders, in which responders do not have direct contact with the hazardous materials/ WMD, focusing on safely controlling or limiting the effects of a release.

Slide 4-8

B. Defensive operational mode.

1. An operational mode characterized as medium risk to emergency responders, in which responders do not have direct contact with the hazardous materials/WMD, focusing on safely controlling or limiting the effects of a release.

2. This operational mode is typically employed when a risk-based analysis determines that some risk to emergency responders is justified to safely complete the incident objectives.

DEFENSIVE MODE (cont'd)

- Pros:
  – More easily accomplished.
  – Less training and resources required.
- Cons:
  – May negatively alter public image.
  – May require the sacrifice of property or increasing environmental damage.

Slide 4-9

a. Pros:

- More easily accomplished.
- Less training and resources required.

b. Cons:

- May negatively alter public image.
- May require the sacrifice of property or increasing environmental damage.

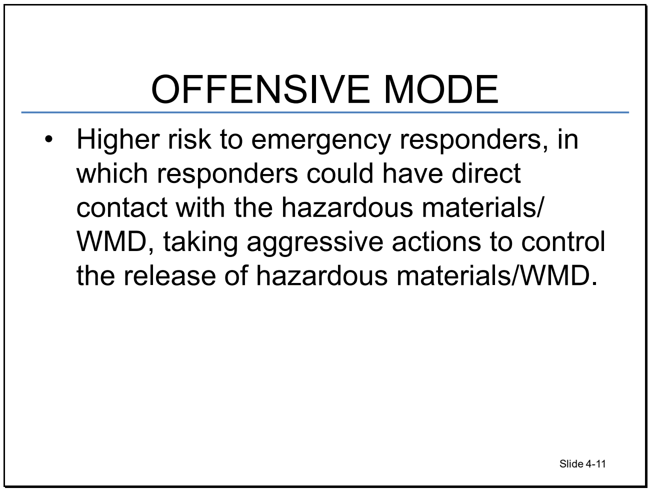
DEFENSIVE MODE (cont'd)

- When to use:
  - When the incident requires resources and/or training that are not currently available.
  - May be necessary until the scene stabilizes.

Slide 4-10

c. When to select this type of operational mode:

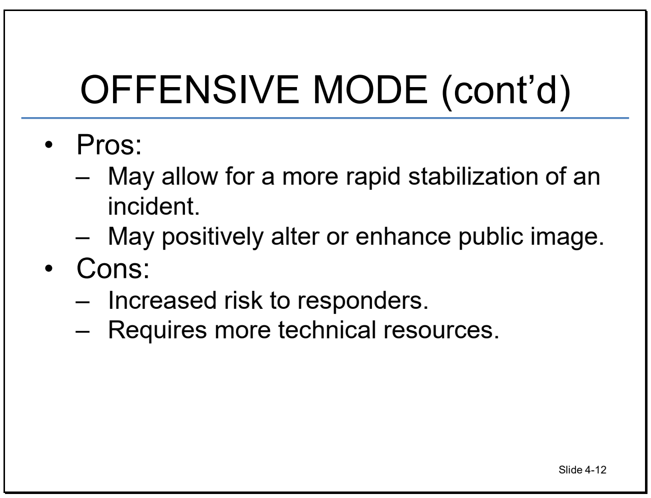
- Defensive operations are used when the incident requires resources and/or training that are not currently available. Controlling the release is the safest option without the means to stop the release.
- Operations in this mode may be necessary until the scene stabilizes.



C. Offensive operational mode.

1. An operational mode characterized as higher risk to emergency responders, in which responders could have direct contact with the hazardous materials/ WMD, taking aggressive actions to control the release of the hazardous materials/WMD.

2. This operational mode is typically employed when a risk-based analysis determines that the increased risk to emergency responders is justified to safely complete the incident objectives.



a. Pros:

- May allow for a more rapid stabilization of an incident.

- May positively alter or enhance public image.

b. Cons:

- Increased risk to responders.

- Requires more technical resources (personnel, training and/or equipment).

OFFENSIVE MODE (cont'd)

- When to use:
  - When the incident outcome can be positively affected.
  - When product contact may be unavoidable.

Slide 4-13

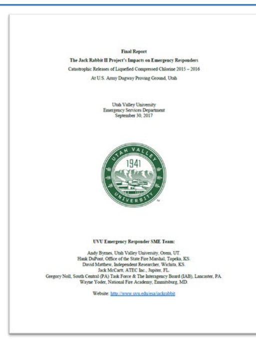
c. When to select this type of operational mode:

- Offensive mode is used when the incident outcome can be positively affected (minimization of incident damage, rescue, etc.).

- Offensive mode is also used when product contact may be unavoidable.

II. OUTCOMES OF THE JACK RABBIT REPORT

OUTCOMES OF THE JACK RABBIT REPORT



Final Report

The Jack Rabbit II Project's Impacts on Emergency Responders

Catastrophic Releases of Liquefied Compressed Chlorine 2015 – 2016

At U.S. Army Dugway Proving Ground, Utah

Utah Valley University
Emergency Services Department
September 30, 2017

UVU Emergency Responder SME Team:

Andy Byrnes, Utah Valley University, Orem, UT.
Hank DuPont, Office of the State Fire Marshal, Topeka, KS.
David Matthew, Independent Researcher, Wichita, KS.
Jack McCartt, ATEC Inc., Jupiter, FL.
Gregory Noll, South Central (PA) Task Force & The Interagency Board (IAB), Lancaster, PA.
Wayne Yoder, National Fire Academy, Emmitsburg, MD.

Website: http://www.uvu.edu/esa/jackrabbit

Slide 4-14

Homeland Security

Science and Technology

JACK RABBIT II

Catastrophic Releases of Liquefied Compressed Gases

BERKELEY LAB

UVU EMERGENCY SERVICES

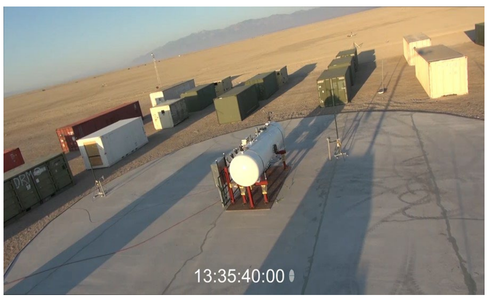
UTAH VALLEY UNIVERSITY

U.S. Fire Administration

Slide 4-15

VIDEO PRESENTATION

“JACK RABBIT II RELEASE 1”



Slide 4-16

A. The 2015 video “Jack Rabbit II Release 1” shows 9 tons of liquid Cl_2 being released, transitioning from liquid to gas.

HIGHEST PRIORITY TOXIC INHALATION HAZARDS — 2009 GAP ANALYSIS — WHY CHLORINE?

The most widely-shipped toxic inhalation hazard (TIH) chemicals in U.S. by route.

Domestic shipping totals by route (U.S. tons)

Chemical	Road	Rail	Water	Total	% of Total
Ammonia (NH_3)	5,793,000	3,470,592	1,718,974	**10,982,566**	**52.8%**
Chlorine (Cl_2)	724,000	3,750,372	137,202	**4,611,574**	**22.2%**
Sulfuric Acid (H_2SO_4)	257,000	207,560	2,057,721	**2,522,281**	**12.1%**
Acrylonitrile (C_3H_3N)	29,000	277,200	671,474	**977,674**	**4.7%**
Ethylene Oxide (C_2H_4O)	106,000	671,260	1,132	**778,392**	**3.7%**
Hydrogen Fluoride (HF)	29,000	264,560		**293,560**	**1.4%**
Sulfur Dioxide (SO_2)	72,000	172,480	361	**244,841**	**1.2%**
Hydrogen Chloride (HCl)	2,000	8,400	166,027	**176,427**	**0.8%**
Hydrogen Cyanide (HCN)	33,000	31,600		**64,600**	**0.3%**
Bromine (Br_2)	61,000			**61,000**	**0.3%**
Nitric Acid (HNO_3)	3,000	35,800	44	**38,844**	**0.2%**

~75%

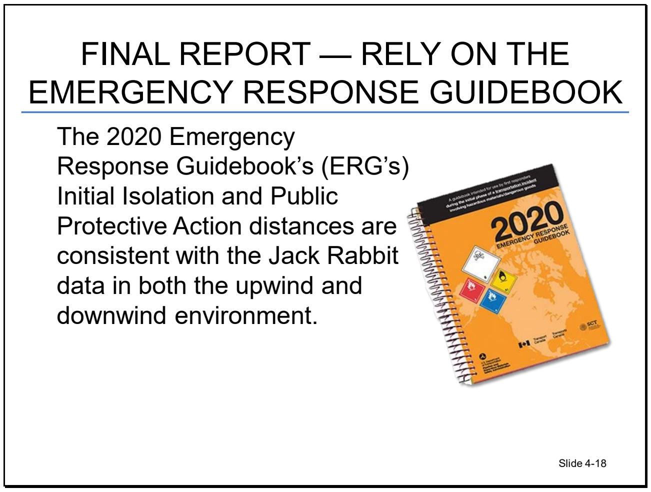
~95%

~99%

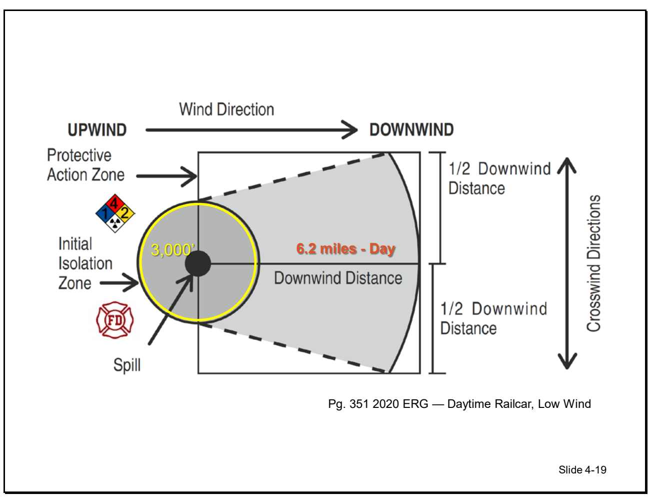
- Ammonia and chlorine dominate volume shipped.
- Consideration of chlorine’s much greater toxicity: Chlorine is TIH of greatest concern in transport.

Slide 4-17

B. Jack Rabbit focused on NH_3 and Cl_2 because they are the two most widely transported toxic inhalation hazard (TIH) materials. Jack Rabbit II used Cl_2 over NH_3 due to the toxicity and the vapor density; Cl_2 was deemed more hazardous. NH_3 will also kill quickly but not hang around as long due to the vapor density being 0.6. NH_3 is much more buoyant and active.



C. The 2020 Emergency Response Guidebook's (ERG's) Initial Isolation and Public Protective Action distances are consistent with the Jack Rabbit data in both the upwind and downwind environment.



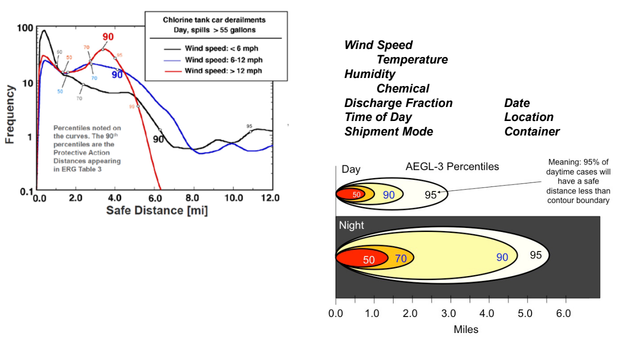
D. The ERG models are correct on a surface without trees, vehicles, fences, hills, rivers, buildings, houses, etc. The models are correct in assessing ERG distances without consideration of barriers, absorbent foliage and, ultimately, wind.

TABLE 3 - INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES FOR LARGE SPILLS FOR DIFFERENT QUANTITIES OF SIX COMMON TIH (PIH in the US) GASES

	First ISOLATE in all Directions		Then PROTECT persons Downwind during											
			DAY						NIGHT					
			Low wind (< 6 mph = < 10 km/h)		Moderate wind (6-12 mph = 10 - 20 km/h)		High wind (> 12 mph = > 20 km/h)		Low wind (< 6 mph = < 10 km/h)		Moderate wind (6-12 mph = 10 - 20 km/h)		High wind (> 12 mph = > 20 km/h)	
	Meters	(Feet)	km	(Miles)	km	(Miles)	km	(Miles)	km	(Miles)	km	(Miles)	km	(Miles)
TRANSPORT CONTAINER	UN1017 Chlorine: Large Spills													
Rail tank car	1000	(3000)	9.9	(6.2)	6.4	(4.0)	5.1	(3.2)	11+	(7+)	9.0	(5.6)	6.7	(4.2)
Highway tank truck or trailer	600	(2000)	5.8	(3.6)	3.4	(2.1)	2.9	(1.8)	6.7	(4.3)	5.0	(3.1)	4.1	(2.5)
Multiple ton cylinders	300	(1000)	2.1	(1.3)	1.3	(0.8)	1.0	(0.6)	4.0	(2.5)	2.4	(1.5)	1.3	(0.8)
Multiple small cylinders or single ton cylinder	150	(500)	1.5	(0.9)	0.8	(0.5)	0.5	(0.3)	2.9	(1.8)	1.3	(0.8)	0.6	(0.4)

Slide 4-20

E. Low winds result in larger protective distances due to the cloud's direction not being moved by higher wind speeds. The plume is likely to sit down and linger without the influence of wind.



Slide 4-21

F. Ten different sections of the U.S. are evaulated (Northwest, Southeast, Midwest, Northern Plains, etc.). Each model considers the 10 parameters shown on the slide for each run. One hundred-thousand model runs per section equals 1,000,000 run calculations. The 90th percentile of all the models considering low wind, moderate wind, and high wind conditions become the published distances — verified by actual conditions at Jack Rabbit.

G. Acute Exposure Guideline Levels (AEGLs) estimate the concentrations at which most people — including sensitive individuals such as old, sick or very young people — will begin to experience health effects if they are exposed to a hazardous chemical for a specific length of time (duration). For a given exposure duration, a chemical may have up to three AEGL values, each of which corresponds to a specific tier of health effects. The three AEGL tiers are defined as follows:

1. AEGL-3 is the airborne concentration, expressed as parts per million (ppm) or milligrams per cubic meter (mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

2. AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape.

3. AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

H. Final AEGLs for chlorine.

1. AEGL-1:

   a. 10 minutes — 0.50 ppm.

   b. 30 minutes — 0.50 ppm.

   c. 60 minutes — 0.50 ppm.

   d. 4 hours — 0.50 ppm.

   e. 8 hours — 0.50 ppm.

2. AEGL-2:

   a. 10 minutes — 2.8 ppm.

   b. 30 minutes — 2.8 ppm.

   c. 60 minutes — 2.0 ppm.

   d. 4 hours — 1.0 ppm.

   e. 8 hours — 0.71 ppm.

3. AEGL-3:

   a. 10 minutes — 50 ppm.

   b. 30 minutes — 28 ppm.

c. 60 minutes — 20 ppm.

d. 4 hours — 10 ppm.

e. 8 hours — 7.1 ppm.

Slide 4-22

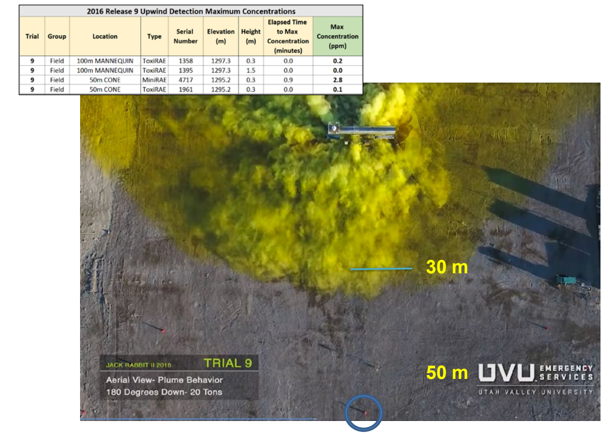
I. Release in Festus, Missouri (Aug. 14, 2002). Hose rupture during an offloading process resulted in 48,000 pounds of liquid Cl_2 being released. Notable in this photo is the concentration of the visible cloud left of the tree line, then left of the raised railbed on the left of the second tree line. The terrain and foliage absorb and stop the main body of concentrated gas before it reaches residential structures. (Note concentrations moving from left to right in the photo.)

VIDEO PRESENTATION

"2015 RELEASE 5 RETROGRADE CREEP"

Slide 4-23

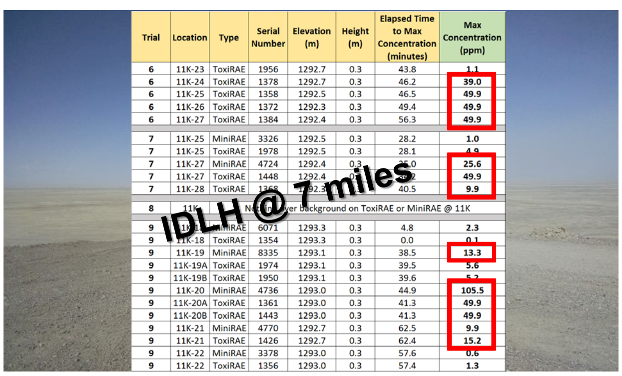
J. Release energy and low-wind conditions create a situation where the upwind environment may become dangerous. The Jack Rabbit test proved that the upwind distances should be observed by responders.



2016 Release 9 Upwind Detection Maximum Concentrations								
Trial	Group	Location	Type	Serial Number	Elevation (m)	Height (m)	Elapsed Time to Max Concentration (minutes)	Max Concentration (ppm)
9	Field	100m MANNEQUIN	ToxiRAE	1358	1297.3	0.3	0.0	0.2
9	Field	100m MANNEQUIN	ToxiRAE	1395	1297.3	1.5	0.0	0.0
9	Field	50m CONE	MiniRAE	4717	1295.2	0.3	0.9	2.8
9	Field	50m CONE	ToxiRAE	1961	1295.2	0.3	0.0	0.1

Slide 4-24

K. 2016 Release 9, a 20-ton release. At 50 meters upwind, no more than 2.8 ppm of Cl_2 were detected. Even with this knowledge, responders should observe the upwind protective distances stated in the ERG due to terrain, wind shifts and other factors that cannot be anticipated.



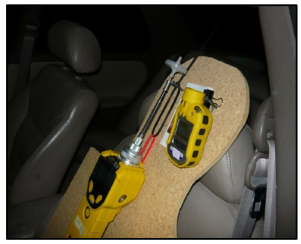
Trial	Location	Type	Serial Number	Elevation (m)	Height (m)	Elapsed Time to Max Concentration (minutes)	Max Concentration (ppm)
6	11K-23	ToxiRAE	1956	1292.7	0.3	43.8	1.1
6	11K-24	ToxiRAE	1378	1292.7	0.3	46.2	39.0
6	11K-25	ToxiRAE	1358	1292.5	0.3	46.5	49.9
6	11K-26	ToxiRAE	1372	1292.3	0.3	49.4	49.9
6	11K-27	ToxiRAE	1384	1292.4	0.3	56.3	49.9
7	11K-25	MiniRAE	3326	1292.5	0.3	28.2	1.0
7	11K-25	ToxiRAE	1978	1292.5	0.3	28.1	4.9
7	11K-27	MiniRAE	4724	1292.4	0.3	[illegible]	25.6
7	11K-27	ToxiRAE	1448	1292.4	[illegible]	[illegible]	49.9
7	11K-28	ToxiRAE	[illegible]	[illegible]	[illegible]	40.5	9.9
8	11K	[illegible] over background on ToxiRAE or MiniRAE @ 11K					
9	[illegible]	[illegible]	6071	1293.3	0.3	4.8	2.3
9	11K-18	ToxiRAE	1354	1293.3	0.3	0.0	0.1
9	11K-19	MiniRAE	8335	1293.1	0.3	38.5	13.3
9	11K-19A	ToxiRAE	1974	1293.1	0.3	39.5	5.6
9	11K-19B	ToxiRAE	1950	1293.1	0.3	39.6	5.2
9	11K-20	MiniRAE	4736	1293.0	0.3	44.9	105.5
9	11K-20A	ToxiRAE	1361	1293.0	0.3	41.3	49.9
9	11K-20B	ToxiRAE	1443	1293.0	0.3	41.3	49.9
9	11K-21	MiniRAE	4770	1292.7	0.3	62.5	9.9
9	11K-21	ToxiRAE	1426	1292.7	0.3	62.4	15.2
9	11K-22	MiniRAE	3378	1293.0	0.3	57.6	0.6
9	11K-22	ToxiRAE	1356	1293.0	0.3	57.4	1.3

Slide 4-25

L. In a flat, featureless world, the 11K (7 mile) mark did show many instances of at least five times, and in one case, 10 times, immediately dangerous to life and health (IDLH) levels for Cl_2 (10 ppm).

FINAL REPORT — SHELTER IN PLACE

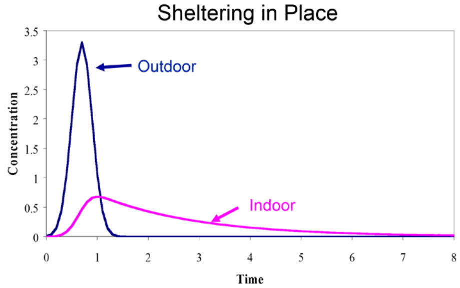
Sheltering in place is the most survivable option as a primary means of public protection during such an emergency if evacuation is not possible. It is better to be inside a structure or vehicle than outside until the outside chlorine concentration drops and the danger has passed. Gas concentrations will be affected by multiple factors, primarily wind and terrain.



Slide 4-26

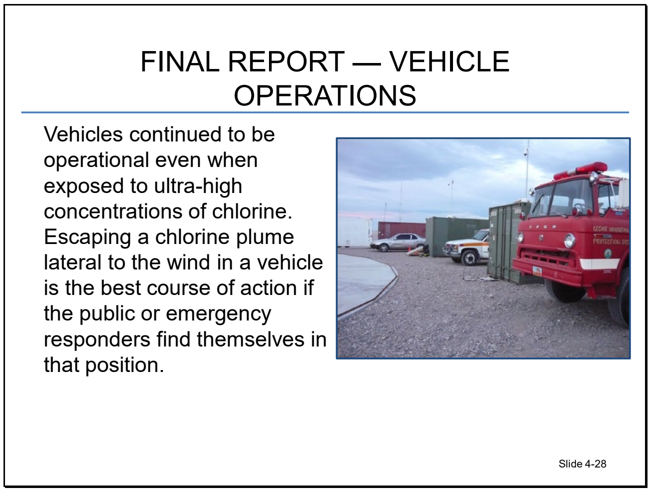
M. Sheltering in place is the most survivable option as a primary means of public protection during such an emergency if evacuation is not possible. It is better to be inside a structure or vehicle than outside until the outside chlorine concentration drops and the danger has passed. Gas concentrations will be affected by multiple factors, primarily wind and terrain.

Theoretical Strategy for Sheltering in Place



Slide 4-27

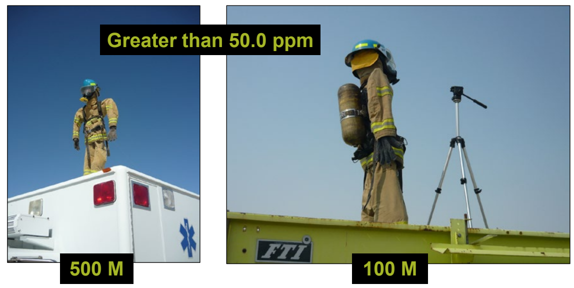
N. It is always better to be indoors than go outside. Close exterior openings and stop ventilation systems when feasible. Retreating to an interior room without windows and away from exterior walls provides a magnitude of protection. A closet is ideal because all of the fabric hanging has a higher sorption rate than a bathroom with tile and glass surfaces. Stay inside until the outdoor concentration is lower than the inside concentration.



O. Vehicles continued to be operational even when exposed to ultra-high concentrations of chlorine. Escaping a chlorine plume lateral to the wind in a vehicle is the best course of action if the public or emergency responders find themselves in that position.

P. The video shows the type of environment that engines were exposed to and continued to run. Note the railroad tie and utility pole soaked in creosote without reaction to a liquid exposure of Cl_2. The turnout gear (top left in the frame) did not bleach out. However, metal snaps, buckles and buttons were immediately corroded. Asphalt shingles did not react.

EMERGENCY PROCEDURES FOR RESPONDERS



Slide 4-30

Q. In a catastrophic release, the vapor density of Cl_2 cannot be used to one's advantage; the plume will never be thin enough for one to get above it, unless there is a building taller than 100 feet that the person can go up to. Plumes were typically 50 feet or more in height.

Slide 4-31

FINAL REPORT — RESILIENCY OF 11.7 ELECTRON VOLT PHOTOIONIZATION DETECTORS

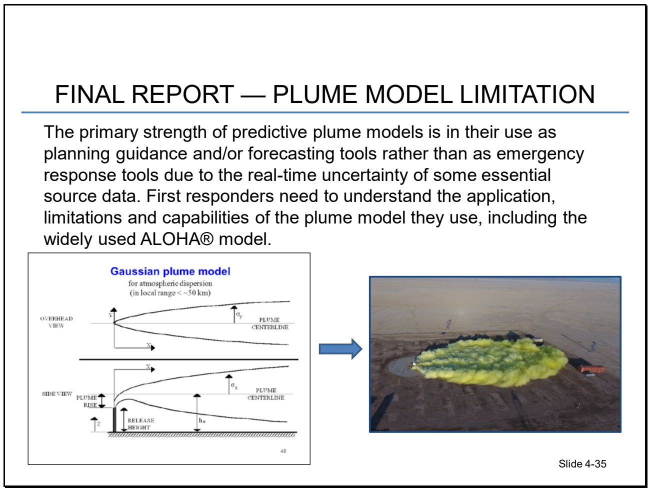
Photoionization detectors (PIDs) with 11.7 electron volt (eV) bulbs detected chlorine with reasonable accuracy and repeatability over broad chlorine concentration ranges.

Slide 4-32

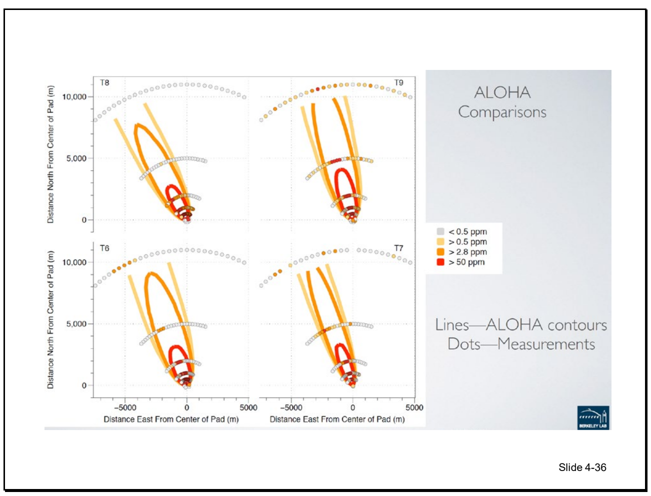
R. Photoionization detectors (PIDs) with 11.7 electron volt (eV) bulbs detected chlorine with reasonable accuracy and repeatability over broad chlorine concentration ranges.

S. Electrochemical sensors (in this case specified to lock out at 49.9 ppm) were also found to be accurate when co-located and compared against a PID. The same concentration of Cl_2 was measured with three devices: electrochemical sensor reads 49.9 — locked out; 11.7 eV PID exposed multiple times to high Cl_2 atmospheres reads 41.4 ppm; and a brand-new, never-been-exposed 11.7 eV PID reads 43.8 ppm. All devices are within an acceptable margin of error.

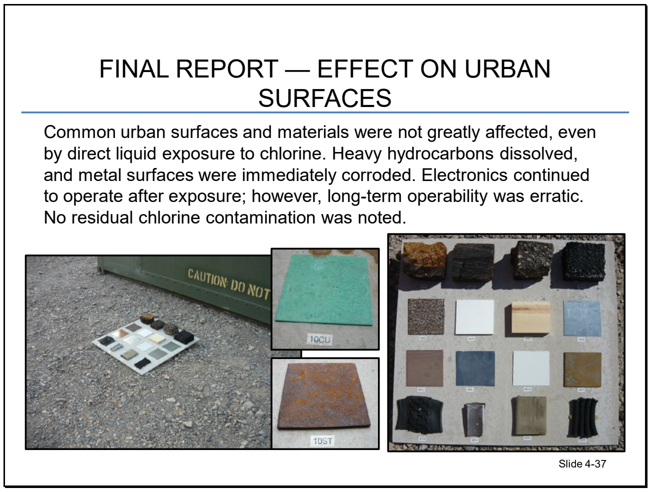
T. Detectors co-located showing the delay in response as the plume rolls over the vehicle. There is some time, but not much time, to get out of the area. The electrochemical sensor locks out, and the PID ultimately reaches 588 ppm, 58 times IDLH levels.



U. The primary strength of predictive plume models is in their use as planning guidance and/or forecasting tools rather than as emergency response tools due to the real-time uncertainty of some essential source data. First responders need to understand the application, limitations and capabilities of the plume model they use, including the widely used ALOHA® model.



V. The lines and dots (Jack Rabbit II detection on the ground) line up accurately when this overlay is studied.



W. Common urban surfaces and materials were not greatly affected, even by direct liquid exposure to chlorine. Heavy hydrocarbons dissolved, and metal surfaces were immediately corroded. Electronics continued to operate after exposure; however, long-term operability was erratic. No residual chlorine contamination was noted.

X. Video of the witness board being exposed to liquid Cl_2 without reaction. Note the super-cooled frozen environment created by the decompressing gas with a boiling point of minus 29 F.

FINAL REPORT — RISK-BASED RESPONSE

The application and use of a risked-based response process is critical to the incident considering the container, stress/breach release, wind, exposures and environmental conditions.

Slide 4-39

Y. Finally, the Utah Valley University team found that the application and use of a risk-based response process is critical to the incident considering the container, stress/breach release, wind, exposures and environmental conditions.

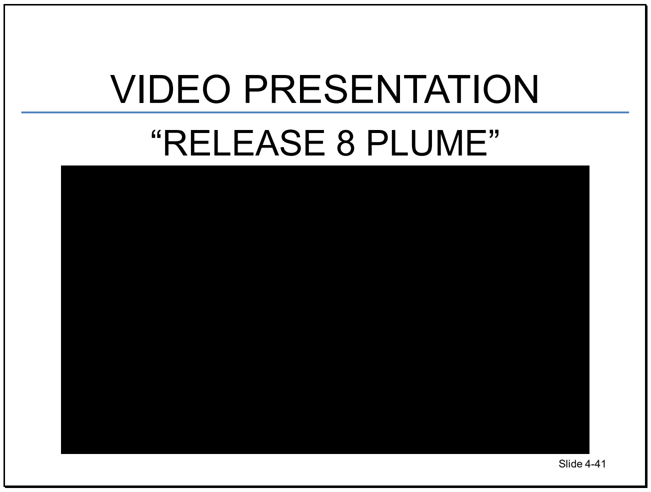
Z. Additional videos of releases. Releases were renumbered from 1 to 4 in 2016 and 6 to 9 in 2017 as a continuation from the releases numbered 1 to 5 in 2015.

VIDEO PRESENTATION

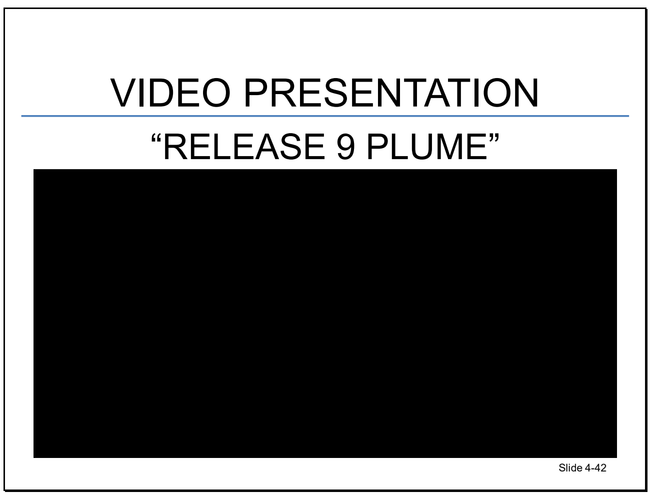
"RELEASE 7 PLUME"

Slide 4-40

1. Release 7 (formerly 2). The video shows the mushroom-shaped catastrophic release plume. This is not a teardrop shape as depicted in most models. The bulk of the release travels downrange followed by a thinner vapor trail until the liquid has changed to gas.



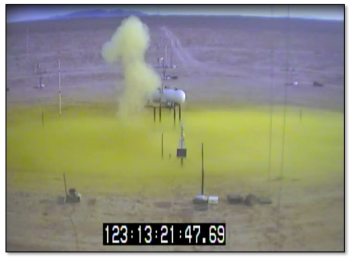
2. Release 8 (formerly 3). This release was in two parts: 1) vertical release with ~175-foot plume and 2) bottom valve release dumping the remaining 70% of the chlorine liquid. It did not “auto-refrigerate.” Rather, it flowed out completely as a liquid.



3. Release 9. A 20-ton final release.

RAPID PHASE TRANSITION SEEN AT JACK RABBIT I IN 2010

About five minutes post-release occurring in the pool. We will likely not and should not be there.

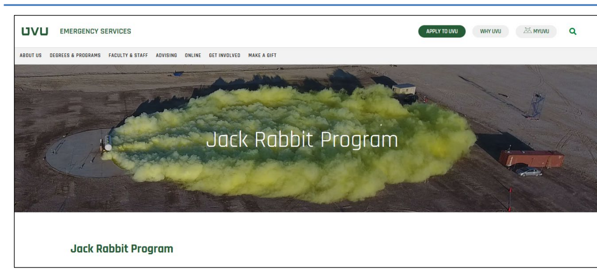


Slide 4-43

AA. Rapid Phase Transition (RPT) seen at Jack Rabbit I in 2010.

RPTs occur on soil, and they have been seen in water where the surface flash freezes and the expanding gas beneath the ice explosively releases into the air. One should not be downrange in the puddle when RPTs occur. They occur around five to nine minutes post-release and inside the pool.

ADDITIONAL INFORMATION



https://www.uvu.edu/es/jack-rabbit/

Slide 4-44

BB. For additional information about the Jack Rabbit Program, visit https://www.uvu.edu/es/jack-rabbit/.

ACTIVITY 4.1

Determining Operational Modes

Purpose

Practice determining the most appropriate operational mode for an incident.

Directions

1. The instructor will assign a scenario to each small group.

2. In your small group, review the scenario with directions from the Incident Commander (IC) (instructor) and determine if the proposed operational modes are appropriate.

3. Be prepared to share your group work with the class.

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ACTIVITY 4.1 (cont'd)

Scenarios

Scenario 1

Your hazardous materials response team has been called to the scene of a leaking liquid oxygen (LOx) tank at a local welding supply company. The IC has prepared a plan of action and called for a **defensive** mode only, such as evacuations, air monitoring and water application for vapor dispersion.

Scenario 2

Your hazardous materials response team has been called to assist the first-due companies (one battalion chief, one engine company, one rescue company and two ambulances) at the scene of a vehicle crash involving a Department of Transportation (DOT) 406 tanker placarded as 1203. It is sunny and clear with an air temperature of 80 F. The tanker has overturned, and product is actively leaking from the dome covers with approximately 300 gallons already spilled onto the roadway in a 40-foot diameter puddle. The IC has prepared a plan of action and called for an **offensive** mode including stopping the active leaks, spill containment, aqueous film forming foam (AFFF) application, drilling of the tank and “stinger” operations.

Scenario 3

Your hazardous materials response team has been called to the scene of a motor vehicle leaking fuel in the driveway of a private home. The IC has prepared a plan of action and called for an **offensive** mode such as plugging and patching of the leak and/or product offloading.

Scenario 4

Your Type 1 hazardous materials response team has been called to the scene of a spill of an unknown liquid in a public school. There are multiple victims who have self-evacuated, and they describe a foul odor and are complaining of nausea, dizziness and headaches. First-due units have confirmed that all occupants have been evacuated from the building and adequate resources are en route to assist the victims. The IC has prepared a plan of action and called for a **nonintervention** mode. The IC wants to treat the aided and allow the school officials to deal with the problem inside their building.

Scenario 5

Your hazardous materials response team has been called to assist the first-due companies (one battalion chief, one engine, one ladder) at the scene of a leaking 420# liquefied petroleum gas (LPG) container in the rear of a local restaurant. The IC has prepared a plan of action and called for a **defensive** mode only, such as evacuations, air monitoring and water application for vapor dispersion.

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III. INCIDENT ACTION PLAN

INCIDENT ACTION PLAN

- ICS Form 202, Incident Objectives.
- ICS Form 204, Assignment List.
- ICS Form 215A-CG, Incident Action Plan Safety Analysis.
- ICS Form 208, Safety Message/Plan.
- ICS Form 208 HM.

Slide 4-46

A. Incident Command System (ICS) Form 202, Incident Objectives describes the basic incident strategy, incident objectives, command emphasis/priorities and safety considerations for use during the next operational period.

B. ICS Form 204, Assignment List informs division and group supervisors of incident assignments. Once the Command and General Staff agree to the assignments, the assignment information is given to the appropriate divisions and groups.

C. ICS Form 215A-CG, Incident Action Plan Safety Analysis form allows for the evaluation of specific hazardous materials-related hazards and potential control. This form also supports incident operations and risk management by prioritizing gain, identifying hazards, determining control measures and providing a risk management key for measuring potential risk.

D. ICS Form 208, Safety Message/Plan expands on the Safety Message and Site Safety Plan and may be included and completed by the safety officer for the Incident Action Plan (IAP).

INCIDENT COMMAND SYSTEM FORM 208 HM, SITE SAFETY AND CONTROL PLAN

- Site Information.
- Organization.
- Hazard/Risk Analysis.
- Hazard Monitoring.
- Decontamination Procedures.
- Site Communications.
- Medical Assistance.

Slide 4-47

E. ICS Form 208 HM, Site Safety and Control Plan.

1. Site Information.

2. Organization.

a. Work assignments.

b. Personal protective equipment (PPE).

- Selection guidance.

  -- National Fire Protection Association (NFPA) 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*.

  -- NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*.

  -- NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*.

  -- NFPA white paper, "Risk-Based Selection of Chemical Protective Clothing."

- Interagency Board (IAB) website and section on PPE (https://www.interagencyboard.org/).

- Selection criteria.

  -- Breakthrough time.

  -- Penetration rate.

  -- Testing methodologies of hazardous materials PPE.

- Limitations.

  -- Safety hazards.

  -- Physiological stressors.

  -- Psychological stressors.

- Emerging trends.

3. Hazard/Risk Analysis.

   a. Product research.

   b. Container research.

4. Hazard Monitoring.

   a. Classification.

      - Wet chemistry.

      - Colorimetric indicators (colorimetric detector tubes, indicating papers such as pH paper, potassium iodide-starch paper, fluoride paper and water finding paper).

      - Flammable gas indicator.

      - Electrochemical cells.

      - Flame ionization detector (FID).

      - Metal oxide sensor.

      - PIDs.

      - Radiation detection and measurement instruments.

      - Ultrasound detection.

      - Thermal indicating device (i.e., infrared thermometer).

   b. Identification.

      - Biological immunoassay indicators reagents, test strips.

      - DNA fluoroscopy.

      - Polymerase chain reaction (PCR).

      - Gamma spectrometer (radioisotope identification device (RIID)).

      - Infrared spectroscopy.

- Raman spectroscopy.
- Ion mobility spectroscopy.
- Surface acoustical wave.
- Gas chromatograph (GC)/mass spectrometer (MS).

c. Other devices.

- Infrared detectors.
- Heat/temperature gun.
- Handheld weather meters.
  -- Air temperature.
  -- Relative humidity.
  -- Wind speed.
  -- Air pressure.
- Handheld rangefinder.
  -- Distance.
- Laser pointer.

5. Decontamination Procedures.

a. Methods.

- Traditional.
- Alternative.

b. Effectiveness of the decontamination method.

c. Methods of assessment.

- Visual.
- Natural light.
- Ultraviolet (UV) light.
- Wipe sampling.
- Cleaning solution analysis.

- Permeation testing.
- Using detection technology.

d. Emerging trends in alternative methods.

- Wipe-Spray-Wipe.
- Electrostatic sprayers.

VIDEO PRESENTATION

"ELECTROSTATIC SPRAYING DEMONSTRATION"

https://youtu.be/UW0XQiyYnfg

Slide 4-48

6. Site Communications.

   Frequencies/channel assignments.

7. Medical Assistance.

   a. Pre-entry.

   b. Post-exit.

INCIDENT COMMAND SYSTEM FORM 208 HM, SITE SAFETY AND CONTROL PLAN (cont'd)

- Site Map.
- Entry Objectives.
- Standard Operating Procedures (SOPs) and Safe Work Practices.
- Emergency Procedures.
- Safety Briefing.

Slide 4-49

8. Site Map.

9. Entry Objectives.

   a. Having a clear plan.

   b. Having correct equipment, training and personnel to be successful.

   c. Reconnaissance: use of people and technology for this role (drone/unmanned aerial vehicle (UAV), robots); need to be flexible and good at intel gathering.

10. Standard Operating Procedures (SOPs) and Safe Work Practices.

    a. Electricity.

    b. Confined space.

    c. Structural collapse.

11. Emergency Procedures.

    a. Communication.

       - Evacuation signals.

       - Hand signals.

    b. Area of safe refuge.

    c. Backup/Rescue/Hazardous Materials Rapid Intervention Team (HM RIT).

12. Safety Briefing.

    a. Who leads the briefing?

       - The hazardous materials safety officer usually leads the briefing but involves others in the team to present specific information.

    b. Who attends the briefing?

       - All hazardous materials personnel as well as the IC attend the briefing.

ACTIVITY 4.2

Completing the Incident Command System Forms 208 HM, Site Safety and Control Plan and 215A-CG, Incident Action Plan Safety Analysis

Purpose

Practice completing the ICS Form 208 HM based on given information.

Directions

1. In your small group, review the provided scenario and the completed ICS Forms 202 and 204. Use the Identification Data book to reference the chemicals. Complete the ICS Forms 208 HM and 215A-CG according to the IC objectives using the large, laminated ICS Forms.

2. Be prepared to share your responses with the class.

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ACTIVITY 4.2 (cont'd)

Scenario

Your hazardous materials response team has been called to the scene of a private residence where a possible clandestine laboratory has been discovered. Earlier, there was a call for an ambulance at this location regarding a sick male with no further information available, and the ambulance crew reported finding a possible laboratory complete with chemicals and glassware. Law enforcement is on scene and requests the assistance of the hazardous materials response team to perform an assessment of the scene and determine what PPE and safety concerns are present.

Refer to the provided ICS Form 202 and ICS Form 204.

Reconnaissance is performed and the following is found:

1. A white, crystalline material is found in an unmarked, 1-pound can with a small amount of material spilled onto countertop.

   ____

   ____

   ____

2. A dark-colored liquid is found in an unmarked glass container (approximately 3 ounces), and approximately 10 milliliters of this same dark-colored liquid is in an adjacent, open test tube in a tube rack.

   ____

   ____

   ____

3. A clear pink liquid is found in an unmarked plastic bottle (approximately 1 liter) with the cap removed.

   ____

   ____

   ____

Environmental data: The inside thermostat in the home is set at 70 F (21 C), and the outside temperature is 80 F (27 C) with a high of 90 F (32 C) expected later today. Humidity is 60%, chance of precipitation is 75% with scattered thunderstorms, and winds are from the east at 5 to 10 miles per hour (mph).

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ACTIVITY 4.2 (cont'd)

Incident Command System Form 215A-CG, Incident Action Plan Safety Analysis

INCIDENT ACTION PLAN SAFETY ANALYSIS

1. Incident Name	2. Date/Time Prepared

3. Division/ Group/ Other Location	4. Work Assignments	5. Gain		6. Hazards	7. Controls	8. ORM Severity	Probability	Exposure	GAR
		Human Health		Check	Check				
		Security							
		Environment							
		Economy							
		Human Health		Check	Check				
		Security							
		Environment							
		Economy							
		Human Health		Check	Check				
		Security							
		Environment							
		Economy							
		Human Health		Check	Check				
		Security							
		Environment							
		Economy							
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		Environment							
		Economy							
		Human Health		Check	Check				
		Security							
		Environment							
		Economy							
		Human Health		Check	Check				
		Security							
		Environment							
		Economy							

ICS-215A-CG (rev 6/06)	Operational Risk Management Key	Scale	1	2	3	4	5
		Severity	Slight	Minimal	Signif-icant	Major	Catas-trophic
		Probability	Remote	Un-likely	50/50	>50	Very Likely
		Exposure	Below Avg	Avg	Above Avg	Great	N/A

Gar Scale #	1-19	20-39	40-59	60-79	80-100
Risk	Slight	Possible	Substantial	High	Very High
Color	Green	Amber	Red	Red	Red
Action	Possibly Acceptable	Attention Needed	Correction Required	Immediate Correction	Discontinue Stop

9. Prepared by (Name and Position)

INCIDENT ACTION PLAN SAFETY ANALYSIS (ICS-215A-CG (rev 6/06))
Instructions for filling out the form

Purpose: The purpose of this worksheet is to aid the Safety Officer in completing an operational risk assessment to prioritize hazards and develop appropriate controls.

Preparation: During the Incident Action Planning cycle where the Operations Section Chief (OSC) is preparing for the tactics meeting, the Safety Officer works alongside the OSC and completes the Incident Action Plan Safety Analysis. This sheet mirrors the ICS 215 form. Work assignments are listed along with associated hazards. A calculation is made that determines what level of risk each work assignment poses. For those assignments having significant risk, controls are developed for safeguarding responders. The net risk is evaluated against the gain. The Incident Commander should be alerted to all safety hazards that receive an amber or red GAR rating after controls have been established.

Distribution: The Operational Hazard Worksheet is attached to the Incident Site Safety Plan and is distributed according to the instruction for Site Safety Plans.

Instructions:

Item #	Item Title	Instructions
1	Incident Name	Print the name assigned to the incident.
2	Date/Time Prepared	Enter date (month, day, year) and time prepared.
3	Division/Group	Enter the Branch, Division or Group title in abbreviated form.
4	Work Assignment	List the work assignment for each Branch, Division or Group.
5	Gain	Check the gain that is achieved when the work assignment is accomplished.
6	Hazards	Using the IAP Safety Analysis Aid (page 2), list the type of hazards likely to be encountered for the work assignment. Place a check mark in the box below the hazard.
7	Controls	Using the IAP Safety Analysis Aid (page 2), list the type of controls likely to be used for addressing the hazards listed. Place a check mark in the box below the control.
8	GAR	Using the "Key", assign a number from 1 to 5 based on the level of severity, probability and exposure. Multiply all numbers together to get a total. Enter this number into the total column. Gar means **G**reen, **A**mber, **R**ed. Using the GAR scale on the bottom of the sheet, assign a color, risk level or action phrase in this block.
9	Prepared by	Enter the name of the person who completed this worksheet.

Page 1 of 2

ICS-215A-CG INCIDENT ACTION PLAN SAFETY ANALYSIS AID

HAZARDS:

Physical	Chemical/Biological	Human
• Slipping	• Explosion	• Violence
• Tripping	• Flammable	• Poor Lifting
• Fall	• Air Reactive	• Repetition
• Overhead	• Water Reactive	• Excessive Force
• Heat Stress	• Chem Reactive	• Poor posture
• Cold Stress	• Alpha Rad	• Awkward motion
• Electrical	• Beta Rad	• Fatigue
• Blunt Objects	• Gamma Rad	• Poor hygiene
• Sharp Objects	• X Rad	• Illness
• Noise	• Bio-weapon	• Alcohol/Drugs
• Vehicle	• Chem-weapon	• Over crowding
• Fire	• Irritant	• Poor comms
• Sun/UV Glare	• Asphyxiant	• Noise interference
• Sun Burn	• Oxidizer	• Smoking
• Moving Pinch Points	• Carcinogen	• Driving
• Unguarded Machinery	• Corrosive	**Animal/Plant**
• Lightning	• Cryogenic	• Bites/Stings
• Drowning	• Toxic	• Poison
• Engulfment	• Biomed/pathogen	• Thorns/burrs
• Limited Egress/Access	• Particulates	• Swarms
	• Fumes (weld etc.)	• Disease
	• O2 Deficiency	• Feces/Coliforms

CONTROLS:

Types of Engineering Controls:

• Barriers	• Shields	• Dams
• Capping	• Covering	• Fencing
• Terminating	• Shutting	• Blocking
• Chocks	• Enclosures	• Diverters
• Flanging	• Guarding	• Substitution
• Anchoring	• Ventilation	• Blowing
• Scaffolding	• Grounding	• Substitution
• Bonding	• Insulation	• Lighting
• Locks, Tags	• Kill-switches	• Shut-off valves
• Taglines	• Circuit Breakers	• Process change
• Plugging, patching	• Sealing	• Absorbers

Types of Administrative Controls:

• Reduced work duration	• Worker rotation	• Safety plans
• Training	• Safety briefs	• Relief personnel
• Maintenance	• Drinking fluids	• Work/rest periods
• Good housekeeping	• Roving security	• Signs
• Warning lights	• Alarms	• Break areas
• Pre-inspections	• Field checks	• Buddy system
• Line of sight comms	• Comms schedule	• Equipt staging
• Load shifting	• Hazard marking	• Placarding
• Labeling	• Hand signals	• Safety observers
• Fendering	• Work plans	• Replenish fluids
• Handcarts/trolleys	• Fire extinguishers	• Drum bulking
• Eye Wash Station	• Hand washers	• Showers

Types of Personal Protective Equipment Controls:

• Hard hats	• Steel-toed shoes	• Safety glasses
• Safety goggles	• Face shields	• Hearing Protection
• Life jacket	• Fall arrests	• SCBA
• APRs	• Chemical suits	• Flash suits
• Fire resistant suits	• Work gloves	• Chemical gloves
• Sun glasses	• Sun-block	• Life rings
• Eye wash stations	• Night vision	• Thermal protection
• Dry/wet suits	• Hand warmers	• Wind breaker coat
• Knee pads	• Over garments	• Coveralls
• Booties	• Cooling vests	• Chap lip protection
• Hats for warming	• Gloves (warmth)	• Clothing (warmth)

Page 2 of 2

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IV. SUMMARY

SUMMARY

- Operational modes.
- Outcomes of the Jack Rabbit Report.
- IAP.

Slide 4-51

- What have you learned in this unit?
- Do you have any questions?

Slide 4-52

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SUPPLEMENTAL MATERIALS

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Unit 4 Supplemental Materials

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Foam Considerations and Calculations

1. Know your product. Are you dealing with a hydrocarbon such as gasoline or a polar solvent such as alcohol?
2. Know how much concentrate you have on hand. Do not begin foam operations until you have calculated the necessary foam concentrate needed **and** you have it on hand.
3. Know how much concentrate you have access to through mutual-aid agreements with other fire departments or private industry. How long will it take for additional supplies to arrive on location?
4. Do **not** rely on aircraft rescue firefighting (ARFF) apparatus from your local airport. They may or may not respond off site as the airport's ability to handle takeoffs and landings is based upon the fire protection capabilities available. Also, ARFF apparatus only carry AFFF for hydrocarbon fuels. If you need AFFF/AR (alcohol resistant foam), the ARFF apparatus will not have the capabilities you need.

Foam Calculations

Foam calculations depend upon the following information:

- Area of spill (Area)
  - length x width for a rectangular area
  - π (3.14) x radius x radius for a circular area
- Critical Application Rate (CAR)
  - 0.1 GPM/ft^2 for hydrocarbons
  - 0.2 GPM/ft^2 for polar solvents
- Induction Rate (ID)
  - 0.01 (1% for hydrocarbons)
  - 0.03 (3% for polar solvents)
- Time (time)
  - Minimum 15-minute application time

Total Concentrate = Area x CAR x ID x Time

Example 1

Hydrocarbon spill in a 100' x 50' diked area

Total Concentrate = Area x CAR x ID x Time

Total Concentrate = (100 x 50) ft^2 x 0.1 GPM/ft^2 x 0.01 x 15 minutes

Total Concentrate = 5000 ft^2 x 0.1 GPM/ft^2 x 0.01 x 15 minutes

Total Concentrate = 75 gallons

Example 2

Polar solvent spill, 40' diameter puddle

Total Concentrate = Area x CAR x ID x time

Total Concentrate = πr^2 x CAR x ID x time

Total Concentrate = (3.14 x 20 x 20) ft^2 x 0.2 GPM/ft^2 x 0.03 x 15 minutes

Total Concentrate = 1256 ft^2 x 0.2 GPM/ft^2 x 0.03 x 15 minutes

Total Concentrate = 113.04 ≈ 115 gallons

Risk-Based Selection of Chemical Protective Clothing

NFPA®

Risk-Based Selection of Chemical-Protective Clothing

April 2018

NATIONAL FIRE PROTECTION ASSOCIATION

The leading information and knowledge resource on fire, electrical and related hazards

By Jeffrey O. Stull and Grace C. Stull, International Personnel Protection, Inc. and Christina M. Baxter, Emergency Response TIPS, LLC

INTRODUCTION

Hazardous material emergencies can occur anywhere, involve any number of substances, and result in a diverse set of environmental and operational conditions. In these situations, when action is needed to save lives and protect property, personal protective equipment (PPE) is the only viable protection for responders who may come into contact with hazardous substances.

> In 1983, a rail car was leaking anhydrous dimethylamine in Benicia, California, and the local hazmat team responded. During this event, a team member noticed the visor lens of his totally encapsulated suit began to crack. The team quickly exited the vapor cloud, but not before the visor had broken open and the team member was exposed. Fortunately, the self-contained breathing apparatus prevented respiratory injury, but the team member developed severe dermatitis as a result of the clothing failure. A subsequent National Transportation Safety Board (NTSB) report determined that, although the manufacturer recommended its suits for the chemical involved, the visor was susceptible to degradation and permeation by the chemical. Information on the visor was not addressed or provided by the manufacturer. As consequence, NTSB recommended the development of national consensus standards to address all parts and relevant performance properties of ensembles used in emergency response.

ROLE OF STANDARDS

Standards and regulations are often developed in response to a specific problem. The incident described above, and other similar incidents that have occurred over the years, helped create the protective equipment standards that exist today. This result illustrates that, in fact, these standards are based on the hard lessons of the real world where people can be hurt, or worse.

Before NFPA standards, first responders chose from a selection of protective clothing products used by the military as chemical warfare suits. These products lacked broad compatibility and performance against the multitude of chemicals and conditions being encountered by emergency responders in a vast range of industry and transportation accidents. Product testing was limited and manufacturer claims varied considerably, presenting a very confusing picture to the emergency responder community.

Today, emergency services end users and protective clothing manufacturers depend on the standards developed by NFPA to help define the appropriate PPE for hazardous materials and other related emergency incidents. These standards have become the benchmarks for establishing protective clothing and equipment minimum design and performance requirements. Thus, when a first responder or other operator dons a certified ensemble, NFPA standards provide assurance that the ensemble and its component parts have been designed and tested to meet a specific hazardous environment. Specific benefits of NFPA standards include:

- Uniform product testing and evaluation.
- Criteria based on specific end user needs.
- Minimum requirements for clothing design, performance, documentation, and labeling.
- Required third-party certification for both initial product qualification and continued review of manufacturer compliance and quality.

To take advantage of the benefits associated with the NFPA standards, some understanding is needed on the different performance characteristics and features that form the basis of the standards. In addition, the history of how standards have evolved to establish the protection levels that exist today is fundamental for being able to select the correct ensemble based on risks associated with a given response environment and other circumstances.

HISTORY OF CHEMICAL-PROTECTIVE CLOTHING STANDARDS

In order to provide protection to the entire body, chemical-protective ensembles must be part of an overall ensemble of PPE. As defined by the U.S. Environmental Protection Agency (EPA) and in the Occupational Safety and Health Administration (OSHA) regulations for hazardous waste site remediation and emergency response (OSHA Title 29 CFR 1910.120)[1], four different levels of protection are established based on different ensembles. These ensembles, further described in *Table 1*, consist of chemical-protective clothing (CPC), a respirator, gloves and boots, hard hats, communications equipment, cooling devices, and various types of undergarments.

First responders generally use Level A- and Level B-protective ensembles. Level A ensembles provide the highest level of protection and consist of a totally encapsulating suit, a self-contained breathing apparatus (SCBA) or combination SCBA and supplied-air respirator, chemically resistant gloves and footwear, and a communications system. Level A ensembles are for use in situations where the highest level of respiratory, skin, and eye protection are needed. Level B ensembles employ the same respiratory protection, but pertain to situations where hazards to the skin and eyes are not as significant as those encountered in Level A situations. Consequently, for Level B ensembles, one- or multi-piece chemical splash suits replace the totally encapsulating suits used in Level A ensembles. Though used to a much lesser extent in the emergency response community, Level C ensembles use the identical clothing

TABLE 1 EPA Levels of Protection

Level	Equipment	Protection Provided	Should Be Used When	Limiting Criteria
A	**Recommended:** • Pressure-demand, full facepiece SCBA or pressure-demand, supplied-air respirator with escape SCBA • Fully encapsulating chemical-resistant suit • Inner chemical-resistant gloves • Chemical-resistant safety boots/shoes • Two-way radio communications **Optional:** • Cooling unit • Coveralls • Long cotton underwear • Hard hat • Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection	The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: • measured (or potential for) high concentration of atmospheric vapors, gases, or particulates, or • site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined	Fully encapsulating suit material must be compatible with the substances involved
B	**Recommended:** • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications **Optional:** • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	The same level of respiratory protection but less skin protection than Level A It is the minimum level recommended for initial site entries until the hazards have been further identified	The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection but less skin protection. This involves atmospheres: • with IDLH concentrations of specific substances that do not represent a severe skin hazard, or • that do not meet the criteria for use of air-purifying respirators Atmosphere contains less than 19.5% oxygen Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin	Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin

systems found in Level B ensembles, but replace SCBA or combination SCBA/supplied-air respirators with air-purifying respirators for situations where lower levels of respiratory hazards are perceived.

Although the EPA levels of protection describe what the ensemble should look like, little guidance is offered for how the ensemble should perform. It is vital that the ensemble elements work together to provide the intended level of protection, which means that ensemble items should fit together (provide good interfaces) and offer consistent performance for the wearer's entire body. Unfortunately, duct tape is often used in an attempt to correct ill-fitting suits and poorly designed interfaces. It can also pose a flammability hazard for those ensembles required to be flame resistant. Chemical-protective suits should be considered as a system,

TABLE 1 (Continued)

Level	Equipment	Protection Provided	Should Be Used When	Limiting Criteria
C	**Recommended:** • Full facepiece, air purifying, canister-equipped respirator • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/shoes • Hard hat • Two-way radio communications **Optional:** • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear	The same level of skin protection as Level B but a lower level of respiratory protection	The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin The types of air contaminants have been identified, concentrations have been measured, and a canister is available that can remove the contaminant All criteria for the use of air-purifying respirators are met	Atmospheric concentration of chemicals must not exceed IDLH levels The atmosphere must contain at least 19.5% oxygen
D	**Recommended:** • Coveralls • Safety boots/shoes • Safety glasses or chemical splash goggles • Hard hat **Optional:** • Gloves • Escape mask • Face shield	No respiratory protection Minimal skin protection	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	This level should not be worn in the hot and warm zones The atmosphere must contain at least 19.5% oxygen

NOTES: SCBA: Self-contained breathing apparatus. IDLH: Immediately dangerous to life and health.

consisting of the base material, seams, closures, and the overall suit design. Often, attention is paid only to the base material, neglecting other parts of the suit that have a significant impact on the suit's effectiveness.

In 1990, three new NFPA standards were approved — NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*[2], NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*[3], and NFPA 1993, *Standard on Support Function Protective Clothing for Hazardous Chemical Operations*[4]. These three standards established minimum requirements for chemical-protective suits and supplemented the EPA Level A and Level B designations with performance-based specifications. Since 1990, these standards have been periodically revised to keep pace with end user and manufacturer feedback, advances in materials, and modern evaluation methods, including incorporating the requirements from NFPA 1993 into NFPA 1992.

NFPA 1991 and NFPA 1992 have profoundly affected the products offered by the industry. Prior to their introduction, there were no manufacturers who provided suits that demonstrated protection against a broad range of chemicals and addressed performance for all parts of the ensemble — suit, visor, gloves, footwear, and seams. The idea of suits having some form of limited flame resistance in combination with material chemical resistance was thought to be unattainable. Once implemented, these standards prompted manufacturers to develop new material technologies and product designs, establishing fully qualified ensembles that improved the level and consistency of protection for first responders.

Before September 11, 2001, NFPA was just completing work on a standard for chemical and biological agent terrorism response, NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*[5], which set criteria for three different classes of protective ensembles that:

- Were responsive to hazards and responses associated with the intentional release of chemical warfare agents (CWAs), toxic industrial chemicals (TICs), and biological agents.
- Addressed a wider range of first responders, including special operations teams, law enforcement, emergency medical, first receivers, and others who were expected to require protection during such events.
- Subsequent revisions to NFPA 1994 addressed biological and radiological particulates; incorporated new methods of evaluation; and improved the understanding of ensemble selection by aligning the ensemble use with respirator use and the chemical/biological/radiological/nuclear (CBRN) criteria developed for respiratory protection.

In 2018, the NFPA 1994 standard's scope and title were modified to show inclusion of operational response to hazardous materials and CBRN terrorism incidents. Additional significant changes in the last series of revisions for these standards have included the following:

- Updating chemical batteries to provide a broader and more pertinent list of chemicals for each of the ensemble types. For example, the chemical battery used in NFPA 1992 now is more relevant to less volatile liquid chemical splash exposures. Additional changes have been made to the chemical lists in NFPA 1991 and NFPA 1994.
- Providing more options in the specification of ensembles such as flash fire escape protection for most standards, a liquefied gas protection option for NFPA 1991, ruggedized categories of performance for most classes of ensembles in NFPA 1994, and a stealth option for NFPA 1994 ensembles when used for law enforcement purposes.

Each of the three NFPA hazardous materials standards addresses entire ensembles to include the suit or garment, visor or faceshield (if present), gloves, and footwear. While respiratory equipment is a necessary part of the responder's protection, all respiratory-protective equipment must be certified to the respect National Institute for Occupational Safety and Health (NIOSH) regulations but these requirements are not specifically covered in the NFPA standards with the exception of SCBA, which further must either meet the NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*[6] or NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*[7] standards, in addition to the NIOSH certification criteria.

A related standard for first responders and other emergency personnel is NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*[8]. This standard was originally developed to define protective clothing for persons providing emergency medical care against exposure to liquid-borne pathogens during emergency medical operations in response to the OSHA Final Rule (29 CFR Part 1910.1030)[1]. The first edition of the standard was introduced in 1992, with successive editions made in the following years to incorporate improved requirements and broaden the scope of the standard. For example, the standard now extends to both first responders engaged in emergency medical operations as well as first receivers. Several categories of protective clothing are covered by the standard, including single- and multiple-use garments, examination gloves, cleaning gloves, work gloves, and various eye and face protection devices such as goggles, faceshields, medical face masks, footwear, footwear covers, and helmets.

A significant amendment was made to the standard in April 2015 to provide a comprehensive revision that entailed creating new product categories of single-use and multiple-use ensembles in response to first responder needs for protection against Ebola Virus Disease. The 2018 edition of NFPA 1999 established the design, performance, certification, and labeling requirements for complete ensembles by specifying combinations of clothing items. The new ensembles are intended to protect individuals against highly infectious diseases that can be transmitted by both liquid and aerosol contact.

ORGANIZATION AND CONTENT OF NFPA STANDARDS

Each NFPA standard consists of a series of requirements that:

- Describes the product covered by the standard and the protection intended by the ensemble.
- Details procedures for independent certification of the product.
- Requires product labeling and user information.
- Contains specific criteria for design of the ensemble.
- Specifies minimum performance levels for the ensemble, its materials, and components evaluated using standardized tests.

A key distinction that the standards provided was the association of vapor protection with EPA Level A totally encapsulating chemical-protective suits and liquid-splash protection with EPA Level B (and Level C) chemical splash suits, with specific tests for demonstrating vapor and liquid protection for whole suits and suit materials. *Table 2* demonstrates the associations

TABLE 2 *Comparison of NFPA Standards and OSHA/EPA Levels for Respiratory Protection*

					Expected Dermal Protection from Suit(s)[5]			
NFPA Standard[1]	**Minimum OSHA/EPA Level**	**Respirator[2]**	**NFPA Barrier Method(s)[3]**	**Type of Challenge[4]**	**Chemical Vapor**	**Chemical Liquid**	**Particulate**	**Liquid-borne viruses**
1991 (2016)	A	SCBA	Permeation resistance	24 toxic industrial chemicals, 2 CWAs	X	X	X	X
1994 Class 1 (2018)	A	SCBA	Permeation resistance	10 toxic industrial chemicals, 2 CWAs	X	X	X	X
1994 Class 2 or 2R (2018)	B	SCBA	Permeation resistance; viral penetration resistance	5 toxic industrial chemicals, 2 CWAs; bacteriophage	X	X	X	X
1992 (2018)	B	SCBA	Penetration resistance	10 toxic industrial chemicals		X		
1994 Class 3 or 3R (2018)	C	CBRN APR or CBRN PAPR	Permeation resistance; viral penetration resistance	5 toxic industrial chemicals, 2 CWAs; bacteriophage	X	X	X	X
1994 Class 4 or 4R (2018)	C	CBRN APR or CBRN PAPR	Viral penetration resistance	Bacteriophage			X	X
1999 Single-Use or Multiple-Use (2018)	C	APR with P100 filter or PAPR with HEPA filter	Viral penetration resistance	Bacteriophage				X

[1] Refers to current edition of NFPA standard that defines complete ensemble (suit or garment, gloves, footwear, and respirator). NFPA 1991 also includes options for liquefied protection and flash fire protection. NFPA 1992 includes option for flash fire protection and addresses both encapsulating and non-encapsulating ensembles. In NFPA 1994, there are four classes of ensembles ranging from Class 1 (highest level of protection) to Class 4 (lowest level of protection). Type R or ruggedized protection is defined for Class 2, 3, and 4 for additional physical protection and durability over baseline ensembles. NFPA 1999 defines two types of ensembles for single use and multiple use (higher level of physical protection and durability).

[2] SCBA: Self-contained breathing apparatus; APR: Air-purifying respirator; PAPR: Powered air-purifying respirator; all SCBA are certified to at least NFPA 1981 for open-circuit SCBA with mandatory CBRN protection. SCBA specified for NFPA 1992 and NFPA 1994 Class 2 or 2R may alternatively be certified to NFPA 1986 (tactical and technical operations SCBA with CBRN protection). Where specified, APR or PAPR are certified as providing CBRN protection; NFPA 1999 does not require CBRN protection and only addresses particulate protection.

[3] Permeation resistance measures molecular transfer of chemical through materials and seams over 1-hr period; depending on standard, different chemical challenge concentrations are applied. NFPA 1991 specifies 100 g/m^2 for liquid challenges and 100% for gas challenges; NFPA 1994, Class 1 specifies 20 g/m^2 for liquid challenges and 1% for gas challenges; NFPA 1994 Class 2 or 2R specifies 10 g/m^2 for liquid challenges and 350 ppm for gas challenges; NFPA 1994 Class 3 or 3R specifies 10 g/m^2 liquid challenge with air flowing and 40 ppm for gas challenges; Penetration resistance testing determines if bulk liquid chemical passes through in 1-hr period, where part of exposure is at 13.8 kPa (2 psi) pressure; Viral penetration resistance determines if bacteriophage (a virus surrogate for Hepatitis virus and HIV) suspended in a liquid passes through material over a 1-hr period where part of the exposure is at 13.8 kPa (2 psi) as determined using a microbiological assay procedure.

[4] Different challenge substances are used for the different standards to represent a broad range of chemical exposures and properties. Where chemical warfare agents (CWAs) are indicated, distilled mustard (HD) and Soman (GD) are evaluated. NFPA 1991 involves the 21 liquid and gaseous chemicals specified in ASTM F1001, less acetonitrile, plus acrolein (liquid), acrylonitrile (liquid), and dimethyl sulfate (liquid); NFPA 1994, Class 1 specifies testing against 10 toxic industrial chemicals that include acrolein (vapor), acrylonitrile (vapor), ammonia (gas), chlorine (gas),

diethylamine (vapor), dimethyl sulfate (liquid), ethyl acetate (vapor), sulfuric acid (liquid), tetrachloroethylene (liquid), and toluene (liquid). NFPA 1992 entails only liquids that include butyl acetate, dimethyl formamide, Fuel H (synthetic gasoline), isopropyl alcohol (91%), methyl isobutyl ketone, nitrobenzene, sodium hydroxide (50%), sodium hypochlorite (10%), sulfuric acid (93%), and tetrachloroethylene (95%). Chemicals for NFPA 1994 Class 2, 2R, 3, and 3R include acrolein (vapor), acrylonitrile (vapor), ammonia (gas), chlorine (gas), and dimethyl sulfate (liquid).

[5] In addition to material and seam testing for barrier performance, ensembles compliant to NFPA standards are evaluated for their integrity to different types of exposures. NFPA 1991 and NFPA 1994 Class 1, 2, 2R, 3, and 3R ensembles are evaluated for man-in-simulant testing (MIST) to determine protection for vapor exposures where different levels of performance are specified for each standard and class. Liquid chemical protection is demonstrated by passing performance using a full ensemble liquid integrity test where the exposure time is varied with the particular standard or class. With the exception of NFPA 1994 Class 4 or 4R, particulate protection is demonstrated through ensembles passing both vapor (MIST) and liquid integrity tests. For NFPA 1994 Class 4 or 4R ensembles, an inward particulate leakage test is conducted. Protection from liquid-borne viruses (and other microorganisms) is demonstrated by the combination of material/seam viral penetration resistance and liquid integrity testing with the exception that NFPA 1994 Class 4 or 4R ensembles are only evaluated for material viral penetration resistance.

between the NFPA protection standards and the EPA levels of protection.

NFPA 1991 and NFPA 1992 each specify one type of ensemble with different variants. NFPA 1994 covers multiple classes of ensembles — Class 1 through Class 4, with Classes 2, 3, and 4 having ruggedized options as well. NFPA 1999 defines two different types of ensembles — single-use and multiple-use — in addition to several individual categories of protective clothing (garments, gloves, eye/facewear, and footwear). The primary elements of each standard are briefly described in the following subsections.

NFPA 1991

The standard specifies the requirements for vapor-protective ensembles intended to offer the highest level of chemical protection, which provide performance consistent with EPA Level A. NFPA 1991 ensembles are used with self-contained breathing apparatus (SCBA) or SCBA/supplied air respirator (SAR) respiratory protection in immediately dangerous to life and health (IDLH) environments. Features of these products include:

- Fully encapsulated suits that cover both the wearer and the respirator.
- Generally have a built-in face shield or visor, attached gloves, and sock-like extensions of the suit.
- Single- and multi-layer material approaches are applied.
- Multiple gloves are used to meet hand protection requirements.
- Suits generally use outer boots combined with the sock-like extensions of the suit (booties) where splash flaps cover the top of the outer boots.
- Covers or flaps are required for certain components such as exhaust valves and closures.
- Provided in at least four sizes.

In terms of key performance attributes, NFPA 1991 ensembles:

- Provide gas-tight integrity (will hold pressure).
- Resist inward leakage of hazardous vapors.
- Demonstrate long-term integrity against liquid (spray) penetration.
- Incorporate materials and seams that resist permeation of a broad range of liquid and gaseous chemicals, including TICs and CWAs with levels at 100% concentration over 1-hour period.
- Meet minimum standards for strength, durability, and functionality.
- Offer limited material flame resistance.
- Can comply with optional criteria defining additional protection against chemical flash fires for escape purposes and/or ability to withstand contact with liquefied gases.

Representative ensembles are pictured in *Exhibit 1*.

EXHIBIT 1 *Example of an NFPA 1991 Compliant Ensemble. (Courtesy of Ansell)*

NFPA 1992

This standard specifies the requirements for liquid splash–protective ensembles; these are not intended for protection from gases or vapors. The standard covers full ensembles and separate garments, gloves, and footwear. NFPA 1992 ensemble performance is consistent with EPA Level B. These ensembles are used with SCBA or SCBA/SAR respiratory protection in IDLH environments. Specific features of NFPA 1992 ensembles include:

- May be one- or multiple-piece garments.
- Some products include attached gloves and footwear.
- Garments may or may not be encapsulating.
- If not encapsulating, interfaces are required for the respirator, gloves, and footwear.
- Multiple gloves may be used to meet hand protection requirements.
- Suits generally use socks combined with outer boots.
- Typically garments are of a single layer construction.
- Garments must be provided in at least four sizes while gloves have to be provided in five sizes.
- Garments may be breathable. Manufacturers making this claim are required to provide data in support of specific claim.

In terms of key performance attributes, NFPA 1992 ensembles:

- Demonstrate integrity against liquid (spray) penetration.
- Are constructed of materials that resist liquid penetration against low volatility liquids, or liquids with high vapor pressures that do not produce hazardous vapors over 1-hour period.
- Meet minimum standards for strength, durability, and functionality (levels lower than NFPA 1991).
- Can be certified to meet optional criteria defining additional protection against chemical flash fires for escape purposes.
- Allow garments, gloves, and footwear to be separately certified.

Representative ensembles are pictured in *Exhibit 2*.

EXHIBIT 2 *Example of an NFPA 1992 Compliant Ensemble. (Courtesy of Saint Gobain Performance Plastics and DuPont Protection Technologies.)*

NFPA 1994 Class 1

The Class 1 requirements of NFPA 1994 are a new category of NFPA 1994 that defines ensembles that protect against chemical warfare agents, toxic industrial chemicals, biological agents (bloodborne pathogens), and particulates. These ensembles are intended for IDLH environments requiring SCBA and provide protection against vapors, liquid droplets, and aerosols where potential skin contact is expected to be at moderate to high levels. Specific expected features of these ensembles include:

- One-piece or multiple-piece garments, which may or may not cover respiratory-protective equipment.
- If not encapsulating, the ensemble is required to have an interface with SCBA, gloves, and footwear.
- Multiple gloves may be used to meet hand protection requirements.
- Garments generally may use socks combined with outer boots.
- Garments typically have a single-layer construction.
- Ensembles must be provided in at least four sizes.

In terms of key performance attributes, NFPA 1994 Class 1 ensembles:

- Demonstrate integrity against vapors and aerosols, and prevent inward leakage of liquid spray (less than NFPA 1991).
- Are constructed of materials and seams that resist permeation by selected chemical warfare agents and toxic industrial chemicals, and also prevent penetration of bloodborne pathogens (tests at realistic concentrations).
- Meet minimum standards for strength, durability, and functionality.
- Must be constructed of materials that provide limited flame resistance.
- Are intended for single exposure, although some products may be worn more than once.
- Can be constructed using optional criteria that define additional protection against chemical flash fires for escape purposes and having stealth characteristics.

NFPA 1994 Class 2

The Class 2 requirements of NFPA 1994 define ensembles that protect against chemical warfare agents, toxic industrial chemicals, biological agents (bloodborne pathogens), and particulates. These ensembles are intended for IDLH environments requiring SCBA and provide protection against vapors, liquid droplets, and aerosols where potential skin contact is expected to be limited. Specific features of NFPA 1994 Class 2 ensembles include:

- One-piece or multiple-piece garments, which may or may not cover respiratory-protective equipment.
- Garments require interface with SCBA (if not encapsulated), gloves, and footwear.
- Multiple gloves may be used to meet hand protection requirements.
- Garments generally use integrated socks combined with outer boots.
- Typically garment materials are of a single-layer construction.
- Ensembles must be provided in at least four sizes.

In terms of key performance attributes, NFPA 1994 Class 2 ensembles:

- Demonstrate integrity against vapors and aerosols, and prevent inward leakage of liquid spray.
- Incorporate materials and seams to resist permeation by selected chemical warfare agents and toxic industrial chemicals, as well as prevent penetration of bloodborne pathogens.
- Meet minimum standards for strength, durability, and functionality.
- Have materials that are not evaluated for limited flame resistance.
- Are intended for single exposure; some products may be worn more than once.
- Can be certified to optional criteria that define additional protection against chemical flash fires for escape purposes and having stealth characteristics.
- May also be certified as ruggedized type with greater durability.

Representative ensembles are pictured in *Exhibit 3*.

a) b)

EXHIBIT 3 *Two Examples of NFPA 1994 Class 2 Compliant Ensembles. [Courtesy of a) Blauer Manufacturing Company, and b) LION First Responder PPE, Inc.]*

NFPA 1994 Class 3

The Class 3 requirements of NFPA 1994 define ensembles that protect against chemical warfare agents, toxic industrial chemicals, biological agents (bloodborne pathogens), and particulates. These ensembles are intended for incidents classified below IDLH conditions and where air-purifying respirators (APRs) or powered air-purifying respirators (PAPRs) are permitted. They are designed for lower levels of protection against vapors, liquid droplets, and aerosols, at lower levels of exposure where direct skin contact is not likely. Specific features of NFPA 1994 Class 3 ensembles include:

- One-piece or multiple-piece garments.
- Ensembles require interface with APR or PAPR, gloves, and footwear.
- Multiple gloves may be used to meet hand protection requirements.
- Garments generally use integrated socks combined with outer boots.
- Garments are typically of single-layer construction.
- Ensembles must be provided in at least four sizes.

In terms of key performance attributes, NFPA 1994 Class 3 ensembles:

- Demonstrate integrity against vapors and aerosols (lower than Class 2 ensembles).
- Prevent inward leakage of liquid spray (shorter liquid exposure durations than Class 2 ensembles).
- Are constructed of materials and seams that resist permeation by selected chemical warfare agents and toxic industrial chemicals (evaluated at lower concentrations and less severe conditions than Class 2).
- Are constructed of materials and seams that prevent penetration of bloodborne pathogens.
- Meet minimum standards for strength, durability, and functionality (lower requirements than Class 2).
- Use materials that have minimum level of breathability.
- Use materials that are not evaluated for limited flame resistance.
- Are intended for single exposure; some products may be worn more than once.
- Can be certified to optional criteria that define additional protection against chemical flash fires for escape purposes and having stealth characteristics.
- May also be certified as ruggedized type with greater durability.

Representative ensembles are pictured in *Exhibit 4*.

EXHIBIT 4 *Examples of NFPA 1994 Class 3 Compliant Ensembles. [Courtesy of a) Blauer Manufacturing Company, and b) LION First Responder PPE, Inc.]*

NFPA 1994 Class 4

The Class 4 requirements of NFPA 1994 define ensembles that protect against biological agents (bloodborne pathogens) and particulates. These ensembles are intended for protection against biological aerosols or radiological-contaminated particulates below IDLH levels where APRs or PAPRs would be suitable; no protection offered against chemical warfare agents or toxic industrial chemicals. An example application is "white powder" (anthrax or fentanyl) response or biological exposure events (e.g., potential victims of Ebola Virus Disease). Specific features of NFPA 1994 Class 4 ensembles include:

- One-piece or multiple-piece garments.
- Garments require interface with APR or PAPR, gloves, and footwear.
- Multiple gloves may be used to meet hand protection requirements.
- Garments generally use booties (or integrated socks) combined with outer boots.
- Garment materials are typically of single-layer construction.
- Ensembles must be provided in at least four sizes.

In terms of key performance attributes, NFPA 1994 Class 4 ensembles:

- Demonstrate integrity against particulate penetration.
- Are constructed of materials and seams that prevent penetration of bloodborne pathogens.
- Meet minimum standards for strength, durability, and functionality.
- Use garments that have minimum level of breathability (more breathable than Class 3).
- Are constructed of materials that are not evaluated for limited flame resistance.
- Are intended for single exposure; some products may be worn more than once.
- Can be certified to optional criteria that define additional protection against chemical flash fires for escape purposes and having stealth characteristics.
- May also be certified as ruggedized type with greater durability.

A representative ensemble is shown in *Exhibit 5*.

EXHIBIT 5 *Example of NFPA 1994 Class 4 Compliant Ensemble. (Courtesy of Blauer Manufacturing Company.)*

NFPA 1999

NFPA 1999 specifies the requirements for single-use and multiple-use medical-protective ensembles for protecting against liquid-borne or airborne highly infectious diseases. Single-use ensembles are intended for one-time use. Multiple-use ensembles are intended for repeated use with reuse predicated on their adequate cleaning and decontamination before reuse. These ensembles have the following characteristics:

- Both ensemble types provide full body coverage with no exposed skin.
- Single-use ensembles include single-use coveralls or two-piece garments, two pairs of examination gloves, multiple-use footwear or single-use footwear covers, and different combinations of eye/face protection devices (e.g., goggles, faceshields, and N95 filtering facepieces).
- Multiple-use ensembles include multiple-use coveralls or two-piece garments, cleaning or work gloves worn over examination gloves, multiple-use footwear, and either a full-face APR with P100 filters, or

tight or loose-fitting PAPR having a high efficiency ("HE") particulate protection level.

In terms of key performance attributes, NFPA 1999 ensembles:

- Prevent inward leakage of liquid spray (multiple-use ensembles are tested for a longer duration exposure).
- Are constructed of materials and seams that prevent penetration of bloodborne pathogens (multiple-use ensembles are evaluated after repeated laundering).
- Have garments that meet minimum standards for strength, durability, and functionality (multiple-use garments are evaluated under more severe conditions with higher criteria).
- Meet individual criteria established for ensemble elements, including gloves, footwear, and eye/face protection devices.
- Separate items of clothing can be certified to NFPA 1999, including single-use garments, multiple-use garments, examination gloves, cleaning gloves, work gloves, footwear, medical receiver footwear (without physical protection), footwear covers, helmets, and PAPR.

A representative ensemble is shown in *Exhibit 6*.

EXHIBIT 6 *Example of NFPA 1999 Compliant Ensemble. (Courtesy of International Personnel Protection, Inc.)*

RELEVANCE OF PERFORMANCE TESTING

An essential component of the NFPA PPE standards is the operational relevance of the testing that is applied to the different ensembles. In developing the NFPA standards, specific test methods and validated criteria for establishing acceptable performance can be summarized by five basic questions.

Question 1: Do NFPA ensembles prevent the penetration of specific chemicals and other substances into the ensemble that may be encountered during emergency operations?

Overall ensemble integrity tests correspond to expected types of exposure stated in each standard and address the most likely pathway for wearer exposure to hazardous substances — ensemble interfaces, seams, and closures.

- Man-in-Simulant Tests (MIST) are used to demonstrate integrity of the ensemble against the penetration of gases and vapors and are applied to NFPA 1991 and NFPA 1994 Class 1, 2, and 3 ensembles. MIST entails human test subjects wearing the ensemble in a controlled chamber where they are exposed to a hazardous chemical simulant (salicylate) while performing a range of exercises. Small, specially designed adsorbent dosimeters are positioned on the test subject's body to collect any penetrating vapor and are analyzed to show the relative protection factor in each area of the body where the dosimeters are located. Quantitative protection factor results are provided for the individual body areas and the overall system.
- Suit inflation testing is performed as a supplemental assessment of gas/vapor integrity for NFPA 1991 ensembles. This test involves inflating the ensemble to a specific pressure and determining the pressure drop after a given period of time to provide an indication of air leakage from the ensemble. In order for the test be performed, the exhaust valves must be blocked.
- Overall liquid integrity testing is applied to all ensembles in each standard with the exception of NFPA 1994 Class 4 ensembles. In this testing, the ensemble is placed on a manikin that is already dressed in a liquid absorptive garment. The ensemble is exposed to surfactant treated water from nozzles positioned around the ensemble at a controlled liquid flow rate. *Exhibit 7* shows an ensemble being evaluated for overall liquid integrity. Over the course of the test, the ensemble is rotated so that all portions of the ensemble are exposed to liquid spray. Different test durations are specified depending on the intended level of liquid integrity. Following the liquid spray exposure and careful removal of the test ensemble, the inner liquid absorptive garment is inspected for liquid marking as evidence of liquid penetration. Test results are reported as pass or fail.
- Inward particle leakage testing is performed on NFPA 1994 Class 4 ensembles where a human subject wears a solid black garment underneath their ensemble and performs a number of exercises in a chamber with fluorescently tagged silica particles.

EXHIBIT 7 *Ensemble Being Evaluated for Overall Liquid Integrity. (Courtesy of International Personnel Protection, Inc.)*

The particles are driven by an airflow during the test subject exposure. Following the exposure and the careful removal of the test ensemble, the test subject is photographed under UV light to show any evidence of particle penetration. Results are reported as pass or fail.

Question 2: Do the materials used in the construction of NFPA ensembles adequately resist permeation and penetration of hazardous substances under relevant exposure conditions?

Resistance of barrier materials and seams is the most extensive requirement of each standard. Each ensemble element, including the suit (or garment), visor, gloves, footwear, and primary seams of the ensemble, are tested; closures are also tested for penetration resistance in NFPA 1991.

- Permeation resistance testing is used for vapor, gases, or highly toxic chemicals, and is applied in NFPA 1991 and NFPA 1994 for Class 1, 2, and 3 ensembles. It is also used in the evaluation of cleaning gloves under NFPA 1999 against selected disinfection chemicals. Permeation resistance testing involves measuring the amount of chemical that passes through a material in a specified test period (1 hour). Permeation resistance testing is carried out in a special test cell where ensemble material specimens divide the test cell into two chambers — the challenge side where the exterior side of the material faces the test chemical, and the collection side on the interior side of the material for collection of permeating chemical. Depending on the NFPA standard, exposure conditions are different in terms of the chemical concentration, temperature, humidity, and airflow over the tested material. The test provides the cumulative permeation (dose of chemical passing through given area of material) for the entire chemical exposure period and at 15-minute intervals.
- Liquid penetration resistance is primarily used when ensembles are expected to protect against short-term chemical contact by liquid splashes. It is principally applied in NFPA 1992 for liquid splash–protective ensembles. It is also used in NFPA 1991 for evaluating the barrier properties of the closure. In penetration resistance testing, ensemble material specimens are placed in a test cell where the ensemble material specimen covers an open cavity while the exterior side of the specimen is visible. Test chemical is placed in the test cell cavity and the exterior side of the material is observed for liquid penetration. During a portion of the 1-hour test, pressure is applied to the liquid. Test results are reported as pass or fail depending on the observation of test chemical coming through the material during the 1-hour exposure period. An example of a failing test is shown in *Exhibit 8*.

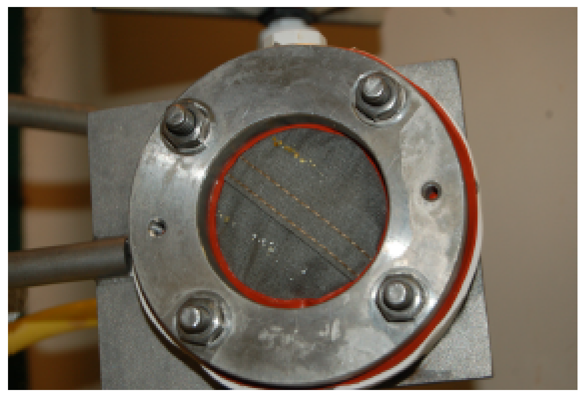

EXHIBIT 8 *Liquid Penetrating Material Samples During Liquid Penetration Resistance Test. (Courtesy of International Personnel Protection, Inc.)*

- Viral penetration resistance testing is used on all NFPA 1994 and NFPA 1999 ensembles. A similar test cell is used as in liquid penetration resistance testing but the test chemical is replaced with a special liquid challenge solution that contains a surrogate virus. At the conclusion of the test, the viewing surface of the ensemble material specimen is rinsed with a clean solution and assayed for the presence of penetrating virus. If any viruses are detected in the assay solution, the specimen fails the test.

Because it is impossible to test with every possible chemical, specific chemicals have been chosen to represent a range of chemical exposure concerns. *Table 3* illustrates the range of chemicals used in the evaluation of ensemble materials that are part of each standard. It includes chemicals that are both skin toxic

TABLE 3 Standard Chemical Batteries for Evaluating Protective Ensemble Materials

Chemical	State	Skin Toxic?	NFPA 1991	NFPA 1991 Liquefied Gases	NFPA 1992	NFPA 1994 Class 1	NFPA 1994 Class 2 and 3
Acetone	Liquid	No	◆				
Acetonitrile	Liquid	Yes	◆				
Acrolein	Liquid*	Yes	◆			◆	◆
Acrylonitrile	Liquid *	Yes	◆			◆	◆
Ammonia	Gas	No	◆	◆		◆	◆
1,3-Butadiene	Gas	No	◆				
Butyl Acetate	Liquid	No			◆		
Carbon Disulfide	Liquid	Yes	◆				
Chlorine	Gas	No	◆	◆		◆	◆
Dichloromethane	Liquid	No	◆				
Diethylamine	Liquid*	Yes	◆			◆	
Dimethylformamide	Liquid	Yes	◆		◆		
Dimethyl sulfate	Liquid	Yes	◆			◆	◆
Ethyl Acetate	Liquid*	No	◆			◆	
Ethylene Oxide	Gas	No	◆	◆			
Fuel H†	Liquid	No			◆		
Hexane	Liquid	Yes	◆				
Hydrogen Chloride	Gas	No	◆				
Isopropyl Alcohol (91%)	Liquid	No			◆		
Methanol	Liquid	Yes	◆				
Methyl Chloride	Gas	Yes	◆				
Methyl Isobutyl Ketone	Liquid	No			◆		
Mustard (distilled)	Liquid	Yes	◆			◆	◆
Nitrobenzene	Liquid	Yes	◆				
Sodium Hydroxide (50%)	Liquid	No	◆		◆		
Sodium Hypochlorite (10%)	Liquid	No			◆		
Soman	Liquid	Yes	◆			◆	◆
Sulfuric Acid (93.1%)	Liquid	No	◆		◆	◆	
Tetrachloroethylene	Liquid	Yes	◆		◆	◆	
Tetrahydrofuran	Liquid	No	◆				
Toluene	Liquid	No	◆			◆	

* Tested as vapor for NFPA 1994 permeation testing applications

† 42.5% Toluene, 42.5% Isooctane, 15% Ethanol

and those that are predictive for a range of chemicals that can affect protective ensemble materials. Some chemicals were selected to represent different classes of chemicals. Different batteries are used in each NFPA standard depending on the intended application of the ensemble.

Question 3: Does the ensemble have the durability and physical properties necessary for the expected use?

The required testing criteria in the standards provide confidence that the protective capabilities will be maintained over time. Ensemble materials are subjected to repeated flexing and abrasion to simulate use prior to barrier testing. Different materials used in the construction of the ensemble are evaluated for relevant physical properties where specific criteria have been set for the respective NFPA standards based on acceptable levels of strength and physical hazard resistance.

- Suit/garment and visor materials are evaluated for burst strength, puncture/tear or impact resistance, and cold temperature stiffness.
- Glove materials are tested for cut resistance (see *Exhibit 9*), puncture resistance, and cold temperature stiffness.

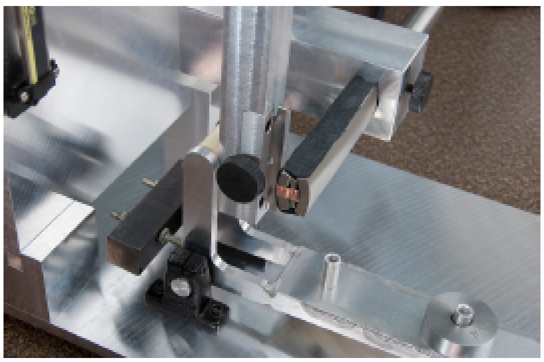

EXHIBIT 9 *Ensemble Glove Material Being Evaluated for Cut Resistance. (Courtesy of International Personnel Protection, Inc.)*

- Footwear is tested for cut resistance, puncture resistance, abrasion resistance, impact/compression resistance, and slip resistance.
- Specialized materials such as those used in interfaces are also evaluated for specific physical properties.

In NFPA 1994, a ruggedized type of each ensemble is specified for Class 2, 3, and 4 ensembles as a variant intended for more physically demanding environments and to allow potential ensemble reuse (considering the ensemble is safe to reuse). The ruggedized type for these ensembles specifies more rigorous physical property requirements for garment and glove materials, and further evaluates garment barrier performance following five wash and dry cycles combined with an increased number of flexing and abrasion cycles.

Question 4: Will ensemble materials contribute to wearer injury in the event of accidental short-term exposure to severe hazards such as flame, flash fire, or liquefied gases?

During an emergency response, accidental flame contact may occur. To ensure ensembles do not readily ignite and continue to burn, test methods are applied to:

- Assess the ease of ignition and the propensity for continued burning of ensemble materials when exposed to a flame (NFPA 1991 and NFPA 1994 Class 1 only). Flame resistance testing involves exposing a folded edge of the ensemble material directly in a burn or flame for a 3-second period and measuring the subsequent continued time the specimen burns (afterflame time). See *Exhibit 10*. Acceptable materials cannot have an afterflame time of more than 2 seconds and are further not permitted to melt and drip when exposed under these conditions.

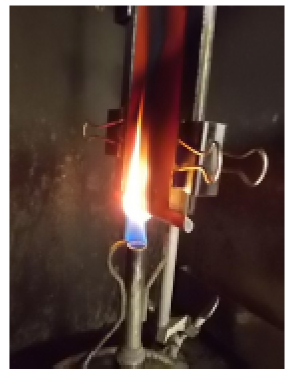

EXHIBIT 10 *Exposure of Ensemble Material in Flame Resistance Test. (Courtesy of International Personnel Protection, Inc.)*

- Apply additional criteria for those ensembles that claim protection against chemical flash fires for escape purposes (NFPA 1991, 1992, and 1994 only). For flash fire testing, a longer flame exposure time is used (12 seconds) and the material cannot show damage over more than 100 mm. In addition, ensemble materials are evaluated for their insulation properties and the overall ensemble is subjected to a simulated flash fire where it is expected to show no continued afterflame and maintain its integrity for permitting the wearer to escape from the flash fire event.
- Ensemble materials used in NFPA 1999 ensembles must demonstrate limited flammability by assessing the rate of flame spread on the material specimen.
- Offer a separate option for protection against liquefied gases — ammonia, chlorine, and ethylene oxide (NFPA 1991 only). Demonstration of protection from liquefied gases is determined by specific permeation resistance testing against selected chemicals and liquefied states in combination with assessments on the physical damage created by the liquefied gas exposure.

Question 5: Will the ensemble limit user functionality and their ability to complete required missions and response activity?

Protection requirements do not come at the expense of ensemble functionality. Each NFPA standard addresses functionality by testing ensembles with their elements to ensure that responders can readily complete mission-based tasks. Functional aspects tested include visor clarity and field of vision, accommodation of hard hats, glove impact on dexterity and hand function, and footwear levels of slip resistance (traction) on smooth surfaces. Ensembles are assessed for overall function by having test subjects wear the ensembles and perform various exercises to determine the range of motion and ability to carry out mission-specific tasks such as moving a 55-gallon drum with a hand truck (*Exhibit 11*); lifting weighted boxes and putting them onto and taking them off of a table; coiling and uncoiling a length of hose; using a wrench and a screwdriver to install/remove a bolt and screw; and climbing a ladder.

Some NFPA standards including NFPA 1994 Class 3 and Class 4 ensembles, as well as the ensembles specified in NFPA 1999, require the garment material to be breathablew by the application of total heat loss, evaporative resistance, or moisture vapor transmission rate test. These requirements are intended to promote improved comfort to the wearer while balancing the barrier characteristics of the ensemble.

Table 4 shows the types of requirements that are applied in the various NFPA standards.

EXHIBIT 11 *Ensemble Being Evaluated for Overall Function by Test Subject Moving 55-Gallon Drum. (Courtesy of Intertek Testing Services.)*

VALUE OF APPLYING NFPA STANDARDS FOR PPE

NFPA standards are developed through a voluntary consensus process accredited by the American National Standards Institute. The process ensures the balanced participation of users, enforcers, consumers, manufacturers, special experts, and labor, research, and testing organizations. No single interest category may constitute more than one-third of the committee voting membership. Standards are developed in an open and transparent way, with specific stages for public input and comment.

TABLE 4 *Matrix of Performance Properties Applied in NFPA Standards*

Performance Areas	**NFPA 1991 (2016)**	**NFPA 1992 (2018)**	**NFPA 1994 Class 1 (2018)**	**NFPA 1994 Class 2 (2018)**	**NFPA 1994 Class 3 (2018)**	**NFPA 1994 Class 4 (2018)**	**NFPA 1999 Multiple Use (2018)**	**NFPA 1999 Single Use (2018)**
Ensemble Integrity Tests								
Inflation (gas-tight integrity)	◆							
Overall airflow	◆		◇					
Man-in-simulant-test (MIST)	Very High		High	Moderate	Low			
Liquid-tight integrity	Long	Moderate	Moderate	Moderate	Short		Short	Very Short
Particulate inward leakage						◇		
Material Barrier Tests								
Permeation resistance								
- Standard industrial chemicals	◆ Very High		◆ High					
- Toxic industrial chemicals	◆ Very High		◆ High	◆ Moderate	◆ Low			
- Chemical warfare agents	◆ Very High		◆ High	◆ Moderate	◆ Low			
Liquid penetration resistance	Closure	◆						
Viral penetration resistance				◇	◇	◇	◇	◇

TABLE 4 (Continued)

Performance Areas	NFPA 1991 (2016)	NFPA 1992 (2018)	NFPA 1994 Class 1 (2018)	NFPA 1994 Class 2 (2018)	NFPA 1994 Class 3 (2018)	NFPA 1994 Class 4 (2018)	NFPA 1999 Multiple Use (2018)	NFPA 1999 Single Use (2018)
Durability/Physical Properties								
Garment burst/puncture-tear resistance	High	Low	High	Moderate	Low	Low	Moderate	Very Low
Garment/visor/glove seam strength	High	Low	High	Low	Low	Low	Moderate	Very Low
Visor impact resistance	◆	◆	◆	◆	◆	◆	◇	
Glove cut/puncture resistance	High	Low	High	Moderate	Low	Low	Moderate	Low
Footwear upper cut/puncture resistance	High	Low	High	Moderate	Low	Low	Moderate	Moderate
Footwear sole abrasion/puncture	◆	◆	◆	◆	◆	◆	◇	◇
Footwear toe impact/compression resistance	◆	◆	◆	◆	◆	◆	◇	◇
Cold temperature performance	◆	◆	◆	◆	◆	◆		
Abrasion/flexing barrier durability	Very High	Moderate	High	Moderate	Moderate	Moderate	Moderate	
Exhaust valve mounting strength	◆		◇					
External fitting pull out strength	◆		◇					
Other Hazards								
Limited flame resistance	◆		◇					
Flash fire performance	◇	◇	◇	◇	◇	◇		
Material flammability							◇	
Liquefied gas protection	◇							
Functionality Tests								
Ensemble effect on wearer mobility	◆	◆	◆	◆	◆	◆	◇	◇
Exhaust valve one-way flow	◆		◇					
Garment total heat loss		◇		◇	◆ Moderate	◆ High	◆ High	
Garment evaporative resistance		◇		◇	◆ High	◆ High	◆ High	
Moisture vapor transmission								◇
Visor clarity	◆	◆	◆	◆	◆	◆	◇	
Ensemble field of vision	◆	◆	◆	◆	◆	◆	◇	
Timed removal of hands from gloves	◆							
Glove-hand dexterity	Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	High
Footwear traction	◆	◆	◆	◆	◆	◆	◇	◇

◆ Requirement applied within standard

◇ Optional requirement for standard; that there is no mandatory requirement for certification to the standard, but the manufacturer may choose to provide this performance for certifying their ensemble. If the manufacturer chooses to provide this additional performance, the optional requirements become mandatory.

Very high, high/low, high/moderate/low, long/moderate/short, or very short provide a comparison of the criteria applied in that standard relative to the other NFPA chemical-protective ensemble standards. Note that low does not mean that the ensemble provides low levels of performance.

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NFPA standards are minimum performance specifications. For example, minimum sizing requirements are specified in each standard. Manufacturers can and do exceed the established criteria. End user organizations can specify higher limits or set additional criteria to meet their intended protection applications. Manufacturers provide a technical data package that consists of detailed descriptions of all ensemble parts and components, and includes the performance data that demonstrates compliance of the ensemble with the respective standard. The NFPA product certification process requires that:

- All ensembles must meet all criteria in the standard in order to be considered compliant. No partial certifications are allowed.
- Each standard includes an independent, third-party certification, minimum manufacturer quality assurance (including manufacturer ISO 9001 quality standard registration), and annual recertification.
- Certifying organizations use unannounced visits to audit manufacturer products for compliance with the applicable standard. Follow-up testing is conducted to ensure products remain compliant.
- The criteria for third-party certification in all three standards exceed industry practices applied in other PPE specifications and standards used in the chemical protection industry, including requirements for a recall or safety alerts, if necessary.

The NFPA standards are by no means all inclusive; they are not a substitute for user education and appropriate training as covered in NFPA 472. Many response organizations consider these standards to be overly rigorous and as producing expensive products. Nevertheless, the NFPA standards do provide a baseline performance that has spurred the development of chemical-protective garments for improved wearer protection. When used in conjunction with user experience, the process for selecting a chemical-protective suit can become much easier.

RISK-BASED APPROACH FOR SELECTING PPE

The selection of PPE must be based on first completing a risk assessment. Two types of risk assessments will aid in selecting PPE for purchase or for use — those performed on the general, expected situations that response teams encounter and assessments that are performed for a specific hazard. In each case, the risk assessment should consist of the following steps:

- Identifying the hazards present or likely to be present
- Estimating the likelihood of exposure
- Understanding the consequences of exposure
- Determining the risk

General Risk Assessment

A simple model for conducting a risk assessment is shown in *Table 5*. In this model, the likelihood of exposure and the consequences of exposure are estimated for each expected hazard. Risk is determined by multiplying the exposure likelihood by the exposure consequences. In this way, risks associated with specific hazards can be determined and ranked to ascertain protection and clothing performance needs.

The hazards alone need not be the determining factor for choosing PPE; rather the potential for exposure should govern selection of CPC. For example, the risk is different when dealing with 1 gal (3.8 L) of toluene versus dealing with a tank car full of the same chemical. Under-protection should be avoided to prevent exposure, but over-protection can be just as dangerous. Over-protection can lead to injury through heat stress and hinder the wearer from safely performing the needed tasks. Contingencies must be planned for, but a sense of realism should prevail when it comes to suit selection. The following factors should be collectively considered when selecting CPC:

- Overall ensemble integrity
- Material chemical resistance
- Material strength and physical hazard resistance
- Ensemble functional properties
- Overall suit design
- Service life
- Cost

Earlier sections of this chapter indicated how specific ensemble performance properties related to overall integrity, material chemical resistance, and material strength and physical hazard resistance, and ensemble functional properties.

Design Features

How the ensemble is designed affects wearer function, fit, and comfort. These features are difficult to measure and are most often subjective of all evaluations, but are still an important part of the selection process. The best way to evaluate suit design is through trial wearing or field testing of prospective ensembles. These trials need to include tasks that replicate the same types of movements and stresses that would be placed on suits during actual use. Through this type of evaluation, end users can determine how the suit impacts their ability to perform work. The following are examples of relevant design features:

- Location and length of the closure (affects ease of putting on and taking off suit)
- Position, size, and type of the visor (affects user ability to see outside the suit)
- The bulk of the suit materials, in terms of the number of layers and the relative stiffness (affects user movement, ability to perform tasks)

TABLE 5 *Risk Assessment Areas for Selection of CPC*

	Body Area Affected					
Hazard Area	**Full Body**	**Respiratory System**	**Head Area**	**Torso**	**Arms/Hands**	**Legs/Feet**
Chemical vapor inhalation		■				
Chemical vapor skin absorption	■					
Chemical liquid skin contact	■					
Chemical ingestion			■			
Falling objects			■		■	■
Flying debris	■		■	■	■	■
Sharp objects	■		■	■	■	■
Rough surfaces	■		■	■	■	■
Slippery surfaces					■	■
Extreme cold	■	■	■	■	■	■
High heat	■	■	■	■	■	■
Flame exposure	■		■	■	■	■
Chemical flash fire	■		■	■	■	■
Static discharge	■		■	■	■	■
Electrical shock	■		■		■	■
Poor visibility	■					
Falling from height	■					
Falling into water	■	■				
Cold stress	■	■	■	■	■	■
Heat stress	■	■	■	■	■	■
Mobility restriction	■		■	■	■	■
Dexterity restriction					■	
Vision restriction						
Hearing restriction						

Note: Shaded boxes indicate where the hazard applies to a specific body area.

- The type of glove system (the number of gloves that must be used and the relative bulk and stiffness)
- The type of footwear system (combination of all footwear articles needed for foot protection)
- Interfaces between the suits and gloves and footwear (affects system integrity)
- The volume inside the suit hood area for accommodating the wearing of a respirator facepiece, head protection, and other equipment
- The overall volume inside the suit for those suits where the respirator is worn inside
- Available suit, glove, and footwear sizes (for accommodating different sized individual responders)
- Accommodation of different types of other response equipment, including respirators, cooling systems, and helmets

These features dramatically affect user function. In particular, glove systems have been found to decrease dexterity and cause hand function problems. Gloves are a problem for hazardous materials responders for some types of ensembles. Currently, many responders use double or triple gloving techniques to compensate for a limited size range and material selection shortcomings. However, using this multiglove technique is not without its tradeoffs, including limited dexterity (e.g., difficulty using gas detector button controls). Some responders carry a small pencil stub or other disposable tool taped to their suit sleeves to help press small meter buttons with accuracy. Sizing is important because manufacturers offer these suits in a number of different sizes and first responders often have to wear other equipment, which affect the ensemble's fit and function. Accommodating particularly large or small people can be difficult with a limited number of sizes. Ill-fitting clothing is particularly apparent for persons not being able to clearly see out of suits having visors or creating restrictions in the ability to move. Many hazardous materials response teams make up for the poor ergonomic design of an ensemble by applying generous amounts of duct tape or its chemical-resistant equivalent, binding clothing areas to keep interfaces in place and improve the profile of the clothing. Yet, an ensemble does not have to fit poorly if it is properly sized and evaluated by each individual wearer.

Service Life

In general, most users perceive inexpensive, lightweight plastic-based products as less durable and disposable, and relatively more expensive, heavy, rubber-based products as reusable. The service life of a product is actually based on its life cycle cost, durability, and ease of decontamination. Life cycle cost includes all costs associated with the use of the product including the initial purchase, maintenance, decontamination, storage, and disposal costs. There are also costs for putting clothing back into use and ensuring that it is safe. While purchase costs may be the principal cost for product use, disposal costs are taking on greater significance.

Determining how well the suit maintains its original condition for providing protection to the wearer best assesses durability. This factor can be evaluated by measuring product chemical resistance for representative products following simulated use (information generally not provided in manufacturer literature). If the clothing loses its chemical resistance from abrasion, repeated flexing, or other forms of wear, this suggests suits might not maintain their barrier performance during use. The ruggedness of the CPC is also a factor for how durable the suit might be.

Ease of decontamination is also important. If the product cannot be easily decontaminated, it becomes disposable regardless of the initial purchase cost. Products that are reused must be decontaminated to an acceptable level, knowing that it is safe to wear the suit without exposing the user to residual levels of chemical contaminants. Making this assessment is not a straightforward process because it requires a detailed knowledge of the interaction of the chemicals with the clothing materials for understanding whether a particular decontamination technique will reliably remove residual chemical. For some chemicals, this may not be a large issue because the combination of a relatively good chemical resistance in CPC materials and the volatility of many chemicals may mean that the chemical is removed by surface cleaning with the remainder evaporating. However, there are many chemicals that can be persistent and that are not easily removed through conventional decontamination techniques. Furthermore, the ability to assess the effectiveness of the decontamination process might be hampered by an inability to measure residual chemical in the clothing and to realize the significance of any measured levels of that chemical.

Cost

The issue of cost cannot be dismissed. In an ideal world, the "best" suit in the marketplace would be purchased. But the fact is that organization resources for multiple forms of protective ensembles are limited. While some organizations have been able to set up programs to recoup PPE costs from those responsible for the incident, this form of chemical-protective suit reimbursement cannot always be relied on. Response organizations want the optimum number and types of protective ensembles in their inventory to minimize selection decisions and obtain the best protection for their team members. Therefore, issues of product service life are also important to the cost as is the recognition that any protective ensemble use can render it disposable.

Specific Selection Approach

The selection process follows the hazard and risk information and an understanding of the NFPA standards and product features through a series of decisions to determine which type of ensemble provides the needed minimum protection.

International Personnel Protection, Inc. developed a risk-based selection tool to assist emergency response personnel in the proper selection of PPE based on the available NFPA standards. The decision logic used in the tool is provided in Appendix A.

REFERENCES

1. Title 29, Code of Federal Regulations, OSHA Parts 1910.120 and 1910.1030, U.S. Government Printing Office, Washington, DC.
2. NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, National Fire Protection Association, 2016.
3. NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, National Fire Protection Association, 2018.
4. NFPA 1993, *Standard on Support Function Protective Clothing for Hazardous Chemical Operations*, National Fire Protection Association, 1994.
5. NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, National Fire Protection Association, 2018
6. NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, National Fire Protection Association, 2013.
7. NFPA 1986, *Standard on Respiratory Protection Equipment for Tactical and Technical Operations*, National Fire Protection Association, 2017.
8. NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*, National Fire Protection Association, 2018.

APPENDIX A

SELECTION OF HAZARDOUS MATERIALS AND CBRN PROTECTIVE ENSEMBLES

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INTRODUCTION

The selection of PPE for a specific response or operational mission should account for the specific hazard levels as well as an understanding for the specific types of available protective ensembles that can provide appropriate levels of protection.

- The selection of the appropriate hazardous materials or CBRN PPE is dependent on a thorough hazard and risk assessment that identifies the specific exposure threats and conditions at the response or operations scene.
- The selection process follows with the hazard and risk information through a series of decisions to determine which type of ensemble provides the needed minimum protection.
- These decisions are set as part of the logical approach where depending on the answers provided, a certain pathway is taken that ultimately ends in a recommended protective ensemble that meets a specific NFPA standard.

PRIMARY ASSUMPTIONS

For selection of appropriate chemical, biological, or CBRN PPE, several assumptions must be made to make the selection process more manageable. These assumptions include:

- The selection process is limited to chemical- or biological-protective clothing for emergency response or other operators and technicians involved in hazardous materials or CBRN operations.
- Individuals involved in the selection process have training in hazardous materials operations at an appropriate level for the selection of PPE.
- Individuals involved in the selection also have knowledge of the different types of chemical- or biological-protective clothing used as part of ensembles.
- At least some forms of clothing and equipment that meet the NFPA standards are available for use.

KEY INFORMATION NEEDED

In order to make specific selection decisions, the following information is needed:

- Type of hazards present in the response area.
- Expected form of exposure to the type of hazard.
- Expected severity of the hazards (or potential consequences of exposure).
- Portions of the body that are likely to come in contact with the hazard.
- Type of response environment and presence of other hazards (heat, cold, physical, etc.).
- Length of the work to be performed while wearing PPE.

GENERAL APPROACH FOR SELECTION DECISIONS

Information gained primarily from the hazard assessment is used to answer a series of questions that result in specific decisions. Depending on the type of answer given, other questions are asked and those answers also lead to different paths that ultimately will lead to a specific type of recommended PPE. This process is known as a decision logic and begins with asking the most significant questions first so that better performing PPE will be selected first in order to ensure appropriate levels of protection to operators and technicians.

There are many different possible choices of PPE that can be selected. In several cases, more than one form of PPE may be recommended. However, one possible outcome from the decision logic is not to enter the situation because adequate protection cannot be guaranteed.

There are many other conditions and circumstances that can also affect the choice of PPE that must also be taken into account. This document attempts to identify the most important factors that go into PPE selection.

STEP 1: PERFORM HAZARD AND RISK ASSESSMENT

PPE selection starts with a detailed hazard and risk assessment which also involves a characterization of the site where the PPE will be used. The hazard assessment is intended to identify all primary hazards that can create potential harm to the responding operators or technicians.

Hazard and risk assessments also take into consideration the likelihood of exposure to a specific hazard as well as the consequences of exposure to that same hazard. The combination of both of these factors establish the potential risk. For example, a low risk may exist for a hazard that is infrequently encountered and produces only moderate effects. Conversely, exposure to a highly hazardous substance that can produce immediate acute effects would be charged as a high risk.

Hazards can be characterized in a number of different ways. For this document, hazards are identified as specific to the substance, the working environment, and the type of work being performed.

Chemical/Biological/Radiological Hazards

The principal hazards during hazardous materials or CBRN responses include those hazards posed by the specific substances present in the response environment. Chemical substances are of varying toxicity and harmful effects where exposure may occur in a variety of forms:

- As a gas or vapor
- As a liquid or aerosol
- As a solid

Biological substances may be presented as either liquids or aerosols, although some forms of solid biotoxins or spores also can exist.

Radiological substances may be by electromagnetic radiation or as contaminated gases, liquids, or solids.

Risk increases with increasing volume and concentration, or strength, of the substance or hazard combined with the length of time where exposure may occur.

Environmental Hazards

The environment where responders must work can equally affect the hazards present. Different environmental factors include the following:

- The overall size of the space (confined spaces represent special hazards because the overall environment limits the dilution or release of the substance, as well as creating other hazards such as slips and falls and limited ease of escape).
- The ambient temperature will affect how quickly volatile substances may evaporate. High temperatures can also lead to heat stress while colder environments can also create hypothermic conditions.
- The physical environment can also lead to hazards at affect response activity and can compromise the barrier materials or integrity of the ensemble. Some aspects of the physical environment may allow for substances to accumulate in certain areas, creating higher risk.

Work/Task Hazards

The type of work can also contribute to hazards at the response scene. Wearing PPE for extended periods of time while undertaking moderate to hard work can create heat stress. In addition, the types of activities required may place strains on the individual operator or technician that lead to mistakes or possible injuries.

Work required on elevated platforms can lead to falls or objects dropped on others below.

STEP 2: DETERMINE KNOWN THREATS

After information is obtained from the hazard and risk assessment, the very first decision is whether the hazards are known. If the hazards are unknown then a separate decision has to be made whether entry into the site is actually needed.

- If there is no significant consequence for not responding, then no entry should be made.
- Even if there is potential loss of life or significant loss of property, any decision to enter a response area where the hazards are not completely characterized brings significant risk, and should be avoided until more information is obtained to ensure the safety of the first responders.
- When entry into the site is determined as necessary, then the highest level of protection in the form of an NFPA 1991 certified ensemble with both flash fire escape and liquefied gas protection should be chosen.

STEP 3: DETERMINE FLASH FIRE THREATS

The next key decision is to determine if there is a potential flash fire or explosive situation involved for the particular response or operation.

This decision is best supported by having portable monitoring equipment to measure the lower explosive limit (LEL). If monitoring equipment or circumstances indicate a LEL that is 10% or greater, then the environment should be considered a flash fire or explosive risk. It is possible that certain chemicals and the conditions of their storage for release will automatically make this determination evident.

As part of this decision, it is necessary to determine whether there is also a toxic threat posed by the substances present at the response scene.

- If toxic threats **DO NOT** exist and there is no threat of an explosion, wear appropriate flame-resistant–protective clothing (compliant to either NFPA 1971 or 2112).
- If toxic threats **DO** exist, then choose an NFPA 1991 ensemble that also meets the optional flash fire escape requirements.

STEP 4: DETERMINE CBRN THREATS

If there is the potential for exposure to a CBRN agent, then a series of different determinations are needed to present the correct path for choosing appropriate PPE.

The first determination as part of this decision process is to identify whether the agent is chemical, biological, or radiological/nuclear:

- If the agent is radiological/nuclear in nature and limited to contaminated particles that are of relatively low radiation levels, then choose an NFPA 1994 Class 4 or 4R ensemble.
- If the agent is chemical in nature, then follow Step 5 or 6 to make decisions for vapor/gas or liquid threats.
- If the agent is biological nature, then follow Step 7 to make decisions for biological threats.

STEP 5: DETERMINE GAS/VAPOR CHEMICAL THREATS

If the hazard/risk assessment identifies chemical agents or substances where exposure can occur either as a gas or vapor, then the following specific decision logic takes one of four paths, depending on the chemical gas or vapor concentration:

- The first path is for environments that present an immediately dangerous to life and health (IDLH) concentration or conditions that warrant the wearing of self-contained breathing apparatus (SCBA). IDLH conditions also include environments that involve potentially flammable vapor, liquefied gases, and oxygen deficiencies. This path is based on gas/vapor concentrations that are over 10,000 ppm or 1%.
- The second path is also IDLH, but exists for substances at lower concentrations (gas/vapor concentrations that are over 350 ppm but equal to or below 10,000 ppm).
- The third path is also IDLH, but exists for substances at even lower concentrations (gas/vapor concentrations that are over 40 ppm but equal to or below 350 ppm).
- The fourth path is for environments that are not determined to be IDLH and where either air-purifying respirators (APR) or powered air purifying respirators (PAPR) are considered acceptable. For this path, gas/vapor concentrations are at 40 ppm or below.

IDLH, Higher Concentrations

The following choices are made along the IDLH pathway:

- If the substance is a liquefied gas and is flammable, then choose an NFPA 1991 ensemble with the optional liquefied gas protection AND flash fire protection.
- If the substance is a liquefied gas but is not flammable, then choose an NFPA 1991 ensemble with the optional liquefied gas protection.
- If the gas or vapor is not skin toxic, then choose structural firefighting clothing or other flash fire–protective clothing that conforms to NFPA 1971 or NFPA 2112, respectively.
- If the substance is flammable vapor at a concentration over 10,000 ppm or 1%, then choose either an NFPA 1991 ensemble that also meets the optional flash fire protection requirements.
- If the substance is vapor at a concentration over 10,000 ppm or 1% that is not flammable, then choose an NFPA 1991 ensemble.
- If the substance is flammable vapor at a concentration over 350 ppm but at or less than 10,000 ppm or 1%, then choose either an NFPA 1994 Class 1 ensemble that also meets the optional flash fire protection requirements.
- If the substance is vapor at a concentration over 350 ppm but at or less than 10,000 ppm or 1% that is not flammable, then choose an NFPA 1994 Class 1 ensemble.

IDLH, Lower Concentrations

Some circumstances exist where the principal threat is a gas or vapor but the concentration is deemed to be relatively low. In these cases, apply the following choices:

- If the substance is flammable vapor at a concentration over 40 ppm but at or less than 350 ppm, then choose an NFPA 1994 Class 2 or 2R ensemble that also meets the optional flash fire protection.
- If the substance is vapor at a concentration over 40 ppm but at or less than 350 ppm that is not flammable, then choose an NFPA 1994 Class 2 ensemble.
- If heavy work is expected or the ensemble may be reused, then choose an NFPA 1994 Class 2R "ruggedized" ensemble.

Non-IDLH

Where relatively low vapor and/or liquid exposures are expected, such as may occur during decontamination, then a lower level of protective ensemble may be used. Where it is acceptable to wear either APR or PAPR, apply the following choices:

- If the substance is below IDLH conditions and flame hazard exists, then choose an NFPA 1994 Class 3 or 3R ensemble that also meets the optional flash fire protection.
- If the substance is below IDLH conditions and there is no flame hazard, then choose an NFPA 1994 Class 3 or 3R ensemble.
- If the above conditions exist and heavy work is expected or the ensemble may be reused, then choose an NFPA 1994 Class 3R "ruggedized" ensemble.

STEP 6: DETERMINE LIQUID/ PARTICULATE CHEMICAL THREATS

Some assessments will show that gas or vapor hazards do not exist and the principal hazards are from either liquid or particulate exposure. Liquid exposures may be at various levels depending on the volume, frequency, applied pressure and length of liquid contact. Severe liquid splash or exposure conditions would include high volumes of liquid, frequent splashes, liquid spraying under pressure, or an expected extended exposure to liquid. In contrast, liquid exposure may involve relatively low volumes or less likely, infrequent contact. In these situations, apply the following choices:

- If severe liquid splash or repeated/extended exposure liquid hazards exist, then choose an NFPA 1992 or NFPA 1994 Class 2 or 2R ensemble.
- If low volume or infrequent liquid exposure hazards exist, then choose an NFPA 1994 Class 3 or 3R "ruggedized" ensemble.
- If exposure is only expected to solid particles, then choose an NFPA 1994 Class 4 or Class 4R ensemble.
- If the above conditions exist and heavy work is expected or the ensemble may be reused, then choose Type R "ruggedized" ensembles.

STEP 7: DETERMINE BIOLOGICAL THREATS

Biological threat may include bloodborne pathogens in the form of infected blood, body fluids, or other liquids, various types of aerosols, or contaminated solid particles or spores. Where biological-only hazards are encountered, then apply the following choices:

- If the primary hazard is from airborne or aerosolized biological substances which are considered dangerous for skin contact, then choose an NFPA 1994 Class 4 or Class 4R ensemble.
- If the primary hazard is from airborne or aerosolized biological substances which are **NOT** transmissible through skin contact, then choose an appropriate respirator such as an air-purifying respirator (APR) with P100 filters or a powered air-purifying respirator (PAPR) with HEPA filter.
- If the primary hazard is from highly hazardous liquid-borne biological substances, then choose either an NFPA 1994 Class 4 or 4R or a single-use or multiple-use NFPA 1999 ensemble.
- If the primary hazard is from potentially infectious blood or body fluids then choose protective NFPA 1999 garments, gloves, footwear, and face/eyewear to protect those portions of the wearer's body where exposure is expected.
- If the above conditions exist and heavy work is expected or the ensemble may be reused, then choose NFPA 1994 Type R "ruggedized" or NFPA 1999 multiple-use ensembles.

OTHER CONSIDERATIONS FOR PPE SELECTION

The preceding steps in the decision logic cover general selection of PPE for hazardous materials and CBRN incidents. The results of the branched decision making are one or more ensembles certified to a given NFPA standard or class within that standard. In many cases, an organization may not have all of the different types of ensembles available. When this occurs, a higher performing ensemble can be selected. The following table provides a hierarchy of protection for each of the major categories of protection.

It is also important to recognize that chemical resistance data for those ensembles for protection against either chemical vapors or liquids can be an additional factor for the selection of an appropriate protective ensemble. The NFPA ensembles are tested to a limited number of chemicals and often there may be no data for the encountered chemical(s) for all of the relevant exposed materials used in the construction of the ensemble that include the garment or suit, hood, gloves, footwear, and seams joining these materials or items. Where possible, chemical resistance data for the respective ensemble should be consulted, but it is important that these data are applied to all portions of the ensemble that may be exposed to the exposure chemical(s).

Level	Chemical Vapors	Chemical Liquids	Biological Liquids	Biological Aerosols	Radiological Particles
Highest	NFPA 1991	NFPA 1991	NFPA 1991	NFPA 1991	NFPA 1991
	NFPA 1994 C1	NFPA 1994 C1	NFPA 1994 C1	NFPA 1994 C1	NFPA 1994 C1
	NFPA 1994 C2	NFPA 1994 C2	NFPA 1994 C2	NFPA 1994 C2	NFPA 1994 C2
	NFPA 1994 C3	NFPA 1992	NFPA 1992	NFPA 1992	NFPA 1992
		NFPA 1994 C3	NFPA 1999 MU	NFPA 1999 MU	NFPA 1999 MU
			NFPA 1994 C3	NFPA 1994 C3	NFPA 1994 C3
Lowest			NFPA 1999 SU	NFPA 1994 C4	NFPA 1994 C4

Several other factors can be considered which may or may not be part of the NFPA Standards. Certain incidents may cover unique hazards or needs. As part of the selection some other considerations include:

- Stealth
- Equipment compatibility
- Differences in design and conformity levels

Stealth

For some types of missions, particularly law enforcement, it may be important that the ensemble provide stealth characteristics so that the responder is not obvious. In these cases, it is important that the ensemble be of a dull dark color and not be reflective. It is also important that the ensemble not create excessive noise during movement. NFPA 1994 includes an optional category for the different classes of ensembles that can be specified if these types of ensemble characteristics are needed.

In addition, the tactical operation requirements of law enforcement will generally dictate ensembles that are form fitting and offer the greatest levels of mobility, functionality, tactility, and dexterity. For these reasons, encapsulating ensembles are generally not considered acceptable for tactical law enforcement or similar operations.

Equipment Compatibility

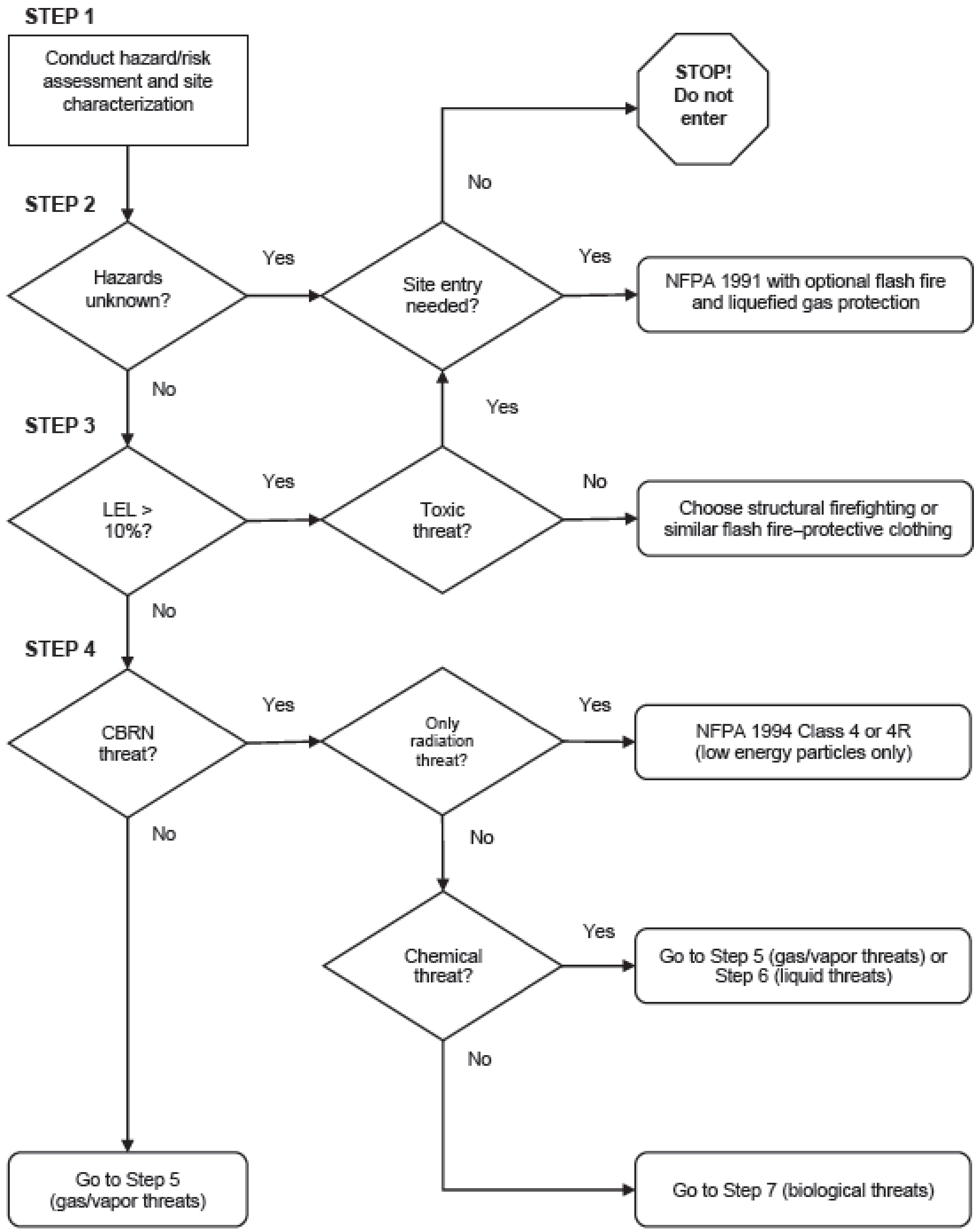
Ensembles consist of the garment or suit along with an attached or unattached hood, gloves, and footwear, as well as a respirator. Yet, depending on the mission, there may also be the requirement for other equipment to be worn by the operator or technician such as a cooling vest, body armor, helmet, communications equipment, or hydration system. The ability of the ensemble to accommodate these additional items is another consideration that must be weighed in selecting an ensemble.

Some equipment computability will also depend on the sizes of ensembles that are offered. While the NFPA Standards specify minimum sizes for the suit, gloves, and footwear, some products may be offered in a larger number of sizes or allow for features that permit adjustment of the ensemble such as side torso take up straps or internal harnesses.

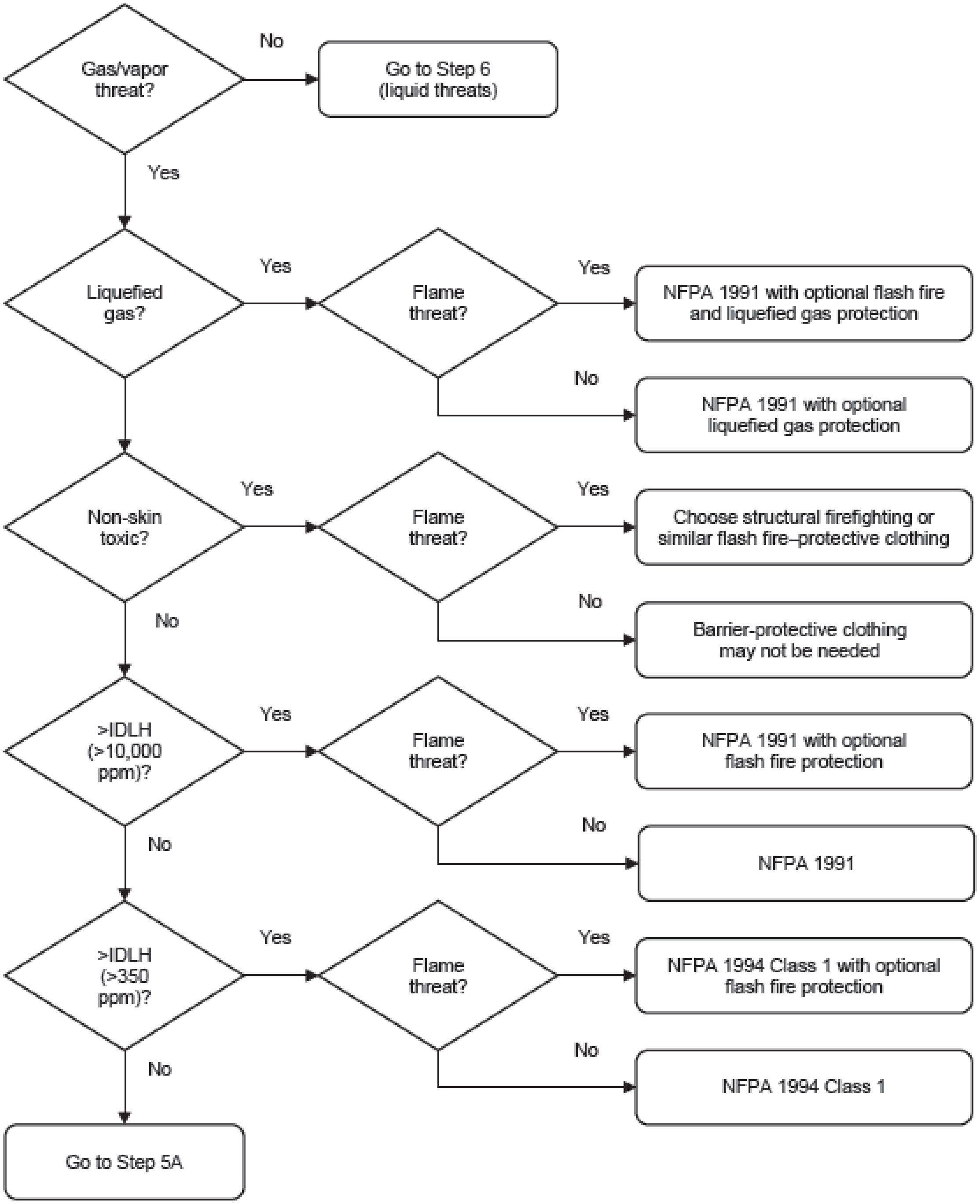
Differences in Design and Conformity Levels

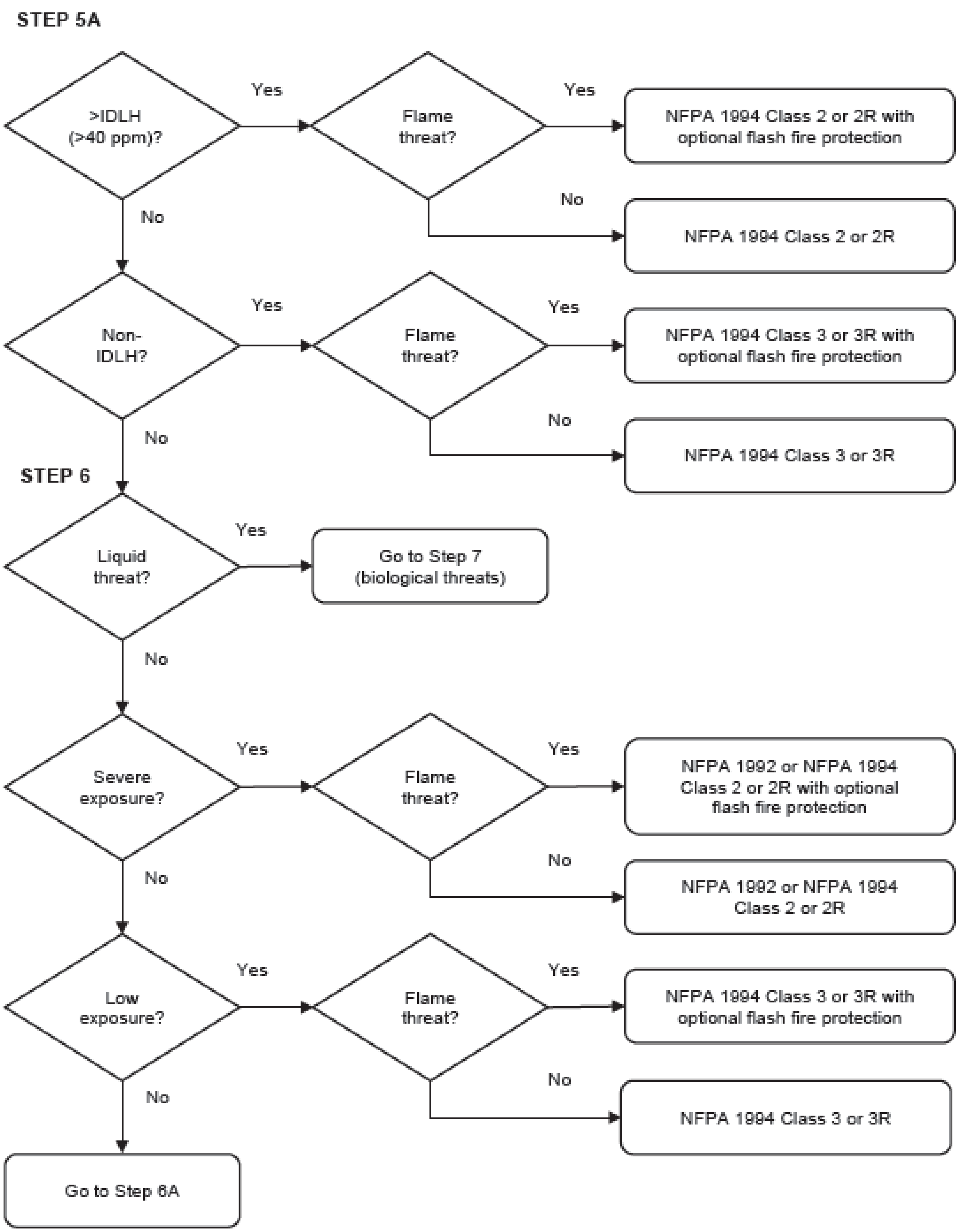
Lastly, not all ensembles that meet a given standard are alike. Each ensemble is required to meet the minimum design, performance, documentation, and labeling requirements of the specific NFPA Standards. Relatively few requirements exist for how the ensemble must be designed, which can lead to different features in the configuration of the ensemble. For example, whether the zipper is placed on the front or back of the ensemble and the type of interface that is used to join a glove to a suit or garment sleeve.

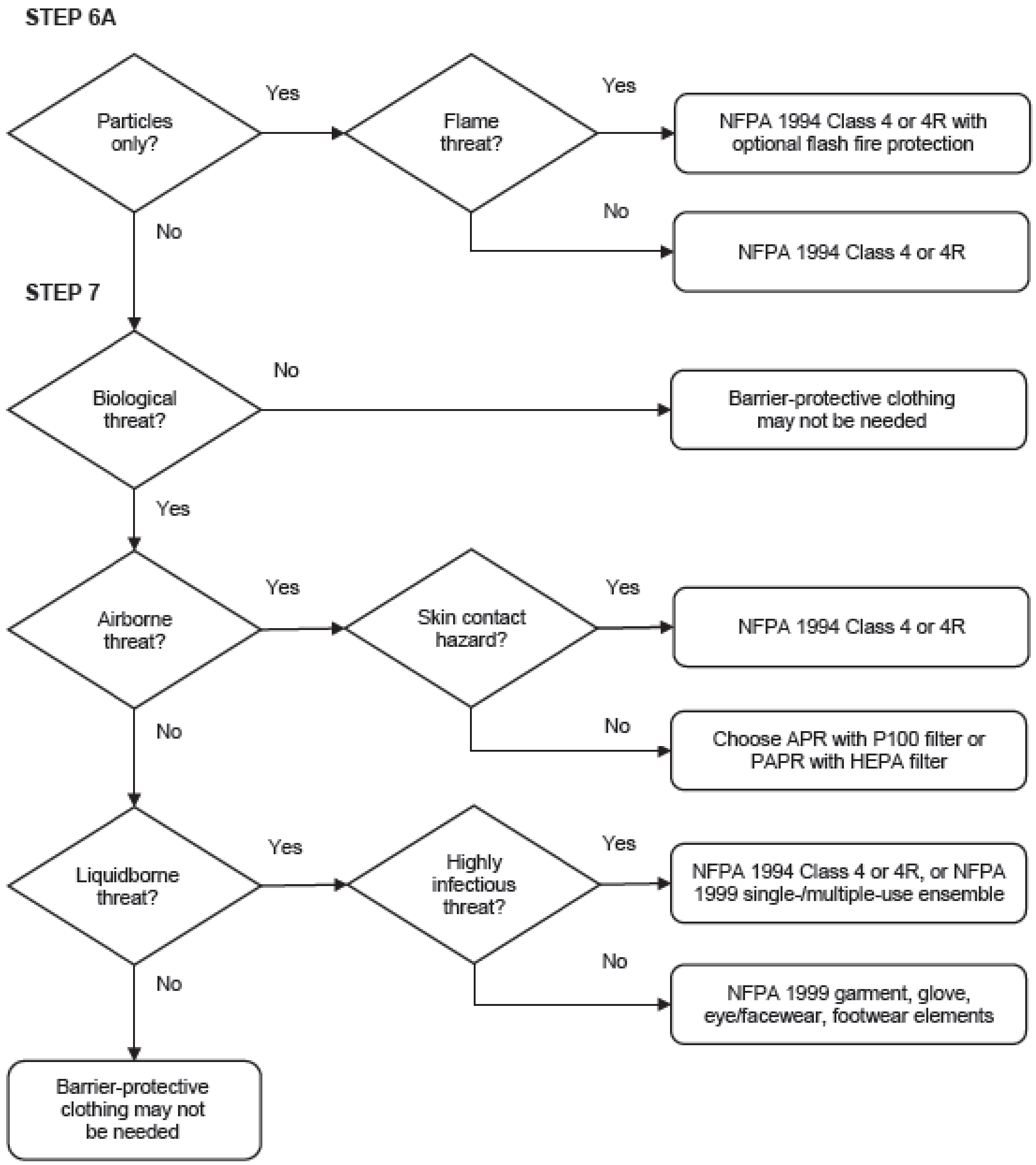
In addition, most products exceed the performance requirement of the respective NFPA Standard. These differences may mean additional chemicals for which the ensemble barrier materials have been tested, increased physical properties, or greater levels of integrity. Differences in products can be ascertained by examining the Technical Data Package that is provided with each ensemble.


STEP 1
Conduct hazard/risk assessment and site characterization
STOP! Do not enter
No
STEP 2
Yes
Yes
Hazards unknown?
Site entry needed?
NFPA 1991 with optional flash fire and liquefied gas protection
No
Yes
STEP 3
Yes
No
LEL > 10%?
Toxic threat?
Choose structural firefighting or similar flash fire–protective clothing
No
STEP 4
Yes
Yes
CBRN threat?
Only radiation threat?
NFPA 1994 Class 4 or 4R (low energy particles only)
No
No
Yes
Chemical threat?
Go to Step 5 (gas/vapor threats) or Step 6 (liquid threats)
No
Go to Step 5 (gas/vapor threats)
Go to Step 7 (biological threats)

STEP 5


Gas/vapor threat?
No
Go to Step 6 (liquid threats)
Yes
Liquefied gas?
Yes
Flame threat?
Yes
NFPA 1991 with optional flash fire and liquefied gas protection
No
NFPA 1991 with optional liquefied gas protection
Non-skin toxic?
Yes
Flame threat?
Yes
Choose structural firefighting or similar flash fire–protective clothing
No
Barrier-protective clothing may not be needed
No
>IDLH (>10,000 ppm)?
Yes
Flame threat?
Yes
NFPA 1991 with optional flash fire protection
No
NFPA 1991
No
>IDLH (>350 ppm)?
Yes
Flame threat?
Yes
NFPA 1994 Class 1 with optional flash fire protection
No
NFPA 1994 Class 1
No
Go to Step 5A


STEP 5A
>IDLH (>40 ppm)?
Yes
No
Flame threat?
Yes
No
NFPA 1994 Class 2 or 2R with optional flash fire protection
NFPA 1994 Class 2 or 2R
Non-IDLH?
Yes
No
Flame threat?
Yes
No
NFPA 1994 Class 3 or 3R with optional flash fire protection
NFPA 1994 Class 3 or 3R
STEP 6
Liquid threat?
Yes
No
Go to Step 7 (biological threats)
Severe exposure?
Yes
No
Flame threat?
Yes
No
NFPA 1992 or NFPA 1994 Class 2 or 2R with optional flash fire protection
NFPA 1992 or NFPA 1994 Class 2 or 2R
Low exposure?
Yes
No
Flame threat?
Yes
No
NFPA 1994 Class 3 or 3R with optional flash fire protection
NFPA 1994 Class 3 or 3R
Go to Step 6A


STEP 6A
Particles only?
Yes
Flame threat?
Yes
NFPA 1994 Class 4 or 4R with optional flash fire protection
No
NFPA 1994 Class 4 or 4R
No
STEP 7
Biological threat?
No
Barrier-protective clothing may not be needed
Yes
Airborne threat?
Yes
Skin contact hazard?
Yes
NFPA 1994 Class 4 or 4R
No
Choose APR with P100 filter or PAPR with HEPA filter
No
Liquidborne threat?
Yes
Highly infectious threat?
Yes
NFPA 1994 Class 4 or 4R, or NFPA 1999 single-/multiple-use ensemble
No
NFPA 1999 garment, glove, eye/facewear, footwear elements
No
Barrier-protective clothing may not be needed

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Hazardous Materials Technology Job Aid

Technology	Capabilities	Applications	Limitations
Colorimetric Papers	Various test strips, reagents and protocols are used to classify unknown solids, liquids and gases/vapors. Sometimes referred to as " wet chemistry."	Classification of unknown solids and liquids. Good for ionic compounds that cannot be identified by other technologies.	A sample must be collected and handled. Several tests can be hazardous, including the use of other chemicals, open flames and possible chemical reactions. The potential for contamination exists. Does not always give definitive identification; sometimes only classification is possible. Some tests are dependent on user interpretation.
Colorimetric Tubes	Reagents react with gases/vapors, causing a color change of the reagent in a glass tube or chip.	Used to indicate presence of known gases/vapors and to classify suspected gases/vapors. Can possibly determine concentrations of known gases/vapors. Particularly useful for corrosive gases and vapors that would damage other equipment.	Multiple cross-sensitivities exist. High margin of error, especially for concentration determinations. Dependent on user interpretation. Temperature and humidity sensitive. Give very localized snapshot. Have expiration dates. Tubes are product specific. Sampling time can be lengthy.
Immunoassays	Immunoassay testing kits use dyes, a buffer solution and antibodies specific to the agent being tested. The solution diffuses across a strip and accumulates on lines that indicate positive or negative results.	Used as a screening tool for biological substances. Used in conjunction with a credible threat, these are a presumptive test to determine the possibility of a biological agent.	Screening tool only; **not** definitive! Can yield false positives and false negatives. Results depend on correct sample size. Requires special collection and handling methods. Multiple agents must be tested for requiring multiple and specific testing kits. Test kits have expiration dates.

Technology	Capabilities	Applications	Limitations
Electrochemical	Electrochemical sensor cells contain an electrolytic solution that reacts with gases/vapors, creating a differential electric current that is indicated on the display in proportion to concentration of gases/vapors.	Toxic sensors detect target gases in low parts per million (ppm). Oxygen sensors detect the amount and/or displacement of oxygen and are required for use in confined spaces.	Multiple cross-sensitivities exist. Sensors have a relatively short life. Temperature, humidity and pressure sensitive. Multiple sensor options exist. Decontamination considerations for unit. Battery-powered equipment.
Combustible Gas Indicators (CGIs)	Catalytic bead CGIs use a balanced circuit (i.e., Wheatstone bridge) that measures the difference in electrical resistance between a reference bead and a bead exposed to an unknown chemical. Heat creates electrical resistance.	Detection of flammable gases or vapors either in a % of lower explosive limit (LEL) or % by volume.	Will not indicate in the low ppm range. Must apply a correction factor to get a true concentration. Correction factor application requires known products. Interference gases can indicate false high LEL readings. May not be accurate in oxygen deficient atmospheres.
Photoionization Detector (PID)	Gases/vapors are ionized using an ultraviolet (UV) light source whose energy is measured in electron volts (eV). Materials with ionization potentials (IPs) below the energy of the UV light source are ionized and collected on a charged grid.	Used to rule in or rule out the presence of vapors in ppm and can be used to pinpoint the source of a spill or leak. Some will detect in the parts per billion range. Standard UV source energy level is 10.6 eV, others exist.	Extremely nonspecific detection. Cannot detect vapors above the energy of the UV light source. Will detect all vapors at or below the energy of the UV light source. Decontamination considerations for unit. Battery-powered equipment. Cannot see hydrocarbons C_1–C_4.
Flame Ionization Detector (FID)	Gases/vapors are ionized using a hydrogen flame. Materials with ionization potentials (IPs) below the energy of the hydrogen flame are ionized and collected on a charged grid.	Used to detect the presence of organic vapors in low ppm. Can read nearly any organic vapor. FIDs operate with a much higher ionization energy source than PIDs. Standard ionization energy is 15.4 eV.	FIDs are subject to flame outs. FIDs do not operate well below 40 F. Extremely nonspecific detection. Will detect all vapors at or below the energy of the hydrogen flame. Hydrogen source is consumable. Battery-powered equipment.

Technology	Capabilities	Applications	Limitations
Geiger-Müller (GM) Tubes (Radiation Detection)	The effect of ionizing radiation is used inside the GM tube to produce a detector reading.	One of the first technologies used in response to unknown materials and threat events. Once the area is surveyed or suspected point sources are tested, the device can simply run in the background of the operations area. The "pancake probe" is universally used in emergency response and is a modified GM tube used for surveying the surfaces within an incident or determining the effectiveness of decontamination.	Cannot efficiently measure high radiation rates. Limited life span when exposed to high radiation. Cannot produce definitive results as to which type of ionizing radiation it is reading. Cannot provide identification information as to the specific isotope(s) encountered.
Ion Mobilization Spectrometry (IMS)	Gases/vapors are ionized using a radioactive source. The ions then flow through a drift tube via a known carrier gas to a detector. The sample is identified by the drift time. Results are rapid.	IMS technology is used in a variety of devices that are designed to detect narcotics, explosives, pharmaceuticals and chemical weapons in very low concentrations (trace amounts) using point source monitoring. Good for chemical identification but not quantification/concentration.	Many molecules have similar drift times. Common household products like floor wax can indicate a false positive for chemical warfare agents. Humidity sensitive. Carrier gas is consumable. Radioactive source can be problematic. Battery-powered equipment.
Raman Spectroscopy	Raman detectors rely on the scattering of monochromatic laser light in the visible or near visible range, which is converted into a spectrum. The spectrum is compared to other spectra stored in a library for identification.	Raman is used for the identification of unknown solids and liquids. Raman may "see" through certain types of containers, so they will not have to be opened. Data can be added to the library for future uses. Water does **not** interfere with Raman technology.	Can only identify solids and liquids with covalent bonds. Fluorescence causes errors in spectra. Not intrinsically safe. Laser safety issues exist due to high energy output. Laser may initiate breakdown of unstable or energetic materials. Battery-powered equipment.

Technology	Capabilities	Applications	Limitations
Fourier Transform Infrared (FTIR) (Solids/Liquids)	FTIRs rely on infrared energy interacting with the covalent bonds within a molecule. The bonds absorb specific wavelengths of the infrared spectrum unique to the bonds within that molecule. A spectrum is created based on the absorbance pattern and compared to a library for identification.	FTIR is used for the identification of solids, liquids and pastes. The spectra can be read by those trained in spectral interpretation. Can be used as a screening device for biological substances and help identify concentrated solutions in water.	Can only see covalent bonds, not ionic bonds. Cannot identify biologicals. Water can " blind" the technology. Mixtures are challenging because overlapping spectra prevent a clean library match unless the mixture is in the library. Identification is limited by the data in the libraries. Battery-powered equipment.
FTIR (Gases/Vapors)	FTIRs rely on infrared energy interacting with the covalent bonds within a molecule. The bonds absorb specific wavelengths of the infrared spectrum unique to the bonds within that molecule. A spectrum is created based on the absorbance pattern and compared to a library for identification.	Contaminated air samples are acquired with a specialized device that uses thermal desorption to concentrate the product into the analyzer. Alternatively, highly concentrated samples (>100 ppm) can be acquired and analyzed using standard Tedlar sample bags.	Same issues as all FTIR technology. Water interference comes in the form of high humidity (>80%). Sample collection can be tedious and difficult to obtain. Gives very localized snapshot.
Gas Chromatography Mass Spectroscopy (GC/MS)	The GC separates molecules as they travel the length of a heated (≈650 F) column with a carrier gas. These molecules emerge at different times (retention time). The MS then ionizes the molecule, detects the atomic mass of the fragments and " reconstructs" the molecule through this unique fingerprint of fragments.	Is widely considered the gold standard for identification of unknown liquids, gases and vapors. The use of a solid phase microextraction (SPME) fiber syringe for sample collection and injection is a significant breakthrough. Will read molecules with a mass range of 44–500 atomic mass unit (AMU).	Samples need to be captured. Samples must be compared against a known standard. Consumables, protocols and maintenance issues have limited the field application of this technology. Newer GC/MS technologies have improved field applications. Battery-powered equipment.

Technology	Capabilities	Applications	Limitations
Gamma Spectroscopy/ Radioisotope Identification Device (RIID)	Gamma spectroscopy uses radioactive emissions from materials undergoing nuclear decay. Each isotope present will emit characteristic gamma rays that will identify it.	Gamma spectroscopy is used for the identification of radiological isotopes. This is important for determining not only if a high energy, radioactive source is present, but also for identifying and classifying the isotope.	Sample has to have sufficient energy to be identified. A mixture of different isotopes can be difficult to distinguish between and identify. Shielding can mask the presence and/or gamma signature of radioactive isotopes. Battery-powered equipment.
Polymerase Chain Reaction (PCR)	PCR is a biochemical technology that replicates and amplifies a particular DNA (deoxyribonucleic acid) sequence.	Used in for identification of specific biological warfare agents (BWAs), including anthrax and plague. PCR provides the most accurate field technology for confirming the specific BWAs.	Technique involves strict sampling and handling protocols. Very temperature-sensitive technique. Extensive training required. Multiple consumable items. Only a few BWAs can be identified in the field.
Scintillators (Radiation Detection)	Scintillations are small flashes of light. Scintillators are materials that fluoresce when they absorb ionizing radiation. Scintillators are coupled to a photomultiplier tube that converts the flashes of light into electrons which create the voltage = readings.	The most common scintillator used is sodium iodide (NaI) crystal type. The proper selection of a scintillator can be used to discriminate between differing types of ionizing radiation.	Scintillator crystals are delicate and can be damaged. Heavy ions can produce a quenching effect which will suppress the detection level. Scintillators cannot provide identification of specific isotopes.
Refrigerant Detectors	Use a variety of technologies for pinpointing leaks of refrigerants in heating, ventilating, and air conditioning (HVAC) systems. Also used to confirm or rule out chlorine or fluorine molecules in emergency response.	Detection of chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs). Some sensors are specific to ammonia.	Sensor can be saturated quickly and have a short life span. Nonselective and UV detector technology cannot be calibrated. Sensors can suffer long-term drift. Many detectors are qualitative, not quantitative. Battery-powered.

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UNIT 5: COMMUNICATING THE PLAN

TERMINAL OBJECTIVE

The students will be able to:

5.1 Conduct a briefing for hazardous materials response personnel performing functions at the incident, given the Incident Commander's (IC's) objectives.

ENABLING OBJECTIVE

The students will be able to:

5.1 Describe the characteristics of a comprehensive briefing.

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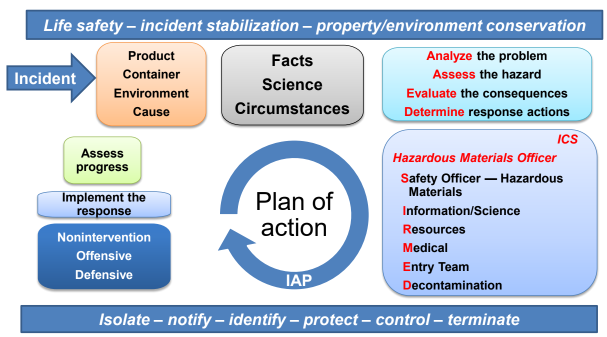
UNIT 5: COMMUNICATING THE PLAN

Slide 5-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



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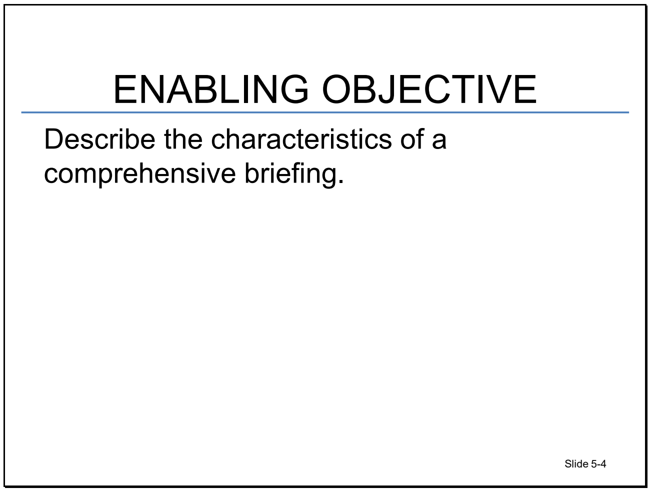
TERMINAL OBJECTIVE

Conduct a briefing for hazardous materials response personnel performing functions at the incident, given the Incident Commander's (IC's) objectives.

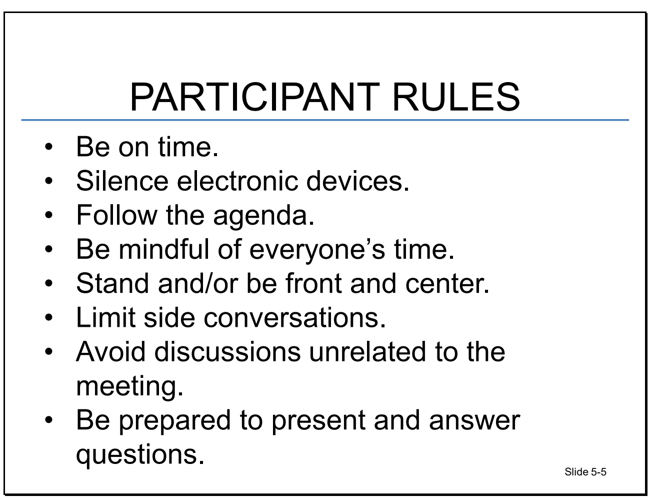
Slide 5-3



I. CHARACTERISTICS OF AN EFFECTIVE BRIEFING

A. A pre-entry briefing is the culmination of the hazardous materials officer, hazardous materials safety officer, information/science officer, entry team leader, medical unit leader and decontamination unit leader working together in order to meet the Incident Commander's (IC's) established incident objectives.

B. Briefings should follow a basic checklist and agenda created by the authority having jurisdiction (AHJ) and be flexible enough to be used for any hazardous materials/weapons of mass destruction (WMD) incident. The basis of an entry briefing will be the Incident Command System (ICS) Form 202, Incident Objectives; ICS Form 204, Assignment List; and ICS Form 208 HM, Site Safety and Control Plan.



C. Participant rules.

1. Be on time. Do not leave the hazardous materials officer and others waiting. On the other hand, make sure everyone knows exactly when and where the next briefing will occur.

2. Silence electronic devices. Avoid cellphone conversations including texting as well as radio traffic; they can wait.

3. Follow the agenda. Agendas will change based on the facts and circumstances of the incident. Cover the basics and anything that might be related to specific circumstances. A set agenda does not always fit the incident; be flexible.

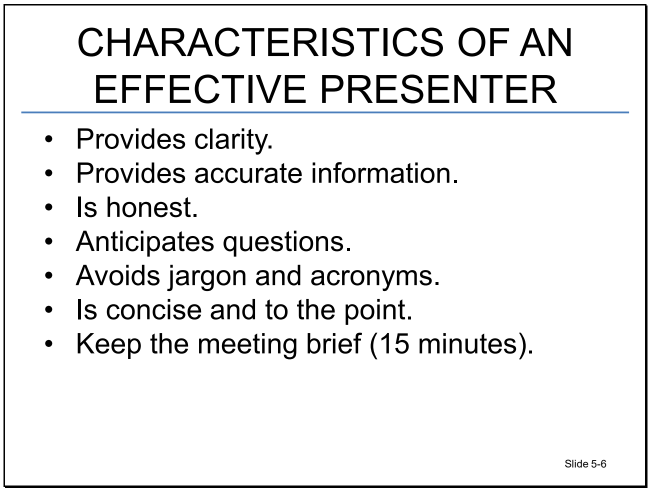
4. Be mindful of everyone's time. Your unit or position is not the only one that matters. Hold your comments or remarks for after the briefing unless called upon to offer them.

5. Stand and/or be front and center. When presenting, own your position. Exhibit confidence and command presence.

6. Limit side conversations. Talking while someone is presenting information is not only rude, it is unprofessional and can distract from someone hearing critical information.

7. Avoid discussions unrelated to the meeting purpose. Presenters should determine what questions or comments could be handled more appropriately after the briefing. Stay on task; do not let discussions go on a tangent.

8. Be prepared to present and take questions. Anticipate questions from the knowledge base of your audience and be prepared to provide responses in the context that will matter to them. Confirm understanding of the information that you have communicated and encourage questions. Ask yourself, "What would I want to know if I was in the audience?" If you do not know the answer to a question asked, write it down and inform that you will get that answer as soon as possible, and make sure you follow up. If it is critical information, communicate it to all those who were at the briefing, not just to the questioner.



D. Characteristics of an effective presenter.

1. Provides clarity: Presenters should be clear and concise in their information. Clarity can be enhanced through preparation and rehearsal with someone who can provide constructive feedback.

2. Provides accurate information: Presenters need to check and recheck their facts and make sure that science and circumstances are applied in order to provide the most accurate situational awareness. Any technical data or circumstantial information should be vetted and validated.

3. Is honest: Presenters should never make up facts or portray assumptions. When a presenter is unsure about information, they should be honest and offer to provide the information as soon as they can verify it.

4. Anticipates questions: Presenters should be prepared to answer questions based on what their audience may ask.

5. Avoids jargon and acronyms: Presenters should not assume that everyone in the audience will understand jargon and acronyms (e.g., “PID” should be communicated clearly as “photoionization detector”).

6. Is concise and to the point: Presenters should avoid rambling or repeating the same information. Practicing what to communicate before the briefing enhances conciseness.

7. Keep the meeting brief: Presenters should try to keep the briefing to 15 minutes or less. However, circumstances and complexity may require a longer briefing. If that is the case, the time must be used wisely. Longer briefings may risk decreased attention from the audience.

UNIT-LEVEL BRIEFINGS ARE CONDUCTED BY

- Hazardous materials officer.
- Hazardous materials safety officer.
- Information/science officer.
- Medical unit leader.
- Entry team leader.
- Decontamination team leader.

Photo courtesy of Andrew Byrnes

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E. Unit-level briefings are conducted by:

1. Hazardous materials officer — hazardous materials group supervisor or hazardous materials branch director. Audience:

   a. Group or branch members.

   b. Unit leaders and entry team.

   c. IC.

   d. Agency administrators and elected officials.

   e. Public Information Officer (PIO).

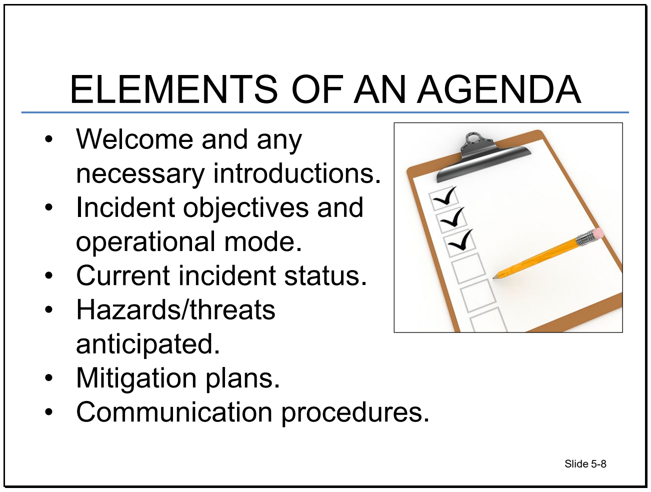
2. Hazardous materials safety officer. Audience: unit leaders and entry team.

3. Information/science officer. Audience: unit leaders and entry team.

4. Medical unit leader. Audience: entry team.

5. Entry team leader. Audience: entry team.

6. Decontamination team leader. Audience: decontamination and entry teams.



F. Elements of an agenda.

1. Welcome and any necessary introductions (hazardous materials officer, hazardous materials group supervisor).

   a. Introduce any multiagency, multijurisdictional players.

   b. Provide briefing documents to everyone. Make sure everyone has them.

      - Individual ICS forms or Incident Action Plan (IAP).

      - Maps, safety data sheets (SDSs) or other required information.

2. Incident objectives and operational mode (hazardous materials officer). Everyone should be clear on the objectives, mode, strategies and tactics by the end of the briefing.

3. Current incident status providing specific situational awareness (hazardous materials officer; assistant safety officer for hazardous materials; or designee, such as a facility representative, technical or product specialist).

   a. What has happened, what is currently happening, what is anticipated to happen.

   b. Weather and/or environmental conditions and safety precautions.

   c. Specialized equipment or resource requirements.

   d. Known or anticipated hazards, threats and harms.

4. Hazards anticipated (thermal, radiation, toxic, chemical, human threat or mechanical) (hazardous materials safety officer and information/science officer).

   a. Avoid providing too much technical detail to administrators.

   b. Provide more technical detail for unit leaders and entry personnel.

5. Mitigation plans: tactics and tasks (entry team leader).

   a. What to do to accomplish the strategies.

   b. Verification of everyone's familiarity with tools, equipment and/or procedures.

      - Determining the need for rehearsal or training prior to entry.

   c. Identification of personnel going downrange as entry, Rapid Intervention Team (RIT) and backup (by name).

   d. Ensuring all equipment is available and operational (hazardous materials resources leader).

6. Communication procedures (entry team leader).

   a. Entry or tactical teams on a dedicated tactical channel.

   b. Emergency communications and procedures.

      - RITs may be on another channel.

      - Hand signals: agency-specific but must be communicated to everyone going downrange in suits.

ELEMENTS OF AN AGENDA (cont'd)

- Detection and monitoring.
- Medical operations.
- Decontamination procedures.
- Personal protective equipment (PPE) requirements.
- Rescue procedures.
- Final hazardous materials officer comments.

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7. Detection and monitoring (entry team leader).

   a. Classification and identification technologies; trained and competent operators.

   b. Sampling plan, if required.

   c. Action levels: alarms and what to do when you hear one.

8. Medical operations (medical unit leader).

   a. Pre- and post-entry requirements.

   b. Location of medical and procedures.

   c. Location of rehab and requirements for pre- and post-entry.

   d. Anticipated signs and symptoms of exposure and emergency procedures.

9. Decontamination procedures (decontamination unit leader).

   a. Technical decontamination detail and location; tool drops, outer boot and glove drops, equipment drops located.

   b. Emergency decontamination detail and location.

   c. Area of safe refuge location.

   d. Personal protective equipment (PPE).

10. PPE requirements (hazardous materials safety officer and information/ science officer).

    a. Entry team members and unit leaders should be comfortable with the PPE decision.

    b. Procedure for significant contamination.

11. Rescue procedures (entry team leader or hazardous materials safety officer).

    a. Procedures and equipment; deploying the RIT and back-up team.

    b. Verbal walk-through of the procedure from launch to decontamination.

12. Final hazardous materials officer comments (hazardous materials officer).

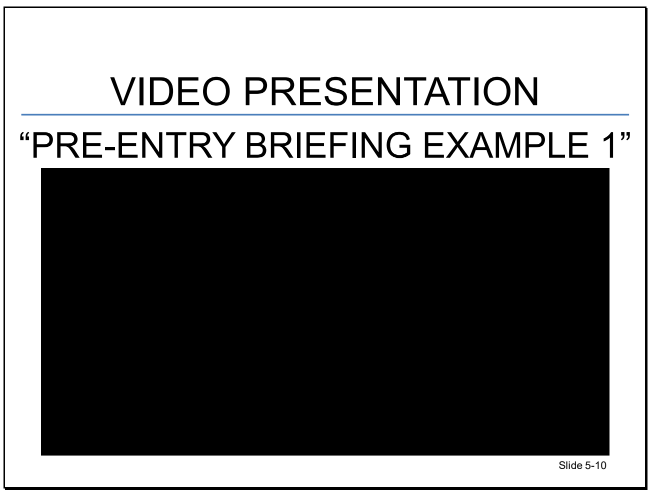
    a. Receive verbal confirmation that the entry team members are satisfied and understand the mission.

    b. Ask if there are any clarifying questions, concerns or comments from anyone.

    c. Provide an expected entry time; gain consensus from unit leaders.

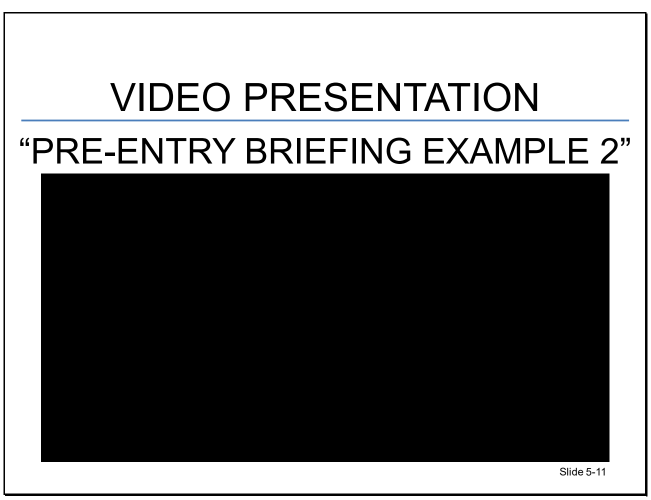
    d. Provide final remarks and words of encouragement.

II. DELIVERING A BRIEFING



Pre-entry briefing.

A. What are some of the improvements that can be made?



B. What elements are done well in this pre-entry briefing?

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ACTIVITY 5.1

Delivering the Pre-entry Briefing

Purpose

Practice conducting a pre-entry briefing using the ICS Form 208 HM developed in Unit 4: Developing the Plan of Action.

Directions

1. In your small group, review the assigned scenario from Unit 4 and the completed ICS Form 202, ICS Form 204 and ICS Form 208 HM.

   Scenario from Activity 4.2: Your hazardous materials response team has been called to the scene of a private residence where a possible clandestine laboratory has been discovered. Earlier there was a call for an ambulance at this location regarding a sick male with no further information available, and the ambulance crew reported finding a possible laboratory complete with chemicals and glassware. Law enforcement is on scene and requests the assistance of the hazardous materials response team to perform an assessment of the scene and determine what PPE and safety concerns are present. (See attached ICS Form 202 and ICS Form 204 in Unit 4.)

   Reconnaissance is performed, and the following is found:

   a. A white, crystalline material is found in an unmarked, 1-pound can with a small amount of material spilled onto countertop.

   b. A dark-colored liquid is found in an unmarked glass container (approximately 3 ounces), and approximately 10 milliliters of this same dark-colored liquid is in an adjacent, open test tube in a tube rack.

   c. A clear, pink liquid is found in an unmarked plastic bottle (approximately 1 liter) with the cap removed.

   Environmental data: The inside thermostat in the home is set at 70 F (21 C), and the outside temperature is 80 F (27 C) with a high of 90 F (32 C) expected later today. Humidity is 60%, chance of precipitation is 75% with scattered thunderstorms, and winds are from the east at 5 to 10 miles per hour (mph).

2. Create a mitigation plan to be communicated to the entry team during an entry briefing.

3. Conduct an entry briefing for the entry team using the information documented on the ICS forms. Each group should display critical information derived from the ICS forms on an easel pad for the briefing.

4. The instructor will assign each member of your small group a role from the following list. Note that some may play multiple roles.

   a. Hazardous materials officer.

   b. Hazardous materials safety officer.

   c. Information/science officer.

   d. Hazardous materials resources leader.

   e. Medical unit leader.

   f. Entry team leader.

   g. Decontamination team leader.

5. Students in the other small groups will serve as the entry team. The entry team will ask clarifying questions for your group before they "go downrange."

6. Your group may use Handout 1-1: Hazardous Materials/Weapons of Mass Destruction Response Infographic and Handout 4-4: Chemistry for Risk-Based Response Infographic.

III. SUMMARY

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SUMMARY

- Characteristics of an effective briefing.
- Delivering a briefing.

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- What have you learned in this unit?
- Do you have any questions?

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REFERENCE

Merriam-Webster. (n.d.). Mitigation. In *Merriam-Webster.com dictionary.* https://www.merriam-webster.com/dictionary/mitigation

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SUPPLEMENTAL MATERIALS

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Unit 5 Supplemental Materials

Table of Contents

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Briefing Checklist

Be brief and focus on objectives and safety.
Briefing is based on Incident Command System (ICS) forms:

ICS Form 202, Incident Objectives
ICS Form 204, Assignment List
ICS Form 208HM, Site Safety and Control Plan

1. Hazardous Materials Branch Director/Hazardous Materials Group Supervisor: Obtain an objectives briefing from the Incident Commander (IC) or Operations Chief.

2. Hazardous Materials Safety Officer: Obtain a briefing from the Hazardous Materials Branch Director/Hazardous Materials Group Supervisor.

3. Hazardous Materials Safety Officer: Provide a safety briefing for entry and decontamination team, task force or group personnel.

4. Entry:

   a. Provide a briefing on entry objectives for all entry team/task force personnel.

   b. Confirm critical safety issues impacting entry operations with the Hazardous Materials Safety Officer.

   c. Identify the decontamination corridor location and method and location.

5. Science/research: Brief Hazardous Materials Branch personnel on potential hazards and personal protective equipment (PPE) requirements.

Briefing Essentials

- ☐ Welcome and any necessary introductions.
- ☐ Current incident status — incident objectives.
- ☐ Hazards/threats anticipated.
- ☐ Mitigation plans.
- ☐ Communications procedures.
- ☐ Medical operations.
- ☐ Detection and monitoring.
- ☐ Entry team: tactics or tasks.
- ☐ PPE requirements.
- ☐ Rescue plan.
- ☐ Decontamination procedures.

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Example Entry Briefing Agenda

Note: This is an example of an entry briefing agenda. Adapt the agenda based on the incident.

- Welcome and any necessary introductions.
  - Hazardous Materials Officer, Hazardous Materials Group Supervisor.
- Incident objectives and operational mode.
  - Hazardous Materials Officer.
- Current incident status providing specific situational awareness.
  - Hazardous Materials Officer, Assistant Hazardous Materials Safety Officer, or designee, such as a facility representative, technical or product specialist.
- Strategies that will be implemented downrange.
  - Hazardous Materials Officer.
- Hazards anticipated.
  - Hazardous Materials Safety Officer, Information/Science Officer.
- Mitigation plans — tactics and tasks.
  - Entry Team Leader.
- Communication procedures.
  - Entry Team Leader.
- Detection and monitoring.
  - Information/Science Officer, Entry Team Leader.
- Medical operations.
  - Medical Unit Leader.
- Decontamination procedures.
  - Decontamination Unit Leader.
- Personal protective equipment (PPE) requirements.
  - Hazardous Materials Safety Officer, Information/Science Officer.
- Rescue procedures.
  - Entry Team Leader or Hazardous Materials Safety Officer.
- Final Hazardous Materials Officer comments.
  - Hazardous Materials Officer.

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UNIT 6: IMPLEMENTING THE PLAN

TERMINAL OBJECTIVE

The students will be able to:

6.1 Implement a response to favorably impact the incident consistent with Incident Command System (ICS) Form 208 HM, Site Safety and Control Plan and 215A-CG, Incident Action Plan Safety Analysis, given the Incident Commander's (IC's) objectives.

ENABLING OBJECTIVES

The students will be able to:

6.1 Determine effective roles and responsibilities of the hazardous materials response team members to ensure a safe response.

6.2 Describe the implementation of best practices regarding incident response equipment to ensure a safe response.

6.3 Describe the implementation of best practices regarding incident response personnel to ensure a safe response.

6.4 Describe the implementation of best practices regarding incident response documentation to ensure a safe response.

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UNIT 6: IMPLEMENTING THE PLAN

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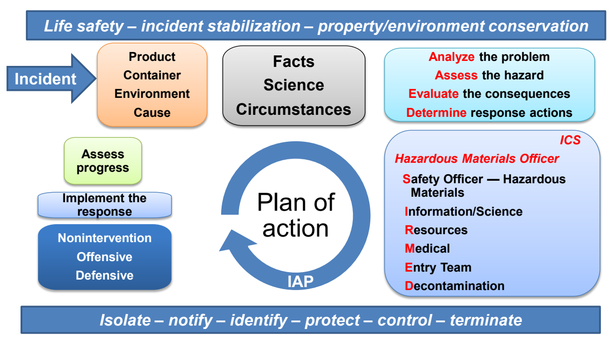
HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



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TERMINAL OBJECTIVE

Implement a response to favorably impact the incident consistent with Incident Command System (ICS) Form 208 HM, Site Safety and Control Plan and 215A-CG, Incident Action Plan Safety Analysis, given the Incident Commander's (IC's) objectives.

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ENABLING OBJECTIVES

- Determine effective roles and responsibilities of the hazardous materials response team members to ensure a safe response.
- Describe the implementation of best practices regarding incident response equipment to ensure a safe response.

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ENABLING OBJECTIVES (cont'd)

- Describe the implementation of best practices regarding incident response personnel to ensure a safe response.
- Describe the implementation of best practices regarding incident response documentation to ensure a safe response.

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I. REVIEW OF ROLES AND RESPONSIBILITIES

HAZARDOUS MATERIALS RESPONSE TEAM POSITIONS

- Hazardous materials officer.
- Hazardous materials safety officer.
- Information/science officer.
- Hazardous materials resources.
- Hazardous materials medical.
- Entry officer.
- Decontamination officer.

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Hazardous materials response team positions.

A. Hazardous materials officer.

B. Hazardous materials safety officer.

C. Information/science officer.

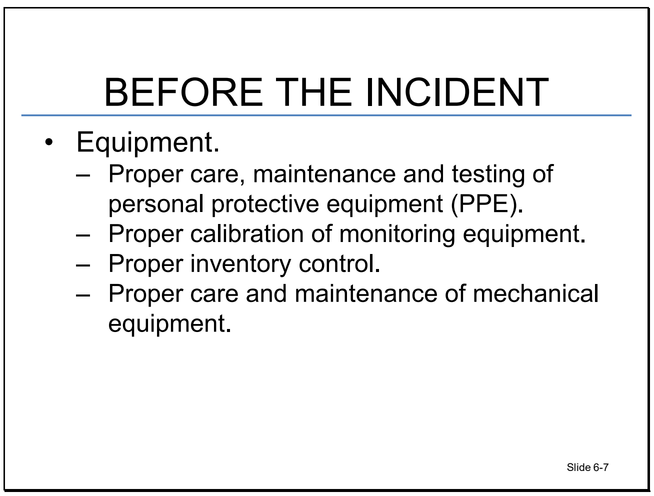
D. Hazardous materials resources.

E. Hazardous materials medical.

F. Entry officer.

G. Decontamination officer.

II. BEST PRACTICES



A. Before the incident.

1. Equipment.

a. Proper care, maintenance and testing of personal protective equipment (PPE).

b. Proper calibration of monitoring equipment.

c. Proper inventory control.

d. Proper care and maintenance of mechanical equipment.

BEFORE THE INCIDENT (cont'd)

- Personnel.
  - Training.
    - Initial certification.
    - Continuing education.
    - Skills competency and proficiency.
  - Identification of special skills/mission-specific competencies.
  - Identification of personnel who can act as hazardous materials response team officers.

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2. Personnel.

   a. Training.

      - Initial certification.

      - Continuing education.

      - Skills competency and proficiency.

   b. Identification of special skills/mission-specific competencies.

   c. Identification of personnel who can act as hazardous materials response team officers.

BEFORE THE INCIDENT (cont'd)

- Documentation.
  - Department standard operating procedures (SOPs), general standard operating guidelines (SOGs), etc.
  - Compliance with appropriate laws and standards.
  - Record-keeping.

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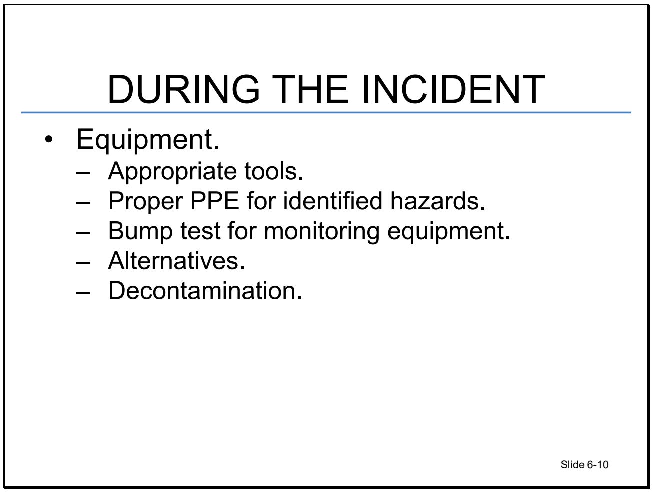
3. Documentation.

   a. Department standard operating procedures (SOPs), general standard operating guidelines (SOGs), etc.

b. Compliance with appropriate laws and standards.

c. Record-keeping.



B. During the incident.

1. Equipment.

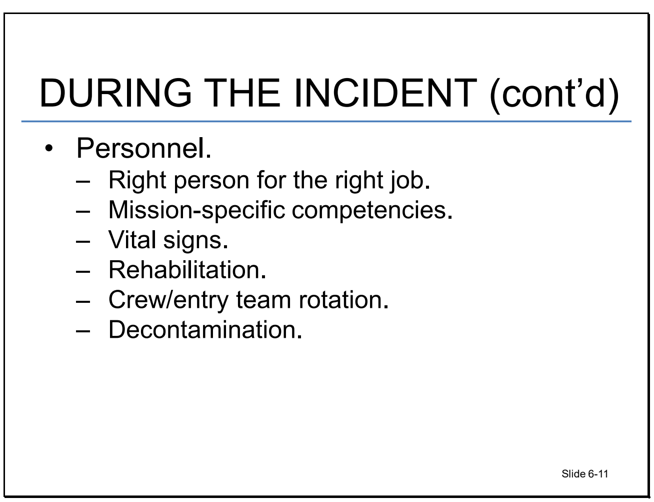
a. Appropriate tools.

b. Proper PPE for identified hazards.

c. Bump test for monitoring equipment.

d. Alternatives.

e. Decontamination.



2. Personnel.

   a. Right person for the right job.

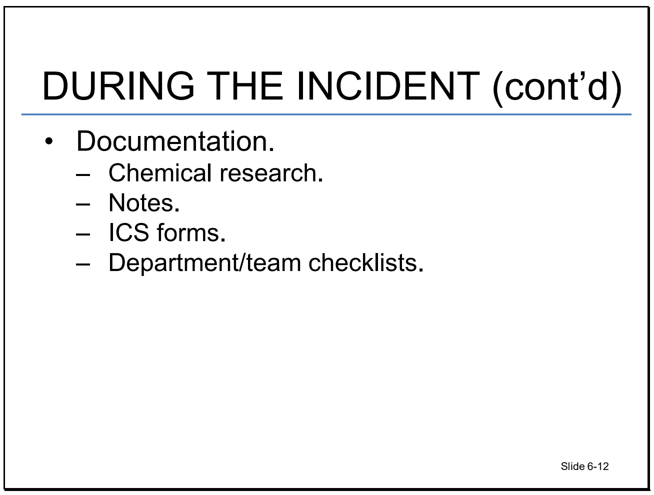
   b. Mission-specific competencies.

   c. Vital signs.

   d. Rehabilitation.

   e. Crew/entry team rotation.

   f. Decontamination.



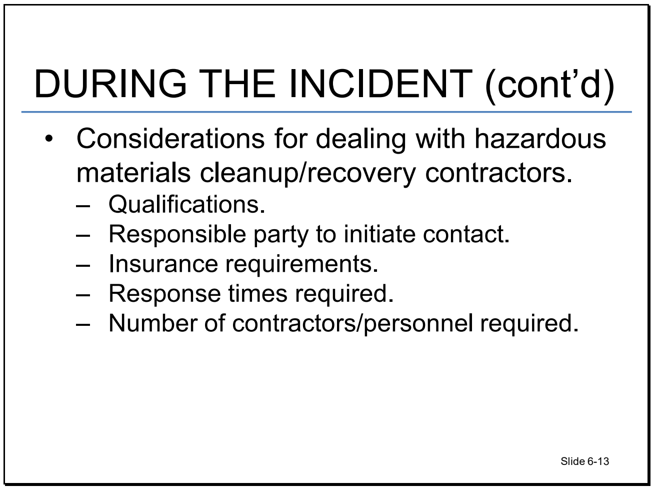
3. Documentation.

   a. Chemical research.

   b. Notes.

   c. Incident Command System (ICS) forms.

   d. Department/team checklists.



4. Considerations for dealing with hazardous materials cleanup/recovery contractors.

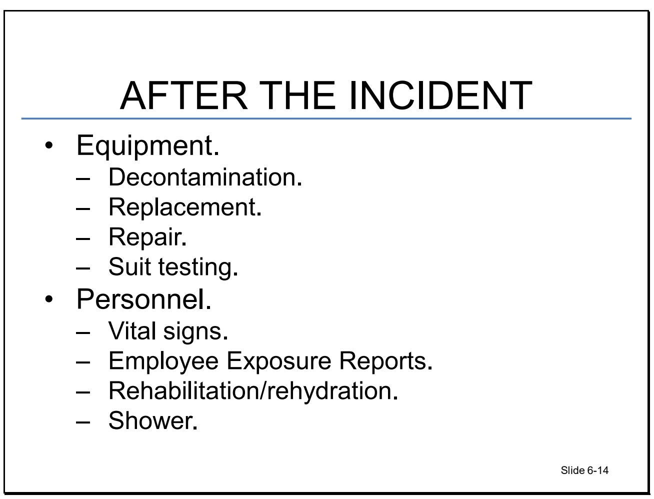
   a. Qualifications.

   b. Responsible party to initiate contact — responsible party or authority having jurisdiction (AHJ).

   c. Insurance requirements.

   d. Response times required.

   e. Number of contractors or contractor personnel required.



C. After the incident.

1. Equipment.

   a. Decontamination.

b. Replacement.

c. Repair.

d. Suit testing.

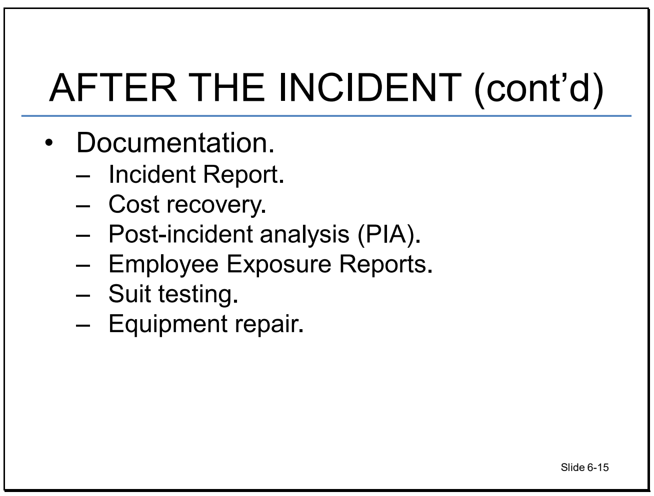
2. Personnel.

a. Vital signs.

b. Employee Exposure Reports.

c. Rehabilitation/rehydration.

d. Shower.



3. Documention.

a. Incident Report.

b. Cost recovery.

c. Post-incident analysis (PIA).

d. Employee Exposure Reports.

e. Suit testing.

f. Equipment repair.

ACTIVITY 6.1

Implementing the Plan

Purpose

Practice completing ICS Forms 208 HM, Site Safety and Control Plan and 215A-CG, Incident Action Plan Safety Analysis and conducting a pre-entry briefing based on the provided Incident Commander's (IC's) objectives.

Directions

1. The instructor will assign a scenario to each small group.

2. In your small group, review the assigned scenario.

3. Complete ICS Forms 208 HM and 215A-CG according to the IC's objectives.

4. Create a PowerPoint® presentation to brief the class on your group's scenario and how your group responded to the incident.

   When another group is presenting, observe and ask clarifying questions as needed from the perspective of the entry team.

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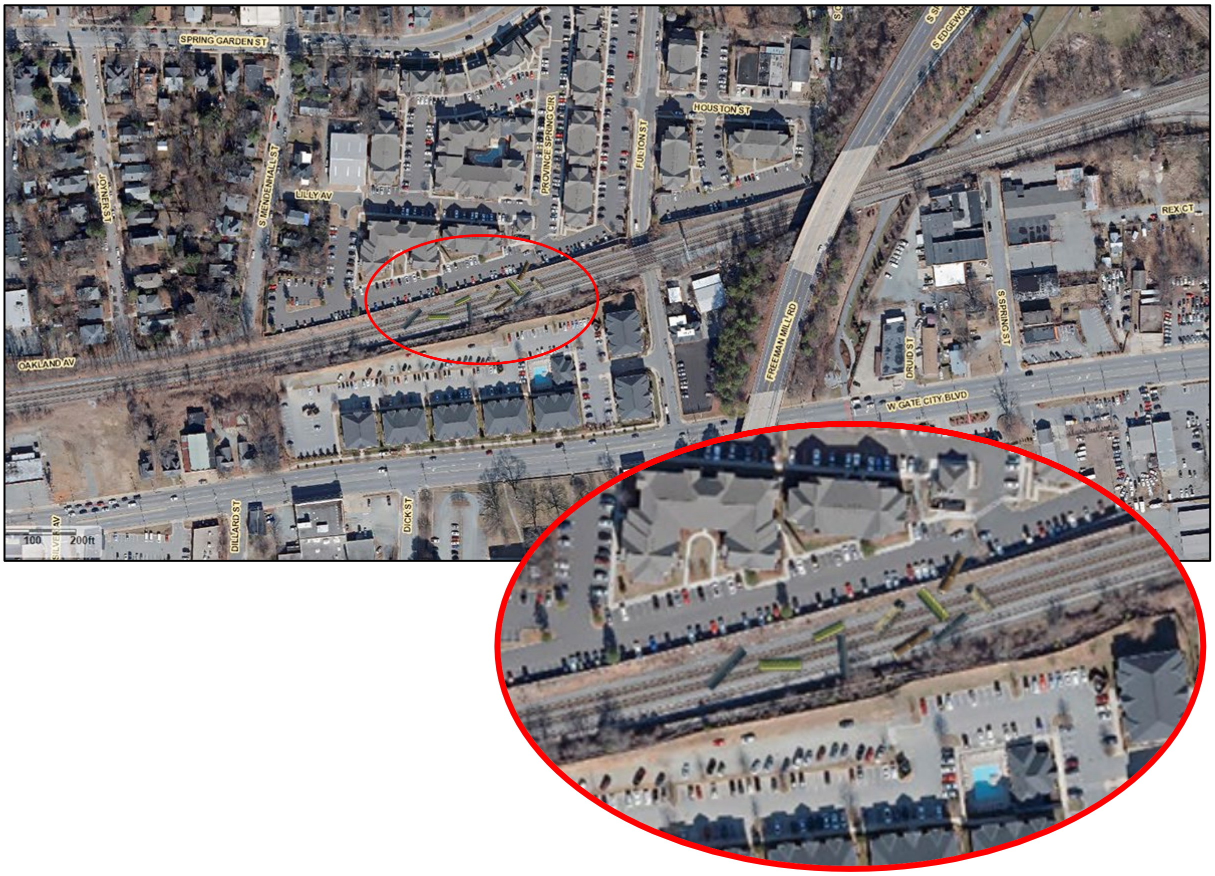
ACTIVITY 6.1 (cont'd)

Scenarios

Scenario 1



At 11:00 a.m. on the Saturday before Labor Day, a 55-car train of the Central & Columbia Railroad was heading west at about 45 miles per hour (mph) on the Reading Line running through Central City. About two blocks east of the Freeman Mill Road overpass, the engineer noticed an unusual vibration, and shortly thereafter, the train lurched to the left. At that point, emergency indicator lights came on and the engineer started emergency braking. Looking back along the train, the engineer saw that a major derailment had occurred. At least eight to 10 cars had left the track, rolled and accordioned. These cars included box cars, flat cars and tank cars. There were several other cars that derailed but did not roll.

First units on the scene reported the above information and indicated that one of the flat cars — a 90-foot automobile carrier — had smashed into one of the apartment buildings on the south side of the railroad tracks and caused a partial building collapse. A tank car placarded as a Department of Transportation (DOT) Hazard Class 3 Flammable Liquid with the UN 1100 was reported to have rolled over about 90 degrees, releasing product from the manway. The product is pooling at the side of the track, covering an area approximately 10 feet by 35 feet. The liquid pool is on fire. The fire presently involves liquid on the ground and is flowing to the west in a downgrade direction on the north side of the tracks. Slightly farther back in the derailment is a box car placarded with the UN 1340. It is not currently on fire. Just in front of the burning tank car is another tank car placarded with the UN 2078.

Upon your arrival, you find that the derailment is located along the tracks between two apartment complexes. There are at least five or six nonplacarded tank cars and several nonplacarded box cars in the pile. The fire presently involves liquid on the ground and is flowing to the west in a downgrade direction on the north side of the tracks.

The IC is requiring the hazardous materials group to develop a primary and secondary plan. Nonintervention is not a desired operational mode.

Container data: Initial reports indicate they are DOT 111J100W1 general service tank cars and box cars. There are multiple cars involved in this scenario.

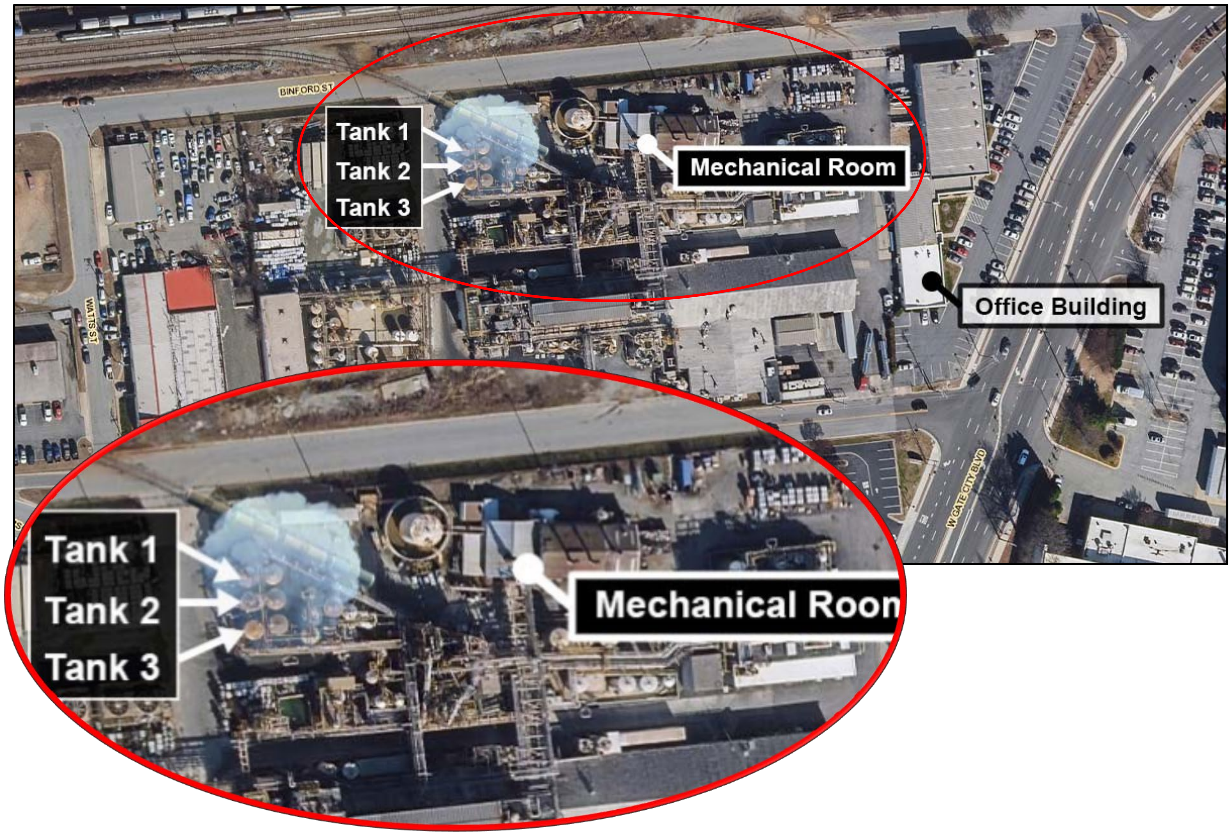
Environmental data: The community has a population of approximately 295,000.

There is a major university located approximately 1 mile to the northwest, and the major downtown business district is located approximately 1 mile to the northeast. Wetlands surround the railbed.

The soil has a relatively high clay content at the surface and generally rests on a limestone base.

The incident occurs on a Saturday in September. The temperature is expected to range from 68 F (20 C) to 85 F (29.4 C). Humidity is expected to range from 68% to 92%. The skies will be sunny, hot and hazy with winds at 5 to 8 mph from the southwest.

Scenario 2



At 11:00 a.m. on a Monday in mid-March, personnel of the D & L Paper and Pulp Company opened a mechanical transfer valve for Chlorine Dioxide Tank 2 (the middle of three vertical pressurized storage tanks) to pump product into the manifold system. After about five minutes of flow, an explosion was heard. As personnel ran to find out what happened, a cloud was seen forming inside the dike area. There is an emergency shut-off valve for the chlorine dioxide tanks on the east wall of the office building.

It was also determined that a section of 4-inch piping, about 3 feet downstream from the tank shut-off valve, was split longitudinally to a point about 6 feet from the manifold for all three tanks. There is a heavy flow of reddish-brown liquid coming from the pipe, and a pool of product is forming within the dike. Conditions deteriorated rapidly in the area, and company personnel were forced to evacuate the area.

It is reported that two other company crews had been offloading a tank car of 50% sodium hydroxide solution into Tank 1 as well as offloading a tank car of chlorine. The tank car personnel were forced to evacuate the area before the product offloading process could be stopped.

The chlorine car is directly connected to the horizontal fixed storage tanks next to the siding. The tanks are equipped with spring-loaded pressure relief devices. The piping leaves the storage area and proceeds to the digesters in overhead pipe racks.

Reconnaissance also reports two pallets are exposed to the vapor cloud; one with four 55-gallon plastic drums of UN 1789 and the other with four 55-gallon steel drums labeled UN 1090 next to the northeast corner of the facility.

The IC is requiring the hazardous materials group to develop a primary and secondary plan. Nonintervention is not a desired operational mode.

Container data: The low-pressure, stainless-steel, vertical storage tanks are built with a dome roof and a fiberglass lining. Each tank has an 80,000-gallon water capacity. Each tank has a 4-inch, spring-loaded, pressure relief valve with an attached vent stack.

The horizontal chlorine tanks have 18,000-gallon water capacity. They are filled from railroad cars on the siding that runs into the facility. Each tank also has a spring-loaded, pressure relief valve and is manifolded for supply to the facility through overhead piping to the digester.

Pipe bridges carry the piping systems to appropriate locations throughout the facility.

Nonbulk containers at the facility include 55-gallon drums made of plastic and steel.

Environmental data: D & L Paper and Pulp is a paper and pulp facility that starts with wood chips and produces both finished paper and bleached pulp. It employs 600 workers and operates three shifts, 24 hours a day, seven days a week.

Ace Chemical manufactures chlorine and chlorine salts. Most of its shipping takes place by rail, from a siding that runs through the D & L Paper and Pulp facility across the street. Ace Chemical employs 100 workers also working three shifts, 24 hours a day, seven days a week.

The area west of the two facilities is light industrial. North of the facilities is a rail yard serving the Central & Columbia Railroad. To the east of the facility is the Central City Coliseum Entertainment Complex. The complex has a variety of venues including a concert hall, aquatics center and a multipurpose arena. Depending on the time of day and venues booked, there may be up to 30,000 people in attendance.

The incident occurs at 11:00 a.m. on a Monday in mid-March. The winds are breezy from the southwest at 9 mph, with a temperature of 68 F (20 C) and a humidity of 89%.

Scenario 3

At about 5:30 a.m. on a Friday morning, a DOT 407 cargo tank hauling epichlorohydrin (UN 2023) was heading east on Interstate 222 onto the exit ramp for Route 220. The cargo tank exited onto Route 222. A 53-foot straight box trailer moved into the middle lane to allow the DOT 407 to merge onto Route 222. A pickup truck swerved into the lane directly in front of the box trailer. As the tractor of the box trailer slammed into the pickup truck, the rig lurched to the left and struck the cargo tank. Both rigs skidded to the left. The cargo tank rolled onto its left side, and the nose of the tank struck and slid along the concrete median barrier. At the same time, the box trailer jackknifed and one of the rear doors swung open.

The cargo tank and the box trailer came to rest in a pile just south of the bridge over Interstate 222. There were 10 30-gallon UN 1H2 containers (with UN 2672 labels) and four UN 13H3 flexible intermediate bulk container (FIBC) (with Dangerous When Wet, UN 1436 labels) containers in the box trailer at the time of the accident. Four of the 1H2 containers fell as the box trailer swung around and now are lying on the highway. There are also two pallets in the truck that are damaged, one with 40 5-gallon pails labeled UN 1490 and another with four 55-gallon stainless-steel drums labeled UN 1830.

First arriving units report that the pickup truck is severely damaged and sitting on the shoulder. The driver of the box trailer appears to be trapped in the cab. The drivers of the pickup truck and the cargo tank have extricated themselves and have nonlife-threatening injuries. The cargo tank driver has the shipping papers, but the box trailer's shipping papers are still in the cab with the driver. There is a small pool of liquid, approximately 10 feet by 15 feet, forming at the front of the cargo tank's tractor and there are several smaller pools of liquid surrounding each of the 1H2 containers that have fallen from the box trailer.

The IC is requiring the hazardous materials group to develop a primary and secondary plan. Nonintervention is not a desired operational mode.

Container data: One tractor trailer involved in this incident is a stainless-steel DOT 407 cargo tank with a capacity of 7,000 gallons. The other tractor trailer is a 53-foot box trailer. The other involved containers are nonbulk and intermediate bulk containers.

The nonbulk containers are marked UN 1H2/X180. The intermediate-bulk containers are marked UN 13H3/08.21/USA/LDM/0/1000.

Environmental data: This incident occurs in Central City, an urban area where Route 220 crosses over Interstate 222. Both routes are heavily traveled. When traveling westbound on Interstate 222, one travels under the Route 220 interchange, which has entrance and exit ramps.

In the immediate area surrounding this interchange, there is a large residential neighborhood directly to the west. Between Route 220 and the residential neighborhood is a small lake where an endangered species of frog has recently been found. To the east of Route 220 is Jana's Restaurant (a large-capacity restaurant and lounge), a series of small commercial buildings and a strip mall.

The temperature is 58 F (14.4 C) and 98% humidity. The skies are partially overcast with light and variable winds (1 to 5 mph) from the northeast.

Scenario 4

The local time is 12:00 p.m. There has been a report of "strange odors" in the area of Battleground Avenue and the Central City Park. Central City 911 receives information that a lawn care truck seems to be creating a visible cloud and is circling the park area. The traffic in the area is becoming heavy with approximately 5,000 people expected to attend the Family Fun Day celebration at Central City Park. Additionally, there is a highway incident involving hazardous materials that has taxed the Central City Fire Department in addition to several surrounding fire departments for the previous four days and is demobilizing at this time. The governor, who is barnstorming this area by bus, will be attending the Family Fun Day at approximately 1:00 p.m. Central City 911 reports that a passerby saw a man "in distress" run into the park restroom from a pickup truck in the parking lot with many different "chemical containers" in the bed of the truck, including a fogger device that is still activated.

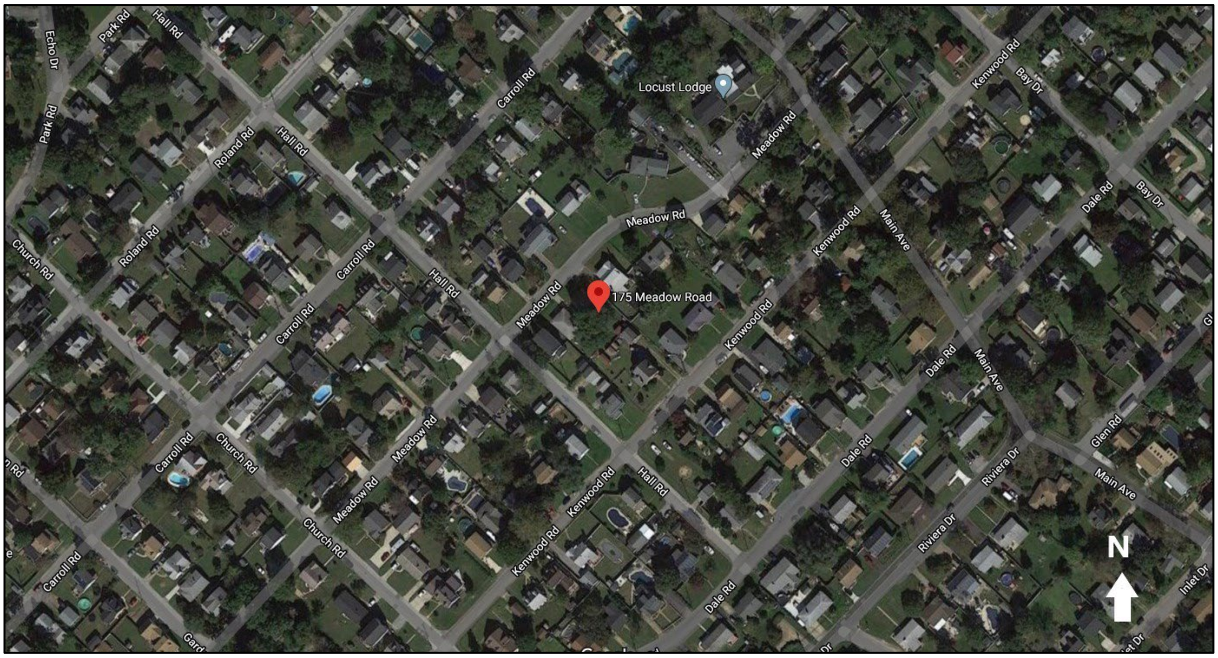
Radio station WSAD received a letter and notified Central City 911 at about the same time as the strange odor report. WSAD also received a telephone call from the "Red White and Blue Militia" stating that they sent the letter and that they "will prevail." The letter is picked up by the Central City Police Department and taken to the police department headquarters. It states that taxes need to go down, illegal wiretapping of citizens must stop, and that "Big Brother" needs to back off so that all can live in peace and harmony. A Central City Police Department officer has found a semiconscious person in the one of the park's restrooms mumbling something about "Red White and Blue Forever!!!"

The IC is requiring the hazardous materials group to develop a primary and secondary plan. Nonintervention is not a desired operational mode.

Container data: In the bed of the pickup truck, plastic jugs, 55-gallon plastic drums, small glass jars and heavy cardboard boxes are found. Along with the chemicals, there are large mixing tubs, portable pumps and spraying equipment. Labels indicate the following materials: Folidol, chlordane, Weedone 638, CEES 97%, Tc-99.

Environmental data: The weather is hot, hazy and humid with projections for the temperature to rise from 75 F (23.9 C) in the morning to 98 F (36.7 C) in the afternoon with 98% humidity and an 80% chance of thunderstorms. The wind is from the southwest at 5 mph.

Scenario 5



Neighbors report “strange odors” coming from a house at 175 Meadow Road in Central City and that there seem to be a lot of short-stay visitors at all hours. The windows are usually shaded with little light seen from the home. The house has no air conditioning, and power has been disconnected. A generator and extension cords provide power from the garage.

One neighbor reported that a young woman she spoke to from the front door told her that they are planning to grow castor plants for oil in the backyard of the property. The residence appears to be currently vacated. None of the neighbors have seen any activity for a couple of days.

Radio station WSAD received a letter and notified Central City 911 at about the same time as the strange odor report was received. They received a call from the Animal Liberation Front (ALF) stating that they sent a letter to the Central City Police Department demanding that all domestic and farm animals be immediately freed “or else.” The letter was received by Central City Police Department. The letter further states that “oppressors will be punished” if their demands are not met in 24 hours.

The IC is requiring the hazardous materials group to develop a primary and secondary plan. Nonintervention is not a desired operational mode.

Container data: There are several 5-gallon plastic pails; numerous consumer packages made of cardboard, paper and metal; and amber-colored glass bottles. There are miscellaneous types of laboratory glassware and equipment in the kitchen of the home. The police department reports a lot of garbage and discarded/empty containers in the home and strewn about the property. Reconnaissance reports the following labels found: red phosphorous, iodine crystals, oleum, acetone, trichloroethylene.

Environmental data: The weather is hot and humid with projections for the temperature to rise from 75 F (23.9 C) in the morning to 98 F (36.7 C) in the afternoon with 96% humidity. There is an 80% chance of thunderstorms. The wind is from the west at 5 mph.

ACTIVITY 6.1 (cont’d)

Incident Command System Form 215A-CG, Incident Action Plan Safety Analysis

INCIDENT ACTION PLAN SAFETY ANALYSIS

1. Incident Name	2. Date/Time Prepared

3. DIVISION/ GROUP/ OTHER LOCATION	4. Work Assignments	5. Gain	6. HAZARDS	7. CONTROLS	8. ORM SEVERITY	PROBABILITY	EXPOSURE	GAR
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				
		Human Health Security Environment Economy	Check	Check				

ICS-215A-CG (rev 6/06)

Operational Risk Management Key

Scale	1	2	3	4	5
Severity	Slight	Minimal	Significant	Major	Catastrophic
Probability	Remote	Un-likely	50/50	>50	Very Likely
Exposure	Below Avg	Avg	Above Avg	Great	N/A

Gar Scale

#	1-19	20-39	40-59	60-79	80-100
Risk	Slight	Possible	Substantial	High	Very High
Color	Green	Amber	Red	Red	Red
Action	Possibly Acceptable	Attention Needed	Correction Required	Immediate Correction	Discontinue, Stop

9. Prepared by (Name and Position)

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III. SUMMARY

FEMA

SUMMARY

U.S. Fire Administration

- Review of roles and responsibilities.
- Best practices.

Slide 6-17

- What have you learned in this unit?
- Do you have any questions?

Slide 6-18

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SUPPLEMENTAL MATERIALS

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Unit 6 Supplemental Materials

Table of Contents

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Hazardous Materials Team Position Checklists

Hazardous Materials Group Supervisor

Date: ______________________________ Incident Number: __________________________

Command Structure and Assignments

	Name	Communication Channel
Incident Commander (IC)		
Hazardous Materials Group Supervisor		
Entry Leader (if needed)		
Site Access Control Leader (if needed)		
Safe Refuge Area Manager (if needed)		
Assistant Safety Officer Hazardous Materials		
Decontamination Leader		
Reference Specialist		

HAZARDOUS MATERIAL UNIT

Hazardous Materials Group Supervisor

Tactical Checklist

Isolation:

[ ] Establish Perimeters __________
[ ] Establish Zones __________
[ ] Deny Entry __________
[ ] Protect Public/Evacuate __________
[ ] Withdraw from the area __________

Weather:

[ ] Wind Direction & Speed __________
[ ] Temperature __________
[ ] Humidity __________
[ ] Conditions (clear, clouds, rain, etc.) __________
[ ] Forecast Conditions __________

Identification:

[ ] Obtain Shipping Documents __________
[ ] Presence of Placards and Labels __________
[ ] Reconnaissance/Investigation __________
[ ] Research Tech. Assigned __________
[ ] Witness' Interview __________
[ ] Property Rep. Interview __________
[ ] Pre-Plan Review __________
[ ] MSDS Review __________
[ ] Chem-Trec 1-800-424-9300 __________

Notification:

[ ] Additional Fire Companies __________
[ ] Emergency Management __________
[ ] Environmental Health __________
[ ] Storm Water Services __________
[ ] EMS __________
[ ] Law Enforcement __________
[ ] NCDOT/GDOT __________
[ ] PIO (Media, Emer. Brdcast) __________
[ ] GFD Staff/Safety Officer __________
[ ] Recovery Contractor __________

Safety:

[ ] EMS Requested __________
[ ] PPE Level *ASOHM __________
[ ] Decontamination *ASOHM __________
[ ] Safe Refuge Area needed? __________
[ ] Site Access Control needs? __________
[ ] Pre-Entry Vitals *ASOHM __________
[ ] Pre-Entry Safety Briefing __________
[ ] Communications *ASOHM __________
[ ] Air Monitoring *ASOHM __________
[ ] Material Sampling*ASOHM __________

*ASOHM indicates that these functions will be performed by the Assistant Safety Officer- HazMat, in coordination with the HM Group Supervisor.

Hazards of Substances Identified:

[ ] Toxic [ ] Flammable [ ] Reactive [ ] Corrosive (pH) [ ] Pyrophoric [ ] Hypergolic
[ ] Irritant [ ] Asphyxiant [ ] Explosive [ ] Oxidizer [ ] Radioactive [ ] Water Reactive
[ ] Other Hazards ____

HAZARDOUS MATERIAL UNIT

Hazardous Materials Group Supervisor

Incident Course/Harm Estimation

Type of Incident: Spill [ ] Leak [ ] Fire [ ] Other [ ] ________________

Type of Release/Spill: Gas/Air [ ] Liquid/Surface [ ] Liquid/Water [ ] Solid/Surface [ ]

Expected Course: Remain as is [ ] Increase spill/leak quantity [ ] Container Failure [ ]
Fire [ ] Explosion/Bleve [ ]

Exposure Potential: None [ ] Moderate [ ] High [ ]

Exposure Type: Fire [ ] Chemical [ ] Contaminated Smoke [ ]

Contamination Potential: Public [ ] Responders [ ] Victims [ ] Environment [ ] Property [ ]

Strategic Options

Spill/Leak Considerations:

Spill:

[ ] Gas/Air ____________
- [ ] Ventilation ____________
- [ ] Vapor Dispersion ____________
- [ ] Vapor Dissolution ____________

[ ] Liquid/Surface ____________
- [ ] Blanketing ____________
- [ ] Diking ____________
- [ ] Absorption ____________
- [ ] Adsorption ____________
- [ ] Retention ____________

[ ] Liquid/Water ____________
- [ ] Damming ____________
- [ ] Diversion ____________
- [ ] Booming ____________
- [ ] Absorption ____________

[ ] Solid/Surface ____________
- [ ] Blanketing ____________

Leak:

[ ] Remote Shut-offs ____________
[ ] Emergency Shut-offs ____________
[ ] Plugging ____________
[ ] Patching ____________
[ ] Product Transfer/Offload ____________
[ ] Overpack ____________
[ ] Clamping line/hose/piping ____________

Fire Considerations:

[ ] Extinguishment ____________
- [ ] Controlled Burn-off ____________
- [ ] Flaring Operation ____________
- [ ] Exposure Protection ____________

Incident Termination:

[ ] Clean-up Operation ____________
[ ] Off Loading Operation ____________
[ ] Container Stability ____________
[ ] Returning Co. in Service ____________
[ ] Cost Recovery Information ____________
[ ] Debriefing Session ____________
[ ] Hazard Communication ____________
[ ] Critique ____________

Hazardous Materials Group Supervisor

Site Specific Information

Incident Location:
Facility Name ____________________
Address ____________________

Property Representative/Responsible Party:
Name ____________________
Address ____________________
Telephone ____________________

Shipping Company:
Name ____________________
Address ____________________
Telephone ____________________

Carrier Company:
Name ____________________
Address ____________________
Telephone ____________________

Insurance Company:
Name ____________________
Address ____________________
Telephone ____________________

Nature of the Problem:

Transportation:	Veh. Accident [ ]	Railway [ ]	Water [ ]	Air [ ]
Fixed Facility:	Residential [ ]	Manufacturing [ ]	Educational [ ]	Business [ ]
	Storage [ ]	Agriculture [ ]		

If Highway transport Incident:
Driver Name ____________________ Drivers Lic. # ____________
Tractor: Lic Number ____________ State ________ Owner Applied # ____________
Trailer: Lic Number ____________ State ________ Owner Applied # ____________

If Railroad incident:
Railroad Name ____________________
Conductor/Engineer Name ____________________
Miscellaneous transporter info: ____________________
____

Product/Container Information:

1. Product ______________________________ UN ID # ______________________________
   Container Type ________________________ Pressure ______________________________
   Est. Spill/Leak _________________________ Remaining Product ____________________
2. Product ______________________________ UN ID # ______________________________
   Container Type ________________________ Pressure ______________________________
   Est. Spill/Leak _________________________ Remaining Product ____________________
3. Product ______________________________ UN ID # ______________________________
   Container Type ________________________ Pressure ______________________________
   Est. Spill/Leak _________________________ Remaining Product ____________________

Miscellaneous Container Info: ____

HAZARDOUS MATERIAL UNIT

Hazardous Materials Group Supervisor

Hazardous Materials Group Supervisor Miscellaneous Event Log	
Time	**Actions**

Hazardous Materials Group Supervisor

Site Sketch:

Hazardous Materials Group Supervisor

Incident Debrief Checklist

Time	Action	Additional Notes
	Materials Involved Communicated to Personnel	
	Exposures Recorded	
	Signs and Symptoms of exposure communicated to personnel	
	Document equipment and apparatus used	
	Document equipment and apparatus out of service	
	Ensure proper handling of contaminated equip and garments	
	Any conditions remaining requiring additional attention	
	Assign personnel to gather information for PIA	
	Summarize activities and identify needs for follow-up	
	Positives and negatives actions for the operation	

HAZARDOUS MATERIAL UNIT

Hazardous Materials Safety Officer

Command Structure and Assignments

	Name	Communication Channel
Incident Commander (IC)	______	______
Hazardous Materials Group Supervisor	______	______
Entry Leader (if needed)	______	______
Site Access Control Leader (if needed)	______	______
Safe Refuge Area Manager (if needed)	______	______
Assistant Safety Officer Hazardous Materials	______	______
Decontamination Leader	______	______
Reference Specialist	______	______

Safety Checklist

ICS 208 Completed	Y[ ] N[ ]	Entry Team Tools Identified	Y[ ] N[ ]
Appropriate PPE Identified	Y[ ] N[ ]	Monitoring and Sampling Needs?	Y[ ] N[ ]
Decontamination Setup and Ready	Y[ ] N[ ]	SCBA Pressure Checked	Y[ ] N[ ]
Appropriate Decontamination Identified	Y[ ] N[ ]	Entry Team Radios Tested	Y[ ] N[ ]
EMS Transport On Scene	Y[ ] N[ ]	Final PPE Check Performed	Y[ ] N[ ]
Communications Needs Identified	Y[ ] N[ ]	Site Security Established	Y[ ] N[ ]
Hazmat Medical/Rehab Established	Y[ ] N[ ]	Post Entry Vital Signs Taken	Y[ ] N[ ]
Pre-Entry Vitals Taken	Y[ ] N[ ]	Decontamination Completed	Y[ ] N[ ]
Pre-Entry Briefing Conducted	Y[ ] N[ ]	Exposure Reports (If applicable)	Y[ ] N[ ]

Personal Protective Equipment Level:

Hot Zone/Entry ______

Decontamination ______

Fire Control ______

EMS/Medical ______

Public Protection Measures:

[ ] Evacuation Distance Initial ______ Downwind ______

[ ] Shelter in place Initial ______ Downwind ______

Refuge Locations ______

Hazardous Materials Safety Officer

Assistant Safety Officer — Hazardous Materials Miscellaneous Event Log

Time	Actions

HAZARDOUS MATERIAL UNIT

Hazardous Materials Safety Officer

Entry Team Time Log and Bottle Pressures			
Time	**Actions**	**Pressure**	**Personnel**
Back-up Team Time Log and Bottle Pressures			
Time	**Actions**	**Pressure**	**Personnel**
Decontamination Personnel Time Log and Bottle Pressures			
Time	**Actions**	**Pressure**	**Personnel**

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HAZARDOUS MATERIAL UNIT

Hazardous Materials Reference Technical Specialist

Date: ______________________________ Incident Number: __________________________

Command Structure and Assignments

	Name	Communication Channel
Incident Commander (IC)		
Hazardous Materials Group Supervisor		
Entry Leader (if needed)		
Site Access Control Leader (if needed)		
Safe Refuge Area Manager (if needed)		
Assistant Safety Officer Hazardous Materials		
Decontamination Leader		
Reference Specialist		

Product Name: _________________________ Formula: ______________________________

Synonyms: ____

Identification: U.N. # ____________________ STCC # ________________________

U.N. Class ____________________ EPA # ________________________

CAS # ____________________

Initial Isolation Distance: _______________________ Secondary ________________________

NFPA 740 Designations Health _______ Flammability _______ Reactivity ________

(NFPA Black Book) Special _______

Status of Release: [ ] None [ ] On-going [ ] Completed [ ] Unknown

Quantity of Release: _____________________ Quantity Remaining: _______________________

Reportable Quantity: _____________________

(Cameo)

Weather: **Wind Speed/Direction** ________________ **Temp.** _______________________

Inversion [ ] Y [ ] N Humidity _______________________

Physical Properties: (NIOSH, CHRIS, MSDS, NFPA)			Flammability:	
	Color	________	**LEL**	________
	Phys. State	________	**UEL**	________
	Phys. Form	________	Flash Pt.	________
	Ph	________	Ign. Temp.	________
(<1 Floats, >1 Sinks in water)	**Spec. Grav.**	________	Explosive Y/N	________
(<1 Rises, >1 Settles in air)	**Vap. Dens.**	________	Decomposition Y/N	________
(760mm/Hg=1 Atm=14.7 psi)	**Vap. Press.**	________	Ionization Potential	________

Hazardous Materials Reference Technical Specialist

HAZARDOUS MATERIAL UNIT

	Solubility	______	Toxicity:	TLV	______
	Boiling Pt.	______		PEL	______
	Melting Pt.	______		**IDLH**	______
				STEL	______
Reactive Properties:	Oxidizer	______		CEILING	______
Answer Y/N	Water Reactive	______		LD50	______
	Pyrophoric	______		LC50	______
	Corrosive	______		Route of exposure	______
	Polymerization	______		Target organs	______
	Explosive	______		Carcinogenic	______

Container Data: ____

Number: ____________ Type: (tanker, drum, tote, etc.) ____________ Size: ______________

Compartment # (if applicable): ________________ Pressure rating: ______________________

Other information: ____

Reactive with: ____

If Radioactive: Form of Material: [ ] Alpha [ ] Beta [ ] Gamma

Monitor Reading __________ (specify R/hr,mR/hr)

Evacuation Area __________

Personal Protective Equipment Level: A [ ] B [ ] C [ ] D [ ]

Suits	Source/Time	Source/Time	Source/Time
HPS	______________	______________	______________
VPS	______________	______________	______________
Chemrel	______________	______________	______________
Barricade	______________	______________	______________
Tychem 9400	______________	______________	______________
Tyvek 23P	______________	______________	______________
Turn-out Gear	______________	______________	______________
Gloves			
HPS/VPS	______________	______________	______________
Butyl	______________	______________	______________
Nitrile	______________	______________	______________
Latex	______________	______________	______________
Kevlar	______________	______________	______________
Boots			
Beta	______________	______________	______________
Turn-out	______________	______________	______________

(found in Cameo, Tomes (Hazard Text),GFD Entry Officer Book Compatibility Charts)

Hazardous Materials Reference Technical Specialist

Air Sampling Readings:

1. Meter & CF: ______________ Actual reading __________ Converted Reading __________
1. Meter & CF: ______________ Actual reading __________ Converted Reading __________
1. Meter & CF: ______________ Actual reading __________ Converted Reading __________
1. Meter & CF: ______________ Actual reading __________ Converted Reading __________

Hazardous Materials Reference Technical Specialist

Entry Team Time Log and Bottle Pressures

Time	Actions	Pressure	Personnel

Back-up Team Time Log and Bottle Pressures

Time	Actions	Pressure	Personnel

Decontamination Personnel Time Log and Bottle Pressures

Time	Actions	Pressure	Personnel

Hazardous Materials Reference Technical Specialist

Research Specialist Miscellaneous Event Log	
Time	**Actions**

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Hazardous Materials Resources Officer

Date: ____________________ Incident Number: ____________________

Consumables Used

Quantity	Item Description

Hazardous Materials Resources Officer

Post Incident Checklist

Cost Recovery Form Completed	______________________________
Equipment Decontaminated	______________________________
Level A Suits Decontaminated	______________________________
Level A Suits Tested	______________________________
Level A Suit Logs Completed	______________________________
Suits Repairs Completed (As Required)	______________________________
Monitoring Equipment Calibrated (As Needed)	______________________________

HAZARDOUS MATERIAL UNIT

Hazardous Materials Medical Officer

ICS Form 206, Medical Plan Completed ______________________________

Medical and Health Plan Worksheet

Product Name: ______________________________
Signs and Symptoms: ______________________________
First Aid needed: ______________________________
Product Name: ______________________________
Signs and Symptoms: ______________________________
First Aid needed: ______________________________
Product Name: ______________________________
Signs and Symptoms: ______________________________
First Aid needed: ______________________________

Rehab needs ______________________________

Medical Triage,
Treatment, and
Transport Area ______________________________
____
____
____
____
____

This form and the Medical Monitoring form should be transferred to emergency medical services (EMS) provider upon their arrival. A copy should also be maintained with Assistant Safety Officer — Hazardous Materials

Hazardous Materials Medical Officer

Medical Monitoring Form

Name:				Date:	
Vital	Exclusion Level	Pre-Entry	Post-Entry	10 min. Post	Intervention thresholds
Time	Previous Entry within 1 hour				
BP	Systolic > 190mm Hg Diastolic > 105mm Hg				Systolic decrease 20mm @ 2 min
Pulse	> 220 - (age x 0.7)				>85% maximum pulse rate
Respirations	>24				
Temp.	Core: >100.5 or < 98 Oral: > 99.5 or < 97				>101 Oral >102 Core
LOC	Alert and Oriented: Time, Location, Person, Event				Disoriented, fainting
Skin Condition	No open sores, wounds, or rashes				Burns, blisters, skin eruptions
Med. Hx.					Altered LOC
Vomiting, diarrhea, fever, heat exposure	Within past 72 hours				Nausea, chest pain, dizziness
Last meal & ETOH consumption	No Heavy ETOH past 24 hours				
Weight					>10% weight loss

Hazardous Materials Medical Officer

Medical Monitoring Form

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Hazardous Materials Medical Officer

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Hazardous Materials Medical Officer

Medical Monitoring Form

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Hazardous Materials Medical Officer

Medical Monitoring Form

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HAZARDOUS MATERIAL UNIT

Hazardous Materials Medical Officer

Medical Monitoring Form

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Last meal & ETOH consumption	No Heavy ETOH past 24 hours				
Weight					>10% weight loss

Hazardous Materials Entry Officer

Date: ______________________________ **Incident Number:** ______________________

Incident Description ____

____

____

Special Knowledge Required ____

____

____

Entry Team ____

____

____

RIT ____

____

____

Back-Up Team ____

____

____

TAC Channel ____

Radio Check **Entry Team** ________________________________

RIT ________________________________

Back-Up ________________________________

Hazardous Materials Entry Officer

Entry Team Time Log and Bottle Pressure

Personnel	Time	Pressure	Actions

Rapid Intervention Team Time Log and Bottle Pressure

Personnel	Time	Pressure	Actions

Hazardous Materials Entry Officer

Back-Up Team Time Log and Bottle Pressure

Personnel	Time	Pressure	Actions

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Hazardous Materials Decontamination Leader

Date: ______________________________ **Incident Number:** ______________________

Command Structure and Assignments

	Name	Communication Channel
Incident Commander (IC)		
Hazardous Materials Group Supervisor		
Entry Leader		
(if needed) Site Access Control Leader		
(if needed) Safe Refuge Area Manager		
(if needed) Assistant Safety Officer Hazardous Materials		
Decontamination Leader		
Reference Specialist		

Substances Involved:

1. ____
2. ____
3. ____

Decontamination Method Selected:

[ ] Dry Decontamination (if so specify) ______________________________

[ ] Wet/Dry Vac [ ] Tac Cloth [ ] Brushing Off Product [ ] Absorption

[ ] Wet Decontamination

[ ] Soap and Water

[ ] Other ______________________________

Decontamination Site Selection Checklist

[ ] Located Uphill/Upwind from Hot Zone if possible.

[ ] If unlevel terrain, Entrance is downhill sloping toward the Hot Zone.

[ ] Entry and exit points visible for entry personnel.

[ ] Site is remote from dressing area, for overspray and other cross contamination purposes.

[ ] Site is isolated and secured to prevent civilian personnel from entering.

Decontamination Tactical Checklist

[ ] Water Supply Established.

[ ] Proper Type and Amount of Solution Identified.

[ ] Proper Decontamination PPE Identified, What Level? ______________________

[ ] Decontamination personnel briefed on hazards.

[ ] Sufficient SCBA bottles for entry personnel.

[ ] Sufficient Backboards for Immobilized Patients to be Handled.

[ ] Decontamination components set up and ready.

[ ] Medical Group located, accessible to entry teams.

[ ] Contaminated equip. isolated for disposal.

Hazardous Materials Decontamination Leader

Decontamination Personnel:

1. ______________________________ **Company Assigned** ____________________
2. ______________________________ **Company Assigned** ____________________
3. ______________________________ **Company Assigned** ____________________
4. ______________________________ **Company Assigned** ____________________
5. ______________________________ **Company Assigned** ____________________
6. ______________________________ **Company Assigned** ____________________
7. ______________________________ **Company Assigned** ____________________
8. ______________________________ **Company Assigned** ____________________

Civilians decontaminated on scene:

Name Address and Telephone #

HAZARDOUS MATERIAL UNIT

Hazardous Materials Decontamination Leader

Decontamination Leader Miscellaneous Event Log

Time	Actions

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UNIT 7: EVALUATING THE PROGRESS OF THE RESPONSE

TERMINAL OBJECTIVE

The students will be able to:

7.1 Evaluate the progress of the planned response to ensure that response objectives are effective, and recommend adjustments to the Incident Command System (ICS) Form 208 HM, Site Safety and Control Plan, accordingly, given the Incident Commander's (IC's) objectives.

ENABLING OBJECTIVES

The students will be able to:

7.1 Describe the elements of information collection on scene.

7.2 Identify considerations for evaluating the progress of the response.

7.3 Describe the implementation of new tactics based on the progress of the incident.

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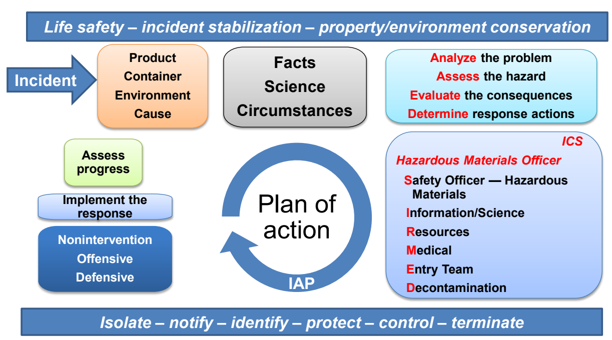
FEMA

U.S. Fire Administration

UNIT 7: EVALUATING THE PROGRESS OF THE RESPONSE

Slide 7-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



Slide 7-2

TERMINAL OBJECTIVE

Evaluate the progress of the planned response to ensure that response objectives are effective, and recommend adjustments to the Incident Command System (ICS) Form 208 HM, Site Safety and Control Plan, accordingly, given the Incident Commander's (IC's) objectives.

Slide 7-3

ENABLING OBJECTIVES

- Describe the elements of information collection on scene.
- Identify considerations for evaluating the progress of the response.
- Describe the implementation of new tactics based on the progress of the incident.

Slide 7-4

ACTIVITY 7.1

Methods for Evaluating Incident Progress

Purpose

Research various methods for evaluating incident progress.

Directions

1. Work in the same small groups formed in Activity 6.1: Implementing the Plan.

2. The instructor(s) will assign one of the following topics:

   a. Direct observation (senses).

   b. Instrumentation.

   c. Law enforcement.

   d. Media.

e. Technical specialists.

____

____

____

f. Periodic reporting.

____

____

____

3. In your small groups, research and discuss the ways that the assigned topic may be used to evaluate the progress of an incident.

4. Be prepared to share your responses with the class.

ACTIVITY 7.2

Best Practices for Evaluating Incident Progress

Purpose

Discuss the best practices used by local jurisdictions for evaluating the progress of an incident.

Directions

1. Continue to work in the same small groups as the previous activity.
2. In your small groups, discuss the best practices used by your local jurisdictions regarding evaluating and reporting the progress of an incident. You may compare the following types of incidents:
    a. Fire.
    b. Technical rescue.
    c. Hazardous materials.
    d. Medical.
    e. Wildfire.
3. Be prepared to share your responses with the class.

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ACTIVITY 7.3

Changes to the Plan of Action

Purpose

Practice making appropriate changes to the plan of action based on situational updates.

Directions

1. Continue to work in the same small groups as the previous activity.
2. In your small group, review the assigned inject applicable to the scenario provided to your small group in Activity 6.1. Assume that initial response objectives have been completed.
3. Based on the inject, make appropriate changes to the plan of action.
4. Inform the instructor when your small group has completed working through the inject.
5. Repeat steps 2 through 4 until the instructor directs you to wrap up and begin your presentation, approximately two hours from the start of the activity.
6. Share your group work of all completed injects with the class.

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- What have you learned in this unit?
- Do you have any questions?

Slide 7-8

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UNIT 8:
TERMINATING THE RESPONSE

TERMINAL OBJECTIVE

The students will be able to:

8.1 Describe the termination activities for the incident, given a hazardous materials/weapons of mass destruction (WMD) scenario.

ENABLING OBJECTIVES

The students will be able to:

8.1 Describe the required incident documentation.

8.2 Describe termination activities.

8.3 Identify considerations for conducting a debrief for incident response personnel.

8.4 Develop a cost recovery analysis.

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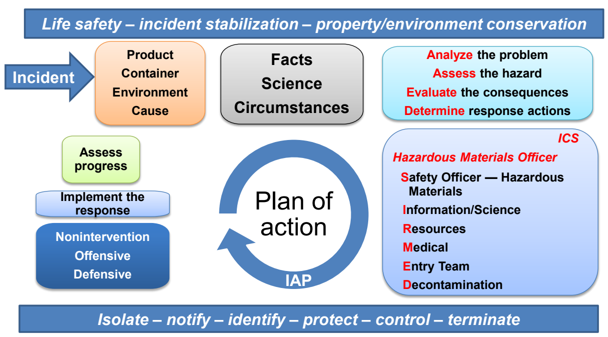
FEMA

U.S. Fire Administration

UNIT 8: TERMINATING THE RESPONSE

Slide 8-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



Slide 8-2

TERMINAL OBJECTIVE

Describe the termination activities for the incident, given a hazardous materials/ weapons of mass destruction (WMD) scenario.

Slide 8-3

I. REQUIRED INCIDENT DOCUMENTATION

A. Documentation and reporting considerations:

1. Reporting requirements of the governmental agencies.

2. Requirements for compiling incident reports, filing documents and maintaining records as defined in the emergency response plan and/or standard operating procedures (SOPs).

DOCUMENTATION AND REPORTING (cont'd)

- Steps in keeping an activity log and exposure records for hazardous materials/WMD incidents.
- Procedures required for legal documentation and chain of custody and continuity described in the SOPs or the emergency response plan.

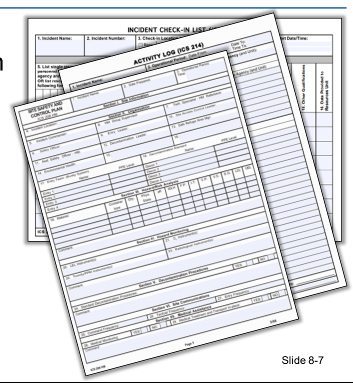
Slide 8-6

3. Steps in keeping an activity log and exposure records for hazardous materials/weapons of mass destruction (WMD) incidents.

4. Procedures required for legal documentation and chain of custody and continuity as described in the SOPs or the emergency response plan.

INICIDENT COMMAND SYSTEM FORMS

- Incident Command System (ICS) Form 211, Incident Check-In List.
- ICS Form 214, Activity Log.
- ICS Form 208 HM, Site Safety and Control Plan.



Slide 8-7

B. Incident Command System (ICS) forms support evidence for cost recovery and decision-making throughout the incident to explain actions and associated costs.

1. ICS Form 211, Incident Check-In List.

2. ICS Form 214, Activity Log.

3. ICS Form 208 HM, Site Safety and Control Plan.

II. COORDINATING HAZARDOUS MATERIALS OPERATIONS FOR POST-INCIDENT OPERATIONS

POST-INCIDENT COORDINATION

- Steps required for terminating the hazardous materials/WMD incident.
- Procedures for transferring command to the authority having jurisdiction (AHJ) having responsibility for post-emergency response operations (PERO).

Slide 8-8

A. Post-incident coordination considerations:

1. Steps required for terminating the hazardous materials/WMD incident.

2. Procedures for transferring command to the authority having jurisdiction (AHJ) having responsibility for post-emergency response operations (PERO).

CONTRACTOR/CLEANUP COMPANY OPERATIONS

- Emergency responders still have remaining responsibility when turning a scene over to private contractors.
- All fire investigations should be considered crime scenes; therefore, proper crime scene considerations must be followed.

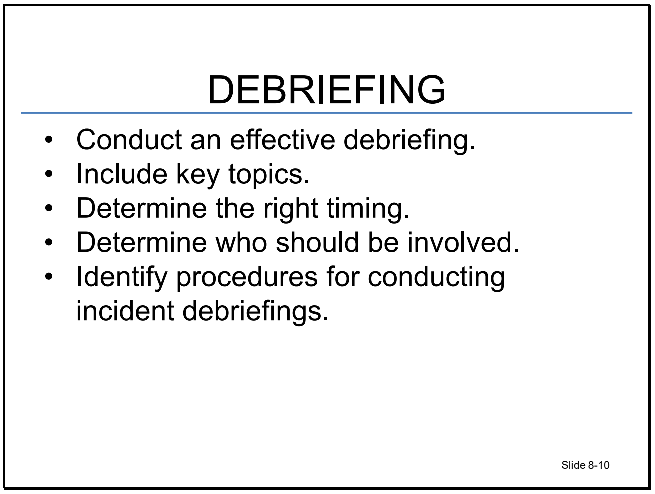
Slide 8-9

B. Contractors/cleanup company operations.

1. Emergency responders still have remaining responsibility when turning a scene over to private contractors. Emergency responders need to ensure that the contractor personnel are competent and licensed. Some jurisdictions may have regulatory ability over contractors. If a contractor has a problem, appropriate emergency responders may be called back.

2. Fire investigations: Many hazardous materials response teams are fire department based, so they should have a working knowledge of fire investigation activities, responsibilities and operations. All fire investigations should be considered crime scenes; therefore, proper crime scene considerations must be followed.

III. ON-SCENE DEBRIEF



A. Debriefing considerations:

1. Conduct an effective debriefing.

a. Gather accurate information.

b. Disseminate accurate information.

c. Include all on-scene personnel.

2. Include key topics in a debriefing.

a. Who, what, when, how and why?

b. Hazard communication requirements include:

- Listing the materials involved.

- Signs and symptoms of exposure.

- Actions to be taken by individuals and contact person for notification of exposure.

- It also may include Critical Incident Stress Debriefing (CISD) information.

3. Determine the right timing of a debriefing.

   The right time may be at the end of an operational period or the end of an incident (prior to the release of personnel and equipment).

4. Determine who should be involved in a debriefing.

   a. All responders should be included in the on-scene debriefing. It is a multiagency event.

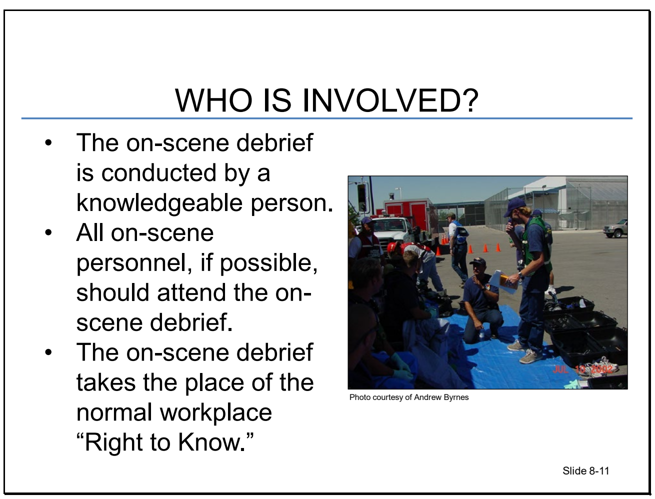
   b. Occupational Safety and Health Administration (OSHA) regulations require the dissemination of the information to all personnel on the scene. The debriefing fulfills the OSHA "Right to Know" requirement.

5. Identify procedures for conducting incident debriefings.

   a. Gather accurate information including technical data, specific occurrences, personnel involved, degree of accomplishment, exposure information and event timeline.

   b. Identify additional needs, especially for additional operational periods.

   c. A sign-in sheet for the debriefing will assist in documentation and compliance.



B. Who is involved?

   1. Who conducts the on-scene debrief?

      The on-scene debrief is conducted by a knowledgeable person: hazardous materials Incident Commander (IC), hazardous materials group supervisor or hazardous materials branch director, possibly with hazardous materials safety officer's and information/science officer's help.

2. Who attends the on-scene debrief?

   a. All on-scene personnel, if possible, should attend the on-scene debrief, no matter their job, agency or discipline.

   b. The on-scene debrief takes the place of the normal workplace "Right to Know."

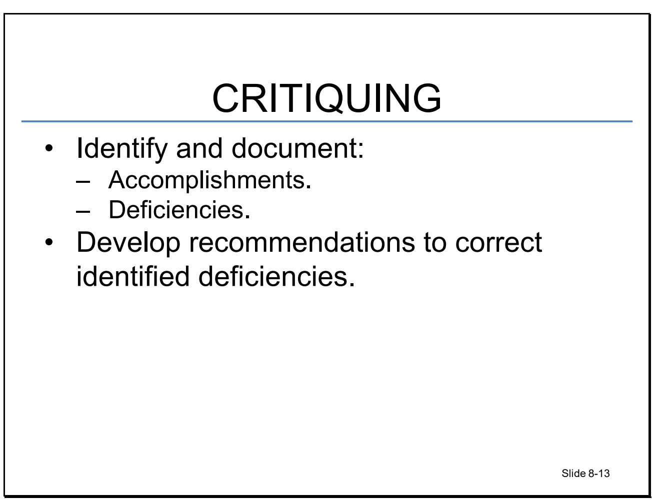
C. What is expected?

1. Distribution of information about the chemical(s) involved.

2. Identification of signs and symptoms of exposure: acute and chronic.

3. Declaration of one central reporting point for **all** agencies to report and track possible exposures.

IV. CRITIQUE



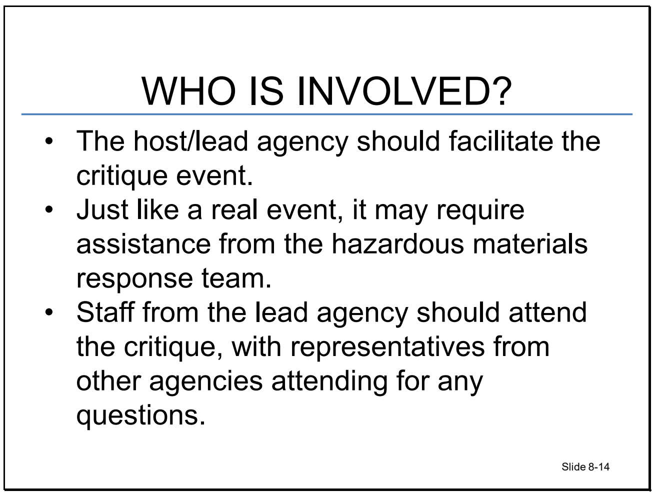
A. Critiquing considerations:

1. Identify and document.

a. Accomplishments.

b. Deficiencies.

2. Develop recommendations to correct identified deficiencies.



B. Who is involved?

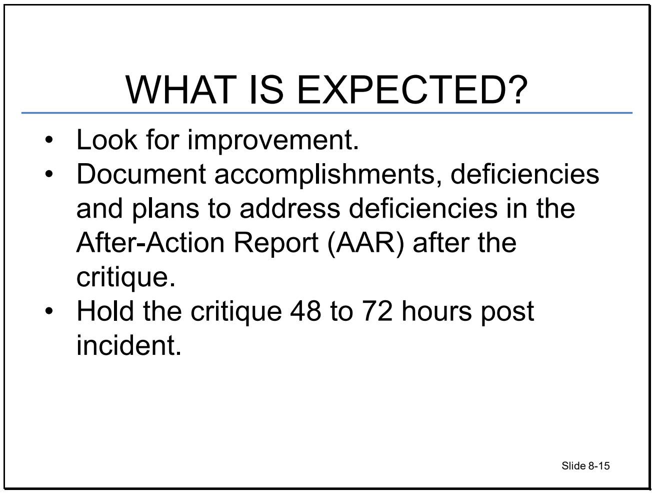
1. Who conducts the critique?

a. The host/lead agency should facilitate the critique event.

b. Just like a real event, it may require assistance from the hazardous materials response team.

2. Who attends the critique?

Staff from the lead agency should attend, with representatives from other agencies attending for any questions.



C. What is expected?

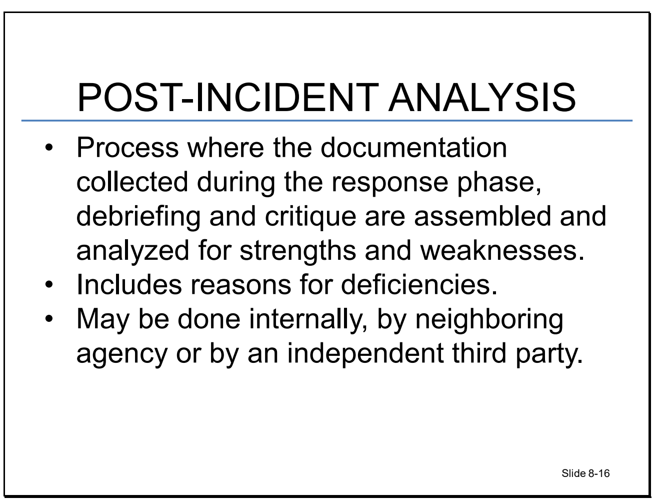
Keep in mind that this is not a blame game. A hazardous materials incident is a low-frequency/high-consequence event where everyone must learn from the occurrences of the event.

1. Look for improvement. If it happened once, it can happen again.

2. Include both accomplishments and deficiencies as well as a plan to address deficiencies to be documented in the After-Action Report (AAR) after the critique.

3. Hold the critique 48 to 72 hours post incident while facts are still fresh and before the "stories" begin.

V. POST-INCIDENT ANALYSIS



A. Post-incident analysis (PIA) is the process where the documentation collected during the response phase as well as the debriefing and critique are assembled and analyzed for strengths and weaknesses.

B. Reasons for the weaknesses/deficiencies should be included in this process. If reasons are not identified, then the weaknesses/deficiencies will reoccur.

C. The PIA may be done internally, by a neighboring agency or by an independent third party.

ACTIVITY 8.1

Incident Debrief

Purpose

Practice developing and conducting an on-scene incident debrief for the hazardous materials response team.

Directions

1. Work in the same small groups formed in Unit 6: Implementing the Plan and Unit 7: Evaluating the Progress of the Response.

2. Using the scenarios and injects assigned to your group in Units 6 and 7, develop an on-scene incident debrief.

3. Conduct the on-scene incident debrief for the class. Instructors and students will provide feedback.

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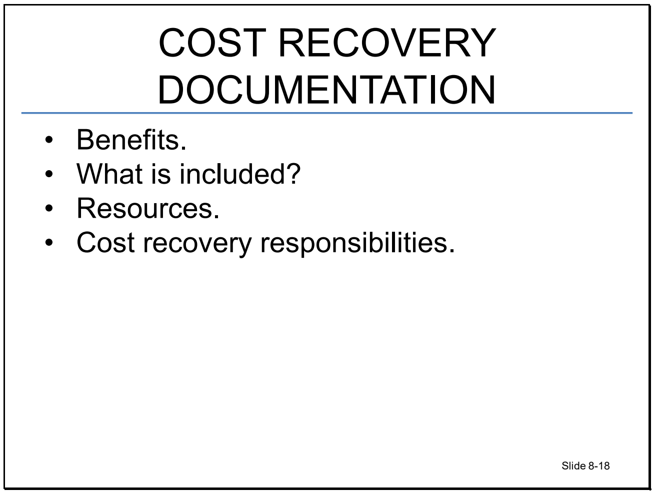
V. POST-INCIDENT ANALYSIS (cont'd)



D. Cost recovery documentation.

1. Benefits.

a. Proper documentation is required to support cost recovery efforts, as the cost may be challenged by applicable courts, insurance companies and/or responsible parties.

b. Cost recovery may be utilized for all incidents involving the release of hazardous materials.

2. What is included?

Cost recovery documentation may include the cost for equipment, personnel, overtime and apparatus.

3. Resources.

a. Worksheets.

b. Price lists.

c. State/local laws.

4. Cost recovery responsibilities.

a. Who is responsible for the cost?

- The hazardous materials response industry operates on the "spiller pays" concept. The responsible party must be identified so cost recovery may occur.

- Federal Motor Carrier Safety Administration's (FMCSA's) Safety and Fitness Electronic Records (SAFER) System (https://safer.fmcsa.dot.gov/CompanySnapshot.aspx) provides company safety data and related services to industry and the public.

b. Who is responsible for the creation of cost recovery documentation?

- The IC is ultimately reponsible for documenting the cost recovery details.
- The hazardous materials officer has the greatest stake in cost recovery, as cost recovery will normally, and most directly, affect the hazardous materials response team.
- For small- to medium-scale incidents, the hazardous materials officer (who may be serving as the IC) should complete the cost recovery documentation.
- For large scale or long-term, multioperational period incidents, a finance/administration branch may be added to the ICS. If so, cost recovery documentation may be assigned to the finance/administration branch with significant input from the hazardous materials officer.

c. Who enforces and/or supplements cost recovery?

- The Environmental Protection Agency (EPA) can pursue either civil or criminal court actions against the responsible party.
  - -- Supplemental Environmental Projects (SEPs) and mitigation can be part of an enforcement settlement. SEPs are environmental improvement projects that a violator voluntarily agrees to perform. These projects are in addition to actions required to correct the violations specified in the settlement. The enforcement settlement may also include restitution to reimburse local responders for costs or equipment.
  - -- The Oil Pollution Act (OPA) consolidated the liability and compensation requirement of certain prior federal oil pollution laws and their supporting funds, including the Federal Water Pollution Control Act (FWPCA), Deepwater Port Act, Trans-Alaska Pipeline System (TAPS) Authorization Act and Outer Continental Shelf Lands Act. It also created the Oil Spill Liability Trust Fund (OSLTF).

-- Under the OPA of 1990, the owner or operator of a facility from which oil is discharged (responsible party) is liable for the costs associated with the containment, cleanup and damages resulting from the spill.

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ACTIVITY 8.2

Cost Recovery Analysis

Purpose

Calculate the costs associated with a hazardous materials response for the purpose of cost recovery/reimbursement.

Directions

1. Continue to work in the same small groups from Activity 8.1.

2. Using the documentation from Units 6, 7 and 8 activities, FEMA's Schedule of Equipment Rates, and the Sample Hazardous Materials Cost Recovery Worksheet, which includes a sample Price List, in the Supplemental Materials section at the end of this unit, calculate the costs that could potentially be recovered for your incident.

3. Present your cost recovery calculations and supporting evidence justifying the calculations. Be prepared to discuss how cost recovery could effect change in your own agencies.

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VI. SUMMARY

SUMMARY

- Required incident documentation.
- Coordinating hazardous materials operations for post-incident operations.
- On-scene debrief.
- Critique.
- Post-incident analysis (PIA).

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- What have you learned in this unit?
- Do you have any questions?

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SUPPLEMENTAL MATERIALS

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Unit 8 Supplemental Materials

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FEMA's Schedule of Equipment Rates

FEMA's SCHEDULE OF EQUIPMENT RATES

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY
RECOVERY DIRECTORATE
PUBLIC ASSISTANCE DIVISION
WASHINGTON, DC 20472

The rates on this Schedule of Equipment Rates are for applicant owned equipment in good mechanical condition, complete with all required attachments. Each rate covers all costs eligible under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. § 5121, et seq., for ownership and operation of equipment, including depreciation, overhead, all maintenance, field repairs, fuel, lubricants, tires, OSHA equipment and other costs incidental to operation. Standby equipment costs are not eligible.

Equipment must be in actual operation performing eligible work in order for reimbursement to be eligible. LABOR COSTS OF OPERATOR ARE NOT INCLUDED in the rates and should be approved separately from equipment costs.

Information regarding the use of the Schedule is contained in 44 CFR § 206.228 Allowable Costs. Rates for equipment not listed will be furnished by FEMA upon request. Any appeals shall be in accordance with 44 CFR § 206.206 Appeals.

THESE RATES ARE APPLICABLE TO MAJOR DISASTERS AND EMERGENCIES
DECLARED BY THE PRESIDENT ON OR AFTER August 15, 2019.

FEMA Code ID		Equipment Description					
Cost Code	Equipment	Specifications	Capacity or Size	HP	Notes	Unit	2019 Updated Rate
8010	Air Compressor	Air Delivery	41 CFM	to 10	Hoses included.	hour	$ 1.62
8011	Air Compressor	Air Delivery	103 CFM	to 30	Hoses included.	hour	$ 9.86
8012	Air Compressor	Air Delivery	130 CFM	to 50	Hoses included.	hour	$ 12.49
8013	Air Compressor	Air Delivery	175 CFM	to 90	Hoses included.	hour	$ 20.98
8014	Air Compressor	Air Delivery	400 CFM	to 145	Hoses included.	hour	$ 32.13
8015	Air Compressor	Air Delivery	575 CFM	to 230	Hoses included.	hour	$ 57.05
8016	Air Compressor	Air Delivery	1100 CFM	to 355	Hoses included.	hour	$ 95.60
8017	Air Compressor	Air Delivery	1600 CFM	to 500	Hoses included.	hour	$ 98.55
8040	Ambulance			to 150		hour	$ 28.09
8041	Ambulance			to 210		hour	$ 41.18
8050	Board, Arrow			to 8	Trailer Mounted.	hour	$ 4.53
8051	Board, Message			to 5	Trailer Mounted.	hour	$ 11.60
8060	Auger, Portable	Hole Diameter	16 in	to 6		hour	$ 2.34
8061	Auger, Portable	Hole Diameter	18 in	to 13		hour	$ 4.65
8062	Auger, Tractor Mntd	Max. Auger Diameter	36 in	to 13	Includes digger, boom and mounting hardware.	hour	$ 3.25
8063	Auger, Truck Mntd	Max. Auger Size	24 in	to 100	Includes digger, boom and mounting hardware. Add this rate to tractor rate for total auger and tractor rate.	hour	$ 34.93
8064	Hydraulic Post Driver					hour	$ 35.27
8065	Auger	Horizontal Directional Boring Machine	250 X 100	300	DD-140B YR-2003	hour	$ 172.29
8066	Auger	Horizontal Directional Boring Machine	50 X 100	24	Average to 7,000 lbs	hour	$ 33.83
8067	Auger, Directional Boring Machine	Auger, Directional Boring Machine	7,000 - 10,000 lbs	45	JT920L (2013)	hour	$ 41.04
8068	Bush Hog	Bush Hog - Model 326	Single Spindle Rotary Cutters			hour	$ 20.61
8068-1	Bush Hog	Bush Hog - Model 3210	Lift, Pull, Semi-Mount & Offset Model			hour	$ 28.74
8068-2	Bush Hog	Bush Hog - Model 2815	Flex Wing Rotary Cutters			hour	$ 43.17
8070	Automobile			to 130	Transporting people.	mile	$ 0.545
8071	Automobile			to 130	Transporting cargo.	hour	$ 12.43
8072	Automobile, Police			to 250	Patrolling.	mile	$ 0.545
8073	Automobile, Police			to 250	Stationary with engine running.	hour	$ 16.05
8075	Motorcycle, Police					mile	$ 0.505
8076	Automible - Chevy Trailblazer	6 or 8 cl		285 to 300		hour	$ 23.99
8077	Automobile - Ford Expedition	Fire Command Center	EcoBoost V-6	360	2015 Model	hour	$ 19.62
8078	MRAP Armored Rescue Vehicle	Search and Rescue	Military Suplus Vehicle	375-450	Qualified foe operational rate on	Hr.	$ 51.80
8079	MRAP C-MTV	Multi-Theater (Military Surplus)Vehicle	gvwr 55000 Lbs	to 350	Qualified foe operational rate on	Hr.	$ 48.35

8080	All Terrain Vehicle (ATV)	Engine 110cc, 4-Wheel; 20" tyre		6.5-7.5		hour	$	8.23
8081	All Terrain Vehicle (ATV)	Engine 125cc, 4-Wheel; 21" tyre		7.6-8.6		hour	$	8.67
8082	All Terrain Vehicle (ATV)	Engine 150cc, 4-Wheel; 22" tyre		9.0-10.0		hour	$	8.68
8083	All Terrain Vehicle (ATV)	Engine 200cc, 4-Wheel; 24" tyre		12-14.0		hour	$	9.23
8084	All Terrain Vehicle (ATV)	Engine 250cc, 4-Wheel; 24" tyre		15-17		hour	$	9.81
8085	All Terrain Vehicle (ATV)	Engine 300cc, 4-Wheel; 24" tyre		18-20		hour	$	10.66
8086	All Terrain Vehicle (ATV)	Engine 400cc. 4-Wheel; 25" tyre		26-28		hour	$	12.20
8087	All Terrain Vehicle (ATV)	Engine 450cc, 4-Wheel; 25" tyre		26-28		hour	$	13.07
8088	All Terrain Vehicle (ATV)	Engine 650cc, 4-Wheel; 25" tyre		38-40		hour	$	13.86
8089	All Terrain Vehicle (ATV)	Engine 750cc, 4-Wheel; 25" tyre		44-46		hour	$	14.79
8110	Barge, Deck	Size	50'x35'x7.25'	0	Push by Tug-Boat	hour	$	52.00
8111	Barge, Deck	Size	50'x35'x9'	0	Push by Tug-Boat	hour	$	61.96
8112	Barge, Deck	Size	120'x45'x10'	0	Push by Tug-Boat	hour	$	109.97
8113	Barge, Deck	Size	160'x45'x11"	0	Push by Tug-Boat	hour	$	136.90
8120	Boat, Tow	Size	55'x20'x5'	to 870	Steel.	hour	$	352.71
8121	Boat, Tow	Size	60'x21'x5'	to 1050	Steel.	hour	$	400.32
8122	Boat, Tow	Size	70'x30'x7.5'	to 1350	Steel.	hour	$	624.56
8123	Boat, Tow	Size	120'x34'x8'	to 2000	Steel.	hour	$	1,181.86
8124	Airboat	815AGIS Airboat w/spray unit	15'x8'	400		hour	$	32.70
8125	Airboat	815AGIS Airboat w/spray unit	15'x8'	425		hour	$	33.06
8126	Swamp Buggy	Conquest		360		hour	$	41.35
8130	Boat, Row			0	Heavy duty.	hour	$	1.46
8131	Boat, Runabout	Size	13'x5'	to 50	Outboard.	hour	$	12.55
8132	Boat, Tender	Size	14'x7'	to 100	Inboard with 360 degree drive.	hour	$	16.58
8133	Boat, Push	Size	45'x21'x6'	to 435	Flat hull.	hour	$	235.03
8134	Boat, Push	Size	54'x21'x6'	to 525	Flat hull.	hour	$	290.74
8135	Boat, Push	Size	58'x24'x7.5'	to 705	Flat hull.	hour	$	355.70
8136	Boat, Push	Size	64'x25'x8'	to 870	Flat hull.	hour	$	359.36
8140	Boat, Tug	Length	16 Ft	to 100		hour	$	47.35
8141	Boat, Tug	Length	18 Ft	to 175		hour	$	70.55
8142	Boat, Tug	Length	26 Ft	to 250		hour	$	90.10
8143	Boat, Tug	Length	40 Ft	to 380		hour	$	215.09
8144	Boat, Tug	Length	51 Ft	to 700		hour	$	302.01
8145	Jet Ski	3-seater				hour	$	27.70
8146	Jet Ski					hour	$	8.60
8147	Boat, Inflatable Rescue Raft	Zodiac		0		hour	$	1.13
8148	Boat, Runabout	1544 lbs	11 passenger capacity	190-250		hour	$	65.51
8149	Boat, removable engine	2000 Johnson Outboard Motor w 15" shaft		15		hour	$	1.58
8151	Broom, Pavement	Broom Length	96 In	to 100		hour	$	30.41
8153	Broom, Pavement, Mntd	Broom Length	72 In	to 18	Add Prime Mover cost for total rate	hour	$	6.24
8154	Broom, Pavement, Pull	Broom Length	84 In	to 20	Add Prime Mover cost for total rate	hour	$	23.75
8155	Broom, Pavement	Broom Length	72 In	to 35		hour	$	25.28
8157	Sweeper, Pavement			to 110		hour	$	78.79
8158	Sweeper, Pavement			to 230		hour	$	102.03
8180	Bus			to 150		hour	$	21.60
8181	Bus			to 210		hour	$	25.82
8182	Bus			to 300		hour	$	39.65
8183	Blower	Gasoline powered Toro Pro Force		27		hour	$	15.40
8183x	Mosquito Sprayer	2015 Adapco Guardian 95 ES	15-gal; 350 lbs			hour	$	18.83
8184	Back-Pack Blower			to 4.4		hour	$	1.53
8185	Walk-Behind Blower			13		hour	$	6.83
8187	Chainsaw	Bar Length = 20 In	3.0 cu In	2.7		hour	$	1.91
8188	Chainsaw	Bar Length = 20 In	5.0 cu In			hour	$	2.59
8189	Chainsaw	Bar Length = 20 In	6.0 cu In	3.4		hour	$	2.77

8190	Chain Saw	Bar Length = 16 in	2.5 cu in	2.4		hour	$	1.80
8191	Chain Saw (STIHL)	Bar Length = 25 in	7.5 cu in	3.62		hour	$	3.73
8192	Chain Saw, Pole	Bar Length = 18 in	4.0 cu in	3.2		hour	$	2.10
8193	Skidder	model 748 E		to 173		hour	$	56.25
8194	Skidder	model 648 G11		to 177		hour	$	105.44
8195	Cutter, Brush	Cutter Size	8 ft	to 150		hour	$	119.52
8196	Cutter, Brush	Cutter Size	8 ft	to 190		hour	$	134.74
8197	Cutter, Brush	Cutter Size	10 ft	to 245		hour	$	142.31
8198	Bruncher Cutter	Cutter, Brush - 247 hp, 1997 Model 511 Feller		to 247		hour	$	193.95
8199	Log Trailer	40 ft		0		hour	$	10.15
8200	Chipper, Brush	Chipping Capacity	6 in	to 35	Trailer Mounted.	hour	$	8.97
8201	Chipper, Brush	Chipping Capacity	9 in	to 65	Trailer Mounted.	hour	$	17.06
8202	Chipper, Brush	Chipping Capacity	12 in	to 100	Trailer Mounted.	hour	$	24.89
8203	Chipper, Brush	Chipping Capacity	15 in	to 125	Trailer Mounted.	hour	$	35.75
8204	Chipper, Brush	Chipping Capacity	18 in	to 200	Trailer Mounted.	hour	$	50.41
8208	Loader - Tractor - Knuckleboom	model Barko 595 ML		to 173		hour	$	169.74
8209	Loader - Wheel	model 210 w/ Buck Saw 50 inch Bar		to 240		hour	$	98.48
8210	Clamshell & Dragline, Crawler		149,999 lbs	to 235	Bucket not included in rate.	hour	$	134.68
8211	Clamshell & Dragline, Crawler		250,000 lbs	to 520	Bucket not included in rate.	hour	$	178.82
8212	Clamshell & Dragline, Truck			to 240	Bucket not included in rate.	hour	$	147.05
8218	BOMAG Compactor	BW100AD-3		33		Hour	$	24.80
8219	Compactor -2-Ton Pavement Roller	Single Drum Vibratoty Compactor	to 2.9 Ton	28		hour	$	28.72
8220	Compactor			to 10		hour	$	15.92
8221	Compactor, towed, Vibratory Drum			to 45	Plus tow Truck	hour	$	33.56
8222	Compactor, Vibratory, Drum			to 75		hour	$	24.09
8223	Compactor, pneumatic, wheel			to 100		hour	$	26.90
8225	Compactor, Sanitation			to 300		hour	$	96.11
8226	Compactor, Sanitation			to 400		hour	$	154.63
8227	Compactor, Sanitation			535		hour	$	264.25
8228	Compactor, towed, Pneumatic, Wheel	Hercules PT-11,	10,000 lbs		11-Wheels (Towed)	hour	$	18.48
8229	Compactor,Towed Steel Drum Static Compactor	GTD-54120	20,000 lbs		Grid Drum (Towed)	hour	$	16.22
8240	Feeder, Grizzly			to 35		hour	$	25.47
8241	Feeder, Grizzly			to 55		hour	$	33.55
8242	Feeder, Grizzly			to 75		hour	$	65.18
8250	Dozer, Crawler	Deere 450J LT		to 75		hour	$	54.20
8251	Dozer, Crawler	Deere 650K LGP; ROPS/FOPS		to 105		hour	$	65.14
8252	Dozer, Crawler			to 160		hour	$	98.77
8253	Dozer, Crawler			to 250		hour	$	153.35
8254	Dozer, Crawler			to 360		hour	$	218.47
8255	Dozer, Crawler	Make/Model: CAT D10T (disc. 2014); Protection: EROPS; Type Semi-U		to 574		hour	$	317.49
8256	Dozer, Crawler			to 850		hour	$	358.48
8260	Dozer, Wheel			to 300		hour	$	66.26
8261	Dozer, Wheel			to 400		hour	$	101.22
8262	Dozer, Wheel			to 500		hour	$	184.08
8263	Dozer, Wheel			to 625		hour	$	239.31
8269	Box Scraper	3 hitch attach for tractor; 2007 Befco		0		hour	$	3.65
8270	Bucket, Clamshell	Capacity	1.0 CY	0	Includes teeth. Does not include Clamshell & Dragline	hour	$	4.64
8271	Bucket, Clamshell	Capacity	2.5 CY	0	Includes teeth. Does not include Clamshell & Dragline	hour	$	8.81
8272	Bucket, Clamshell	Capacity	5.0 CY	0	Includes teeth. Does not include Clamshell & Dragline	hour	$	13.19
8273	Bucket, Clamshell	Capacity	7.5 CY	0	Includes teeth. Does not include Clamshell & Dragline	hour	$	23.31
8275	Bucket, Dragline	Capacity	2.0 CY	0	Does not include Clamshell & Dragline	hour	$	3.98
8276	Bucket, Dragline	Capacity	5.0 CY	0	Does not include Clamshell & Dragline	hour	$	9.93

8277	Bucket, Dragline	Capacity	10 CY	0	Does not include Clamshell & Dragline	hour	$	14.19
8278	Bucket, Dragline	Capacity	14 CY	0	Does not include Clamshell & Dragline	hour	$	18.72
8280	Excavator, Hydraulic	Bucket Capacity	0.5 CY	to 45	Crawler, Truck & Wheel. Includes bucket.	hour	$	18.97
8281	Excavator, Hydraulic	Bucket Capacity	1.0 CY	to 90	Crawler, Truck & Wheel. Includes bucket.	hour	$	36.06
8282	Excavator, Hydraulic	Bucket Capacity	1.5 CY	to 160	Crawler, Truck & Wheel. Includes bucket.	hour	$	55.30
8283	Excavator, Hydraulic	Bucket Capacity	2.5 CY	to 265	Crawler, Truck & Wheel. Includes bucket.	hour	$	158.86
8284	Excavator, Hydraulic	Bucket Capacity	4.5 CY	to 420	Crawler, Truck & Wheel. Includes bucket.	hour	$	264.64
8285	Excavator, Hydraulic	Bucket Capacity	7.5 CY	to 650	Crawler, Truck & Wheel. Includes bucket.	hour	$	304.91
8286	Excavator, Hydraulic	Bucket Capacity	12 CY	to 1000	Crawler, Truck & Wheel. Includes bucket.	hour	$	466.41
8287	Excavator	2007 model Gradall XL3100 III		184		hour	$	102.62
8288	Excavator	2003 model Gradall XL4100 III		238		hour	$	117.66
8289	Excavator	2006 model Gradall XL5100		230		hour	$	109.03
8290	Trowel, Concrete	Diameter	48 In	to 12		hour	$	4.94
8300	Fork Lift	Capacity	6000 Lbs	to 60		hour	$	14.73
8301	Fork Lift	Capacity	12000 Lbs	to 90		hour	$	21.12
8302	Fork Lift	Capacity	18000 Lbs	to 140		hour	$	28.79
8303	Fork Lift	Capacity	50000 Lbs	to 215		hour	$	63.25
8306	Fork Lift Material handler	Diesel, CAT TH360B	6600-11500 gvwr lbs	94.9	3.1- 3.5 Mton	hour	$	44.62
8307	Fork Lift Material handler	Diesel, CAT TH460B	9000 Lbs	94.9	4.5 - 4.9 Mton	hour	$	51.93
8308	Fork Lift Material handler	Diesel, CAT TH560B	10000 Lbs	117.5	4.5 - 4.9 Mton	hour	$	56.14
8309	Fork Lift Accessory	2003 ACS Paddle Fork		0		hour	$	3.53
8310	Generator	Prime Output	5.5 KW	to 10		hour	$	5.36
8311	Generator	Prime Output	16 KW	to 25		hour	$	7.81
8312	Generator	Prime Output	60KW	to 88		hour	$	25.56
8313	Generator	Prime Output	100 KW	to 125		hour	$	43.60
8314	Generator	Prime Output	150 KW	to 240		hour	$	62.83
8315	Generator	Prime Output	210 KW	to 300		hour	$	85.70
8316	Generator	Prime Output	280 KW	to 400		hour	$	103.34
8317	Generator	Prime Output	350 KW	to 500		hour	$	114.23
8318	Generator	Prime Output	530 KW	to 750		hour	$	202.00
8319	Generator	Prime Output	710 KW	to 1000		hour	$	225.34
8327	Generator	Prime Output	800 KW	1065		hour	$	232.46
8328	Generator	Prime Output	900 KW	1355		hour	$	295.15
8329	Generator	Prime Output	1000 KW	1000	Open	hour	$	356.94
8320	Generator	Prime Output	1100 KW	1645	Open	hour	$	393.43
8321	Generator	Prime Output	2500 KW	to 3000		hour	$	553.78
8322	Generator	Prime Output	1,000 KW	to 1645	Enclosed	hour	$	450.78
8323	Generator	Prime Output	1,500 KW	to 2500	Enclosed	hour	$	583.01
8324	Generator	Prime Output	1100KW	2500	Enclosed	hour	$	567.48
8325	Generator	Prime Output	40KW	63	Open	hour	$	23.16
8326	Generator	Prime Output	20KW	35	Open/Closeed	hour	$	18.05
8327	Generator Large	Prime Output	80 KW	120		Hr.	$	31.65
8328	Generator Heavy Duty	Prime Output	2000KW		Open	Hr.	$	490.00
8330	Graders	Moldboard Size	10 Ft	to 110	Includes Rigid and Articulate equipment.	hour	$	43.98
8331	Graders	Moldboard Size	12 Ft	to 150	Includes Rigid and Articulate equipment.	hour	$	63.63
8332	Graders	Moldboard Size	14 Ft	to 225	Includes Rigid and Articulate equipment.	hour	$	80.43
8350	Hose, Discharge	Diameter	3 In	0	Per 25 foot length. Includes couplings.	hour	$	0.16
8351	Hose, Discharge	Diameter	4 In	0	Per 25 foot length. Includes couplings.	hour	$	0.24
8352	Hose, Discharge	Diameter	6 In	0	Per 25 foot length. Includes couplings.	hour	$	0.62
8353	Hose, Discharge	Diameter	8 In	0	Per 25 foot length. Includes couplings.	hour	$	0.62

8354	Hose, Discharge	Diameter	12 in	0	Per 25 foot length. Includes couplings.	hour	$ 0.92
8355	Hose, Discharge	Diameter	16 in	0	Per 25 foot length. Includes couplings.	hour	$ 1.71
8356	Hose, Suction	Diameter	3 in	0	Per 25 foot length. Includes couplings.	hour	$ 0.31
8357	Hose, Suction	Diameter	4 in	0	Per 25 foot length. Includes couplings.	hour	$ 0.37
8358	Hose, Suction	Diameter	6 in	0	Per 25 foot length. Includes couplings.	hour	$ 1.17
8359	Hose, Suction	Diameter	8 in	0	Per 25 foot length. Includes couplings.	hour	$ 1.11
8360	Hose, Suction	Diameter	12 in	0	Per 25 foot length. Includes couplings.	hour	$ 1.73
8361	Hose, Suction	Diameter	16 in	0	Per 25 foot length. Includes couplings.	hour	$ 3.29
8380	Loader, Crawler	Bucket Capacity	0.5 CY	to 32	Includes bucket.	hour	$ 19.59
8381	Loader, Crawler	Bucket Capacity	1 CY	to 60	Includes bucket.	hour	$ 36.87
8382	Loader, Crawler	Bucket Capacity	2 CY	to 118	Includes bucket.	hour	$ 69.24
8383	Loader, Crawler	Bucket Capacity	3 CY	to 178	Includes bucket.	hour	$ 103.22
8384	Loader, Crawler	Bucket Capacity	4 CY	to 238	Includes bucket.	hour	$ 123.73
8390	Loader, Wheel	Bucket Capacity	0.5 CY	to 38		hour	$ 20.80
8391	Loader, Wheel	Bucket Capacity	1 CY	to 60		hour	$ 41.33
8392	Loader, Wheel	Bucket Capacity	2 CY	to 105	CAT-926	hour	$ 38.10
8393	Loader, Wheel	Bucket Capacity	3 CY	to 152		hour	$ 46.17
8394	Loader, Wheel	Bucket Capacity	4 CY	232		hour	$ 76.27
8395	Loader, Wheel	Bucket Capacity	5 CY	255		hour	$ 79.50
8396	Loader, Wheel	Bucket Capacity	6 CY	to 305		hour	$ 116.12
8397	Loader, Wheel	Bucket Capacity	7 CY	to 360		hour	$ 129.40
8398	Loader, Wheel	Bucket Capacity	8 CY	to 530		hour	$ 188.87
8401	Loader, Tractor, Wheel	Bucket Capacity	0.87 CY	to 80	Case 580 Super L	hour	$ 37.13
8410	Mixer, Concrete Portable	Batching Capacity	10 Cft	8	Diesel Powered	hour	$ 3.13
8411	Mixer, Concrete Portable	Batching Capacity	12 Cft	11	Gasoline Powered	hour	$ 4.31
8412	Mixer, Concrete, Trailer Mntd	Batching Capacity	11 Cft	to 10		hour	$ 15.32
8413	Mixer, Concrete, Trailer Mntd	Batching Capacity	16 Cft	to 25		hour	$ 20.47
8414	Truck, Concrete Mixer	Mixer Capacity	13 CY	to 300		hour	$ 84.71
8419	Hand-Held, Pavement Breakers	Weight	25~90 Lbs	0	Air Tool/Electric Power	hour	$ 1.12
8420	Self-Propelled Pavement Breaker,			to 70-80	Self-Propelled (Diesel)	hour	$ 59.54
8421	Vibrator, Concrete	Hand Held		to 4		hour	$ 1.63
8423	Spreader, Chip	Spread Hopper Width	12.5 Ft	to 152		hour	$ 90.67
8424	Spreader, Chip	Spread Hopper Width	16.5 Ft	to 215		hour	$ 125.19
8425	Spreader, Chip, Mntd	Hopper Size	8 Ft	to 8	Trailer & truck mounted.	hour	$ 4.77
8430	Paver, Asphalt, Towed			0	Does not include Prime Mover.	hour	$ 12.67
8431	Paver, Asphalt	Crawler		to 50	Includes wheel and crawler equipment.	hour	$ 76.41
8432	Paver, Asphalt	Crawler		to 125	Includes wheel and crawler equipment.	hour	$ 96.52
8433	Paver, Asphalt	Crawler		to 175	Includes wheel and crawler equipment.	hour	$ 144.69
8434	Paver, Asphalt		35,000Lbs & Over	to 250	Includes wheel and crawler equipment.	hour	$ 224.01
8436	Pick-up, Asphalt			to 110		hour	$ 98.06
8437	Pick-up, Asphalt	Cederapids	CR MS-2	113 to 140	Asphalt-Pick-up Machine	hour	$ 140.59
8438	Pick-up, Asphalt	Blaw-Knox	MC-330	184 to 200	Asphalt-Pick-up Machine	hour	$ 189.75
8439	Pick-up, Asphalt		MTV 1000C	to 275	Asphalt-Pick-up Machine	hour	$ 214.03
8440	Striper	Paint Capacity	40 Gal	to 22		hour	$ 16.92
8441	Striper	Paint Capacity	90 Gal	to 60		hour	$ 24.24
8442	Striper	Paint Capacity	120 Gal	to 122		hour	$ 45.28
8445	Striper, Truck Mntd	Paint Capacity	120 Gal	to 460		hour	$ 83.35
8446	Striper, Walk-behind	Paint Capacity	12 Gal	5		hour	$ 4.23
8447	Paver accessory -Belt Extension	2002 Leeboy Conveyor Belt Extension	24' X 50'	0	crawler	hour	$ 33.48
8450	Plow, Snow, Grader Mntd	Width	to 10 Ft	0	Include Grader for total cost	hour	$ 28.28
8451	Plow, Snow, Grader Mntd	Width	to 14 Ft	0	Include Grader for total cost	hour	$ 33.21

8452	Plow, Truck Mntd	Width	to 15 Ft	0	Include truck for total cost	hour	$ 25.23
8453	Plow, Truck Mntd	Width	to 15 Ft	0	With leveling wing. Include truck for total cost	hour	$ 41.04
8455	Spreader, Sand	Mounting	Tailgate, Chassis	0	Truck not included	hour	$ 8.24
8456	Spreader, Sand	Mounting	Dump Body	0	Truck not included	hour	$ 10.55
8457	Spreader, Sand	Mounting	Truck (10yd)	0	Truck not included	hour	$ 13.41
8458	Spreader, Chemical	Capacity	5 CY	to 4	Trailer & truck mounted.	hour	$ 6.30
8469	Pump - Trash Pump	10 MTC	2" Pump	to 7	10,000 gph	hour	$ 7.87
8470	Pump	Centrifugal, 8M pump	2" - 10,000 gal/hr.	to 4.5	Hoses not included.	hour	$ 6.31
8471	Pump	Diaphragm pump	2" - 3,000 gal/hr.	to 6	Hoses not included.	hour	$ 6.98
8472	Pump	Centrifugal, 18M pump	3" - 18,000 gal/hr. pump	to 10	Hoses not included.	hour	$ 8.05
8473	Pump			to 15	Hoses not included.	hour	$ 12.08
8474	Pump			to 25	Hoses not included.	hour	$ 13.77
8475	Pump			to 40	Hoses not included.	hour	$ 16.98
8476	Pump	4" - 40,000 gal/hr.	4" - 40,000 gal/hr.	to 60	Hoses not included.	hour	$ 27.45
8477	Pump			to 95	Hoses not included.	hour	$ 32.77
8478	Pump			to 140	Hoses not included.	hour	$ 41.84
8479	Pump			to 200	Hoses not included.	hour	$ 50.79
8480	Pump			to 275	Does not include Hoses.	hour	$ 68.33
8481	Pump			to 350	Does not include Hoses.	hour	$ 81.66
8482	Pump			to 425	Does not include Hoses.	hour	$ 99.01
8483	Pump			to 500	Does not include Hoses.	hour	$ 117.21
8484	Pump			to 575	Does not include Hoses.	hour	$ 136.53
8485	Pump			to 650	Does not include Hoses.	hour	$ 154.88
8486	Aerial Lift, Truck Mntd	Max. Platform Height	40 Ft		Add this rate to truck rate for total lift and truck rate	hour	$ 11.63
8487	Aerial Lift, Truck Mntd	Max. Platform Height	61 Ft		Add this rate to truck rate for total lift and truck rate	hour	$ 21.99
8488	Aerial Lift, Truck Mntd	Max. Platform Height	80 Ft		Add this rate to truck rate for total lift and truck rate	hour	$ 39.80
8489	Aerial Lift, Truck Mntd	Max. Platform Load - 600Lbs	81 Ft -100 Ft. Ht.		Articulated and Telescoping. Add this rate to truck rate for total lift and truck rate	hour	$ 42.16
8490	Aerial Lift, Self-Propelled	Max. Platform Height	37 Ft. Ht.	to 15	Articulated, Telescoping, Scissor.	hour	$ 9.02
8491	Aerial Lift, Self-Propelled	Max. Platform Height	60 Ft. Ht.	to 30	Articulated, Telescoping, Scissor.	hour	$ 17.39
8492	Aerial Lift, Self-Propelled	Max. Platform Height	70 Ft. Ht.	to 50	Articulated, Telescoping, Scissor.	hour	$ 31.57
8493	Aerial Lift, Self-Propelled	Max. Platform Height	125 Ft. Ht.	to 85	Articulated and Telescoping.	hour	$ 56.70
8494	Aerial Lift, Self-Propelled	Max. Platform Height	150 Ft. Ht.	to 130	Articulated and Telescoping.	hour	$ 73.90
8495	I.C. Aerial Lift, Self-Propelled	Max. Platform Load - 500 Lbs	75"x155", 40Ft Ht.	to 80	2000 Lbs Capacity	hour	$ 29.71
8496	Crane, Truck Mntd	Max. Lift Capacity	24000 Lbs	0	Include truck rate for total cost	hour	$ 16.54
8497	Crane, Truck Mntd	Max. Lift Capacity	36000 Lbs	0	Include truck rate for total cost	hour	$ 23.17
8498	Crane, Truck Mntd	Max. Lift Capacity	60000 Lbs	0	Include truck rate for total cost	hour	$ 37.46
8499	Pump - Trash-Pump	CPB Rating - 10MTC	10000 gal/Hr	7	Self- Priming Trash Pump	hour	$ 7.76
8500	Crane	Max. Lift Capacity	8 MT	to 80		hour	$ 40.75
8501	Crane	Max. Lift Capacity	15 MT	to 150		hour	$ 67.83
8502	Crane	Max. Lift Capacity	50 MT	to 200		hour	$ 93.95
8503	Crane	Max. Lift Capacity	70 MT	to 300		hour	$ 180.23
8504	Crane	Max. Lift Capacity	110 MT	to 350		hour	$ 258.23
8510	Saw, Concrete	Blade Diameter	14 In	to 14		hour	$ 7.62
8511	Saw, Concrete	Blade Diameter	26 In	to 35		hour	$ 12.47
8512	Saw, Concrete	Blade Diameter	48 In	to 65		hour	$ 26.81
8513	Saw, Rock	Blade Diameter		to 100		hour	$ 35.13
8514	Saw, Rock	Blade Diameter		to 200		hour	$ 68.85
8517	Jackhammer (Dry)	Weight Class	25-45 Lbs	0	Pneumatic Powered	hour	$ 1.77
8518	Jackhammer (Wet)	Weight Class	30-55 Lbs	0	Pneumatic Powered	hour	$ 2.02
8521	Scraper	Scraper Capacity	15 CY	to 262		hour	$ 133.80
8522	Scraper	Scraper Capacity	22 CY	to 365		hour	$ 174.30
8523	Scraper	Scraper Capacity	34 CY	to 500		hour	$ 322.77

8524	Scraper	Scraper Capacity	44 CY	to 604		hour	$	354.84
8540	Loader, Skid-Steer	Operating Capacity	976 - 1250 Lbs	to 36		hour	$	26.83
8541	Loader, Skid-Steer	Operating Capacity	1751 - 2200 Lbs	to 66		hour	$	35.47
8542	Loader, Skid-Steer	Operating Capacity	2901 to 3300 Lbs	to 81		hour	$	38.72
8550	Snow Blower, Truck Mntd	Capacity	600 Tph	to 75	Does not include truck	hour	$	35.39
8551	Snow Blower, Truck Mntd	Capacity	1400 Tph	to 200	Does not include truck	hour	$	94.72
8552	Snow Blower, Truck Mntd	Capacity	2000 Tph	to 340	Does not include truck	hour	$	143.88
8553	Snow Blower, Truck Mntd	Capacity	2500 Tph	to 400	Does not include truck	hour	$	156.93
8558	Snow Thrower, Walk Behind	Cutting Width	25 in	to 5		hour	$	2.97
8559	Snow Thrower, Walk Behind	Cutting Width	60 in	to 15		hour	$	14.47
8560	Snow Blower	Capacity	2,000 Tph	to 400		hour	$	234.49
8561	Snow Blower	Capacity	2,500 Tph	to 500		hour	$	256.20
8562	Snow Blower	Capacity	3,500 Tph	to 600		hour	$	285.56
8563	The Vammas 4500	Snow Remover	26ft Plow, 20ft Broom + Airblast	428	Equip with Plow & Broom	hour	$	260.00
8564	The Vammas 5500	RM300	96"W x 20"D	350	Soil Stabilization, Reclaimer	hour	$	212.00
8565	Oshkosh Pavement Sweeper	H-Series		420	Equip with Broom	hour	$	229.00
8569	Dust Control De-Ice Unit	1300-2000 gal	173"Lx98"Wx51"H	5.5	Hydro Pump w/100' 1/2" hose	hour	$	3.54
8570	Loader-Backhoe, Wheel	Loader Bucket Capacity	0.5 CY	to 40	Loader and Backhoe Buckets included.	hour	$	23.95
8571	Loader-Backhoe, Wheel	Loader Bucket Capacity	1 CY	to 70	Loader and Backhoe Buckets included.	hour	$	33.36
8572	Loader-Backhoe, Wheel	Loader Bucket Capacity	1.5 CY	to 95	Loader and Backhoe Buckets included.	hour	$	43.46
8573	Loader-Backhoe, Wheel	Loader Bucket Capacity	1.75 CY	to 115	Loader and Backhoe Buckets included.	hour	$	49.55
8580	Distributor, Asphalt	Tank Capacity Mounted on Trailer	550 Gal	16	burners, insulated tank, and circulating spray bar.	hour	$	14.97
8581	Distributor, Asphalt	Tank Capacity Mounted on Trailer	1000 Gal	38	Truck Mounted. Includes burners, insulated tank, and circulating spray bar. Include truck rate.	hour	$	22.45
8582	Distributor, Asphalt	Tank Capacity Mounted on Truck	4000 Gal		Truck Mounted. Includes burners, insulated tank, and circulating spray bar. Include truck rate.	hour	$	32.52
8583	Distributor	ETNYRE Oil Distributor Model - PB348		300		hour	$	43.57
8584	Distributor	ETNYRE Quad Chip Spreader		280		hour	$	90.67
8590	Trailer, Dump	Capacity	20 CY	0	Does not include Prime Mover.	hour	$	13.13
8591	Trailer, Dump	Capacity	30 CY	0	Does not include Prime Mover.	hour	$	13.37
8600	Trailer, Equipment	Capacity	30 Tons	0		hour	$	16.71
8601	Trailer, Equipment	Capacity	40 Tons	0		hour	$	18.49
8602	Trailer, Equipment	Capacity	60 Tons	0		hour	$	19.30
8603	Trailer, Equipment	Capacity	120 Tons	0		hour	$	30.52
8610	Trailer, Water	Tank Capacity	4000 Gal	0	Includes a centrifugal pump with sump and a rear spraybar.	hour	$	15.85
8611	Trailer, Water	Tank Capacity	6000 Gal	0	Includes a centrifugal pump with sump and a rear spraybar.	hour	$	19.49
8612	Trailer, Water	Tank Capacity	10000 Gal	0	Includes a centrifugal pump with sump and a rear spraybar.	hour	$	22.76
8613	Trailer, Water	Tank Capacity	14000 Gal	0	Includes a centrifugal pump with sump and a rear spraybar.	hour	$	28.39
8614	Truck- Water Tanker	1000 gal. tank		175		hour	$	35.84
8620	Tub Grinder			to 440		hour	$	98.30
8621	Tub Grinder			to 630		hour	$	148.62
8622	Tub Grinder			to 760		hour	$	189.56
8623	Tub Grinder			to 1000		hour	$	332.79
8627	Horizontal Grinder	Model HG6000		630		hour	$	59.12
8628	Stump Grinder	1988 Vermeer SC-112		102		hour	$	48.59
8629	Stump Grinder	24" grinding wheel		110		hour	$	46.31
8630	Sprayer, Seed	Working Capacity	750 Gal	to 30	Trailer & truck mounted. Does not include Prime Mover.	hour	$	14.78
8631	Sprayer, Seed	Working Capacity	1250 Gal	to 50	Trailer & truck mounted. Does not include Prime Mover.	hour	$	19.74
8632	Sprayer, Seed	Working Capacity	3500 Gal	to 115	Trailer & truck mounted. Does not include Prime Mover.	hour	$	32.52
8633	Mulcher, Trailer Mntd	Working Capacity	7 TPH	to 35		hour	$	15.59

8634	Mulcher, Trailer Mntd	Working Capacity	10 TPH	to 55		hour	$	23.12
8635	Mulcher, Trailer Mntd	Working Capacity	20 TPH	to 120		hour	$	33.58
8636	Scraper	Soil Recycler WR 2400	w 317 gal fuel tank	563		hour	$	265.76
8637	Trailer CAT	Double Belly Bottom-dump Trailer	26 CY of soil in one dump	330	13 CY of soil each berry	hour	$	95.10
8638	Rake	Barber Beach Sand Rake 600HDr, towed		0	Towed by Beach vehicle	hour	$	15.78
8639	Chipper	Wildcat 626 Cougar Trommel Screen chipper w belt		125		hour	$	35.38
8640	Trailer, Office	Trailer Size	8' x 24'	0	Cargo Size 16ft	hour	$	2.31
8641	Trailer, Office	Trailer Size	8' x 32'	0	Cargo Size 24ft	hour	$	2.76
8642	Trailer, Office	Trailer Size	10' x 32'	0	Cargo Size 20ft	hour	$	3.69
8643	Trailer	Haz-Mat Equipment trailer	8'x18'	0	Move by Tractor to Location	hour	$	38.88
8644	Trailer, Covered Utility Trailer	(7' X 16')		0	Move by Tractor to Location	hour	$	5.88
8645	Trailer, Dodge Ram	8' x 24' shower trailer- 12 showers		101		hour	$	30.33
8646	Trailer, Dodge	8' x 32' flatbed water	25,000 MGVW	200	4x2-Axle	hour	$	28.60
8650	Trencher			to 40	Walk-behind, Crawler & Wheel Mounted. Chain and Wheel.	hour	$	16.91
8651	Trencher			to 85	Walk-behind, Crawler & Wheel Mounted. Chain and Wheel.	hour	$	29.53
8654	Trencher accessories	2008 Griswold Trenchbox		0		hour	$	1.96
8660	Plow, Cable	Plow Depth	24 in	to 30		hour	$	13.77
8661	Plow, Cable	Plow Depth	36 in	to 65		hour	$	40.07
8662	Plow, Cable	Plow Depth	48 in	to 110		hour	$	44.60
8670	Derrick, Hydraulic Digger	Max. Boom = 60 Ft, 12,000 Ft-Lb Hydraulic	Lift Capacity 15,500 Lbs	275	Includes hydraulic pole alignment attachment. Include truck rate	hour	$	35.07
8671	Derrick, Hydraulic Digger	Max. Boom = 90 Ft, 14000 Ft-Lb Hydraulic	Lift Capacity 26,700 Lbs	310	Includes hydraulic pole alignment attachment. Include truck rate	hour	$	56.12
8672	Movax SP-60	28-32 ton Head	134KW	178	Sonic Sidegrip Vibratory Pile Driver	Hour	$	109.20
8680	Truck, Fire -Industrial -112Ft Ladder Aerial Platform	Pump/Tank Capacity	3000gpm/1000 gal Water or Foam	600	2-1000gpm Nozzles 1-Each side of Platform	Hour	$	198.30
8681	Truck, Fire, Engine Type-1	Pump/Tank Capacity	1000GPM/300gal		Engine, with Pump & Roll	hour	$	140.00
8682	Truck, Fire, Engine Type-2	Pump/Tank Capacity	500GPM/300gal		Engine, with Pump & Roll	hour	$	132.00
8683	Truck, Fire, Ladder(48ft)(Type-III)	Pump/Tank Capacity	150gpm/500gal.	115-149	Hose 1-1/2"D 500' Long	hour	$	119.30
8684	Truck, Fire, Aerial (Cummins IXL9)100Ft Ladder	Pump/Tank Capacity	2000gpm/500gal	450	1500gpm Monitor/nozzle	hour	$	178.00
8685	Truck, Fire, Ladder(48ft)(Type-I)	Pump/Tank Capacity	1000gpm/400gal, 500gpm Master Stream	200-250	Hose 2-1/2"D 1200' Long	hour	$	154.00
8686	Truck, Fire, Ladder(48ft)(Type-II)	Pump/Tank Capacity	500gpm/300gal,	100-199	Hose 2-1/2"D 1000' Long	hour	$	131.50
8687	Truck, Fire, Support Water Tender S1	Pump/Tank Capacity	300GPM/4000+gal	115-149	S1 Water Tender	hour	$	114.50
8688	Truck, Fire, Support Water Tender S2	Pump/Tank Capacity	200GPM/2500+gal		S2 Water Tender	hour	$	103.50
8689	Truck, Fire, Support Water Tender S3	Pump/Tank Capacity	200GPM/1000+gal		S3 Water Tender	hour	$	79.00
8690	Truck, Fire - Water Tender	Pump Capacity	1000 GPM @150 psi			hour	$	70.33
8691	Truck, Fire, Tanker	Pump/Tank Capacity	1250 GPM/2500 gal	500		hour	$	74.57
8692	Truck, Fire, Pumper	Pump/Tank Capacity	1500 GPM/1000 gal	500		hour	$	81.10
8693	Truck, Fire, Pumper	Pump Capacity	2000 GPM			hour	$	84.04
8694	Truck, Fire Aerial Ladder (75Ft)	Pump/Tank Capacity	1500GPM/600 gal	475		hour	$	121.00
8695	Truck, Fire Aerial Ladder (150Ft)	Ladder length	150 FT		No Platform,	hour	$	146.43
8696	Truck, Fire (Rescure)	No Ladder		330	Rescure Equipment	hour	$	96.36
8697	Truck, Fire, Tactical Water Tender T1	Pump/Tank Capacity	250GPM/2000+gal	175		hour	$	119.50
8698	Truck, Fire, Tactical Water Tender T2	Pump/Tank Capacity	250GPM/1000+gal			hour	$	102.67
8699	Truck, Fire, Engine Type-3	Pump/Tank Capacity	150GPM/500gal		Engine, with Pump & Roll	hour	$	126.50
8700	Truck, Flatbed	Maximum Gvw	15000 Lbs	to 200	Diesel Engine	hour	$	25.46
8701	Truck, Flatbed	Maximum Gvw	25000 Lbs	to 275	Gasoline Engine	hour	$	40.36
8701-1	Truck, Flatbed	Maximum Gvw	25000 Lbs	200	Diesel Engine	hour	$	28.55
8702	Truck, Flatbed	Maximum Gvw	30000 Lbs	217	Diesel Engine	hour	$	32.90
8703	Truck, Flatbed	Maximum Gvw	45000 Lbs	to 380	Diesel Engine	hour	$	52.73
8708	Trailer, semi	48ft to 53ft, flat-bed, freight, two axle	50,000+ gvwr	0		hour	$	8.67
8709	Trailer, semi	enclosed 48 ft to 53 ft, two axles	50,000+ gvwr	0	Enclosed	hour	$	9.82
8710	Trailer, semi	28ft, single axle, freight	25,000 gvwr	0		hour	$	10.01

8711	Flat bed utility trailer	6 ton		0		hour	$	3.21
8712	Cleaner, Sewer/Catch Basin	Hopper Capacity	5 CY	50	Truck Mounted. (350 gal)	hour	$	25.51
8713	Cleaner, Sewer/Catch Basin	Hopper Capacity	14 CY	60	Truck Mounted. (1500 Gal)	hour	$	32.02
8714	Vactor-Combined Sewer Cleaning	800 Gal Spoils/400 Gal Water	500/800 gal	190	with water & waste Tanks	hour	$	85.10
8714-1	Vector Combine Vaccum Truck	1500 gal Water	15 Cu Yd	330	with water & waste Tanks	hour	$	86.94
8715	Truck, Hydro Vac	model LP555DT	36 - Hp pump	36	Towed by tractor	hour	$	18.50
8716	Leaf Vac	Tow by Truck 22,000 cfm capacity		85	Leaf Vac + Truck Code 8811	hour	$	52.93
8717	Truck, Vacuum	60,000 GVW		400		hour	$	76.72
8719	Litter Picker	model 2007 Barber		0	Towed by tractor	hour	$	9.60
8720	Truck, Dump	Struck Capacity	8 CY	to 220		hour	$	57.70
8721	Truck, Dump	Struck Capacity	10 CY	to 320		hour	$	72.05
8722	Truck, Dump	Struck Capacity	12 CY	to 400		hour	$	79.62
8723	Truck, Dump	Struck Capacity	14 CY	to 400		hour	$	77.50
8724	Truck, Dump, Off Highway	Struck Capacity	28 CY	to 450		hour	$	136.57
8725	Truck, Dump	Struck Capacity	18 CY	to 400		hour	$	91.65
8730	Truck, Garbage	Capacity	25 CY	to 255		hour	$	49.79
8731	Truck, Garbage	Capacity	32 CY	to 325		hour	$	57.06
8733	E-BAM Services	Environmental Beta Attenuation Air Monitor		0	Powered by Solar System	hour	$	3.07
8734	Attenuator, safety	that can stop a vehicle at 60 mph		0		hour	$	5.64
8735	Truck, Attenuator	2004 Truck Mounted for 60 mph		0		hour	$	3.89
8736	Truck, tow	1987 Chevy Kodiak 70		175		hour	$	28.73
8744	Van, Custom	Special Service Canteen Truck		350		hour	$	18.35
8745	Van, step	model MT10FD		300		hour	$	22.05
8746	Van-up to 15 passenger	light duty, class 1		225-300		hour	$	20.48
8747	Van-up to 15 passenger	light duty, class 2		225-300		hour	$	20.77
8748	Van-cargo	light duty, class 1		225 - 300		hour	$	22.44
8749	Van-cargo	light duty, class 2		225-300		hour	$	22.68
8750	Vehicle, Small			to 30		hour	$	6.41
8753	Vehicle, Recreational			to 10		hour	$	2.87
8754	Motor Coach	GVW=50534	56 Passenger + 1-Driver	430	Passenger Transportation	Hour	$	63.94
8755	Golf Cart	Capacity	2 person	0	Battery operated	hour	$	3.80
8770	Welder, Portable			to 16	Includes ground cable and lead cable.	hour	$	4.11
8771	Welder, Portable			to 34	Includes ground cable and lead cable.	hour	$	7.21
8772	Welder, Portable			to 50	Includes ground cable and lead cable.	hour	$	13.66
8773	Welder, Portable			to 80	Includes ground cable and lead cable.	hour	$	13.75
8780	Truck, Water	Tank Capacity	2500 Gal	to 175	Include pump and rear spray system.	hour	$	31.05
8781	Truck, Water	Tank Capacity	4000 Gal	to 250	Include pump and rear spray system.	hour	$	56.57
8788	Container & roll off truck	Roll off Truck	30 yds,	200	Roll-off-Truck only	hour	$	23.73
8789	Truck, Tractor	1997 Freightliner F120		430		hour	$	56.81
8790	Truck, Tractor	4 x 2	25000 lbs	to 210		hour	$	43.43
8791	Truck, Tractor	4 x 2	35000 lbs	to 330		hour	$	47.57
8792	Truck, Tractor	6 x 2	45000 lbs	to 360		hour	$	52.98
8794	Truck, freight	Enclosed w/lift gate. Medium duty class 5	gvwr 16000-19500 Lbs	200	4 X 2 Axle (D)	hour	$	27.25
8795	Truck, backhoe carrier	Three axle, class 8, heavy duty	over 33000Lbs	280		hour	$	34.56
8796	Truck, freight	Eenclosed w/lift gate. Heavy duty, class 7	26,001 to 33,000 lbs gvwr	217	4 X 2 Axle (D)	hour	$	31.43
8798	Truck	Tilt and roll-back, two axle, class 7 heavy duty,	to 33,000 gvwr	217	4 X 2 Axle (D)	hour	$	32.13
8799	Truck,	Tilt and roll back, three axle. class 8 heavy duty	over 33,001+ gvwr	280	6 X 4 Axle (D)	hour	$	42.33
8800	Truck, Pickup				When transporting people.	mile	$	0.545
8801	Truck, Pickup	1/2-ton Pickup Truck	4x2-Axle	160		hour	$	12.78
8802	Truck, Pickup	1-ton Pickup Truck	4x2-Axle	234		hour	$	17.91
8803	Truck, Pickup	1 1/4-ton Pickup Truck	4x2-Axle	260		hour	$	21.10
8804	Truck, Pickup	1 1/2-ton Pickup Truck	4x2-Axle	300		hour	$	23.22

8805	Truck, Pickup	1 3/4-ton Pickup Truck	4x2-Axle	300		hour	$ 24.85
8806	Truck, Pickup	3/4-ton Pickup Truck	4x2-Axle	165		hour	$ 14.32
8807	Truck, Pickup	3/4-ton Pickup Truck	4x4-Axle	285	Crew	hour	$ 22.64
8808	Truck, Pickup	1-ton Pickup Truck	4x4-Axle	340	Crew	hour	$ 22.99
8809	Truck, Pickup	1 1/4-ton Pickup Truck	4x4-Axle	360	Crew	hour	$ 26.55
8810	Truck, Pickup	1 1/2-ton Pickup Truck	4x4-Axle	362	Crew	hour	$ 26.82
8811	Truck, Pickup	1 3/4-ton Pickup Truck	4x4-Axle	362	Crew	hour	$ 27.55
8820	Skidder accessory	2005 JCB Grapple Claw		0		hour	$ 1.75
8821	Forklift, accessory	2005 ACS Grapple Bucket		0		hour	$ 1.56
8822	Truck, Loader	Debris/Log (Knuckleboom Loader/Truck)		230		hour	$ 53.22
8823	Chipper- Wood Recycler	Cat 16 engine		700		hour	$ 118.50
8824	Skidder	model Cat 525B		up to 160		hour	$ 64.79
8825	Skidder	40K lbs- model Cat 525C		161 and up		hour	$ 128.67
8840	Truck, service	fuel and lube	up to 26,000 gvwr	215-225		hour	$ 40.19
8841	Truck, fuel	2009 International 1,800 gal. storage tank		200		hour	$ 32.01
8842	Mobile Command Trailer	(8' X 28') with 7.5 KW Generator		0	Move to Location by Tractor	hour	$ 14.73
8843	Mobile Response Trailer	(8' X 31') with 4.5 KW Generator?		0	Move to Location by Tractor	hour	$ 13.87
8844	Mobile Command Center	(unified) (RV) Ultimaster MP-35	43 FT Long with Generator	400		hour	$ 86.10
8845	Mobile Command Post Vehicle	(RV) (In- Motion)	22-Ft Long	340		hour	$ 31.55
8846	Mobile Command Post Vehicle	(RV) (Stationary) w/9.6 KW Generator	22-Ft Long	340		hour	$ 20.33
8847	Mobile Command Center (Trailer)	48'x8' Trailer, Fully Equiped Mobile Command Center	48-Ft Long	0	Move to Location by Tractor	hour	$ 31.69
8848	Mobile Command Center (Trailer)	48'x8' When being Moved w/Truck Tractor		310		hour	$ 50.69
8849	Mobile Command Center	43'x8.5' x 13.5'H with self 30kw Generator		280	Generator Rate not included	hour	$ 55.37
8850	Mobile Command Center	2007-Freightliner MT-55, (RV)		260		hour	$ 47.12
8851	Mobile Command Van	1990- Ford Econoline- Communication Van		230	Communication Equipment	hour	$ 42.78
8852	Mobile Command Center	47.5' X 8.75 Fully Equip' (In motion) (RV)		410		hour	$ 68.04
8853	Mobile Command Center	47.5' X 8.75 Fully Equip' (Stationary)		410		hour	$ 45.89
8854	Mobile Command Vehicle	53' X 8.75 Fully Equip		480-550		hour	$ 98.84
8870	Light Tower	Terex/Amida AL 4000. with (4) 500 watt lights	w/10kw power unit	13.5		hour	$ 11.11
8871	Light Tower	2004 Allmand				hour	$ 6.93
8872	SandBagger Machine	(Spider) automatic	w/Vibration & Conveyor Motors	2-4.5		hour	$ 49.42
8900	Helicopter	OH-58 KIOWA (Military) is the same as "Bell-206B3		420		hour	$ 467.00
8901	Helicopter	OH-58 KIOWA (Military) is the same as "Bell-206BR		420		hour	$ 489.00
8902	Helicopter	Model Bell 206-L3 Jet Range Helicopter		650	Jet Range III-Helicopter	hour	$ 575.00
8903	Helicopter	Model Bell 206L1 Long Ranger		650	Long Ranger	hour	$ 585.47
8904	Helicopter	Model Bell 206LT Long Range Twinranger		450	Twinranger	hour	$ 763.30
8905	Helicopter	Model Bell 407 EMS- Ambulance		250		hour	$ 625.35
8906	Piper-Fixed wing	Model Navajo PA-31		310		hour	$ 476.60
8907	Piper-Fixed wing	PA-31-350, Navajo Chieftin twin engine		350		hour	$ 507.20
8908	Sikorsky Helicopter	Model UH-60 (Blackhawk) medium lift	Medium Lift	1890	Fire Fighter Same as 870C	hour	$ 2,974.45
8909	Helicopter	Model UH-A (Blackhawk) Medium lift	Medium Lift	1890	Fire Fighter	hour	$ 5,559.04
8910	Boeing Helicopter	Model CH-47 (Chinook) heavy lift	Heavy Lift	2850	Fire Fighter	hour	$ 10,857.50
8911	Helicopter- light utility	Model Bell 407GX - 7 seater	7-Seaters	675	Passenger Aircraft	hour	$ 620.38
8912	Helicopter- light utility	Modle Bell 206L- 7 seater	7-Seaters	420	Passenger Aircraft	hour	$ 607.92
8913	Helicopter	Model Bell-206L4		726		hour	$ 570.24
8914	King Air 200 Turboprop Aircraft	Blackhawk King Air B200XP61		669		hour	$ 1,318.11
8915	Turboprops Blackhawk Aircraft	Blackhawk Caravan XP42 A		850		hour	$ 738.12
8916	Turboprops Blackhawk Aircraft	King Air C90 XP135 A		550		hour	$ 1,108.33
8917	Aerostar Piston Aircraft	Aerostar 601P		290		hour	$ 466.67
8918	Bell UH -1H Huey Helicopter II	Engine:1 × Lycoming T53-L-11 turboshaft		1100	Travel Range 253 Nautical Miles	hour	$ 1,376.74

8943	Wire Puller Machine	Overhead Wire Pulling Machine		30	Overhead/Underground Wire Pulling Machine	hour	$	20.16
8944	Wire Tensioning Machine	3000 Lbs			Overhead Wire Tensioning Machine	hour	$	14.84
8945	Aerial Lift - 20 Ft High	model 2008 Genie Scissor Lift	1000 Lbs		24 Volt	hour	$	6.44

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Sample Hazardous Materials Cost Recovery Worksheet

General instructions

- Use the Hazardous Materials Cost Recovery Worksheet page to document and calculate cost.
- Document responding unit(s) in Section A: Fees, under Fire Companies. The available options are listed in the Companies page.
- Enter dispatch and assignment complete times and calculate the total time. (Time format example: 00:00 to 23:59.)
- Find the applicable rate using the Price List page and calculate the charge.
- Enter the quantity and type of equipment used in Section B: Materials/Equipment.
- Find the applicable price of the item in the Price List page and calculate the total.
- Enter any other charges in Section B: Other Charges. (This field is generally not used, but available for charges necessary by other city departments. Type in description and cost.)
- Adjustments for Section A: Towards the bottom of the form, enter any adjustments for fees (Section A). The four available options for adjustments are:
  - Adjustment: 30 min waived for extended standby.
  - Adjustment: 1 hour waived for extended standby.
  - Adjustment: Fee waived — materials only.
  - Adjustment: Other — see comments.
- Calculate the total cost based on Sections A, B and C, as well as any adjustments applied.

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Hazardous Materials Cost Recovery Worksheet

Incident Date: ____________________________ **Incident Number:** _______________________

Location: ____

Responsible Company/Individual

Company Name: ____
Individual Name: ____
Address: ____
City, State, Zip: ____
Mailing Address: ____
Phone(s): ____

A. Fees

Fire Companies	Dispatch	Complete	Time	Rate	Charge

B. Materials/Equipment (Replacement Costs)

Quantity	Item Description	Cost Each	Cost Total

C. Other Charges (Charges by other City Departments, etc.)

Item Description	Charges

Section A Fees: _______________________

____
Battalion Chief

Adjustments: _________________________

Section B Materials/Equipment: ________

____
Deputy Chief

Section C Other Charges: _____________

Comments: ___________________________
____

Mandated write-off: __________________

Total Charges: _______________________

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Companies

Fire	Hazmat	Command	Type
Engine 1	Hazmat 71	Car 1	Fire Apparatus
Engine 2	Hazmat 72	Car 2	Full Hazmat
Engine 4	Hazmat 71 & 72	Car 3	Modified Hazmat
Engine 5		Car 4	Command
Engine 7		Car 5	Emergency Mgmt
Engine 8		Car 6	
Engine 10		Car 7	
Engine 11		Car 8	
Engine 14		Car 9	
Engine 17		Car 10	
Engine 18		Car 11	
Engine 19		Car 12	
Engine 20		Car 13	
Engine 21		Car 18	
Engine 23		Car 19	
Engine 40			
Engine 41		Car 42	
Engine 43		Other Car	
Engine 48			
Engine 49			Engine, Ladder or Rescue
Engine 52			
Engine 53			
Engine 55			
Engine 56			
Engine 61			
Engine 63			
Ladder 5			
Ladder 7			
Ladder 10			
Ladder 11			
Ladder 14			
Quint 16			
Ladder 20			
Ladder 21			
Ladder 43			
Ladder 52			
Ladder 57			
Ladder 59			
Rescue 5			
Chem 17			
Foam Tender 19			

Hazmat 71			
Hazmat 72			
Hazmat 71 & 72			
Decon 71			
Truck 71/72			
Air 1			
Car 1			
Car 2			
Car 3			
Car 4			
Car 5			
Car 6			
Car 7			
Car 8			
Car 9			
Car 10			
Car 11			
Car 12			
Car 13			
Car 18			
Car 42			
Car 44			
Other Car			

Price List

20 GAL SPILLFIX POOL	$85.00
66 GAL SPILLFIX POOL	$105.00
150 GAL SPILLFIX POOL	$115.00
SARANEX 23P SUIT (OLD STYLE)	$20.03
TYCHEM SL SUIT	$32.40
TYCHEM BR SUIT	$118.50
M8 PAPER, PKG OF 10 SHEETS	$4.56
M9 TAPE, ROLL	$33.47
M256 KIT, PER TEST	$19.02
AIR PURIFYING RESPIRATOR	$177.75
FILTER CARTRIDGE FOR RESPIRATOR	$32.35
NITRILE GLOVES (GREEN)	$2.65
NEOPRENE GLOVES (YEL/BLUE)	$2.25
BUTYL GLOVES (BLACK)	$27.72
BATA BOOTS (GREEN)	$52.48
BOOT COVERS	$4.50
DUCT TAPE, ROLL	$3.17
CHEM TAPE (YELLOW), ROLL	$17.70
PLUGGING COMPOUND, 1 LB	$3.50
ABSORBENT PADS (2' X 2')	$0.32
ABSORBENT BOOM (10')	$23.00
ABSORBENT MATERIAL (oil dri, per bag)	$10.70
USE OF ELECTRONIC MONITOR (EACH MONITOR)	$50.00
USE OF HAZCAT CLASSIFIER KIT	$25.00
USE OF LEVEL A, ENCAPSULATING SUIT	$375.00
LITMUS PAPER, PER FOOT	$1.35
55 GALLON DRUM	$40.00
FUEL RECOVERY PUMP	$50.00
CLASS B FOAM PER GALLON	$37.50
FOAM FOOTBALL LEAK PLUG	$100.00
FOAM GOLF BALL LEAK PLUG	$50.00
Fire Apparatus	**$175/hr**
Full Hazmat	**$350/hr**
Modified Hazmat	**$175/hr**
Command	**$50/hr**
Emergency Mgmt	**$50/hr**

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Sample Cost Recovery Ordinance

Cost recovery by the fire marshal and responding agencies.

Cost recovery shall be available to the fire marshal and any responding agencies working in conjunction with the fire marshal pursuant to this ordinance.

Cost recovery shall encompass any and all of the following costs and expenses that directly resulted from a hazardous materials incident or a threatened release, and that were directly incurred by the fire marshal and/or other responding agencies when working with the fire marshal:

1. The reasonable and necessary costs incurred for response, incident assessment, control, containment and abatement of a hazardous materials incident or a threatened release.
2. The reasonable costs associated with transportation and storage of hazardous materials, if necessary, for control and containment of a hazardous materials incident or a threatened release.
3. The reasonable and necessary costs of ensuring the safety of the public, both on and off the site of the hazardous materials incident or a threatened release.
4. The reasonable and necessary costs of repairing or replacing equipment damaged or destroyed as a direct result of a hazardous material incident or a threatened release.
5. The reasonable and necessary contract labor and equipment costs, including those allowed to volunteer/combination/career fire departments, directly related to a hazardous material release.
6. The reasonable and necessary overtime costs for time devoted specifically to a hazardous materials incident or a threatened release.
7. The reasonable and necessary costs of disposable materials and supplies consumed and expended as a result of a hazardous materials incident or a threatened release.
8. The reasonable and necessary costs of the decontamination of equipment utilized during and after a hazardous materials incident or a threatened release.
9. The reasonable and necessary laboratory costs associated with analyzing samples taken associated with a hazardous materials incident or a threatened release.

All responding agencies shall keep a detailed record of costs and expenses associated with a hazardous material release or response to a threatened release, including receipts when available.

The fire marshal and responding agencies shall not recover:

1. Costs incurred for fire suppression services that are routinely provided by fire departments within the county.
2. Costs associated with normal wear and tear of equipment used by responding agencies.
3. Any other costs typically incurred by the fire marshal or other responding agencies associated with routine code enforcement or response duties.

A claim by a responding agency for cost recovery from the responsible party as determined based upon investigation, along with any supporting documentation, shall be submitted within thirty (30) days of the incident, or of the discovery of damage to any equipment specifically related to the incident, to the fire marshal. It is the responsibility of each responding agency to fully document and support any claim for reimbursement.

The fire marshal shall forward all claims for reasonable and necessary costs to the responsible party (e.g., transportation) within thirty (30) days. All claims for costs shall be paid by the responsible party within ninety (90) days of their receipt.

Cost recovery shall not be deemed a fee or penalty, as defined within this ordinance.

Any claim for cost recovery may be appealed, in writing by certified mail, return receipt requested, to the Fire Commission. The Fire Commission shall, within twenty-one (21) days of the receipt of the appeal, make a written determination whether the costs were reasonable, necessary and consistent with this article. The written determination shall be provided to the appealing party and shall constitute a final agency determination.

Debriefing Checklist

Be thorough and focus on safety.
Briefing is based on facts, science and circumstances.

- Who: Inclusion of **all** on-scene personnel, no matter their job, agency or discipline.

- What:

  - Gathering of accurate information.
  - Dissemination of accurate information.
  - Designation of a central reporting point for possible exposures.
  - May include Critical Incident Stress Debriefing (CISD) information.
  - Identify additional needs, especially for additional operational periods.

- When: at the end of an operational period or the end of an incident (prior to the release of personnel and equipment).

- Where: at a safe, quiet area either at the scene or at nearby designated location.

- How: via knowledgeable person(s); Hazardous Materials Incident Commander, possibly with Hazardous Materials Safety & Science/Research.

- Why: Hazard communication (29 CFR 1910.1200) requirements include listing materials involved, signs and symptoms of exposure, actions to be taken by individuals and contact person for notification of exposure. On-scene debrief takes the place of the normal workplace "Right to Know."

Note: A sign-in sheet for the debriefing will assist in documentation and compliance.

Debriefing Essentials

- [ ] Advise personnel of chemicals involved.
- [ ] Provide signs and symptoms of exposure.
- [ ] Provide instructions in case of exposure.
- [ ] Provide information on central reporting point for post-incident development of signs/ symptoms of exposure.
- [ ] Provide CISD info if needed.
- [ ] Determine equipment replacement/repair needs.
- [ ] Determine required additional resources if needed.

UNIT 9: ASSESSMENT

TERMINAL OBJECTIVE

The students will be able to:

9.1 Brief the Incident Commander (IC) on the plan, given a hazardous materials/weapons of mass destruction (WMD) scenario with the IC's objectives.

ENABLING OBJECTIVES

The students will be able to:

9.1 Analyze the incident to determine the needs of the response and organize the hazardous materials response team.

9.2 Plan a response within the capabilities and competencies of available personnel, personal protective equipment (PPE) and response equipment.

9.3 Conduct a briefing for hazardous materials response personnel performing functions at the incident.

9.4 Conduct a debriefing for incident response personnel.

9.5 Demonstrate the ability to communicate new information related to hazardous materials/WMD using the principles of a good briefing.

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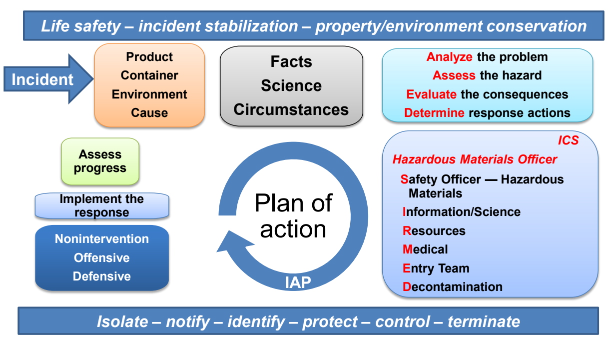
FEMA

U.S. Fire Administration

UNIT 9: ASSESSMENT

Slide 9-1

HAZARDOUS MATERIALS/WEAPONS OF MASS DESTRUCTION RESPONSE INFOGRAPHIC



Slide 9-2

TERMINAL OBJECTIVE

Brief the Incident Commander (IC) on the plan, given a hazardous materials/weapons of mass destruction (WMD) scenario with the IC's objectives.

Slide 9-3

ENABLING OBJECTIVES

- Analyze the incident to determine the needs of the response and organize the hazardous materials response team.
- Plan a response within the capabilities and competencies of available personnel, personal protective equipment (PPE) and response equipment.

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ENABLING OBJECTIVES (cont'd)

- Conduct a briefing for hazardous materials response personnel performing functions at the incident.
- Conduct a debriefing for incident response personnel.
- Demonstrate the ability to communicate new information related to hazardous materials/WMD using the principles of a good briefing.

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ACTIVITY 9.1

Team Project

Purpose

Assess the knowledge and understanding of the information presented in class through a demonstrated exercise.

Directions

1. Work in small groups assigned by the instructor. The instructor will also assign a scenario to each group.

2. In your project team, review the assigned scenario.

3. Implement, evaluate and terminate the incident. This involves:

    a. Analyzing the incident.

    b. Completing the Incident Command System (ICS) Form 208 HM, Site Safety and Control Plan as part of the Incident Action Plan (IAP). Consider the operational mode as offensive.

    c. Conducting a pre-entry briefing.

    d. Evaluating the progress of the response.

    e. Developing an on-scene incident debrief.

    f. Conducting a pre-entry briefing.

    g. Developing and conducting the on-scene incident debrief.

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ACTIVITY 9.1 (cont'd)

Scenarios

Scenario 1 Situation

At 1800 hours on the Fourth of July, your hazardous materials response team is requested to respond to assist the fire investigator at the scene of a commercial building fire. Your hazardous materials team has arrived on the scene to be provided the following situational brief. The fire has been extinguished and overhaul operations are nearly complete. The fire investigator was about to begin the origin-and-cause investigation, but in the course of the interviews with the building/business owner, TLC Lawn Care and Pest Control, it was discovered that the building housed multiple chemicals. The building is a one-story, 50-by-100-foot concrete block building with wooden rafters, asphaltic shingle roof and several garage doors. The entire building has been affected by fire, smoke, water and heat damage.

The remnants of several National Fire Protection Association (NFPA) 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, signs can be seen on the heavily damaged garage doors. Boxes, bags, and plastic and glass bottles can be observed throughout the building, and all are damaged and have spilled their contents. There is a very unpleasant odor coming from the center of the building. There are also boxes, bags and plastic containers that appear intact. The business owner is able to provide you with a list of the chemicals that were in the building at the time of the fire.

Environmental data: The building is on a street of similar commercial storage buildings. All other buildings are unoccupied due to the holiday. There is a creek that runs behind the buildings approximately 20 feet away.

The incident occurs on the Fourth of July. The temperature is currently 85 F (29.4 C) and will drop to an overnight low of 68 F (20 C). Humidity is 90%. It is hazy with winds at 5 to 8 miles per hour (mph) from the west and the threat of a pop-up thunderstorm.

Incident objective:

The Incident Commander (IC) has established the following incident objectives to be implemented by the Hazmat Branch/Group.

- Conduct Recon Mission.
- Identify any hazards present at the incident location.

Scenario 2 Situation

At 0900 hours on a Monday in mid-January, your hazardous materials response team is requested to respond to an unknown liquid and odors coming from a unit at a self-storage facility. Your hazardous materials team has arrived to find a four-story self-storage facility, and the unit in question is an interior unit on the third floor: unit 3302. The first-due fire companies are on the scene and have confirmed that a clear liquid has leaked from under the closed door to the storage unit.

The self-storage manager states that he attempted to call the contact number listed on the unit's rental agreement, but the phone number is no longer in service. A check of records also indicates that this unit has been prepaid for a period of 12 months and was rented six months ago. The manager has the master key to unlock the unit but called the fire department before doing so due to the spilled/leaking liquid.

Environmental data: The building is on the main street through your town. The outside temperature is approximately 20 F (-6.67 C) with a 15 mph wind from the north, but the facility is climate controlled to 72 F (22.2 C). The facility is still currently open to the public and several renters are on site throughout the facility.

Incident objective:

The IC has established the following incident objectives to be implemented by the Hazmat Branch/Group.

- Conduct Recon Mission.
- Identify any hazards present at the incident location.

Scenario 3 Situation

At 0200 hours on a Wednesday in early May, your hazardous materials response team is requested to respond to the three-story dormitory building at the local university. Reports have been received indicating an unknown odor on the second floor with approximately 20 students complaining of difficulty breathing, stinging eyes and burning throats. Your hazardous materials team has arrived to find the building contains 90 two-person dormitory rooms, and the building has been evacuated prior to your arrival via the activation of the fire alarm.

The sergeant of the campus security unit indicates that she has five officers on duty and can request more if needed. She also informs you that it is finals week on campus and that many students have already begun to complain due to the late hour. She also informs you that the president of the university and the chief of campus security are en route and will be on scene in approximately 15 minutes.

First-due fire units and campus security determined that the source of the odors is coming from room 2F, and security officers are attempting to locate the students assigned to that room but have not been successful. The captain of the first-due engine company states that his crew entered the room while wearing turnout gear and self-contained breathing apparatus (SCBA) and noted the following:

There is a large pot on the electric stove that is boiling an unknown, brownish liquid. There is a container labeled protein powder spilled on the kitchen counter. There is a container of table salt spilled next to an open saltshaker on the kitchen counter. There is a hookah on the floor of the bedroom, and there are many pouches of a brown, fibrous material labeled tobacco as well as several 1-gallon, metal containers of acetone on the floor next to the hookah.

Environmental data: The building is on the college campus with an identical building next door. The outside temperature is approximately 60 F (15.5 C) with a 3 mph wind from the north, and it is starting to rain lightly.

Incident objective:

The IC has established the following incident objectives to be implemented by the Hazmat Branch/Group.

- Conduct Recon Mission.
- Identify any hazards present at the incident location.

Scenario 4 Situation

At 1000 hours on a Monday in early August, your hazardous materials response team is requested to respond to the local municipal waste facility for an activated radiation portal alarm. Your hazardous materials team has arrived on the scene to be provided the following situational brief. The garbage truck that tripped the alarm has been put in a remote parking lot and has already dumped its contents into that parking lot. As you arrive, the facility operator runs out to meet you and reports that two sanitation workers from the truck in question have collapsed, and a white cloud can be seen coming from the rear of the truck and the pile of garbage dumped from the truck.

The driver of the truck is located in the bathroom, and interviews with him indicate that they had made only one pickup this morning, but it was at an apartment complex with multiple dumpsters. He is also able to tell you that he was able to read the labels of multiple crushed and damaged containers after he dumped the contents of the garbage truck. Pictures on his phone show two of the labels can be read and are Toluene and Sodium Hydroxide. He planned on complaining to building management due to the large amount of hazardous products found in the trash that also did not appear to be for residential use.

Environmental data: The municipal waste facility is a large property with approximately 10 buildings. The facility is very active at this point in the day with both homeowners in their private vehicles as well as many public and private sanitation vehicles constantly cycling through. You are told it is scheduled to remain this busy until approximately 1400 hours as this is the only municipal waste facility for 50 miles. It is already 90 F (32.2 C), and it is expected to reach 110 F (43.3 C) today. Humidity is 25%, the chance of precipitation is 0%, and there are no appreciable winds.

Incident objective:

The IC has established the following incident objectives to be implemented by the Hazmat Branch/Group.

- Conduct Recon Mission.
- Identify any hazards present at the incident location.

Scenario 5 Situation

At 1000 hours on a Sunday in early April, your hazardous materials response team is requested to respond to a local agricultural/hardware store in the busy downtown area of your town. The incident involves a forklift accident that toppled several racks of storage in the east end of the building. The facility is very busy, especially at the garden supply/nursery area in the west end of the building. The forklift driver is not visibly injured but has been in contact with several of the chemicals that spilled when the storage racks fell and is beginning to complain of itchy skin.

The store manager is busy telling customers that everything is ok, even as those customers are beginning to complain about the odors now permeating the store. The assistant store manager is closing off the first shopping aisle immediately adjacent to the warehouse/storage area.

Your hazardous materials team has arrived to receive a report that several 55-gallon drums as well as cardboard boxes can be seen to have spilled their contents and/or are actively leaking onto several pallets of bagged items.

Environmental data: This “big-box store” has approximately 100,000 square feet of interior space with an additional 30,000 square-foot garden center attached. The store is very busy on this Sunday morning in early spring with hundreds of shoppers present. The store’s climate control is set to 68 F (20 C), and the outside temperature is 72 F (22.2 C) with a high of 80 F (26.7 C) expected later today. Humidity is 50%, the chance of precipitation is 0%, and winds are from the east at 5 mph.

Incident objective:

The IC has established the following incident objectives to be implemented by the Hazmat Branch/Group.

- Conduct Recon Mission.
- Identify any hazards present at the incident location.

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I. COURSE REVIEW

COURSE REVIEW

- Risk-based response process and standard of care.
- Hazardous materials response team organization.
- Developing the plan of action based on facts, science and circumstances.
- Conducting a briefing.
- Implementing the plan.
- Evaluating the progress of the response.
- Terminating the response and debriefing.

Slide 9-7

In this course, we have learned about:

A. Risk-based response process and standard of care (Unit 2: Risk-Based Response Process and Standard of Care).

B. Hazardous materials response team organization (Unit 3: Hazardous Materials Response Team Organization and Incident Command System).

C. Developing the plan of action based on facts, science and circumstances (Unit 4: Developing the Plan of Action).

D. Conducting a briefing (Unit 5: Communicating the Plan).

E. Implementing the plan (Unit 6: Implementing the Plan).

F. Evaluating the progress of the response (Unit 7: Evaluating the Progress of the Response).

G. Terminating the response and debriefing (Unit 8: Terminating the Response).

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ACTIVITY 9.2

Final Exam

Purpose

Assess the knowledge and understanding of the information presented in class.

Directions

1. The instructor will administer the exam.

2. You will have 60 minutes to complete the exam.

3. When you are finished, return the exam to the instructor.

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ACTIVITY 9.3

The Way Forward: Presentation

Purpose

Share new ideas, technologies and/or procedures in management and safety of hazardous materials/weapons of mass destruction (WMD) response.

Directions

1. Your small group (formed in Activity 3.6: The Way Forward Research Group) will present your researched topic to the larger group. Distribute your summary handout to the audience.

2. Answer any questions from the instructor(s) or students.

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II. SUMMARY

FEMA

SUMMARY

U.S. Fire Administration

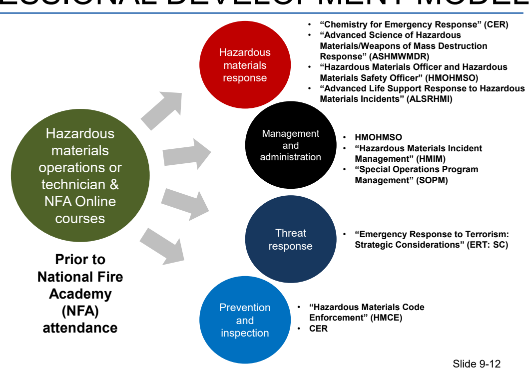
- Course review.
- Hazardous materials professional development model.

Slide 9-10

- What have you learned in this course?
- Do you have any questions?

Slide 9-11

HAZARDOUS MATERIALS PROFESSIONAL DEVELOPMENT MODEL



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APPENDIX A

POST-COURSE ORGANIZATIONAL DISCOVERY ACTIVITY

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Post-Course Organizational Discovery Activity

These reflective questions are provided for you to take back to your organization and apply as you perceive the benefit to your response team. You are encouraged to carefully consider each question and provide your organization with a realistic and accurate response in a comprehensive, formal report or spreadsheet.

Unit 1: Introduction

- Within your organization, discover the level of training of those who may find themselves in command of a hazardous materials/weapons of mass destruction (WMD) incident or assigned as the hazardous materials officer or assistant safety officer for hazardous materials.

- Compile a list of the number of officers, or officer eligible personnel, at the operations or technician level.

Unit 2: Risk-Based Response Process and Standard of Care

- Discover your organization's written standard operating procedures (SOPs) related to hazardous materials/WMD response.

- Discover your organization's written standard operating guidelines (SOGs) related to hazardous materials/WMD response.

- Is your state an "Occupational Safety and Health Administration (OSHA) state," having an OSHA state plan?

- Discover your state's relevant state environmental/hazardous materials regulations. Are you in compliance?

- Is your organization aware of the requirements or expectations of your state's environmental regulations?

- What phone number do you call to contact your state office of environmental/hazardous materials regulation?

- What is the phone number of the local/county/regional health department?

- Who is the chair of your Local Emergency Planning Committee (LEPC)?

- How do you contact your local LEPC?

- Is anyone in your organization on the LEPC? The State Education Resource Center? Who is it?
- Where does your LEPC meet and when?
- Has your response team trained on the requirements for emergency response found in 29 Code of Federal Regulations (CFR) 1910.120 (q)?
- Has your response team trained on the requirements for emergency response found in National Fire Protection Association (NFPA) 470, *Hazardous Materials/Weapons of Mass Destruction (WMD) Standard for Responders*?
- Has your response team trained on the definition of risk-based response and does the team understand the process?
- Has your response team used the risk-based response to analyze, plan, implement and evaluate scenarios in tabletop or field exercises?

Unit 3: Hazardous Materials Response Team Organization and Incident Command System

- Is your team proficient in using the current Emergency Response Guidebook (ERG)? If not, when can training be arranged?
- Does your organization train any responders to an "Operations Plus" level (e.g., vapor-tight personal protective equipment (PPE), victim rescue and recovery, and/or detection and monitoring)?
- Does your organization need more responders trained to a specific level? If yes, which level and when can training be arranged?
- Do your technicians need specialty training based on the mission or target hazards in your jurisdiction? If yes, when can training be arranged?
- How many of your team members have not received hazardous materials/WMD chemistry or advanced science training?
- Have you considered sponsoring a National Fire Academy (NFA) course for regional or local training?
- How do you arrange to have NFA courses delivered locally/regionally?
- What state certifications do you require for members of your hazardous materials/WMD response team?

- Does your organization, your mutual aid agencies, your hazardous materials response regional teams or state response organization require any credentialing for participation in an emergency response? Should they if they do not?
- How would you implement a credentialing process in your area?
- How is your team funded?
- Are there any funding sources, partnerships and/or services-in-kind that are available that are not being utilized? How can you access them?
- Who controls your response team's budget?
- What is the annual budget allotted to your response team?
- What is your organization's mission statement?
- Does your response team have a mission statement?
- What level of response does your administration expect from your team?
- Who is the point of contact for the railroad or railyard in your jurisdiction? How do I contact them?
- Have you considered inviting a chemist or product or facility specialist to your team to fill the role of a technical advisor to the hazardous materials officer?
- What Federal Emergency Management Agency (FEMA) typing level (1, 2, 3 or 4) is your response team?
    - Minimum personnel.
    - Capabilities.
    - Field presumptive testing and field screening.
    - Air monitoring.
    - Substance detection and monitoring.
    - Radiation detection and monitoring.
    - PPE.
    - Technical referencing.
    - Communications.
- What type of FEMA team does your community realistically need?
- Does your organization have a rehabilitation unit/apparatus and policy?

- Does your organization have medical evaluation action levels, in policy, for participation in the response (e.g., heart rate, blood pressure, body temperature, respiratory rate, weight, electrocardiogram (EKG) (3 Lead), etc.)? If not, should you institute these action levels for your team?

Unit 4: Developing the Plan of Action

- Have you shared Handout 1-1: Hazardous Materials/Weapons of Mass Destruction Response Infographic with your organization and provided training associated with its guidance for field use?

- Does your organization understand the elements of the three operational modes as set forth in NFPA 470: non-intervention, defensive and offensive?

- What are the minimum Incident Command System (ICS) forms required by your organization that would constitute an effective Incident Action Plan (IAP)?

- Where do you find ICS forms and how are they filled out in your organization?

- Is your organization familiar with the use and execution of ICS Form 208 HM, Site Safety and Control Plan?

- Does your team understand how to calculate the foam requirements for any given spill scenario?

- Where can large quantities of foam be found? How would you access it? What type of foam is it? What materials will the foam work on? What is the lead time between order and arrival of foam resources?

- Would the supplied Foam Considerations and Calculations found in the Supplemental Materials of Unit 4 be beneficial as a training tool?

- Would the supplied Hazardous Materials Technology Job Aid in the Supplemental Materials of Unit 4 listing the applications, limitations and capabilities of the various detection and monitoring technologies be beneficial as a training tool for your organization?

- Does your response team understand the new NFPA standards as they relate to PPE for hazardous materials/WMD response (Class 1, 2, 3 and 4)?

Unit 5: Communicating the Plan

- Does your organization have a checklist for each position within the hazardous materials/ WMD group pertaining to:
  - Unit briefings.
  - Group briefings.
  - Pre-entry briefings.
  - Post-entry debriefings.
  - Incident debriefings.
- Does your response team train on and practice using briefing checklists and conducting various briefings?
- Does your organization have prepared agendas for each briefing?

Unit 6: Implementing the Plan

Has your team identified the minimum qualifications, roles and responsibilities of the hazardous materials/WMD group?

- Hazardous materials/WMD officer.
- Assistant safety officer for hazardous materials/WMD.
- Information/science/technical reference.
- Resources unit leader.
- Medical unit leader.
- Entry unit leader.
- Decontamination unit leader.

Unit 7: Evaluating the Progress of the Response

- Does your organization have the capability to model a plume?
- Do you have multiple people proficient at implementing a plume model?
- Do you have the capability to monitor current weather conditions?
- Do you know how to contact the local weather center or access weather information via technology that provides an hourly forecast?
- Does your team have multiple people trained and proficient at maintaining and operating the detection and monitoring equipment on your team?

- What is the process, if one exists, to contact local law enforcement support for your incident? What is the procedure?
- Who are the fire battalion chief level counterparts in your law enforcement agency? Do these operational leaders know each other?
- Describe the procedure, if one exists, to contact the local Special Weapons and Tactics (SWAT) Team or Hostage Recovery Team.
- Describe the procedure, if one exists, to contact the local explosives ordinance disposal team.
- Does your team have a designated Public Information Officer (PIO)? Who is it? How do you contact them?
- Does your organization have a "Use of Social Media by On-scene Responders" policy?

Unit 8: Terminating the Response

- Does your organization have a "Termination and Transfer of Command" policy?
- Does your organization have a "Minimum Incident Documentation" policy?
- Does your organization utilize cleanup contractors?
- Does your organization have a policy that requires the oversight of contractors on hazardous materials/WMD incidents? Are you required to relinquish oversight of an incident once the contractor arrives?
- Who do you call if you are in need of an arson investigator? What is their contact information?
- Does your response team train on and practice using a debriefing checklist and conducting a debriefing?
- Does your response team train on and practice using a critique checklist and conducting a critique?
- Who would be invited to collect incident documentation and conduct a post-incident analysis (PIA)? Who is it? How do you contact them?
- Does your organization use a cost-recovery process? Is it in organizational policy?
- Is there a jurisdictional ordinance or statute authorizing cost recovery?

- Does your organization have a prepared worksheet specifically for tracking costs in preparation for the cost-recovery process?

- In your organization, who is responsible for tracking the consumable supplies and equipment that needs to be repaired or replaced in preparation for cost recovery?

- Does your organization have the most recent version of the FEMA Schedule of Equipment Rates table?

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APPENDIX B

INCIDENT COMMAND SYSTEM FORMS

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INCIDENT BRIEFING (ICS 201)

1. Incident Name:	**2. Incident Number:**	**3. Date/Time Initiated:** Date: Time:

4. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)**:**

5. Situation Summary and Health and Safety Briefing (for briefings or transfer of command)**:** Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.

6. Prepared by: Name: ________________ Position/Title: ________________ Signature: ________________

ICS 201, Page 1	Date/Time: ______________________________

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	**2. Incident Number:**	**3. Date/Time Initiated:** Date: Time:

7. Current and Planned Objectives:

8. Current and Planned Actions, Strategies, and Tactics:

Time:	Actions:

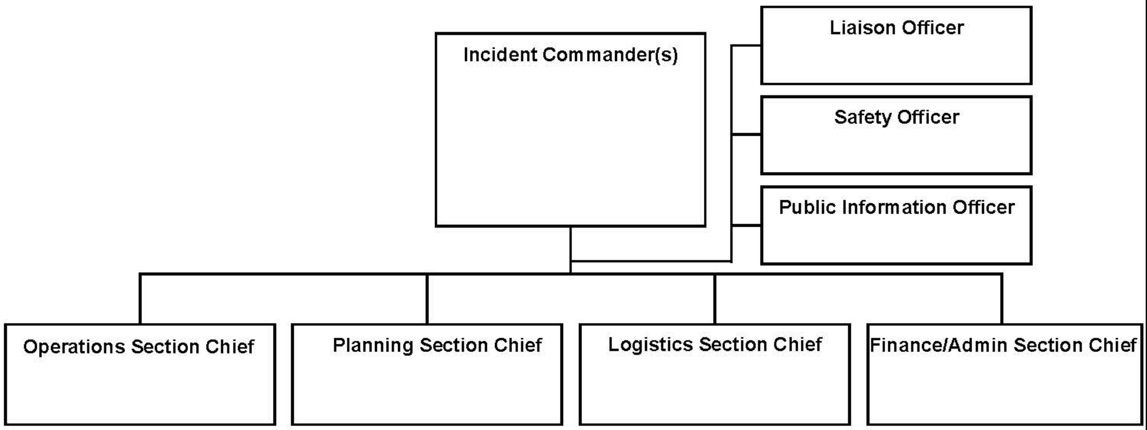
6. Prepared by: Name: ____________________ Position/Title: ____________________ Signature: ____________________

ICS 201, Page 2 Date/Time: ____

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated: Date: Time:

9. Current Organization (fill in additional organization as appropriate)**:**



6. Prepared by: Name: ________________ Position/Title: ________________ Signature: ________________

ICS 201, Page 3 Date/Time: ____

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated: Date: Time:

10. Resource Summary:

Resource	Resource Identifier	Date/Time Ordered	ETA	Arrived	Notes (location/assignment/status)
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	

6. Prepared by: Name: ________________ Position/Title: ________________ Signature: ________________

ICS 201, Page 4 Date/Time: ________________________________

ICS 201
Incident Briefing

Purpose. The Incident Briefing (ICS 201) provides the Incident Commander (and the Command and General Staffs) with basic information regarding the incident situation and the resources allocated to the incident. In addition to a briefing document, the ICS 201 also serves as an initial action worksheet. It serves as a permanent record of the initial response to the incident.

Preparation. The briefing form is prepared by the Incident Commander for presentation to the incoming Incident Commander along with a more detailed oral briefing.

Distribution. Ideally, the ICS 201 is duplicated and distributed before the initial briefing of the Command and General Staffs or other responders as appropriate. The “Map/Sketch” and “Current and Planned Actions, Strategies, and Tactics” sections (pages 1–2) of the briefing form are given to the Situation Unit, while the “Current Organization” and “Resource Summary” sections (pages 3–4) are given to the Resources Unit.

Notes:
- The ICS 201 can serve as part of the initial Incident Action Plan (IAP).
- If additional pages are needed for any form page, use a blank ICS 201 and repaginate as needed.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Incident Number**	Enter the number assigned to the incident.
3	**Date/Time Initiated** • Date, Time	Enter date initiated (month/day/year) and time initiated (using the 24-hour clock).
4	**Map/Sketch** (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)	Show perimeter and other graphics depicting situational status, resource assignments, incident facilities, and other special information on a map/sketch or with attached maps. Utilize commonly accepted ICS map symbology. If specific geospatial reference points are needed about the incident’s location or area outside the ICS organization at the incident, that information should be submitted on the Incident Status Summary (ICS 209). North should be at the top of page unless noted otherwise.
5	**Situation Summary and Health and Safety Briefing (**for briefings or transfer of command): Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.	Self-explanatory.
6	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position/title, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).
7	**Current and Planned Objectives**	Enter the objectives used on the incident and note any specific problem areas.

Block Number	Block Title	Instructions
8	**Current and Planned Actions, Strategies, and Tactics** • Time • Actions	Enter the current and planned actions, strategies, and tactics and time they may or did occur to attain the objectives. If additional pages are needed, use a blank sheet or another ICS 201 (Page 2), and adjust page numbers accordingly.
9	**Current Organization** (fill in additional organization as appropriate) • Incident Commander(s) • Liaison Officer • Safety Officer • Public Information Officer • Planning Section Chief • Operations Section Chief • Finance/Administration Section Chief • Logistics Section Chief	• Enter on the organization chart the names of the individuals assigned to each position. • Modify the chart as necessary, and add any lines/spaces needed for Command Staff Assistants, Agency Representatives, and the organization of each of the General Staff Sections. • If Unified Command is being used, split the Incident Commander box. • Indicate agency for each of the Incident Commanders listed if Unified Command is being used.
10	**Resource Summary**	Enter the following information about the resources allocated to the incident. If additional pages are needed, use a blank sheet or another ICS 201 (Page 4), and adjust page numbers accordingly.
	• Resource	Enter the number and appropriate category, kind, or type of resource ordered.
	• Resource Identifier	Enter the relevant agency designator and/or resource designator (if any).
	• Date/Time Ordered	Enter the date (month/day/year) and time (24-hour clock) the resource was ordered.
	• ETA	Enter the estimated time of arrival (ETA) to the incident (use 24-hour clock).
	• Arrived	Enter an “X” or a checkmark upon arrival to the incident.
	• Notes (location/ assignment/status)	Enter notes such as the assigned location of the resource and/or the actual assignment and status.

INCIDENT OBJECTIVES (ICS 202)

1. Incident Name:	**2. Operational Period:** Date From: Date To: Time From: Time To:
3. Objective(s):	
4. Operational Period Command Emphasis:	
General Situational Awareness	
5. Site Safety Plan Required? Yes ☐ No ☐ **Approved Site Safety Plan(s) Located at:**	
6. Incident Action Plan (the items checked below are included in this Incident Action Plan)**:** ☐ ICS 203 ☐ ICS 207 ☐ ICS 204 ☐ ICS 208 ☐ ICS 205 ☐ Map/Chart ☐ ICS 205A ☐ Weather Forecast/Tides/Currents ☐ ICS 206	Other Attachments: ☐ ______ ☐ ______ ☐ ______ ☐ ______
7. Prepared by: Name: ______ Position/Title: ______ Signature: ______	
8. Approved by Incident Commander: Name: ______ Signature: ______	
ICS 202 **IAP Page** _____	Date/Time: ______

ICS 202
Incident Objectives

Purpose. The Incident Objectives (ICS 202) describes the basic incident strategy, incident objectives, command emphasis/priorities, and safety considerations for use during the next operational period.

Preparation. The ICS 202 is completed by the Planning Section following each Command and General Staff meeting conducted to prepare the Incident Action Plan (IAP). In case of a Unified Command, one Incident Commander (IC) may approve the ICS 202. If additional IC signatures are used, attach a blank page.

Distribution. The ICS 202 may be reproduced with the IAP and may be part of the IAP and given to all supervisory personnel at the Section, Branch, Division/Group, and Unit levels. All completed original forms must be given to the Documentation Unit.

Notes:
- The ICS 202 is part of the IAP and can be used as the opening or cover page.
- If additional pages are needed, use a blank ICS 202 and repaginate as needed.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident. If needed, an incident number can be added.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Objective(s)**	Enter clear, concise statements of the objectives for managing the response. Ideally, these objectives will be listed in priority order. These objectives are for the incident response for this operational period as well as for the duration of the incident. Include alternative and/or specific tactical objectives as applicable. Objectives should follow the SMART model or a similar approach: **S**pecific – Is the wording precise and unambiguous? **M**easurable – How will achievements be measured? **A**ction-oriented – Is an action verb used to describe expected accomplishments? **R**ealistic – Is the outcome achievable with given available resources? **T**ime-sensitive – What is the timeframe?
4	**Operational Period Command Emphasis**	Enter command emphasis for the operational period, which may include tactical priorities or a general weather forecast for the operational period. It may be a sequence of events or order of events to address. This is not a narrative on the objectives, but a discussion about where to place emphasis if there are needs to prioritize based on the Incident Commander's or Unified Command's direction. Examples: Be aware of falling debris, secondary explosions, etc.
	General Situational Awareness	General situational awareness may include a weather forecast, incident conditions, and/or a general safety message. If a safety message is included here, it should be reviewed by the Safety Officer to ensure it is in alignment with the Safety Message/Plan (ICS 208).
5	**Site Safety Plan Required?** Yes ☐ No ☐	Safety Officer should check whether or not a site safety plan is required for this incident.
	Approved Site Safety Plan(s) Located At	Enter the location of the approved Site Safety Plan(s).

Block Number	Block Title	Instructions
6	**Incident Action Plan** (the items checked below are included in this Incident Action Plan): ☐ ICS 203 ☐ ICS 204 ☐ ICS 205 ☐ ICS 205A ☐ ICS 206 ☐ ICS 207 ☐ ICS 208 ☐ Map/Chart ☐ Weather Forecast/ Tides/Currents Other Attachments:	Check appropriate forms and list other relevant documents that are included in the IAP. ☐ ICS 203 – Organization Assignment List ☐ ICS 204 – Assignment List ☐ ICS 205 – Incident Radio Communications Plan ☐ ICS 205A – Communications List ☐ ICS 206 – Medical Plan ☐ ICS 207 – Incident Organization Chart ☐ ICS 208 – Safety Message/Plan
7	**Prepared by** • Name • Position/Title • Signature	Enter the name, ICS position, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).
8	**Approved by Incident Commander** • Name • Signature • Date/Time	In the case of a Unified Command, one IC may approve the ICS 202. If additional IC signatures are used, attach a blank page.

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ORGANIZATION ASSIGNMENT LIST (ICS 203)

1. Incident Name:	2. Operational Period: Date From: Date To: Time From: Time To:

3. Incident Commander(s) and Command Staff:

IC/UCs	
Deputy	
Safety Officer	
Public Info. Officer	
Liaison Officer	

4. Agency/Organization Representatives:

Agency/Organization	Name

5. Planning Section:

Chief	
Deputy	
Resources Unit	
Situation Unit	
Documentation Unit	
Demobilization Unit	
Technical Specialists	

6. Logistics Section:

Chief	
Deputy	
Support Branch	
Director	
Supply Unit	
Facilities Unit	
Ground Support Unit	
Service Branch	
Director	
Communications Unit	
Medical Unit	
Food Unit	

7. Operations Section:

Chief		
Deputy		
Staging Area		
Branch		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Branch		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Branch		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Air Operations Branch		
Air Ops Branch Dir.		

8. Finance/Administration Section:

Chief	
Deputy	
Time Unit	
Procurement Unit	
Comp/Claims Unit	
Cost Unit	

9. Prepared by: Name: ________________ Position/Title: ________________Signature: ________________

ICS 203 | **IAP Page** _____ | Date/Time: ____

ICS 203
Organization Assignment List

Purpose. The Organization Assignment List (ICS 203) provides ICS personnel with information on the units that are currently activated and the names of personnel staffing each position/unit. It is used to complete the Incident Organization Chart (ICS 207) which is posted on the Incident Command Post display. An actual organization will be incident or event-specific. **Not all positions need to be filled.** Some blocks may contain more than one name. The size of the organization is dependent on the magnitude of the incident, and can be expanded or contracted as necessary.

Preparation. The Resources Unit prepares and maintains this list under the direction of the Planning Section Chief. Complete only the blocks for the positions that are being used for the incident. If a trainee is assigned to a position, indicate this with a "T" in parentheses behind the name (e.g., "A. Smith (T)").

Distribution. The ICS 203 is duplicated and attached to the Incident Objectives (ICS 202) and given to all recipients as part of the Incident Action Plan (IAP). All completed original forms must be given to the Documentation Unit.

Notes:

- The ICS 203 serves as part of the IAP.
- If needed, more than one name can be put in each block by inserting a slash.
- If additional pages are needed, use a blank ICS 203 and repaginate as needed.
- ICS allows for organizational flexibility, so the Intelligence/Investigations Function can be embedded in several different places within the organizational structure.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Incident Commander(s) and Command Staff** • IC/UCs • Deputy • Safety Officer • Public Information Officer • Liaison Officer	Enter the names of the Incident Commander(s) and Command Staff. Label Assistants to Command Staff as such (for example, "Assistant Safety Officer"). For all individuals, use at least the first initial and last name. For Unified Command, also include agency names.
4	**Agency/Organization Representatives** • Agency/Organization • Name	Enter the agency/organization names and the names of their representatives. For all individuals, use at least the first initial and last name.
5	**Planning Section** • Chief • Deputy • Resources Unit • Situation Unit • Documentation Unit • Demobilization Unit • Technical Specialists	Enter the name of the Planning Section Chief, Deputy, and Unit Leaders after each position title. List Technical Specialists with an indication of specialty. If there is a shift change during the specified operational period, list both names, separated by a slash. For all individuals, use at least the first initial and last name.

Block Number	Block Title	Instructions
6	**Logistics Section** • Chief • Deputy **Support Branch** • Director • Supply Unit • Facilities Unit • Ground Support Unit **Service Branch** • Director • Communications Unit • Medical Unit • Food Unit	Enter the name of the Logistics Section Chief, Deputy, Branch Directors, and Unit Leaders after each position title. If there is a shift change during the specified operational period, list both names, separated by a slash. For all individuals, use at least the first initial and last name.
7	**Operations Section** • Chief • Deputy • Staging Area **Branch** • Branch Director • Deputy • Division/Group **Air Operations Branch** • Air Operations Branch Director	Enter the name of the Operations Section Chief, Deputy, Branch Director(s), Deputies, and personnel staffing each of the listed positions. For Divisions/Groups, enter the Division/Group identifier in the left column and the individual's name in the right column. Branches and Divisions/Groups may be named for functionality or by geography. For Divisions/Groups, indicate Division/Group Supervisor. Use an additional page if more than three Branches are activated. If there is a shift change during the specified operational period, list both names, separated by a slash. For all individuals, use at least the first initial and last name.
8	**Finance/Administration Section** • Chief • Deputy • Time Unit • Procurement Unit • Compensation/Claims Unit • Cost Unit	Enter the name of the Finance/Administration Section Chief, Deputy, and Unit Leaders after each position title. If there is a shift change during the specified operational period, list both names, separated by a slash. For all individuals, use at least the first initial and last name.
9	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).

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ASSIGNMENT LIST (ICS 204)

1. Incident Name:	**2. Operational Period:** Date From: Date To: Time From: Time To:	**3.** **Branch:** **Division:** **Group:** **Staging Area:**

4. Operations Personnel: Name Contact Number(s)

Operations Section Chief: ____________________

Branch Director: ____________________

Division/Group Supervisor: ____________________

5. Resources Assigned:

Resource Identifier	Leader	# of Persons	Contact (e.g., phone, pager, radio frequency, etc.)	Reporting Location, Special Equipment and Supplies, Remarks, Notes, Information

6. Work Assignments:

7. Special Instructions:

8. Communications (radio and/or phone contact numbers needed for this assignment)**:**

Name/Function	Primary Contact: indicate cell, pager, or radio (frequency/system/channel)
/	
/	
/	
/	

9. Prepared by: Name: __________ Position/Title: __________ Signature: __________

ICS 204 | **IAP Page** _____ | Date/Time: __________

ICS 204
Assignment List

Purpose. The Assignment List(s) (ICS 204) informs Division and Group supervisors of incident assignments. Once the Command and General Staffs agree to the assignments, the assignment information is given to the appropriate Divisions and Groups.

Preparation. The ICS 204 is normally prepared by the Resources Unit, using guidance from the Incident Objectives (ICS 202), Operational Planning Worksheet (ICS 215), and the Operations Section Chief. It must be approved by the Incident Commander, but may be reviewed and initialed by the Planning Section Chief and Operations Section Chief as well.

Distribution. The ICS 204 is duplicated and attached to the ICS 202 and given to all recipients as part of the Incident Action Plan (IAP). In some cases, assignments may be communicated via radio/telephone/fax. All completed original forms must be given to the Documentation Unit.

Notes:
- The ICS 204 details assignments at Division and Group levels and is part of the IAP.
- Multiple pages/copies can be used if needed.
- If additional pages are needed, use a blank ICS 204 and repaginate as needed.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Branch** **Division** **Group** **Staging Area**	This block is for use in a large IAP for reference only. Write the alphanumeric abbreviation for the Branch, Division, Group, and Staging Area (e.g., “Branch 1,” “Division D,” “Group 1A”) in large letters for easy referencing.
4	**Operations Personnel** • Name, Contact Number(s) – Operations Section Chief – Branch Director – Division/Group Supervisor	Enter the name and contact numbers of the Operations Section Chief, applicable Branch Director(s), and Division/Group Supervisor(s).
5	**Resources Assigned**	Enter the following information about the resources assigned to the Division or Group for this period:
	• Resource Identifier	The identifier is a unique way to identify a resource (e.g., ENG-13, IA-SCC-413). If the resource has been ordered but no identification has been received, use TBD (to be determined).
	• Leader	Enter resource leader’s name.
	• # of Persons	Enter total number of persons for the resource assigned, including the leader.
	• Contact (e.g., phone, pager, radio frequency, etc.)	Enter primary means of contacting the leader or contact person (e.g., radio, phone, pager, etc.). Be sure to include the area code when listing a phone number.
5 (continued)	• Reporting Location, Special Equipment and Supplies, Remarks, Notes, Information	Provide special notes or directions specific to this resource. If required, add notes to indicate: (1) specific location/time where the resource should report or be dropped off/picked up; (2) special equipment and supplies that will be used or needed; (3) whether or not the resource received briefings; (4) transportation needs; or (5) other information.

Block Number	Block Title	Instructions
6	**Work Assignments**	Provide a statement of the tactical objectives to be achieved within the operational period by personnel assigned to this Division or Group.
7	**Special Instructions**	Enter a statement noting any safety problems, specific precautions to be exercised, dropoff or pickup points, or other important information.
8	**Communications** (radio and/or phone contact numbers needed for this assignment) • Name/Function • Primary Contact: indicate cell, pager, or radio (frequency/system/channel)	Enter specific communications information (including emergency numbers) for this Branch/Division/Group. If radios are being used, enter function (command, tactical, support, etc.), frequency, system, and channel from the Incident Radio Communications Plan (ICS 205). Phone and pager numbers should include the area code and any satellite phone specifics. In light of potential IAP distribution, use sensitivity when including cell phone number. Add a secondary contact (phone number or radio) if needed.
9	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).

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MEDICAL PLAN (ICS 206)

1. Incident Name:	**2. Operational Period:** Date From: Date To: Time From: Time To:

3. Medical Aid Stations:

Name	Location	Contact Number(s)/Frequency	Paramedics on Site?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

4. Transportation (indicate air or ground)**:**

Ambulance Service	Location	Contact Number(s)/Frequency	Level of Service
			☐ ALS ☐ BLS
			☐ ALS ☐ BLS
			☐ ALS ☐ BLS
			☐ ALS ☐ BLS

5. Hospitals:

Hospital Name	Address, Latitude & Longitude if Helipad	Contact Number(s)/ Frequency	Travel Time		Trauma Center	Burn Center	Helipad
			Air	Ground			
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No

6. Special Medical Emergency Procedures:

☐ Check box if aviation assets are utilized for rescue. If assets are used, coordinate with Air Operations.

7. Prepared by (Medical Unit Leader)**:** Name: ______________________ Signature: ______________________

8. Approved by (Safety Officer)**:** Name: ______________________ Signature: ______________________

ICS 206	**IAP Page** _____	Date/Time: ______________________

ICS 206
Medical Plan

Purpose. The Medical Plan (ICS 206) provides information on incident medical aid stations, transportation services, hospitals, and medical emergency procedures.

Preparation. The ICS 206 is prepared by the Medical Unit Leader and reviewed by the Safety Officer to ensure ICS coordination. If aviation assets are utilized for rescue, coordinate with Air Operations.

Distribution. The ICS 206 is duplicated and attached to the Incident Objectives (ICS 202) and given to all recipients as part of the Incident Action Plan (IAP). Information from the plan pertaining to incident medical aid stations and medical emergency procedures may be noted on the Assignment List (ICS 204). All completed original forms must be given to the Documentation Unit.

Notes:

- The ICS 206 serves as part of the IAP.
- This form can include multiple pages.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Medical Aid Stations**	Enter the following information on the incident medical aid station(s):
	• Name	Enter name of the medical aid station.
	• Location	Enter the location of the medical aid station (e.g., Staging Area, Camp Ground).
	• Contact Number(s)/Frequency	Enter the contact number(s) and frequency for the medical aid station(s).
	• Paramedics on Site? ☐ Yes ☐ No	Indicate (yes or no) if paramedics are at the site indicated.
4	**Transportation** (indicate air or ground)	Enter the following information for ambulance services available to the incident:
	• Ambulance Service	Enter name of ambulance service.
	• Location	Enter the location of the ambulance service.
	• Contact Number(s)/Frequency	Enter the contact number(s) and frequency for the ambulance service.
	• Level of Service ☐ ALS ☐ BLS	Indicate the level of service available for each ambulance, either ALS (Advanced Life Support) or BLS (Basic Life Support).

Block Number	Block Title	Instructions
5	**Hospitals**	Enter the following information for hospital(s) that could serve this incident:
	• Hospital Name	Enter hospital name and identify any predesignated medivac aircraft by name a frequency.
	• Address, Latitude & Longitude if Helipad	Enter the physical address of the hospital and the latitude and longitude if the hospital has a helipad.
	• Contact Number(s)/ Frequency	Enter the contact number(s) and/or communications frequency(s) for the hospital.
	• Travel Time • Air • Ground	Enter the travel time by air and ground from the incident to the hospital.
	• Trauma Center ☐ Yes Level:______	Indicate yes and the trauma level if the hospital has a trauma center.
	• Burn Center ☐ Yes ☐ No	Indicate (yes or no) if the hospital has a burn center.
	• Helipad ☐ Yes ☐ No	Indicate (yes or no) if the hospital has a helipad. Latitude and Longitude data format need to compliment Medical Evacuation Helicopters and Medical Air Resources
6	**Special Medical Emergency Procedures**	Note any special emergency instructions for use by incident personnel, including (1) who should be contacted, (2) how should they be contacted; and (3) who manages an incident within an incident due to a rescue, accident, etc. Include procedures for how to report medical emergencies.
	☐ Check box if aviation assets are utilized for rescue. If assets are used, coordinate with Air Operations.	Self explanatory. Incident assigned aviation assets should be included in ICS 220.
7	**Prepared by** (Medical Unit Leader) • Name • Signature	Enter the name and signature of the person preparing the form, typically the Medical Unit Leader. Enter date (month/day/year) and time prepared (24-hour clock).
8	**Approved by** (Safety Officer) • Name • Signature • Date/Time	Enter the name of the person who approved the plan, typically the Safety Officer. Enter date (month/day/year) and time reviewed (24-hour clock).

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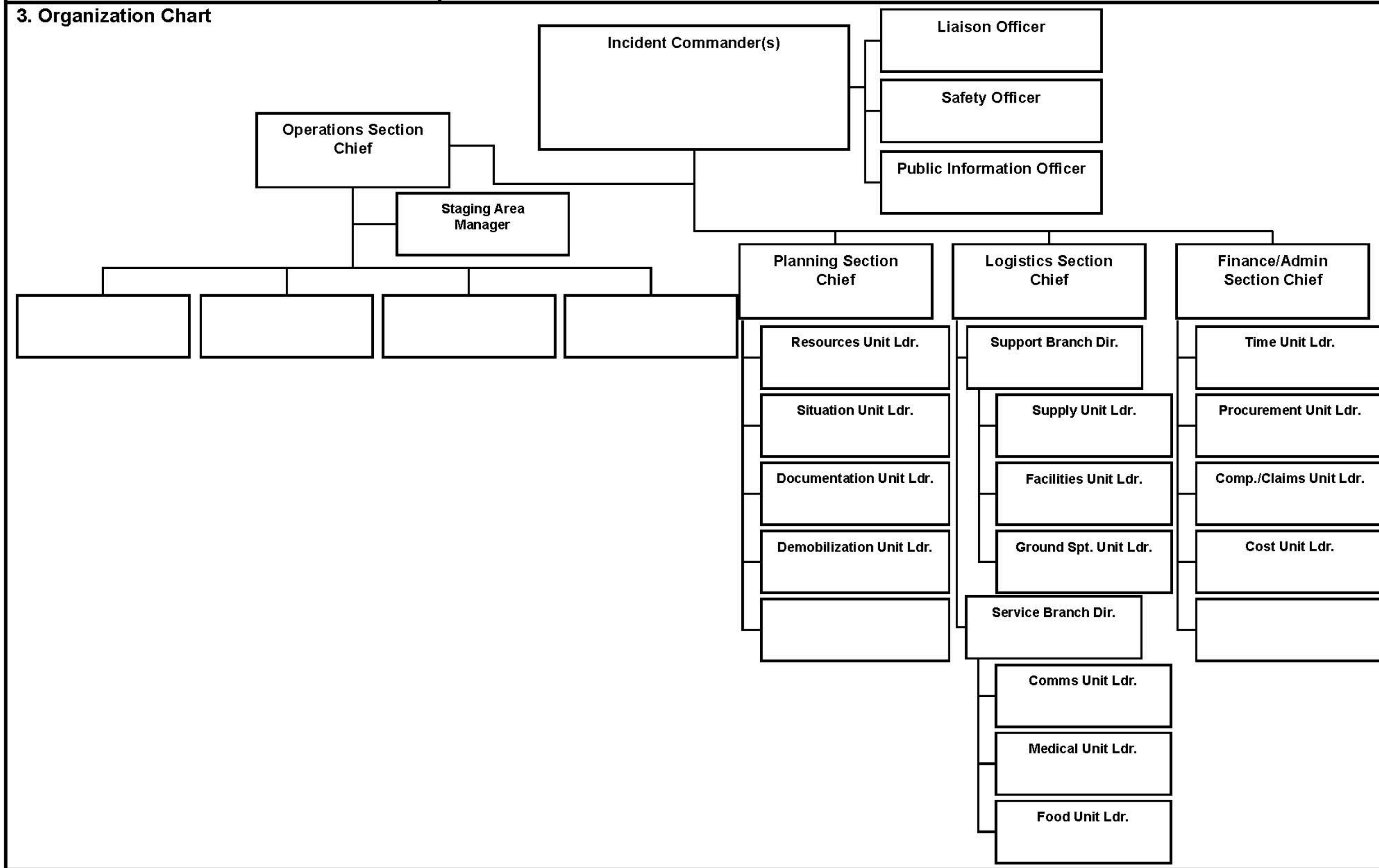
INCIDENT ORGANIZATION CHART (ICS 207)

1. Incident Name:	2. Operational Period: Date From: Date To: Time From: Time To:

3. Organization Chart



ICS 207	IAP Page ___	4. Prepared by: Name:__________ Position/Title: __________ Signature: ___________ Date/Time: _______

ICS 207
Incident Organization Chart

Purpose. The Incident Organization Chart (ICS 207) provides a **visual wall chart** depicting the ICS organization position assignments for the incident. The ICS 207 is used to indicate what ICS organizational elements are currently activated and the names of personnel staffing each element. An actual organization will be event-specific. The size of the organization is dependent on the specifics and magnitude of the incident and is scalable and flexible. Personnel responsible for managing organizational positions are listed in each box as appropriate.

Preparation. The ICS 207 is prepared by the Resources Unit Leader and reviewed by the Incident Commander. Complete only the blocks where positions have been activated, and add additional blocks as needed, especially for Agency Representatives and all Operations Section organizational elements. For detailed information about positions, consult the NIMS ICS Field Operations Guide. The ICS 207 is intended to be used as a wall-size chart and printed on a plotter for better visibility. A chart is completed for each operational period, and updated when organizational changes occur.

Distribution. The ICS 207 is intended to be **wall mounted** at Incident Command Posts and other incident locations as needed, and is not intended to be part of the Incident Action Plan (IAP). All completed original forms must be given to the Documentation Unit.

Notes:

- The ICS 207 is intended to be **wall mounted** (printed on a plotter). Document size can be modified based on individual needs.
- Also available as 8½ x 14 (legal size) chart.
- ICS allows for organizational flexibility, so the Intelligence/Investigative Function can be embedded in several different places within the organizational structure.
- Use additional pages if more than three branches are activated. Additional pages can be added based on individual need (such as to distinguish more Division/Groups and Branches as they are activated).

Block Number	Block Title	Instructions
1	**Incident Name**	Print the name assigned to the incident.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Organization Chart**	• Complete the incident organization chart. • For all individuals, use at least the first initial and last name. • List agency where it is appropriate, such as for Unified Commanders. • If there is a shift change during the specified operational period, list both names, separated by a slash.
4	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).

SAFETY MESSAGE/PLAN (ICS 208)

1. Incident Name:	**2. Operational Period:** Date From: Date To: Time From: Time To:
3. Safety Message/Expanded Safety Message, Safety Plan, Site Safety Plan:	
4. Site Safety Plan Required? Yes ☐ No ☐ **Approved Site Safety Plan(s) Located At:**	
5. Prepared by: Name: ________ Position/Title: ________ Signature: ________	
ICS 208	**IAP Page** _____ Date/Time: ________

ICS 208
Safety Message/Plan

Purpose. The Safety Message/Plan (ICS 208) expands on the Safety Message and Site Safety Plan.

Preparation. The ICS 208 is an optional form that may be included and completed by the Safety Officer for the Incident Action Plan (IAP).

Distribution. The ICS 208, if developed, will be reproduced with the IAP and given to all recipients as part of the IAP. All completed original forms must be given to the Documentation Unit.

Notes:
- The ICS 208 may serve (optionally) as part of the IAP.
- Use additional copies for continuation sheets as needed, and indicate pagination as used.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Safety Message/Expanded Safety Message, Safety Plan, Site Safety Plan**	Enter clear, concise statements for safety message(s), priorities, and key command emphasis/decisions/directions. Enter information such as known safety hazards and specific precautions to be observed during this operational period. If needed, additional safety message(s) should be referenced and attached.
4	**Site Safety Plan Required?** Yes ☐ No ☐	Check whether or not a site safety plan is required for this incident.
	Approved Site Safety Plan(s) Located At	Enter where the approved Site Safety Plan(s) is located.
5	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).

SITE SAFETY AND CONTROL PLAN ICS 208 HM	1. Incident Name:	2. Date Prepared:	3. Operational Period: Time:

Section I. Site Information

4. Incident Location:

Section II. Organization

5. Incident Commander:	6. HM Group Supervisor:	7. Tech. Specialist - HM Reference:
8. Safety Officer:	9. Entry Leader:	10. Site Access Control Leader:
11. Asst. Safety Officer - HM:	12. Decontamination Leader:	13. Safe Refuge Area Mgr:
14. Environmental Health:	15.	16.

17. Entry Team: (Buddy System) Name:	PPE Level	18. Decontamination Element: Name:	PPE Level
Entry 1		Decon 1	
Entry 2		Decon 2	
Entry 3		Decon 3	
Entry 4		Decon 4	

Section III. Hazard/Risk Analysis

19. Material:	Container type	Qty.	Phys. State	pH	IDLH	F.P.	I.T.	V.P.	V.D.	S.G.	LEL	UEL

Comment:

Section IV. Hazard Monitoring

20. LEL Instrument(s):	21. O_2 Instrument(s):
22. Toxicity/PPM Instrument(s):	23. Radiological Instrument(s):

Comment:

Section V. Decontamination Procedures

24. Standard Decontamination Procedures: YES: ☐ NO: ☐

Comment:

Section VI. Site Communications

25. Command Frequency:	26. Tactical Frequency:	27. Entry Frequency:

Section VII. Medical Assistance

28. Medical Monitoring: YES: ☐ NO: ☐ 29. Medical Treatment and Transport In-place: YES: ☐ NO: ☐

Comment:

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Section VIII. Site Map

30. Site Map:

Weather ☐ Command Post ☐ Zones ☐ Assembly Areas ☐ Escape Routes ☐ Other ☐

Section IX. Entry Objectives

31. Entry Objectives:

Section X. SOP S and Safe Work Practices

32. Modifications to Documented SOP s or Work Practices: YES: ☐ NO: ☐

Comment:

Section XI. Emergency Procedures

33. Emergency Procedures:

Section XII. Safety Briefing

34. Asst. Safety Officer - HM Signature:	Safety Briefing Completed (Time):
35. HM Group Supervisor Signature:	36. Incident Commander Signature:

ICS 208 HM Page 2 3/98

INSTRUCTIONS FOR COMPLETING THE SITE SAFETY AND CONTROL PLAN
ICS 208 HM

A Site Safety and Control Plan must be completed by the Hazardous Materials Group Supervisor and reviewed by all within the Hazardous Materials Group prior to operations commencing within the Exclusion Zone.

Item Number	Item Title	Instructions
1.	Incident Name/Number	Print name and/or incident number.
2.	Date and Time	Enter date and time prepared.
3.	Operational Period	Enter the time interval for which the form applies.
4.	Incident Location	Enter the address and or map coordinates of the incident.
5 - 16.	Organization	Enter names of all individuals assigned to ICS positions. (Entries 5 & 8 mandatory). Use Boxes 15 and 16 for other functions: i.e. Medical Monitoring.
17 - 18.	Entry Team/Decon Element	Enter names and level of PPE of Entry & Decon personnel. (Entries 1 - 4 mandatory buddy system and back-up.)
19.	Material	Enter names and pertinent information of all known chemical products. Enter UNK if material is not known. Include any which apply to chemical properties. (Definitions: ph = Potential for Hydrogen (Corrosivity), IDLH = Immediately Dangerous to Life and Health, F.P. = Flash Point, I.T. = Ignition Temperature, V.P. = Vapor Pressure, V.D. = Vapor Density, S.G. = Specific Gravity, LEL = Lower Explosive Limit, UEL = Upper Explosive Limit)
20 - 23.	Hazard Monitoring	List the instruments which will be used to monitor for chemical.
24.	Decontamination Procedures	Check NO if modifications are made to standard decontamination procedures and make appropriate Comments including type of solutions.
25 - 27.	Site Communications	Enter the radio frequency(ies) which apply.
28 - 29.	Medical Assistance	Enter comments if NO is checked.
30.	Site Map	Sketch or attach a site map which defines all locations and layouts of operational zones. (Check boxes are mandatory to be identified.)
31.	Entry Objectives	List all objectives to be performed by the Entry Team in the Exclusion Zone and any parameters which will alter or stop entry operations.
32 - 33.	SOP s, Safe Work Practices, and Emergency Procedures	List in Comments if any modifications to SOP s and any emergency procedures which will be affected if an emergency occurs while personnel are within the Exclusion Zone.
34 - 36.	Safety Briefing	Have the appropriate individual place their signature in the box once the Site Safety and Control Plan is reviewed. Note the time in box 34 when the safety briefing has been completed.

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OPERATIONAL PLANNING WORKSHEET (ICS 215)

1. Incident Name:	2. Operational Period: Date From: Time From:	Date To: Time To:

3. Branch	4. Division, Group, or Other	5. Work Assignment & Special Instructions	6. Resources													7. Overhead Position(s)	8. Special Equipment & Supplies	9. Reporting Location	10. Requested Arrival Time
			Req.																
			Have																
			Need																
			Req.																
			Have																
			Need																
			Req.																
			Have																
			Need																
			Req.																
			Have																
			Need																
			Req.																
			Have																
			Need																
			Req.																
			Have																
			Need																

	11. Total Resources Required													14. Prepared by:
	12. Total Resources Have on Hand													Name: ______ Position/Title: ______
ICS 215	13. Total Resources Need To Order													Signature: ______ Date/Time: ______

ICS 215
Operational Planning Worksheet

Purpose. The Operational Planning Worksheet (ICS 215) communicates the decisions made by the Operations Section Chief during the Tactics Meeting concerning resource assignments and needs for the next operational period. The ICS 215 is used by the Resources Unit to complete the Assignment Lists (ICS 204) and by the Logistics Section Chief for ordering resources for the incident.

Preparation. The ICS 215 is initiated by the Operations Section Chief and often involves logistics personnel, the Resources Unit, and the Safety Officer. The form is shared with the rest of the Command and General Staffs during the Planning Meeting. It may be useful in some disciplines or jurisdictions to prefill ICS 215 copies prior to incidents.

Distribution. When the Branch, Division, or Group work assignments and accompanying resource allocations are agreed upon, the form is distributed to the Resources Unit to assist in the preparation of the ICS 204. The Logistics Section will use a copy of this worksheet for preparing requests for resources required for the next operational period.

Notes:

- This worksheet can be made into a wall mount.
- Also available as 8½ x 14 (legal size) and 11 x 17 chart.
- If additional pages are needed, use a blank ICS 215 and repaginate as needed.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (using the 24-hour clock) and end date and time for the operational period to which the form applies.
3	**Branch**	Enter the Branch of the work assignment for the resources.
4	**Division, Group, or Other**	Enter the Division, Group, or other location (e.g., Staging Area) of the work assignment for the resources.
5	**Work Assignment & Special Instructions**	Enter the specific work assignments given to each of the Divisions/Groups and any special instructions, as required.
6	**Resources**	Complete resource headings for category, kind, and type as appropriate for the incident. The use of a slash indicates a single resource in the upper portion of the slash and a Strike Team or Task Force in the bottom portion of the slash.
	• Required	Enter, for the appropriate resources, the number of resources by type (engine, squad car, Advanced Life Support ambulance, etc.) required to perform the work assignment.
	• Have	Enter, for the appropriate resources, the number of resources by type (engines, crew, etc.) available to perform the work assignment.
	• Need	Enter the number of resources needed by subtracting the number in the “Have” row from the number in the “Required” row.
7	**Overhead Position(s)**	List any supervisory and nonsupervisory ICS position(s) not directly assigned to a previously identified resource (e.g., Division/Group Supervisor, Assistant Safety Officer, Technical Specialist, etc.).
8	**Special Equipment & Supplies**	List special equipment and supplies, including aviation support, used or needed. This may be a useful place to monitor span of control.
9	**Reporting Location**	Enter the specific location where the resources are to report (Staging Area, location at incident, etc.).
10	**Requested Arrival Time**	Enter the time (24-hour clock) that resources are requested to arrive at the reporting location.

Block Number	Block Title	Instructions
11	**Total Resources Required**	Enter the total number of resources required by category/kind/type as preferred (e.g., engine, squad car, ALS ambulance, etc.). A slash can be used again to indicate total single resources in the upper portion of the slash and total Strike Teams/ Task Forces in the bottom portion of the slash.
12	**Total Resources Have on Hand**	Enter the total number of resources on hand that are assigned to the incident for incident use. A slash can be used again to indicate total single resources in the upper portion of the slash and total Strike Teams/Task Forces in the bottom portion of the slash.
13	**Total Resources Need To Order**	Enter the total number of resources needed. A slash can be used again to indicate total single resources in the upper portion of the slash and total Strike Teams/Task Forces in the bottom portion of the slash.
14	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).

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INCIDENT ACTION PLAN SAFETY ANALYSIS (ICS 215A)

1. Incident Name:		**2. Incident Number:**
3. Date/Time Prepared: Date: Time:	**4. Operational Period:** Date From: Date To: Time From: Time To:	
5. Incident Area	**6. Hazards/Risks**	**7. Mitigations**

8. Prepared by (Safety Officer)**:** Name: ______________________ Signature: ______________________

Prepared by (Operations Section Chief)**:** Name: ____________________ Signature: ____________________

ICS 215A | Date/Time: ____

ICS 215A
Incident Action Plan Safety Analysis

Purpose. The purpose of the Incident Action Plan Safety Analysis (ICS 215A) is to aid the Safety Officer in completing an operational risk assessment to prioritize hazards, safety, and health issues, and to develop appropriate controls. This worksheet addresses communications challenges between planning and operations, and is best utilized in the planning phase and for Operations Section briefings.

Preparation. The ICS 215A is typically prepared by the Safety Officer during the incident action planning cycle. When the Operations Section Chief is preparing for the tactics meeting, the Safety Officer collaborates with the Operations Section Chief to complete the Incident Action Plan Safety Analysis. This worksheet is closely linked to the Operational Planning Worksheet (ICS 215). Incident areas or regions are listed along with associated hazards and risks. For those assignments involving risks and hazards, mitigations or controls should be developed to safeguard responders, and appropriate incident personnel should be briefed on the hazards, mitigations, and related measures. Use additional sheets as needed.

Distribution. When the safety analysis is completed, the form is distributed to the Resources Unit to help prepare the Operations Section briefing. All completed original forms must be given to the Documentation Unit.

Notes:

- This worksheet can be made into a wall mount, and can be part of the IAP.
- If additional pages are needed, use a blank ICS 215A and repaginate as needed.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Incident Number**	Enter the number assigned to the incident.
3	**Date/Time Prepared**	Enter date (month/day/year) and time (using the 24-hour clock) prepared.
4	**Operational Period** • Date and Time From • Date and Time To	Enter the start date (month/day/year) and time (24-hour clock) and end date and time for the operational period to which the form applies.
5	**Incident Area**	Enter the incident areas where personnel or resources are likely to encounter risks. This may be specified as a Branch, Division, or Group.
6	**Hazards/Risks**	List the types of hazards and/or risks likely to be encountered by personnel or resources at the incident area relevant to the work assignment.
7	**Mitigations**	List actions taken to reduce risk for each hazard indicated (e.g., specify personal protective equipment or use of a buddy system or escape routes).
8	**Prepared by** (Safety Officer and Operations Section Chief) • Name • Signature • Date/Time	Enter the name of both the Safety Officer and the Operations Section Chief, who should collaborate on form preparation. Enter date (month/day/year) and time (24-hour clock) reviewed.

ACRONYMS

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ACRONYMS

AAR	After-Action Report
ACGIH	American Conference of Governmental Industrial Hygienists Inc.
AEGL	Acute Exposure Guideline Level
AFFF	aqueous film forming foam
AHJ	authority having jurisdiction
ALF	Animal Liberation Front
ALSRHMI	"Advanced Life Support Response to Hazardous Materials Incidents"
AMU	atomic mass unit
ANSI	American National Standards Institute
APIE	Analyze, Plan, Implement, and Evaluate
ARFF	aircraft rescue firefighting
ASHMWMDR	"Advanced Science of Hazardous Materials/Weapons of Mass Destruction Response"
BWA	biological warfare agent
CAR	Critical Application Rate
CER	"Chemistry for Emergency Response"
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CISD	Critical Incident Stress Debriefing
CSI	crime scene investigator

CWA	Clean Water Act
DOT	Department of Transportation
ED	education rate
EKG	electrocardiogram
EMS	emergency medical services
EOC	Emergency Operation Center
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ER	emergency room
ERG	Emergency Response Guidebook
ERT: SC	"Emergency Response to Terrorism: Strategic Considerations"
eV	electron volt
FEMA	Federal Emergency Management Agency
FIBC	flexible intermediate bulk container
FID	Flame Ionization Detector
FMCSA	Federal Motor Carrier Safety Administration
FTIR	Fourier Transform Infrared
FWPCA	Federal Water Pollution Control Act
GC/MS	gas chromatograph/mass spectrometer
GM	Geiger-Müller
gpm	gallons per minute
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCFC	hydrochlorofluorocarbon

HMCE	“Hazardous Materials Code Enforcement”
HMOHMSO	“Hazardous Materials Officer and Hazardous Materials Safety Officer”
HMIM	“Hazardous Materials Incident Management”
HMOSP	“Hazardous Materials Operating Site Practices”
HM RIT	Hazardous Materials Rapid Intervention Team
HVAC	heating, ventilating, and air conditioning
IAB	Interagency Board
IAFF	International Association of Fire Fighters
IAP	Incident Action Plan
IC	Incident Commander
ICS	Incident Command System
IDLH	immediately dangerous to life and health
IED	improvised explosive device
IFSAC	International Fire Service Accreditation Congress
IMS	Ion Mobilization Spectrometry
IP	ionization potential
ISS	Instructional Systems Specialist
JPR	job performance requirement
KSA	knowledge, skills and abilities
LEL	lower explosive limit
LEPC	Local Emergency Planning Committee
LOx	liquid oxygen
LPG	liquefied petroleum gas

MEK	methyl ethyl ketone
mg/m^3	milligrams per cubic meter
mph	miles per hour
NFA	National Fire Academy
NFPA	National Fire Protection Association
NGO	nongovernmental organization
NIMS	National Incident Management System
NIST	National Institute of Standards and Technology
NRC	National Response Center
NVFC	National Volunteer Fire Council
OPA	Oil Pollution Act
ORM	Operational Risk Management
OSHA	Occupational Safety and Health Administration
OSLTF	Oil Spill Liability Trust Fund
PAR	Personnel and Accountability Report
PCR	Polymerase chain reaction
PERO	post-emergency response operations
PIA	post-incident analysis
PID	photoionization detector
PIO	Public Information Officer
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million

PRV	pressure relief valve
RCRA	Resource Conservation and Recovery Act
RH	relative humidity
RIID	radioisotope identification device
RIT	Rapid Intervention Team
RPT	Rapid Phase Transition
SAFER	Safety and Fitness Electronic Records
SARA	Superfund Amendments and Reauthorization Act
SAW	Student Activity Worksheet
SCBA	self-contained breathing apparatus
SDS	Safety Data Sheet
SEP	Supplemental Environmental Project
SERC	State Emergency Response Commission
SFPE	Society of Fire Protection Engineers
SIRMED	Hazardous Materials, Information/Science Resources, Medical, Entry Team, Decontamination
SM	Student Manual
SME	subject matter expert
SOG	standard operating guideline
SOP	standard operating procedure
SOPM	“Special Operations Program Management”
SPME	solid phase microextraction
SWAT	Special Weapons and Tactics
TAPS	Trans-Alaska Pipeline System

TIH	toxic inhalation hazard
UAV	Unmanned Aerial Vehicle
USCG	U.S. Coast Guard
UV	ultraviolet
VOC	volatile organic compound
WMD	weapons of mass destruction
WMD-CST	Weapons of Mass Destruction Civil Support Team