



# **40-hour Technician-level Emergency Responder Review Guide**

Copyright © 2024

Midwest Consortium for Hazardous Waste Worker Training

### Acknowledgments

The Midwest Consortium developed this course for emergency responders under grant D42 ES07200 and cooperative agreement number U45 ES 06184 from the National Institute of Environmental Health Sciences. Several member institutions of the Midwest Consortium contributed to the development of this program. See <https://mwc.umn.edu> for a listing of contacts at each member institution and additional information. We encourage you to comment on these materials.

Please give your suggestions to those teaching the program in which you are now enrolled or forward them to the Midwest Consortium for Hazardous Waste Worker Training by clicking on 'contact us' at <https://mwc.umn.edu>.

### Warning

This material has been copyrighted by the Midwest Consortium for Hazardous Waste Worker Training. A recipient of the material, other than the Federal Government, may not reproduce it without permission of the copyright owner.

The material was prepared for use by experienced instructors in the training of persons who are or who anticipate responding to chemical emergencies at the technician level. Authors of this material have prepared it for the training of this category of workers as of the date specified on the title page. Users are cautioned that the subject is constantly evolving. Therefore, the material may require additions, deletions, or modifications to incorporate the effects of that evolution occurring after the date of this material preparation.

### Contents

For each major topic in the program, key terms are provided for you to define and to describe why the idea is important to safe emergency responses; these are followed by review questions. The topics generally follow titles of sessions on the program agenda but some linking of topics (such as exposure levels and PPE) is also included. Use references and resources as needed.

**Table of Contents**

Chemical Properties .....	1
Toxicology and Health Effects.....	5
PPE – Introduction and RPE .....	11
PPE – CPC and Other Gear.....	19
Material Identification .....	25
Monitoring .....	29
Work Practices .....	35
Decontamination .....	39
Rights and Responsibilities .....	45
Emergency Response and Termination .....	49

Some of the questions in this review guide have a ‘for certain’ correct answer; others may generate discussion as the answer depends on the situation and additional information that you would need to ‘be certain’. Bring questions to the morning review session for further discussion. No two hazardous waste sites have the same hazards in the same geography or are remediated with the same technology and resources. In addition, participants bring a wide range of prior experience. Discussions during training will provide important insights to you for work at remediation sites.

# **Chemical Properties**

---

## **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Boiling point (BP)
- Vapor pressure (VP)
- Specific Gravity (SpGr)
- Flash point (FIPT)
- Relative gas density (RGasD)
- Acid
- Base

- pH
- Element
- Organic chemical
- Inorganic chemical
- Solvent
- Incompatible chemicals
- Reactive materials
- Flammable
- Combustible
- Ignitable
- Explosive Limits
- Lower Explosive Limit (LEL)
- Upper Explosive Limit (UEL)
- Fire tetrahedron
- Chemical chain reaction
- Oxidizer
- Spontaneous combustion
- Explosion
- Combustible dust explosion

- BLEVE
- CAS number

## **Review Questions**

---

1. What is the range of the pH scale?

2. List three compounds with low pH.

What word characterizes compounds with low pH?

3. List three compounds with high pH.

What word characterizes compounds with high pH?

4. Give two examples of the result of a chemical reaction.

5. What four factors are necessary for a fire to burn?
  
  
  
  
  
  
  
  
  
  
6. Describe three potential results of improper storage of chemicals.
  
  
  
  
  
  
  
  
  
  
7. Describe an important resource for finding properties of a chemical.
  
  
  
  
  
  
  
  
  
  
8. List three uses of chemical property information to evaluate risks from exposure.

# **Toxicology and Health Effects**

---

## **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Exposure
- Response
- Acute
- Chronic
- Routes of entry
  - Inhalation

- Skin absorption
  - Ingestion
  - Injection
- Dose
- Exposure-response
- Dose-response
- Exposure interactions
  - Additive
  - Antagonistic
  - Synergistic
  - Potentiation
- Local effect
- Systemic effect
- Target Organ
- Carcinogen
- Mutagen
- Reproductive toxicity
- Teratogen
- Sensitizer
- Aspiration
- Heat Stress
  - Heat Cramps

- Heat Exhaustion
  - Heat Stroke
- Frostbite
- Hypothermia
- Exposure record
- Medical Surveillance

## **Review Questions**

---

1. Describe the effect on the eyes of an acute exposure to corrosives.
  
  
  
  
  
  
  
  
  
  
2. Name four target organs and a chemical exposure that might affect each target organ.
  
  
  
  
  
  
  
  
  
  
3. Name the four routes of entry of chemicals into the body.

4. Name the two areas of the body that absorb the chemicals fastest through the skin.

5. Describe the difference between an acute and a chronic exposure to carbon monoxide.

Give an example of an emergency response situation that is a chronic exposure to carbon monoxide.

Give an example of an emergency response situation that is an acute exposure to carbon monoxide.

6. Show a local effect and a systemic effect of exposure to a solvent.

7. You have been called to respond to a scene where a tanker overturned on a county road; a farmer working in a nearby field called in the report. A clear liquid is being released and pooling in the ditch and you can see the top of a placard that is red.

What route(s) of entry may put you at risk of exposure?

What route(s) of entry may put the farmer at risk of exposure?

What actions do you take to reduce exposure?

8. Exposure monitoring has been conducted during a response. List two actions you should take.

You learn that exposure is 1 ppm. What resource can you use to help understand this measure of concentration and any possible effect that might be related to a 1 ppm exposure?

9. During a response, you were struck by an emergency vehicle, with possible injury to your shoulder. The IC wants you to see a physician.

Is this exam required by HAZWOPER?

During the exam, shrapnel from an injury during service in Iraq is found in your upper arm.

Can the information be provided by the physician to your employer?

Why?

10. List four reasons that medical surveillance is important for responders.

11. List the four types of heat-related illness. Which is the most serious?

12. List three work situations where cold exposure might put a responder at risk of injury.

## **PPE – Introduction and RPE**

---

### **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Personal protective equipment (PPE)
- Hierarchy of controls
  - Elimination
  - Substitution
  - Modify the process
  - Contain the contaminant
  - Ventilation
- Don and doff

- IDLH
- PEL
- TLV
- REL
- C
- STEL
- TWA
- Biological Exposure Standards
- BEI
- APR
- ASR
- Full facepiece
- Half facepiece
- Particulate filters
- N, R, P filters
- Chemical cartridges
- End-of-service-life
- PAPR
- SAR
- SCBA
- Positive pressure SAR
- Escape bottle

- Qualitative fit testing
- Quantitative fit testing
- Positive-pressure user check
- Negative-pressure user check
- Assigned Protection factor
- Fit Factor
- Maximum Use Concentration
- Respiratory Protection Program
- Medical fitness to wear a respirator
- Respirator training
- Concentration
  - ppm
  - mg/m<sup>3</sup>
  - f/cc

## **Review Questions**

1. Describe the hierarchy of controls.

Where is PPE on the hierarchy of controls?

2. List five considerations in respirator selection.

6. List two advantages of qualitative fit testing.

List two advantages of quantitative fit testing.

7. What is 'NIOSH approval' for respirators?

How can you determine if a respirator is NIOSH-approved?

8. If APRs are used, what must be known?

9. How often are each of the following done:

medical exam for respirator use?

fit testing?

user fit checks?

10. What is a safe O<sub>2</sub> range to use a PAPR?



11. Mark the important parts of the unit shown above.

12. Explain the importance of respirator

Cleaning

Storage

Inspection

Maintenance

13. List eight topics that must be included in a written respiratory protection program.  
Why is each important?

14. Why are medical exams required to use a respirator?

15. List reasons that you should be trained to use the RPE available to you.
  
  
  
  
  
  
  
  
  
  
16. Identify a hazard to emergency responders that could be controlled by a work practice.
  
  
  
  
  
  
  
  
  
  
17. Identify a hazard to responders that can only be controlled by use of PPE.
  
  
  
  
  
  
  
  
  
  
18. In the hierarchy of controls, why is elimination a difficult control for emergency responders to implement?
  
  
  
  
  
  
  
  
  
  
19. Is it possible to remove all the hazards at a response? Why?
  
  
  
  
  
  
  
  
  
  
20. Is it possible to control identified hazards during a response? Why?

## **PPE – CPC and Other Protective Gear**

---

### **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Chemical-Protective Clothing (CPC)
- PPE program
- Totally encapsulating chemical-protective suit (TCEP)
- Partially encapsulated chemical-protective suit (PECP)
- Disposable suits

- Hazard assessment
- Chemical resistance
- Physical integrity
- Resistance to temperature extremes
- Ability to be cleaned
- Cost
- Flexibility
- Size
- Design
- Level A protection
- Level B protection
- Level C protection
- Level D protection
- Penetration
- Permeation
- Degradation
- High-Temperature Clothing
- Arc Flash Protection
- dB

### **Review Questions**

1. What is the main purpose of CPC?
  
  
  
  
  
  
  
  
  
  
2. When would PECP be chosen over TECP?
  
  
  
  
  
  
  
  
  
  
3. List eight considerations in a hazard assessment to select CPC. Show why each is important.

4. List 10 elements of a PPE program. Why is each important?

5. Describe a response activity requiring each of the following:

Level A

Level B

Level C

Level D

6. List three areas on a CPC ensemble of full-body suit and gloves where penetration can occur.

7. Can you determine degradation of CPC visually? Why?

8. List 5 factors that affect permeation.

9. List six reasons to inspect CPC or RPE.

10. Why is it essential to know the chemicals that may be contacted in order to select appropriate chemical-resistant gloves?

11. Describe six precautions when wearing PPE.

12. List five types of PPE aside from RPE and CPC that may be required

13. Above what noise level should be considered a hazard?

## **Material Identification**

---

### **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Containers
  - Tanks
  - Drums
  - Cylinders
  - Bulk Containers or Totes
- Hazard Communication, 29 CFR 1910.1200
- HCS2012
- Safety Data Sheet (SDS)
- Pictograms
- Hazard class

- Signal word
- Precautionary statement
- NFPA-704 system
- HMIS system
- Emergency Response Guidebook
- DOT Placard and Label system
- Pesticide label
- Infectious material label
- Radioactive material label
- Shipping Papers
- Bill of Lading
- Manifest form
- Waste Profile Sheet

**Review Questions**

1. How can the size and shape of a container provide clues to the contents?
2. What resource shows rail car and road trailer shapes?

3. Name at least one feature unique to:

HCS2012 label

HMIS label

NFPA label

DOT placard

Infectious material label

Radioactive material label

4. Where would you find a listing of the 16 parts of an SDS?

List them here:

5. In 4, above,

Underline the part(s) of the SDS where you find health hazards.

Circle the part(s) of the SDS where you find safety hazards.

Put a \* beside part(s) of the SDS where you find emergency control/response information.

6. What is the source of information regarding the contents of hazardous material being transported by:

Air

Rail

Waterway

Road

7. Name two types of stationary containers and the expected contents (based on shape/material of construction).

## Monitoring

---

### Key Terms

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Detect
- Measure
- Concentrations
- Oxygen-deficient atmosphere
- Oxygen-enriched atmosphere
- Lower Explosive Limit
- Upper Explosive Limit
- Explosive Range

- Toxic chemicals
- Corrosivity
- Air sampling
- Soil sampling
- Water sampling
- Surface sampling
- Sampling plan or protocol
- Direct-reading instruments
- Personal monitoring
- Calibration
- Chain of custody
- pH paper
- Oxygen/Combustible Gas/Combination Instruments
- Colorimetric tubes
- Personal Alarms
- Hydrocarbon Detectors
- Photoionization Detectors
- Flame Ionization Detectors
- Radiation Exposure Monitoring
- Noise Monitoring
- Personal Monitoring for Organic Vapors and Particles
- Area air monitoring

**Review Questions**

1. List five reasons air monitoring might be conducted at a response.

2. During a response, a pool of liquid has been found in an existing trench. There is an odor according to two of the four-person team that discovered it; the other team members reported no odor. One responder who smelled it, is now vomiting.

Would you use device(s) to detect a substance? Why?

Would you take device(s) to measure the concentration? Why?

3. List four monitoring tools/instruments that might be used during a response. For each, show the information learned from the results.

4. Provide at least five reasons to have a sampling plan.
5. Give an example of
  - oxygen-deficient atmosphere
  - oxygen-enriched atmosphere
  - potentially explosive atmosphere
6. List four reasons for training prior to using monitoring equipment.
7. The combustible-gas indicator gives a reading of 0%. What are the possible reasons for this reading?

8. When would you choose to use an FID vs PID instrument?
9. Show the device/method you would use to measure/collect each of the following:
- LEL
  - IDLH
  - TWA
  - acidity
  - alpha radiation
  - dBA
  - organic vapor
  - particulate downwind of a fire
  - water in a surface pond
  - water in a sampling well
  - below surface soil sample
  - tool contamination

10. List three advantages of real time (direct reading) monitoring.

11. List three advantages of sampling requiring laboratory analysis.

## **Work Practices**

---

### **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Standard Operating Procedure (SOP)
- Standard Operating Guide (SOG)
- Buddy system
- Permit-required confined space
- Lock-out/tag-out
- Bonding and grounding
- Spill containment program
- Confinement
  - Diking
  - Blocking
  - Absorption

- Collecting
- Containment
  - Plugging
  - Patching
  - Over packing
- Radiation
  - Ionizing/Non-ionizing
  - Time
  - Distance
  - Shielding
- Other types of Hazards
  - ponds and lagoons
  - slips, trips, and falls
  - steam
  - electricity
  - vehicle operation
  - ergonomics

## **Review Questions**

1. List five reasons why SOPs are required as part of the Emergency Response Plan.

2. For one work practice, list essential elements included in a work practice SOG or SOP.

3. Why is practice needed to conduct responses safely?

4. What are the criteria for a Permit-required confined space?

Is every confined space a permit-required confined space?

5. Give an example of a confined space becoming a permit-required confined space during a response.

6. List three injuries that will be prevented by compliance with lock-out/tag-out.

7. You are going to control a release by plugging a leak in a drum that appears to have good structural integrity. List five considerations before you do this work.
  
  
  
  
  
  
  
  
  
  
8. List two reasons that ionizing radiation is a hazard.
  
  
  
  
  
  
  
  
  
  
9. The most frequent workplace fatalities occur during driving. What are four activities during emergency response work that pose a risk of injury during operation of a vehicle?
  
  
  
  
  
  
  
  
  
  
10. Think about your experience at previous responses. List four safety hazards you have observed and for each show one or more work practices that would have limited the risk of injury from a chemical or physical exposure.

## **Decontamination**

---

### **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Emergency Response Plan
- Decontamination
- Work zones
- Hot Zone/Exclusion Zone/Danger Zone
- Warm Zone/Contamination Reduction Zone/Decontamination Zone
- Cold Zone /Support Zone/Clean Zone

- Contamination Reduction Corridor
- Decon Line
- Physical removal
- Chemical removal
- Rinsing off
- Disinfecting/sterilizing
- Effectiveness of decon

## Review Questions

1. List six components that must be included in a decon plan.

2. List four reasons to plan for decon.

3. Describe four situations when decon should be used at a response.

4. List at least five ways you can help prevent contamination.

5. What is the overall goal of decontaminating the following:

- PPE
- personnel
- equipment/supplies

6. Name the three work zones at a response and least two activities that would be conducted in each

- zone 1

- zone 2

- zone 3

7. Where do you find the layout of the decon line and the procedures to be used?

8. List four decon methods and show why each might be used.

9. List four methods to evaluate the effectiveness of decontamination without destroying the PPE.
  
  
  
  
  
  
  
  
  
  
10. Describe problems that might occur when decontaminating tools with wooden handles.
  
  
  
  
  
  
  
  
  
  
11. What level of protection is most likely to be worn by the workers performing decontamination of responders who have been working in the hot zone in Level B?
  
  
  
  
  
  
  
  
  
  
12. List six safety considerations during decon.

13. List four considerations when a responder in the hot zone shows signs of heat illness and must be brought out for emergency medical evaluation.

## **Rights and Responsibilities**

---

### **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- SARA
- OSHA
- HAZWOPER
- OSHAAct
- Worker rights
- Employer rights

- Filing a complaint
- Worker responsibilities
- Employer responsibilities
- OSHA form 300A
- EPA
- DOT
- USCG
- NRC
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP)
- Hazardous Materials Transportation Uniform Safety Act (HMTUSA)
- TSCA
- RCRA
- CERCLA

### **Review Questions**

1. How is HAZWOPER related to SARA?

2. List thirteen employee rights under OSHA.

3. List five worker responsibilities under OSHA.

4. List an employer right under OSHA

List four employer responsibilities under OSHA.

5. Where can you find more information about rights and responsibilities?

6. For each of the following questions, answer true (T) or false (F).

- T or F     The EPA studies and regulates environmental quality including air, water, and land resources of the U.S.
- T or F     The DOT regulations and guidance cover interstate transport of hazardous materials.
- T or F     State-run OSHA programs are not monitored by federal OSHA.
- T or F     RCRA does not apply to underground storage tank (UST) installation, operation, or removal.
- T or F     HMTUSA regulates cleanup of hazardous material spills on waterways
- T or F     The requirement to establish worker safety and health standards for hazardous waste operations and emergency response is mandated in SARA.

# **Emergency Response and Termination**

---

## **Key Terms**

---

Define each of these terms and THEN

Describe why the term is important for emergency responders:

- Emergency
- Emergency Response Plan (ERP)
- Hazardous material
- National Incident Management System
- Incident Command System (ICS)
- Incident Commander
- Safety Officer
- Liaison Officer

- Public Information Officer
- Operations Officer
- Planning Officer
- Logistics Officer
- Finance Officer
- Training levels
  - Awareness
  - Operations
  - Technician
  - Specialist
- Local Emergency Planning Committee (LEPC)
- State Emergency Response Commission (SEPC)
- Communication systems
- Site control
- Termination

### Review Questions

1. List the 11 elements of an ERP.

2. List three procedures that assure communication/alerting.
3. What is the first priority in any emergency?
4. List the eight personnel roles in the ICS, provide at least one duty.
5. Draw stick figures for hand signals for the three situations below:

## In trouble

cannot finish

out of air

6. What information should be included in the initial size-up?
7. Where do your response activities fit in the ICS structure?
8. Identify the five levels of training and the primary competencies for responders at each level.

What is the required training before moving to the next level?

Who certifies competency?

9. List eight activities associated with Termination. Why is each important?