



40-Hour Hazardous Waste Site Worker Facilitator Guide

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Midwest Consortium for Hazardous Waste Worker Training

Acknowledgments

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See <http://med.uc.edu/eh/academics/training/mwc> 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, University of Cincinnati, P.O. Box 670056, Cincinnati, Ohio 45267-0056 or click on 'contact us' at <http://med.uc.edu/eh/academics/training/mwc>

Warning

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Disclaimer

The Occupational Safety and Health Administration (OSHA) rule to help assure worker health and safety at hazardous waste sites requires introductory, general training on basic hazard recognition, use of provided protective equipment, basic hazard control, decontamination procedures and other relevant standard operating procedures, as well as training at each site. This program is intended to meet the requirements of the introductory, general training. It must be followed by on-site training, during which the specifics of the protective equipment, decontamination methods, and other procedures and information at the site are discussed and practiced. At that time, the elements of the site-specific standard operating procedures are detailed.

Additional training is necessary to perform many activities. These activities include implementing the emergency response plan, identifying materials using monitoring instruments, selecting protective equipment, and performing advanced control containment or confinement. Additional site-specific training for emergency response must be provided so that you understand how to recognize and respond to alarms at the site and can carry out any role which may be assigned during a response.

For information about this matter, consult the training facilitator, your company safety and health plan, or your company health and safety representative.

All web links included in this manual are valid as of June 27, 2019.

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Course Overview – Facilitator Guide

This hazardous waste worker training course was developed in response to the need for waste site employees to obtain 40-hour training under OSHA 29 CFR 1910.120.

This Facilitator Guide provides a step-by-step outline for preparing to teach the *40-Hour Hazardous Waste Worker* course. By following the outlined format and activities in this guide, you will be better able to enhance learning, stimulate class discussion, and maintain the training objectives.

This course complies with the Final Rule, 29CFR1910.120, and is designed to be taught in 40 hours. Included in the 40 hours are daily material presentations, material reviews, labs, exercises and activities, and pre- and post- tests. Breaks and lunch are not included in the 40 hours. An example of a recommended format for a 40-hour agenda is on the next page and should be used when preparing the course outline. It is the desire of the Midwest Consortium for Hazardous Waste Worker Training to allow professional instructional freedom yet maintain consistency of training. Therefore, an alternate agenda, must be carefully prepared so that 40 hours of training is completed by the end of the course; the agenda for the program as presented must be placed in the program documentation. This course was revised and updated in 2019 to incorporate additional guidance and resources. Participant experiences will be incorporated as an integral part of the instruction.

It is recommended that a minimum of two experienced facilitators team-teach this course. Additional experienced station leaders may be required to "pull off" the site simulation activity effectively and assist with labs. To provide an effective participant /teacher ratio and maximize learning, limit the class to no more than 24 participants.

Recommended Agenda

| Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|--|--|--|
| Course Introduction & Pretest 1 hour | Review Day 1 0.25 hour | Review Day 2 0.25 hour | Review Day 3 0.25 hour | Review Day 4 0.25 hour |
| Introduction to Hazwoper Make List interests/concerns 1 hour | Material and Safety Hazards Identification 3 hours | Monitoring 1 hour | Hazard Control 2 hours | Site Simulation 2.5 hours |
| Chemical Properties Toxicology and Health Effects 2 hours | SDS Exercise 1 hour | Work Practices (WP) 2 hour Monitoring Exercise 1 hour | Rights & Responsibilities 1 hour Emergency Response 1 hour | Critique 0.75 hour Final Questions |
| <i>Lunch</i> | <i>Lunch</i> | <i>Lunch</i> | <i>Lunch</i> | <i>Lunch</i> |
| Intro to PPE Respirators 1.5 hours | CPC/Other 1.5 hours | Decontamination & Demo 1.5 hours | Preparation for Simulation – Bringing it all together - 3.5 hours | Review and Toxic Jeopardy 1.5 hours |
| RPE Demo & Workshop 2.5 hours | PPE Demo & Workshops 2.5 hours | WP, & Decon Exercises 2.5 hours | | Examination 1 hour |
| Review Content and List Review Guide 0.25 hours | Review Content and List Review Guide 0.25 hours | Review Content and List Review Guide 0.25 hours | Review Content and List Review Guide 0.25 hours | Course Evaluation and Closing 1 hour |
| 8.25 hours | 8.25 hours | 8.5 hours | 8 hours | 7 hours |

Facilitator Preparation

The 40-hour course incorporates a variety of teaching methods to meet varied learning styles. Material presentation, discussion, small-group activities, exercises, demonstrations, and site simulations are used to present material. These varied formats are designed to meet the different types of learners who might be present in your courses. The Facilitator Guide provides step-by-step instructions for presenting the material. Each chapter of the Facilitator Guide includes information such as time requirements, teaching methods, required materials, suggested facilitator preparation, minimum content requirements, issues which may arise, and reference materials. Every facilitator should be familiar with the material in the Participant Guide, the Facilitator Guide, the Exercises and the content being taught. In addition, facilitators should be familiar with the OSHA Standard, 29CFR1910.120 and other applicable standards mentioned in the text. Review the number of participants and assure that you have sufficient staff to meet the Minimum Criteria; see <http://tools.niehs.nih.gov/wetp/>.

Carefully review the section(s) of the Facilitator Guide which correspond to the topics you are teaching.

Prepare or assure that you know the answers to Review Guide questions for your sections. The lead facilitator should have answers to all questions ready for the program. Some may generate discussion and morning facilitators should be prepared to field questions as part of the review session. Review the answers provided for Exercises. Based on experience and additional information (when provided) different answers may be provided by participants; use these occurrences to teach and as needed defer to 'unknowns' or 'in my experience' comments. It is never inappropriate to protect to a level higher than might be shown in an exercise.

Do this review before preparing your lesson. Lesson outline forms may be helpful when drafting your presentation outline. Examples of lesson outline forms are shown on the following two pages.

Lesson Plan Form 1

| Teaching Methods for This Lesson Plan | Audiovisual Requirements |
|--|--|
| <ul style="list-style-type: none"> <input type="checkbox"/> Lecture <input type="checkbox"/> Discussion <input type="checkbox"/> Question and answer <input type="checkbox"/> Hands-on simulation <input type="checkbox"/> Team teaching <input type="checkbox"/> Small-group exercises <input type="checkbox"/> Case study <input type="checkbox"/> Other (describe): | <ul style="list-style-type: none"> <input type="checkbox"/> Training handbook <input type="checkbox"/> Supplemental handbook material <input type="checkbox"/> CD ROM <input type="checkbox"/> Web Sites: <input type="checkbox"/> Whiteboard, easels and paper, or chalkboards <input type="checkbox"/> Hands-on simulation <input type="checkbox"/> Other (describe): |
| Reference Materials | Special Space or Facility Requirements |
| | (List any room size or special facility regulations here, such as set-up areas, equipment storage concerns, etc.) |
| Suggested Discussion Questions | Suggested Facilitator Preparation |
| | |

Lesson Plan Form 2

| Subject Area or Element | Detail | Reference Number or Citation |
|--|--|--|
| Major subject heading or Roman numeral item from outline format. | Detailed breakdown of subject area or element. This area will necessarily occupy more space than the column to the left. | e.g., page number in training notebook, section number of regulation, or audiovisual material. |
| | | |

Instructional Resources

The instructional resources listed below are integral parts of the *40-Hour Hazardous Waste Site Worker* course. Many publications are available free from the U.S. Government Printing Office; other resources are available for a minimal cost. Many resources are also available on the internet.

The following instructional resources are required for the *40-Hour Hazardous Waste Worker* course:

1. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. October 1985. NIOSH/OSHA/USCG/DHHS (NIOSH) Publications No. 85-115, <http://www.osha.gov/Publications/complinks/OSHG-HazWaste/4agency.html>
2. *NIOSH Pocket Guide to Chemical Hazards*. NIOSH, <http://www.cdc.gov/niosh/npg/>
3. *Standard Operating Safety Guides*. June 1992. U.S. EPA (Office of Emergency and Remedial Response), http://www7.nau.edu/itep/main/HazSubMap/docs/HzRep/EPASStandardOperationsSafetyGuides_1992.pdf
4. Hazardous Waste Operations and Emergency Response: Final Rule. (29 CFR 1910.120). March 6, 1989. OSHA, <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.120>. And shown here: [http://med.uc.edu/eh/academics/training/mwc/hazwoper-\(29-cfr-1910-120\)](http://med.uc.edu/eh/academics/training/mwc/hazwoper-(29-cfr-1910-120))
5. Hazard Communication: Final Rule. (29 CFR 1910.1200), released March 26, 2012. OSHA, <http://www.osha.gov/dsg/hazcom/ghs-final-rule.html>
6. Technical terms defined or acronyms spelled out at <http://med.uc.edu/eh/academics/training/mwc/glossary/glossary> or use an SDS Dictionary

Presentation of Material

Each day should begin and end with at least 15 minutes of review. Reinforce key points and objectives. As guide chapters are covered, you may want to refer participants to the Review Guide pages.

Graphics and Audiovisuals

Graphics are available and should be used to assist with in-class instruction.

Graphics appear throughout the Participant Guide to illustrate chemical properties, monitoring instruments, respiratory protective equipment, and protective clothing.

Refer participants to these illustrations as you discuss the material.

Photographs, sketches, charts, posters, short videos, and PowerPoint slides are also useful training tools and may be introduced in the lesson where appropriate.

PowerPoint slides should be limited to those which support lesson presentation. Avoid using one-word slides, slides with term definitions, and slides as lecture outlines. These types of slides are not effective at keeping participant attention. Effective slides contain questions, color graphics and short lists.

Exercises and Labs

Small-Group Activities and Exercises

Small-group activities and exercises are incorporated throughout this training course. Exercises are collected in a separate document, “40-Hour Exercises”. In the Facilitator Guide, the discussion of activities is limited to instructions for presentation. The purpose of these activities and exercises is to experientially involve participants in clarifying information, identifying options and developing skills.

Participants may complete the activities or exercises on their own, work individually and share their reactions in class, or take assignments home and return the next day prepared for discussion. In any case, be sure to allow sufficient time for participants to complete activities.

Class activities and exercises enhance the learning process; therefore, it is strongly recommended that you make activities and discussions comfortable so that everyone can participate. Assume that every class will have participants with a wide range of communication skills. Some participants will have no problems participating in group discussion, while others may have a hard time talking in front of the group.

Suggestions for handling group activities and discussions include the following:

- Allow participants to freely express their values, attitudes, and opinions.
- Do not judge participant responses.
- Facilitate discussion by paraphrasing and clarifying. It is seldom appropriate for the facilitator to give opinions.
- Avoid putting people on the spot. Instead of asking individuals for answers, have a voluntary group spokesperson present answers to the class.
- Keep the groups focused on the task at hand. Because small-group exercises can draw heavily on the participants' personal experience, sometimes one person can dominate and run away with the discussion. If you see this happening, steer the discussion back on track by asking another group for reactions.
- Keep the participants alert and interested by encouraging participation. If the groups are not participating or giving only cursory answers, ask them probing questions about their answers to make them be more specific.

Labs

Labs are designed to provide the opportunity for participants to observe demonstrations and receive hands-on experience using equipment while reinforcing theoretical aspects learned in class. Most labs are set up as four rotating stations with an assistant facilitator at each station. Performance checklists are completed by the participant during the lab exercises. At the end of each station exercise and before a rotation is made, performance checklists must be signed by the facilitator, collected, and retained by the training center as part of the participant permanent records.

Introduction

| | |
|-------------------------|--|
| Time Requirement: | 1 hour |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria |

Materials

- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Sign-in sheets
- Registration Materials (if not collected prior to the course)
- Course Agenda
- Pre-tests
- Pencils and notepaper for participants

Objectives

- Introducing the course agenda and objectives
- Learning about the participants' backgrounds and their reasons for taking the course
- Administering the pretest
- Answering initial questions that participants may have

Teaching Methods

Discussion

Suggested Facilitator Preparation

- Review Agenda and Participant Guide
- Test web links prior to the session and If any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Download the timeline and evaluation forms (ask Program Director for website)
- Download the pretest and answer guide (ask Program Director for website)

Minimum Content Requirements

- Welcome everyone and facilitate brief introductions
- Review the HAZWOPER acronym and the MWC
- Present a local example
- Review the agenda
- Each participant completes the pretest

Questions you may be asked

1. Why is there a test?

The pre-test allows us to determine what topics the class may already be strong at or may need more attention. We also will use it to measure how much knowledge has been gained during the course.

2. Why does this take all week?

OSHA regulations require 40 hours of off-site training prior to starting waste site work. This is followed by 3-days of on-site training. The on-site training will be referenced many times during the training program, to alert participants that site-specific SOPs must be known and practiced. As a program funded by the National Institute of Environmental Health Sciences (NIEHS), we are devoted to hands-on training so that skills are developed and practiced. This takes time. We could read you the material in a much shorter amount of time but back at work you would not be able to do the tasks.

Presentation of the Session

This session can be presented as follows:

1. Welcome the class

- Participants can be welcomed by an employer, union representative, or similar person in support of the program if it is held on-site
- Have participants sign in
- Explain why the program is required and reference HAZWOPER

2. Introduce the program presenters

- The training institution conducting the training
- The Midwest Consortium
- The facilitators who are present

3. Introduce the participants

Ask the participants to introduce themselves to the class. Have them briefly tell their name and where they are from. Their experience with hazardous materials, why they are taking the class and how they will use this 40-hour training will be explored in more depth during the second hour of the class.

4. Describe the week of activities

- Present the overall goals of the class:
 - Recognize the hazards of hazardous waste site work

- Recognize the adverse health effects of those hazards
- Use work practices and protective equipment that will reduce hazards
- Use written programs such as Standard Operating Guides (SOGs) to control hazards
- Use federal regulations to protect your health and safety and that of your fellow employees in the field of hazardous waste site work
- Go through the agenda:
 - Explain training policies (e.g., smoking, breaks, phone policies, etc.)
 - Collect medical release forms, if not done previously
 - Explain why evaluation forms are part of training

5. Administer the pretest

6. Collect the pretest

- Ask participants if they have any questions
- Encourage participants to feel free to ask questions throughout the training presentations

Summary

Review the objectives.

- Introducing the course agenda and objectives
- Learning about the participants' backgrounds and their reasons for taking the course
- Administering the pretest
- Answering initial questions that participants may have

Ask if there are any additional questions and provide answer or place in the parking lot.

Introduction to HAZWOPER

Time Requirement: 1 hour

Number of Facilitators: 1 or more, consistent with ratio shown in the Minimum Criteria

Materials

- Participant Materials (Participant Guide and exercise)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- 29CFR1910.120 (paper copies or access to electronic version)
[https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9765;](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9765)

Objectives

- Become familiar with some site activities
- Describe previous work experience
- Identify training requirements using the HAZWOPER standard
- Access information resources

Teaching Methods

- Discussion
- Small-group activity

Suggested Facilitator Preparation

- Review Participant Guide and exercise
- Assure web access, if to be used to access HAZWOPER
- Test all web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdir@ucmail.uc.edu
- Read the HAZWOPER standard
- Be prepared to reference participant experience throughout this section

Questions you may be asked

1. All I am going to do is observe and report. Am I at the correct training?

If you are observing operations on a hazardous waste site, the training is required.

2. You said we have to do this every year?

OSHA requires refresher training each year in order to update and maintain competencies for site work.

Minimum Content Requirements

- Participants' previous work experience and expectations
- Training requirements of HAZWOPER

Optional: Show a video or photos of site work. Some possible examples are:

- [Del Amo Cleanup - YouTube](http://www.youtube.com/watch?v=ZqsMkf_IY2U)
http://www.youtube.com/watch?v=ZqsMkf_IY2U
- [Denny Farm Hazardous Waste Site Cleanup 1980 US EPA - YouTube](http://www.youtube.com/watch?v=dZmfrNZwBtU)
<http://www.youtube.com/watch?v=dZmfrNZwBtU>

- [Hazardous chemicals gone from Slinger factory - YouTube](http://www.youtube.com/watch?v=8apidi9TIIM)
http://www.youtube.com/watch?v=8apidi9TIIM
- Nydia Velazquez EPA Community Meeting: Gowanus Canal Cleanup. 3/27/13 - YouTube, <http://www.youtube.com/watch?v=s260QSzcde4>
- [EPA cleanup, Sanford, Maine - YouTube](http://www.youtube.com/watch?v=oARNbMuMhi4)
http://www.youtube.com/watch?v=oARNbMuMhi4
- [EPA Brownsfield Cleanup - YouTube](http://www.youtube.com/watch?v=XTGfmn4EP-M)
http://www.youtube.com/watch?v=XTGfmn4EP-M
- [Part of Olympics 2012 site contaminated - YouTube](http://www.youtube.com/watch?v=sYYeb0j4Eoc)
http://www.youtube.com/watch?v=sYYeb0j4Eoc
- [Going for Green - Soil Cleaning in the Olympic Park - YouTube](http://www.youtube.com/watch?v=l7y8kfX04gg)
http://www.youtube.com/watch?v=l7y8kfX04gg
- [EPA finds 3,069 chemical containers with possibly hazardous materials - YouTube](http://www.youtube.com/watch?v=Xyck9lrQRqU), <http://www.youtube.com/watch?v=Xyck9lrQRqU>
- [Hazardous Waste Drum Site Cleanup USEPA 1998 - YouTube](http://www.youtube.com/watch?v=3ibUTrWs2kg)
<http://www.youtube.com/watch?v=3ibUTrWs2kg>
- Hazardous Waste: SQG Management & Minimization,
<http://www.youtube.com/watch?v=zSjL2tXajsM&ad=3785650224&kw=disposal+hazardous+waste&lr=1&feature=pyv>

Presentation of the Session

This session can be presented as follows:

Previous Experience You Bring to Training

Make a list of participants' experience, workplaces and potential exposures. This is a pivotal part of the class. This information will be used to tailor the course to the needs and abilities of participants. Refer back to this list from time to time during the course.

1. Explore previous work experience of participants. This may include:
 - Construction
 - Chemicals
 - Hazards and hazardous situations

- Use of respirators and protective clothing
 - Other kinds of remediation, such as lead or asbestos
2. Ask participants about their current employment, why they are taking the class, what they hope to learn during the class, and how they will use this 40-hour training.
 3. Make a list of any specific chemicals/hazards of concern. They can be incorporated into subsequent exercises.

The Requirements of HAZWOPER

Discuss the primary purpose of HAZWOPER (to improve safety and health at sites) and its paragraph numbering system.

Exercise — Using HAZWOPER

Working in groups, participants will use the HAZWOPER standard to look up paragraph 29 CFR 1910.120(e)(3). If groups are struggling, assist them in deciphering the numbering system.

- Does this definition fit their jobs?
- Based on the paragraph, what training is required?

Training Requirements of HAZWOPER

- Include in the discussion an overview of training requirements, and talk about how these fit into the agenda for the 40-hour course.
- Refer back to the list of what participants hope to learn from the course, and tie that into the training topics.
- During the discussion, refer to CFR 1910.120, and review for the participants how to identify specific paragraphs within the standard.

Some Useful Resources

Discuss useful resources to find information:

- Show participants the reference materials provided in the classroom.
- Talk about information that can be found in each, and when they will be used during the course.
- Refer to MWC website <http://med.uc.edu/eh/academics/training/mwc>

Summary

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are some hazardous waste site activities?

- Become familiar with some site activities
- Describe previous work experience
- Identify training requirements using the HAZWOPER standard
- Access information resources

Ask if there are any additional questions and provide answer or place in the parking lot.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director.

Are there other 'Questions you may be asked' that should be included?

Chemical Properties

| | |
|-------------------------|--|
| Time Requirement: | 1 hour |
| Number of Facilitators: | at least 2 (one lead facilitator and one lab assistant), consistent with ratio shown in the Minimum Criteria |

Materials

- Participant Materials (Participant Guide and exercise)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- NIOSH Pocket Guide

Objectives

- Identify properties of chemical, radiological and biological hazards that may be present at a hazardous waste site
- Use properties to evaluate risk to health
- Identify the factors needed for fire or explosion
- Demonstrate an ability to find properties of chemicals in resources

Teaching Methods

- Small-group activity
- Presentation
- Demonstration

Suggested Facilitator Preparation

- Review the Participant Guide and exercise
- Test all web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Prepare class notes
- Review background reading materials

Minimum Content Requirements

- Fundamentals of chemical and radiological hazards, including fires and explosions
- Selected physical and chemical properties of hazardous wastes
- Discussion of at least five of the physical and chemical properties of chemicals
- Fire Tetrahedron and Lower and Upper Explosive Limits
- The characteristics of incompatible chemicals
- Use of the *NIOSH Pocket Guide to Chemical Hazards* to find chemical properties

Stories and Case Studies

Stories and case studies may be used when discussing specific hazards or in response to questions.

Questions you may be asked

Why do I need to know about things like vapor pressure and gas density?

Knowing the properties of chemicals can help predict their behavior, such as how a release from a ruptured drum might behave. This could be important for your safety and the safety of your co-workers.

Presentation of the Session

This session can be presented as follows:

Introduction to Chemical Terms

Ask "What are chemicals?" Name some chemicals used at your facility or that you have experience with. Refer back to the list generated during "Previous Experience You Bring to Training".

- List chemicals separately, forming three columns:
 - The first column should be chemicals that you know do not contain carbon. You will use this list to explain inorganic.
 - The second column should be chemicals that you know do contain carbon. You will use this list to explain organic.
 - The third column will be responses from the participants that are trade names, compounds, or chemicals with which you are not immediately familiar.
- Have the lab assistant look up trade names and indicate the name listed in the NIOSH guide. Take a moment at the break to look up any entry of particular concern on this list; or, if time permits, come back to this after the NIOSH Pocket Guide exercise and look up with the class several of the entries to reinforce how to use the Guide, using the first two columns.
- Ask "In your work have you ever experienced or observed adverse or other chemical reactions?"
 - Possible answers include:
 - Acids degrading stainless steel or other metals (oxidation of metals, corrosion)
 - Blew a safety valve (pressure build-up due to temperature increase or chemical reaction)
 - Explosion (exceeded the Lower Explosive Limit and generated some source of spark)
- Ask "What chemical properties do you think are important to know when cleaning up hazardous waste?"
- List answers. As you present, add the properties the participants missed.

- As you introduce each chemical property, ask the participants if they can give an example of a chemical that is flammable, has high vapor pressure, etc. Keep them thinking and participating.

As time permits, the videos listed in the following paragraphs may be helpful in explaining selected chemical properties:

Boiling Point and Vapor Pressure

A fun video showing a vapor pressure experiment can be found on YouTube at: <http://www.youtube.com/watch?v=cMAYcwCjggo> (running time 3:14, but they repeat the experiment several times, so you can see the whole experiment in 1 minute). When the water in the aluminum can heats up, the vapor pressure of the water increases until it reaches the same air pressure as the room. At this temperature (the Boiling Point), the water boils and fills the can with warm water vapor. Plunging the can into ice water suddenly drops the vapor pressure inside the can, so that the air pressure of the room can crush the can.

This can actually happen when working with chemicals. If a container of a hot chemical is sealed up tight, and the temperature surrounding the container drops, the container can start to collapse.

Specific Gravity

Ask participants for examples of substances that will float or sink in water.

Relative Gas Density

Sulfur hexafluoride is heavier than air (R_{GasD} = 5.11). In a short YouTube video <http://www.youtube.com/watch?v=1PJTq2xQiQ0> running time 0:30, an aluminum “boat” floats on a sea of sulfur hexafluoride, and is then sunk by filling it up with the gas, much as you might fill a boat with water and sink it. Emphasize that gases that are heavier than air can be very dangerous if they leak, as they will accumulate in low places.

Hydrogen Ion Concentration (pH), Acids, Bases

Ask participants to give examples of acids and bases. Have participants look at the pH Scale in the Participant Guide and talk about strong acids and strong bases (alkalis) as corrosive.

A small amount of water added to concentrated acid can generate a lot of heat, causing splashing. When diluting acid, it is always safer to add the acid to the water than to add the water to the acid. Hence the saying: Always Add Acid.

Organic and Inorganic Chemicals/Incompatible Chemicals

Refer back to the list generated during “Introduction to Chemical Hazards”. Identify each chemical as organic or inorganic. Stress that the terms, “organic chemicals, hydrocarbons, or solvents,” may be used when describing incompatible chemicals. It is important to know whether a chemical is organic or not.

In this video, <http://www.youtube.com/watch?v=m48lihPKkPY> (running time: 0:40), the maker of the video mixed several oxidizers with sugar. From right to left, they are potassium perchlorate, sodium nitrate, potassium permanganate and potassium nitrate. Note how high the flames are. Would sugar alone burn so hot?

Note that bromine, chlorine and fluorine can also be oxidizers.

Reactive Materials

An example of water-reactive chemicals may be found at:

<http://www.youtube.com/watch?v=QSZ-3wScePM> (running time 1.09).

Discuss other reactive materials:

- Ethers stored for a long time can form shock-sensitive peroxides that can explode
- The inhibitors in monomers such as vinyl chloride may become ineffective, allowing runaway polymerization to occur, possibly rupturing containers
- Acids + sulfur-containing compounds produce hydrogen sulfide gas
- Acids + cyanide-containing compounds produce hydrogen cyanide gas
- Hydrogen sulfide and hydrogen cyanide exposure can be fatal

Flammable, Combustible, Ignitable/Explosive Limits/Fire Tetrahedron

A video explaining vapor density and the fire tetrahedron can be found at:

<mailto:https://www.youtube.com/watch?v=xJ2bhus74yc%20> from 11:46 to 14:14. A much shorter, very retro (1947) demonstration of explosive limits is found at:

http://www.youtube.com/watch?v=MWkG_sJ1i2M (running time 0:54). Note that oxygen is present in the air, fuel in the gasoline vapors, and a spark is provided by the hand-held device.

Spontaneous Combustion

Emphasize that oily rags must be stored in a tightly closed container to avoid the risk of spontaneous combustion.

Exercise — Using the NIOSH Pocket Guide to Find Chemical Properties

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 20 minutes (15 for exercise and 5 for report-back)

Materials

- NIOSH Pocket Guide and worksheet in Exercises
- List of chemicals generated during “Introduction to Chemical Hazards”

Procedure

After guiding the participants through looking up the first chemical, have them work in small groups or individually and ask each to assess a different compound assigned by you.

Guide the participants through the exercise as needed.

Try to assign chemicals that represent different hazards, using the list generated during “Introduction to Chemical Hazards”.

Have participants select a representative from each group to report to the entire class (if time allows). The worksheet in the Exercises is for organizing their information and for future reference.

Some relevant points:

- A single chemical may be referred to by several different names and trade names, but its CAS number is unique. (example: hydrogen chloride)
- Comparing the BP to the ambient temperature will tell you whether a substance will be a liquid or gas. (example: petroleum distillates) As a chemical warms up, the closer it gets to the BP, the higher the VP will be.

- If your chemical has a low solubility, what will happen if it is spilled in water (specific gravity)? (example: petroleum distillates)
- Flash point and Explosive limits: The lower the flash point and the wider the explosive limits, the more hazardous the chemical is for fire and explosion risk (example: dimethyl ether). More information on explosions follows this exercise.
- What chemicals are incompatible with the chemical that you looked up? What could happen if they are mixed?
- What does the line above “Incompatibilities & Reactivities” tell you? It tells about the flammability of the chemical.

Collect and grade worksheets to return to the evaluation center.

Explosions

Explosions can occur under several different circumstances:

- Mixing incompatible chemicals
- Shaking, heating or compressing reactive materials, such as ether peroxides or monomers
- Combustible dust explosions
- Give examples from your own experience or from the internet as time permits

Radioactivity

The four forms of ionizing radiation (radioactivity):

- Alpha
- Beta
- Gamma
- Neutron

The use of instruments to detect radioactivity will be discussed in the Monitoring chapter.

Biological Hazards

Hazardous waste site workers should also be aware of biologic hazards, especially when working outdoors.

Summary – Chemical Properties

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are the factors needed for a fire or explosion?

- Identify properties of chemical, radiological and biological hazards that may be present at a hazardous waste site
- Use properties to evaluate risk to health
- Identify the factors needed for fire or explosion
- Demonstrate an ability to find properties of chemicals in resources

Ask if there are any additional questions and provide answer or place in the parking lot.

Ask the participants to give examples of practical chemistry as you go over the summary. The NIOSH Pocket Guide is a useful reference. Here are some examples:

- Producing a direct effect by contact
 - Corrosives
- Releasing Toxic Gases
 - Cyanide and acids -> hydrogen cyanide gas
 - Sulfides and acids -> hydrogen sulfide gas
- Large Amounts of Heat
 - Acids and alkalis
 - Water plus strong acids and alkalis
- Causing fires or explosions
 - Oxidizers and incompatible chemicals
 - Above the LEL and below the UEL of a chemical
 - Shaking, heating or compressing ether peroxides
 - Disturbing combustible dust
- Boiling point
 - If a chemical boils at or below ambient temperature, it will become a gas or vapor. If it is close to its boiling point, the vapor pressure will be high.
- Flash point/Explosive limits
 - Must evacuate if above a certain percentage of the LEL.
 - Fire Tetrahedron: Oxygen will almost always be present.
 - Important to know to avoid generating sparks around flammable, combustible or ignitable chemicals.

- Radiation
 - Can't be seen, heard, smelled or tasted.

- Biologic hazards
 - From insects, spiders, animals or plants

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

Toxicology and Health Effects

| | |
|-------------------------|--|
| Time Requirement: | 1 hour |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria |

Materials

- Participant Materials (Participant Guide and exercises)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Wall charts or slides of organ systems
- Medical dictionary
- Masking tape

Objectives

- Identify several principles of toxicology
- Identify human responses to some chemical exposures
- Use resources to find occupational exposure limits
- List reasons why medical surveillance is important to waste site workers

Teaching Methods

- Presentation/Discussion
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide and exercises
- Test all web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Prepare an outline to follow. Different groups will have different needs. It is better to respond to their concerns rather than to follow an outline rigidly. Refer back to the list generated during “Previous Experience You Bring to Training”.

Minimum Content Requirements

- Basics of toxicology
- Effects of selected exposures
- Each class is different, and you will need to go into some areas in depth, depending on the group interest. Emphasize the target organs and adverse health effects of chemicals on the list the participants created at the beginning of the class.
- Some discussion of chemically caused cancer

Questions You May Be Asked

1. Why doesn't every employer use the lowest value shown in the NIOSH Pocket Guide?

OSHA generally enforces the levels shown in 1910.1000 or the compound specific standards. It is possible for OSHA to build a case that the OSHA value is inadequate, but substantial documentation is needed and it can be challenged by the employer in a formal contest of a citation; therefore this is rarely done. Some states (most notable California) sets standards that differ from federal OSHA and are more protective. Most state plans incorporate the Federal standards. Be aware that some companies use lower values in-house; these are usually referred to as Occupational Exposure Levels, are company-specific, and lower than or equal to the Federal OSHA value.

2, Why is it important to distinguish between acute and chronic? If an exposure results in an acute affect, the signs and symptoms of the exposure may require immediate treatment.

If a health effect is not immediate (chronic) it may be easier to not take an exposure seriously. For example, have you heard a person who smokes note that a relative smoked for many years and never had a problem with lung disease? Not everyone develops the health effects associated with smoking (or any other hazard) for many reasons, but many will. Standards to protect against the effects of chronic exposures are set to limit the number of workers who may be affected; some workers never exposed above the standard may still be affected.

Presentation of the Session

The session can be presented as follows:

Basic Principles of Toxicology

- Ask, "What is a response to exposure?"
- If no one answers, use the example of alcohol or inhaling second-hand smoke
- Discuss how the body responds to alcohol, cigarette smoke, or other chemicals

Exercise – Responses to Exposures

Use "Exercise - Responses to Exposures" in Exercises to begin a presentation of the material in this section. Specific suggestions for presentation of additional materials follow.

- Ask "What toxic responses have you experienced, observed, or read about?"
- Get the class talking. You will then know the level of information of the class, and the participants will feel free to ask questions. List answers where all can see. Refer back to the list generated during "Previous Experience You Bring to Training", and the chemicals you looked up during the previous chapter. Refer to the chemicals throughout the presentation.
- Participants will enter the names of chemicals and toxic responses in the table provided in the Exercise. If you can't get the participants to talk, ask direct

questions such as: "What about strong acids? Cleaning products? Carbon monoxide or diesel exhaust? Solvents? Pesticides?"

Possible Health Effects

Acute Effects or Acute Toxicity

- Ask "What is an acute exposure?"
- If no one answers, write the answer (while speaking) where all can see. Write or print in big letters.
- Discuss acute exposures and health effects from examples provided by individuals in the class or your own experience. Talk about the dangers of acute exposures to chemicals. Most of the exposures discussed during the previous exercise were probably acute exposures.

If they don't seem to get the point:

- Ask "What toxic effect does alcohol have on humans?"
- Participants usually mention liver damage rather than central nervous system effects.

Ask, "What is meant by saying acute exposures can be prevented by the warning properties of the chemical?" Some examples:

- Severe irritants of eyes, throat, airways, and skin
- Solvents-central nervous system effects
- Smells bad; the sense of smell can be unreliable-don't depend on your nose

Emphasize that warning properties are a very unreliable way of avoiding exposure.

Ask the participants to name some chemicals that don't have good warning properties:

- Carbon monoxide (CO) (210 times the affinity for hemoglobin that oxygen has.) CO also binds much tighter than oxygen.
- Lead exposure and heavy metals in general
- Asbestos

Challenge the participants by asking questions. If no one speaks, answer your own question while writing the answers where all can see. If you have the participants "hooked" by being interactive, they will listen and feel free to ask any questions that pop into their heads.

Chronic Effects or Chronic Toxicity

Ask "What is a chronic exposure?"

Write some examples of chronic exposures where all participants can see.

Ask "What do you worry about from chronic exposures?"

- Cancer
 - Participants may have a high level of concern about cancer
 - Ask "Do you know anyone who developed cancer after working with chemicals?"
- Lung disease (from fibers, dusts, etc.)
- Damage to skin, eyes, liver, nervous system, kidneys, heart, and reproductive system

Emphasize that some exposures can cause either acute or chronic effects.

Routes of Entry

Ask "What are the routes of entry?"

- Distinguish between skin damage and skin absorption
- Discuss inhalation, skin absorption, ingestion, and injection

Factors That Influence the Body's Response to Exposure

Using the example of alcohol, ask the participants to imagine that you serve everyone in a large group a jigger of whiskey and you all drink it together at one time. (What route of entry is this?)

- Dose-response: The more you drink, the greater the effects

Imagine that you keep repeating the process until someone appears silly or unsteady. (Is this an acute or a chronic effect?) At this point, some individuals still don't appear drunk. Imagine that you keep repeating the process until half of the people pass out.

There still will be one or two people who don't appear drunk.

You should emphasize that each person has his or her own dose response to alcohol, and the same is true for chemicals.

Ask "Why do you think people respond differently to alcohol and other chemicals?"

- Some reasons are:
 - Heredity (includes sensitivity to allergens, metabolism, biochemical mechanisms, susceptibility, etc.)
 - Gender
- Body weight
- Age
- Health condition
- Personal habits
- Participants may come up with other factors

Effects of Chemicals on the Body - Local and Systemic Effects and Target Organs

Ask whether the chemicals you have been talking about have local effects on contact (skin, eyes, airways) or get into the bloodstream (systemic).

Ask "What is the difference between local and systemic effects?"

- Discuss what is meant by chemicals having target organs.
- Points to be emphasized:
 - Chemicals have an organ as a target in causing cancer (liver, skin, etc.).
 - The more frequent the exposure to chemical carcinogens, the shorter the time to develop cancer.
- Refer to the first illustration, *Health Effects: What Affects Your Body?* In the Participant Guide, for local and systemic effects and target organs.
 - Refer back to exposures and effects that participants mentioned during the previous Exercise. Ask participants if there are exposures they do not recognize; facilitate finding definitions using available resources; add any that cannot be identified in the 'parking lot' for future discussion.
- Refer to the second illustration, *Health Effects: How Does Your Body React?*, for possible symptoms of exposure and adverse health effects. Ask participants if there are effects they do not recognize; facilitate finding definitions using available resources; add any that cannot be identified in the 'parking lot' for future discussion.
- Wall charts, slides, or a take-apart model may be used to illustrate this section.

Occupational Exposure Limits and Guidelines

Measures of Concentration

Go over the examples of measures of concentration given in the Participant Guide.

Key points:

- Emphasize that 1 ppm, 1 mg/m³ or 1 f/cc are very dilute concentrations. Some chemicals are hazardous even at these low concentrations.
- Percent is used for more concentrated solutions. A solution of 1% would be 10,000 ppm.

IDLH/PEL/TLV/REL/STEL/C

Points to be emphasized:

- There are several occupational exposure limits, but only PELs are legally-enforceable
- PELs are often not the most protective exposure limits

Time-Weighted Averages (TWAs)

- Many limits are expressed as an 8-hour time-weighted average
- Even though an exposure may be high for a short period of time, the PEL may not be exceeded
- Short-term exposures should be compared to the STEL or C, if one exists

Biological Exposure Standards and Indices

- Few exposures are measured by biological samples
- Measurements of chemicals in blood, breath or urine may be used to assess exposure to lead, carbon monoxide, n-hexane, Parathion or trichloroethylene
- OSHA requires biological monitoring for workers exposed to lead and cadmium

Exercise — Using the NIOSH Pocket Guide to Find Occupational Exposure Limits

Number of Facilitators Required: 1 or more, consistent with ration shown in the Minimum Criteria

Time Requirement: approximately 20 minutes

Materials: NIOSH Pocket Guide and worksheet in Exercises

Procedure:

Ask participants to look up the information listed on the worksheet in Exercises for a given chemical. A chemical from the list generated at the beginning of class may be a good choice. If participants are working in groups, have each group look up a different chemical and have them select a representative from each group to report to the entire class (if time allows). The worksheet in the Exercises is for organizing their information and for future reference.

Some relevant points:

- The lower the exposure limits, the more toxic or hazardous the chemical is
- If a chemical is classified as a carcinogen, “Ca” will appear in the REL and IDLH areas in the NPG
- For carcinogens, there may be no safe level of exposure
- The TLV is not found in the NPG. It is found in most SDSs, if it exists.

Collect the worksheets, grade them, and save them to be returned to the evaluation center.

Exposure Records

- OSHA gives employees the right to see their exposure and medical records
- Such records must be kept for 30 years after the worker ceases employment

Medical Surveillance

Key points:

- HAZWOPER requires medical surveillance for certain groups of workers exposed to hazardous materials
- Employers are required to pay for required medical exams

- The employer must keep records of medical exams and exposure monitoring until 30 years after the worker's employment ends
- The employee should report all work-related injuries and illnesses immediately

Summary–Toxicology and Health Effects

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: why is medical surveillance important to waste site workers?

- Identify several principles of toxicology
- Identify human responses to some chemical exposures
- Use resources to find occupational exposure limits
- List reasons why medical surveillance is important to waste site workers

Ask if there are any additional questions and provide answer or place in the parking lot.

Ask participants to give examples as you go through the terms learned in this chapter:

- Acute exposure
- Chronic exposure
- Local effects
- Systemic effects
- Target organs
- Routes of entry
- Dose-response
- Exposure-response
- Occupational exposure limits
- Occupational exposure guidelines
- Medical surveillance

Facilitator Follow up

Make this section better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

Respiratory Protective Equipment

| | |
|-------------------------|--|
| Time Requirement: | Presentation – 1.5 hours Demonstration and Workshops – 2.5 hours |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria (more may be needed for labs) |

Materials

- Participant Materials (Participant Guide, Exercises, Review Guide)
- Open-space room which will allow groups mobility with protective equipment
- Four tables set up as lab stations
- SCBA units (one per participant)
- Plastic wash basins (1 per every 2 participants)
- Soap and disinfectant
- Sponges
- Paper towels
- Air-purifying respirators
- Cylinders of breathing air (1 breathing air cylinder per participant)

Objectives

When they have completed RPE, participants will be better able to:

- Describe the appropriate uses for respiratory protection
- Evaluate scenarios to determine if respiratory protection is required
- Identify the requirements of a respiratory protection program
- Demonstrate donning and doffing of respirators
- Identify the elements of respirator training that should be provided by the employer

Teaching Methods

The respiratory protection section combines presentation/discussion, demonstration, lab and small group activity. You should provide various examples of the types of respirators. If possible, as the different types of respirators are introduced, pass the face pieces around the room for the participants to look at. At the end of the initial presentation/discussion, continue by asking review questions to review the material. Long question-and-answer sessions with the participants should be avoided, because many of their questions will be answered during the lab.

Suggested Facilitator Preparation

- Review the Participant Guide
- Prepare an outline for notes
- Review exercises and activities including answers

Respirator Protection Factor

Respiratory Protection lab

- Donning and Doffing SCBA
- Fit testing an APR
- Inspecting and Cleaning Respirators
- Wearing an airline with escape unit

Respiratory Protection Scenarios

- Test all web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu

- Review background reading materials listed at the end of the chapter
- Review manufacturer information and instructions for equipment used during module
- Assemble supplies and equipment for initial presentation/discussion and for the lab stations
- Review 29CFR1910.134, Respiratory Protection

Minimum Content Requirements

- Selection-when respiratory protective equipment should be used and what type
- Use-respirator fit, medical fitness required
- Care and maintenance of respirators
- Donning and doffing SCBAs and APRs
- Labs

Questions You May Be Asked

1. Students might remark, "We did not do any the inspection at my last employer; is this just for site workers? So what could I have done?" Inspection and checkout is required when 1910.134 is applies at a workplace. Be prepared to facilitate a discussion about working through union or management representatives to facilitate review and possible changes in the facility Safety and Health Plan, referred to in OSHA resources as Health and Safety Plan (HASP). Emphasize that HAZWOPER requires the development and implementation of written procedures. Alternative procedures may be effective. Stress that inspection should be performed.

2. "What do I do if my employer tells me there is no budget to get new suits, but I have lost weight and need a smaller size?" Be prepared to facilitate a discussion on strategies to improve the company program through discussions with employee or management representatives. Emphasize that the law requires that employers provide protective gear. Perhaps the employer is waiting to order a smaller size when the current supply runs out?

3. "What about facial hair? My employer has a 'no beard' policy, and I don't like it." Emphasize that facial hair prevents a good fit, resulting in exposure to toxic substances.

4. "What about medical clearance?" Facilitate a discussion of the stresses of wearing PPE. Medical clearance is needed for respirator use; employers may have additional requirements based on other PPE requirements and company policies.

5. "We use SABA, not SCBA." SABA is the global term that includes SCBA. Useful video clips at <https://www.youtube.com/watch?v=5p2VSdejjvA>

Presentation of the Session

The session can be presented as follows:

Personal Protective Equipment Program

Emphasize that PPE is the last line of defense against hazards. Under the hierarchy of controls, from most preferable to least preferable:

- Eliminate the hazard
- Substitute a less-hazardous alternative
- Employ an engineering control (such as local ventilation, for instance)
- Employ an administrative control (such as limiting the work time in a hazardous area)
- Wear PPE

Discuss requirements of the written personal protective equipment program required under HAZWOPER as part of the employer health and safety program.

This would be a good time to refer back to the list created at the beginning of the course. Ask participants about respirator use in their previous employment, and which chemicals of concern on the list may require respirator use.

Respiratory Selection

OSHA standard 29CFR1910.134 covers Respiratory Protection.

Types of Respirators

- Ask "What considerations should be made when selecting respiratory protection?"
- List responses (for example):
 - Oxygen in the atmosphere
 - Hazardous substances at the work site
 - Exposure to confined space
 - Exposure to extreme temperatures
 - Communication needs

Air-Purifying Respirators

- Ask "What is an air-purifying respirator (APR)?"
- Refer to the illustrations of full-face and half-face APRs in the Participant Guide. Be able to discuss when APRs are appropriate and their limitations.

Filters and Cartridges

Ask "What do you know about filters used with APR?"

- Discuss particulate filters and chemical cartridges, including:
 - When not to use chemical cartridges.
 - The meaning of color labels.
 - When to change cartridge.

Other Air-Purifying Respirators

- Discuss characteristics of gas masks and PAPRs. It may be useful to note that the definition of oxygen-enriched (>23.5%) is taken from 29CFR1910.147; OSHA cites greater than 22%
<https://www.osha.gov/SLTC/etools/shipyard/shiprepair/confinedspace/oxygendeficient.html>
- 22% for use in shipbuilding. Company guidance could show values lower than a maximum of 23.5%. Vendors do provide intrinsically safe PAPRs.

Atmosphere-Supplying Respirators (ASR)Supplied-Air Respirators (SAR)

Ask "What is a supplied-air respirator (SAR)?"

Ask "What is a self-contained breathing apparatus (SCBA)?"

- Discuss key parts of a SCBA including air tank, face piece, hose, demand regulator, main-line valve, and by-pass valve.
- Demonstrate donning and doffing a SCBA, using the following checklist:
 - Check gauges and valves.
 - Turn on cylinder valve and listen for low-pressure alarm.
 - Put on the tank and harness and adjust straps.
 - Don the face piece and check the face piece seal. (Fit-testing will be reviewed later in this chapter.)
 - Check the main-line and by-pass valves.

Have another facilitator demonstrate the procedures for donning and doffing the SCBA while the lead facilitator narrates the step-by-step procedures.

Respirator Fit

Ask "What do you do to assure that your respirator fits?" and "How do you know when you have a 'good' fit?"

Ask "What are two types of respirator fit testing?"

Review qualitative and quantitative fit-testing, including:

- Purpose for testing
- Method of testing
- Cautions when testing

Review positive- and negative-pressure user checks including:

- Purpose for the check
- Method of checking
- When checking is necessary

Discuss difficulties that may occur while using respirators.

Assigned Protection Factors/Maximum Use Concentration

Review how respirators are selected.

Discuss:

- Assigned protection factors
- Fit factor calculation. (Review sample calculation in the Participant Guide.)
- Maximum Use Concentration

Exercise - Respiratory Protection Factor Exercise

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 20 minutes (15 for exercise and 5 for report-back)

Materials:

- NIOSH Pocket Guide and worksheet in Exercises.
- 40 Hour Participant Guide.

Procedure:

This exercise will calculate whether a respirator is safe to wear in a given atmosphere. Perform this exercise in small groups.

1. Calculate the MUC.
 - The APF for the respirator (full-face SCBA in demand mode = 50) is found in the APF table two pages before the exercise in the Participant Guide.
 - The PEL (75 ppm) and IDLH (1000 ppm) for the chemical may be found in the NPG.
 - Use the MUC equation on the same page as the exercise in the Participant Guide to calculate the MUC (calculated value is 3750 ppm).
 - However, MUC must be compared to the IDLH concentration. Only a *positive pressure* SCBA or SAR with escape bottle may be used in an IDLH atmosphere (notice the much-higher APFs in the APF table.). If the calculated MUC is higher than the IDLH (as it is in this case), the actual MUC will be the IDLH concentration.
2. Find the minimum safe respirator.
 - Use the NPG to find the PEL (50 ppm) and the IDLH (300 ppm).
 - Exposure is above the IDLH, so only a self-contained breathing apparatus equipped with a full face piece and operated in a pressure-demand or other positive-pressure mode, or a pressure-demand SAR with a full-face piece in combination with an auxiliary pressure-demand SCBA may be worn.

Cleaning, Storage, Inspection and Maintenance of Respirators

Discuss the significance of maintaining respiratory equipment. Refer to the checklist in the Participant Guide to review when inspecting, cleaning, and storing respirators.

Minimum Requirements for a Respirator Program

Ask "What criteria should be required for a respirator program?"

- List responses.
- Refer to the list in the Participant Guide for points to consider. Also refer to the Sample Respirator Program.

Medical Fitness to Wear a Respirator

Ask "Why should a physician review the job and examine you if you are assigned to wear a respirator?" List responses and discuss:

- Some of the possible physical conditions which may *prevent* an individual from wearing a respirator.
- Need for physical examinations prior to wearing a respirator. Include in the discussion who pays for the exam, how often exams are required, and who retains medical records for workers who wear respiratory protection.
- Some of the difficulties that may occur while wearing respirators.

Some Respiratory Protection Programs may limit the use of APRs to compounds not known to be human carcinogens. Being more protective than what is required by OSHA is a public health and worker protection decision made by a company or negotiated in a labor-management discussion.

See for example the chemical methyl chloride, with an OSHA PEL of 100 ppm for an 8-hour TWA and a ceiling value of 200 ppm (<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ2>). Using these values and measurements, a Protection Factor could be calculated and compared with fit-testing results. An APR might be selected.

However, NIOSH recognizes methyl chloride as a carcinogen and recommends use of SCBA only.

Exercise – Respiratory Protection Lab

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 2 hours

Materials:

- NIOSH Pocket Guide and worksheet in Exercises
- List of chemicals generated during “Introduction to Chemical Hazards”

Procedure:

Introduction

The purpose of providing two-and-a-half hours of workshop is to give the participants an opportunity to wear and become familiar with SCBAs, APRs and airline egress units, and cleaning and inspection procedures. Also during this time, participants practice proper fit-testing procedures, learn the difference between various models and sizes of full-face APRs, and learn to clean, assemble, and inspect a respirator for defective parts.

The four stations include:

1. Donning and Doffing SCBA.
2. Fit-Testing APR.
3. Inspecting and Cleaning Respirators.
4. Wearing airline with escape unit.

Each training center must have at least six functioning SCBAs if a full class of 24 participants is present.

Each of the four stations requires one lead facilitator who has experience with or is very familiar with the equipment to be donned so that questions can be answered as needed. Each station has a checklist to guide the participant and facilitator as to what occurs at the station. After the participant does the required tasks and completes the checklist, the form should be brought to the station leader, who signs off, indicating that the participant has completed the station.

It is Consortium policy that all "open-enrollment" participants wear SCBA, egress unit, and APR. If enough equipment exists for only three rotations, then the Inspection and Cleaning Station can be modified to require participants to wash the APR face piece during the Fit-Testing Station and demonstrate respirator procedures and assembly in large-group presentation. If three stations are used (numbers 1, 3, and 4), then document the Station 2 checklist form with the APR Station Leader signing it and writing across the sheet "Wash APR at Station 1 and Inspection Demonstrated."

The checklists are part of the Consortium documentation of training and must be collected from the participants and maintained by the training institutions. Make copies of the checklist from your master facilitator guide. Each participant should receive copies of each checklist. Each station leader needs to read through the checklists to know the station objectives

Station 1: Donning and Doffing an SCBA

Equipment

- One SCBA per participant
- Extra face pieces in various sizes
- Minimum of 1200 lbs of air pressure for each participant
- Manufacturer procedures for donning and doffing SCBA
- One table for every four participants
- Paper towels and mild cleaning solution, or moist wipes.
- Performance checklist (see Exercises) with clipboard and pen for each participant

Organization:

- Depending on class size and equipment, determine how many groups to have.
- Set up an equipment pick-up area.
- Set up large tables (one for every 4 participants) for donning and doffing.

Instructions:

- Issue face piece and SCBA.

- Review and demonstrate the manufacturer suggested procedures for donning and doffing SCBA. For example, if the manufacturer has a video, you may want to show it. Then demonstrate the procedures on one participant.
- With your guidance, have participants don SCBA, following the step-by-step instructions. The general steps follow:
 - Check air in SCBA to ensure that it is adequate for the duration of the lab (approximately 1200 lbs).
 - Inspect SCBA to see whether all parts are functional.
 - Follow manufacturer suggested "check-out" procedure, and don the SCBA.
 - Turn on the emergency valve.
 - Have participants wear the SCBA.
- Give participants the opportunity to walk up and down steps.
- Discuss hyperventilation; you should check to see that no one is hyperventilating and make eye contact to ensure that all are doing okay.
- Check emergency valve; reinforce that 5 minutes of air remain when the bell goes off.
- Have participants doff SCBA, following step-by-step instructions:
 - Bleed air out of high-pressure hose, then remove from cylinder.
 - Remove and replace cylinder.
 - Check condition of the "O-ring."
- Return to classroom with the face piece, which will be used in other labs.
- Have participants complete the Lab Performance Checklist, which you will review and sign.

Station 2: Qualitative Fit-Testing an APR

Materials:

One APR per participant - assorted sizes and brands

Cartridges to match APRs-various types and brands

Qualitative fit-testing supplies:

- Ventilation smoke tubes-stannic chloride (not recommended by NIOSH)
- Aspirator bulbs
- Isoamyl acetate or banana oil ampules
- Saccharine kit (3M™ makes a kit with saccharine/bitter mister.)
- Anti-fogging solution
- Paper towels
- Cleaning solutions (MSA™ has a cleaner/sanitizer in packets.)
- 2 plastic wash basins
- Clipboard and pen for each team
- Performance checklist for each participant

Organization:

Depending on class size, determine whether to have one or two groups.

Set up an area with respirators, fit-testing chamber, and other supplies. Equipment should be displayed so participants can handle it.

Instructions:

- Each participant should select a respirator
- Review and demonstrate maintenance and inspection procedures
- Check face piece seal. Review degradation, and reinforce need for proper storage
- Remove cartridges, and check valves
- Check face shield
- Check head straps and clips
- Demonstrate and perform fit-testing
- Review and demonstrate various types of fit-testing (routine or periodic)
 - Olfactory (smell)-isoamyl acetate or banana oil
 - Taste sensor-saccharine or bitter
- Show various types of cartridges

- Don respirators
- Check to see that proper procedures are followed
- Emphasize no facial hair; describe problems with contact lenses and dentures
- Review requirement for optical kit in full-face piece for workers requiring glasses
- Fit-test each participant
- Demonstrate cleaning and disinfecting techniques (optional)
- Dips
- Anti-fogging solutions
- Doffing
- Demonstrate proper doffing technique
- Observe each participant doff respirator
- Review maintenance procedures briefly
- Label respirators for exclusive use of each participant during the remainder of the program
- Complete Lab Performance Checklist, which is reviewed and signed by the facilitator

Station 3: Inspecting and Cleaning Respirators

Materials:

Each station should have:

- Plastic wash basin
- Soap and disinfectant
- Sponges
- Paper towels
- Clipboard and pen
- Lab Performance Checklist

Organization:

- Have station set up with equipment for cleaning respirators

Instructions:

- Participants should pair up and share wash basins, sponges, soap, and disinfectant (maximum 2 participants per basin)
- Review and demonstrate inspecting and cleaning of respirators
- Disassemble respirator and all its parts
- Inspect respirators for worn parts and defects
- Wash and dry respirator
- Reassemble respirator

Provide information for SCBAs to allow completion of questions 6-8 on checklist. From the OSHA Technical Manual:

- For all respirators, inspections must include a check of respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the face piece, head straps, valves, connecting tube, and cartridges, canisters, or filters. In addition, the elastomeric parts must be evaluated for pliability and signs of deterioration.
- For SCBAs, which require monthly inspections, the air and oxygen cylinders must be maintained in a fully charged state and recharged when the pressure falls to 90% of the manufacturer recommended pressure level. In addition, the regulator and warning devices must be inspected to ensure that they function properly.

Have participants complete Lab Performance Checklist, which you will sign and keep.

Station 4: Wearing an Airline with Escape UnitMaterials:

- Four wash basins set up for cleaning respirators
- SAR (one per participant)
- Minimum 1200 lbs. air pressure for each participant
- Egress units (one for each participant)
- Clipboard and pen for each participant
- Lab Performance Checklist

Organization:

- Have station set up with equipment for cleaning respirators.

Instructions:

- Review and demonstrate connecting to and disconnecting from egress unit using SAR
- Have participants practice connecting to and disconnecting from egress unit
- Review, sign, and collect the participants' completed Lab Performance
- Checklists: The checklists are retained by the training center as part of each participant's permanent record

Exercise – Respiratory Protection Scenarios

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 20 minutes (15 for exercise and 5 for report-back)

Materials:

- NIOSH Pocket Guide and worksheet in Exercises
- List of chemicals generated during “Introduction to Chemical Hazards”

Procedure:

- Working in groups, participants will evaluate the safety of wearing a respirator in given situations.

Scenario 1

Make a fit factor calculation:

APR for a full-face APR is 50.

$$\frac{\text{measured chemical concentration (ppm)}}{APF} = \text{parts per million (ppm)}$$

$$\frac{750 \text{ ppm}}{50} = 15 \text{ ppm}$$

The PEL of 50 ppm is greater than 15 ppm, so the full-face APR gives enough protection. The IDLH is greater than the measured concentration of 750 ppm, so an APR may be used.

Scenario 2

If you do a fit factor calculation as above, you would get a value of:

$$\frac{200 \text{ ppm}}{50} = 4 \text{ ppm}$$

Even though this is below the PEL, the measured concentration of 200 ppm is above the IDLH, so the APR may not be used.

Summary—Respiratory Protection

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are the requirements of a respiratory protection program?

- Describe the appropriate uses for respiratory protection
- Evaluate scenarios to determine if respiratory protection is required
- Identify the requirements of a respiratory protection program
- Demonstrate donning and doffing of respirators
- Identify the elements of respirator training that should be provided by the employer

Ask if there are any additional questions and provide answer or place in the parking lot.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

PPE – Chemical Protective Clothing

| | |
|-------------------------|---|
| Time Requirement: | Presentation – 1.5 hours Demonstration and Workshops – 2.5 hours |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria (2 or more during exercises) |

Materials

The following materials will be needed for all exercises:

- Participant Materials (Participant Guide, Exercises, Review guide)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Table
- NIOSH Pocket Guides
- Open-space room which will allow groups mobility with protective equipment
- Four tables set up as lab stations
- Chemical protective clothing (CPC)
- Tape recommended by the manufacturer should be used in the field
- SCBA units (one per participant)
- Cylinder of breathing air (1 breathing air cylinder per participant)

- Supplied-air respirator
- Air-purifying respirators
- Fit test hood and materials
- Cleaning wipes
- Plastic wash basins (1 per every 2 participants)
- Soap and disinfectant
- Sponges
- Paper towels

Objectives

When completed, participants will be better able to:

- Identify use of several types of chemical protective suits
- Identify criteria used for selecting CPC
- Identify the different levels of protection
- Identify ways in which the effectiveness of CPC can be reduced
- Identify the advantages and disadvantages of commonly used chemical resistant materials
- Identify precautions to take while wearing PPE
- Describe the reasons to properly inspect, maintain and store PPE
- Demonstrate donning and doffing of a level protection

Teaching Methods

- Presentation
- Demonstration
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review background reading materials

- Prepare class notes
- Review exercises and activities
 - Levels of PPE
 - PPE Lab
 - Don and Doff Level A
 - Don and Doff Level B
 - Don and Doff Level C
 - Inspect and Maintain PPE
- Review manufacturer information and instructions for equipment used during module
- Note: Levels A and B suits must be tested. See:
 - 29 CFR 1910.120, Appendix A - PPE Test Methods
 - ASTM F23.50.01, Practice for Pressure Testing of TECP
 - NFPA 1991, Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies (EPA Level A)
 - NFPA 1992, Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies (EPA Level B)
 - ANSI/ISEA-101-1996, Limited-Use and Disposable Coveralls—Size and Labeling Requirements
 - Chemical-Resistant Clothing: ASTM F739, Permeation; ASTM F903, Penetration
- Assemble supplies and equipment for lab stations

Minimum Content Requirements

- The different types of chemical protective clothing (CPC) that are available
- Recognize when CPC should be used and what type
- Different levels of protection of PPE
- Strengths and limitations of PPE
- Use, care and maintenance of CPC
- Donning and doffing of PPE

Questions you may be asked

1. Participants might remark, "Where does other safety equipment come in—like fall protection?"

That too is PPE, but it is covered in specific training for those who will be doing remediation tasks at heights. Facilitate a discussion about whether the same principles apply—hazard analysis, provided and maintained, appropriately fit, training, maintained.

2. "What do I do when my employer gives me the wrong PPE and tells me that I've got to wear it or else?"

Be prepared to facilitate a discussion on strategies to improve the company respirator program through discussions with employee or management representatives. Emphasize that the law requires that employers provide adequate protection from respiratory hazards.

3. "Why doesn't everyone eliminate hazards?"

This is done when possible, but at a hazardous waste site, elimination is difficult. For many activities, there are no engineering controls that are feasible. One example is during drum sampling at a staging pad—it is not feasible to provide mechanical ventilation, so respiratory protection is required.

Presentation of the Session

This session can be presented as follows:

Chemical-Protective Clothing

- Ask "Why is protective clothing necessary?"
- Ask "What are the types of protective clothing you have used at a work site?"
- Ask "What are situations in which protective clothing is required?"
 - List responses where the entire class can see them.
- Ask "What considerations should be made when selecting protective clothing?"
 - List responses where the entire class can see them.
- Refer back to the list of chemicals from the beginning of class, to relate them to the need for CPC.

Types of Chemical-Protective Suits

- Emphasize that different types of CPC are needed to protect against different hazards.

- Stress that totally encapsulating chemical-protective suits are the only ones that can protect from vapor hazards.
- Also note that CPC can have an expiration date, because it can and does degrade even in storage.

Selection of CPC and other PPE

Ask: What hazards are present at your current work site or at sites where you have worked in the past?

List responses where all participants can see them. Point out that different hazards will require different PPE.

Levels of PPE

- Ask "What equipment, according to OSHA, makes up Level A protective clothing?" and "What is required, and what is optional equipment?"
- If available, have a second facilitator demonstrate Level A.
- Ask "When is Level A equipment necessary?"
- Repeat these questions and demonstration for Levels B, C, and D protection.
 - Non-vapor-tight TECPs may be used for Level B protection.

Characteristics and Properties of CPC

- Discuss the following terms:
 - Penetration
 - Degradation
 - Permeation
- Refer to the Participant Guide for a list of CPC materials and their advantages and disadvantages.

Precautions When Wearing CPC

- List 5 precautions to consider when selecting CPC, as listed in Participant guide
 - Have participants make a list of five precautions to consider. This task should take about 3 minutes. Ask for volunteers to state what they considered.

- List participant responses where everyone in the class can see them. Add additional responses to complete the list.
- Refer participants to the Participant Guide for a list of precautions in the use of CPC.
- Discuss issues when wearing PPE such as:
 - Hearing impairment
 - Vision impairment
 - Heat stress
 - Slips, trips, and falls
 - Care taken when donning and doffing gloves to avoid rips and tears
 - Avoiding placing hands and knees on the ground to prevent permeation of chemicals and abrasion of suit material
 - Use of the buddy system

Inspection, Maintenance, and Storage of CPC

- Ask "Why is it important to inspect, maintain, and properly store CPC?"
- Demonstrate how to inspect CPC including examining suits for cuts, holes, rips and tears, abrasions, weakness in zippers, signs of malfunctioning, and discolorations and visible chemical contaminants.

Exposure Specific Protective Clothing

- Discuss the different types of exposure specific clothing that may be used, with emphasis on those that participants may require.

Exercise - Levels of PPE

This exercise may be performed in small groups. It can be tailored to the needs of participants. Supply additional details to each description or ask participants what other information they could have used. This will add to the report back discussion. It may also be interesting to develop some follow-up questions, such as in item 6, 'would you respond differently if breaches of drums during handling' had been reported; should other methods such as remote handling be considered?

1. At XYZ Dumpgrounds, 15 barrels are unearthed and identified as dioxane. What level of protection should be used to remove the barrels?

Supplied-air respirator with full face piece and level B. Dioxane is a carcinogen, and the IDLH level is 500 ppm.

2. Spent chlorine cylinders are being off-loaded from a semi into a staging area. What level of protection should be worn?

Level B with air-purifying respirators.

3. You are to do initial decontamination of a pump and piping area “crusted over” with corrosion before the millwrights begin dismantling the unit. What level of protection is needed?

Level A.

4. You are scheduled to clean an empty culvert, where oxygen concentrations have been measured at 18% in the past. What level of protection should be worn?

Confined space, Level A.

5. You are assisting the safety coordinator with monitoring air concentrations around a waste lagoon, and you are told to draw the necessary equipment from the tool crib area. What PPE and safety equipment are needed?

Rubber boots and gloves and air-purifying respirator. Note that neither the chemical nor the nature of the lagoon (how much water vs. solid) is identified. This is an opportunity to facilitate discussion among participants.

6. You are moving 55-gallon drums of hydrochloric acid. During the past two days, workers have reported that the drum integrity is poor. What level of protection should be worn?

Level B.

Donning and Doffing PPE

Stress the following:

- PPE should be inspected every time it is donned and doffed.

- All tape should include tabs for ease of removal. Tape should be the brand/type recommended by the manufacturer. Positive and negative user checks of respirators should be performed every time a respirator is donned.
- Be sure there are annual pressure checks for suits

Exercise - PPE Lab

The purpose of this workshop is to give participants the opportunity to wear and become familiar with proper donning and doffing of Levels A, B, and C protective clothing and to teach participants inspection procedures of the various parts, such as boots, hard hat, gloves, CPC suit, etc.

The 2-1/2 hours were allotted because of the time it takes to rotate four groups through Level A. Depending upon the number of SCBA units an institution has, may require Level B to be with the egress units and rotate turns wearing the two units within the allotted time. Each institution must have at least six functioning SCBAs if a full class (24 participants) is enrolled.

Each station requires one leader/facilitator who is experienced or very familiar with the clothing and respiratory equipment to be donned so that questions can be answered as needed. Each station has a checklist to guide the participant and facilitator as to what occurs at the station. After the participant has donned and doffed the suit and completed the checklist, you review, sign, and collect the checklist.

Unless it is documented from the employer, that Level A will never be used on the site, it is expected that Levels A, B, and C will be worn by all participants during training. If Level A is not included, note should be made on the certificate. Station 4, Inspection Methods, can be done in a large group if the training center has enough equipment to do fewer rotations of Level A.

If three stations are used (numbers 1, 2, and 3), the PPE facilitator should sign the Station 4 Lab Performance Checklist and write across the page "Inspection demonstrated in larger group." The full-face respirator would be washed at Station 3 (Level C) after doffing, as should the last group of Level A and Level B if there is no Station 4.

Lab Performance Checklists are part of the Consortium documentation of training and must be collected from the participants and maintained by the training institution. Copies of checklists may be given upon request by the participant or his/her employer.

Before running a station, each station leader should wear the PPE and read through the checklists to know what is expected of him/her and the participants.

Stations 1-3: Donning and Doffing SCBA and Protective Clothing

Materials

- SCBAs (one per participant)
- Extra face pieces in various sizes
- Minimum of 1200 lbs air pressure
- Manufacturer procedures for donning and doffing SCBA
- One table for every four participants
- Paper towels
- Mild cleaning solution
- Moist wipes
- Cylinders of air
- Levels A, B, and C protective clothing
- Tape recommended by the manufacturer should be used in the field
- Clipboards and pens
- Lab checklists
- Selected suits, gloves, boots, and hard hats

Organization:

- Depending on class size and equipment, determine how many groups to have
- Set up an equipment pick-up area
- Set up large tables (one for every 4 participants) for donning and doffing

Station 4

Allow participants to handle all available clothing. Make specific points including:

- Suits
 - Types of seams
 - Hoods versus no hoods
 - Stress points
 - Sizes
 - Face shield not tested for permeation
 - Tape may degrade

- Gloves
 - Performance charts
 - Sizes
 - Damage
 - Inspection
- Boots
 - Steel Toes
 - Stitching, molded seams
 - Shank
- Hard Hats
 - Approved versus not approved
 - Bump caps
 - Respiratory Protection

Summary – Chemical Protective Clothing

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are the criteria for selecting CPC?

- Identify use of several types of chemical protective suits
- Identify criteria used for selecting CPC
- Identify the different levels of protection
- Identify ways in which the effectiveness of CPC can be reduced
- Identify the advantages and disadvantages of commonly used chemical resistant materials
- Identify precautions to take while wearing PPE
- Describe the reasons to properly inspect, maintain and store PPE
- Demonstrate donning and doffing of a level protection

Ask if there are any additional questions and provide answer or place in the parking lot.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

PPE —Other Protective Gear

Time Requirement: 30 minutes total

Number of Instructors: 1 or more, consistent with ratio shown in the Minimum Criteria

Materials

- Student materials (Participant Guide, Exercise Manual)
- Whiteboard, easel and easel paper, or chalkboard
- Markers or chalk
- Copies of OSHA standards (or sufficient number of electronic devices)
- Optional: Electronic media such as smart phone or laptop

Section Objective

When completed, participants will be better able to:

- Identify OSHA or other guidelines for hearing, eye/face, head and foot, hand/arm protection

Teaching Methods

Presentation/discussion

Suggested Instructor Preparation

- Review the Participant Guide and Exercise
- Review the PPE standards and guidelines listed in the Participant Guide
- Test all web links prior to the session and If any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review the noise section in Material Identification and Physical Safety Hazards.
- Prepare copies of the standards/guidelines (or assure sufficient number of electronic devices are available)
- Prepare an outline for notes to be included in the program file

Minimum Content Requirements

- Review list of other PPE standards shown in the Participant Guide
- Exercise—use selected standards relevant to the group of participants

Questions You May be Asked

1. What are these other agencies? The American National Standards Institute (ANSI) develops consensus documents referred to as standards, but that are not enforced by ANSI.

ASTM (originally American Society of Testing Materials, now ASTM International) publishes voluntary consensus standards for testing products, including industrial footwear. The standards are not enforced by ASTM International.

2. How can OSHA enforce standards set by others?

When compliance with a standard or guideline set by others is included in an OSHA standard, then the Agency can evaluate compliance with that requirement.

Presentation of the Session

The session can be presented as follows:

Review the objective

Review the listed standards: noise, eye/face, head, foot, electrical, hand. Assure that you know the answers to the items on the worksheet (some may be employer-specific). Note that noise will be presented in the next section.

Summary - Other PPE Requirements

Review the learning objective. This can be interactive by turning it into a question. For example, ask: what are OSHA or other guidelines for hearing, eye/face, head and foot, hand/arm protection?

- Identify OSHA or other guidelines for hearing, eye/face, head and foot, hand/arm protection

Ask if there are any additional questions and provide answer or place in the parking lot.

OSHA has specific standards for

- Hearing Protection
- General Requirements: Personal Protective Equipment
- Eye and Face Protection
- Head Protection
- Foot Protection
- Hand Protection

The general Personal Protective Equipment standard (1910.132) requires selection and use of all PPE is based on a documented hazard assessment and specifies the training required for all workers who must use PPE.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

Material Identification, Physical and Safety Hazards

Time Requirement: 4 hours (1.5 hours for Material Identification,
1.5 hours for Physical and Safety Hazards,
1.0 hour for SDSs)

Number of Facilitators: 1 or more, consistent with ratio shown in the Minimum Criteria

Materials

- Participant Materials (Participant Guide, Exercises, Review guide)
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk
- NIOSH Pocket Guide and other electronic resources, such as WISER, New Jersey Fact Sheets, CAMEO Chemicals, etc.
- Hazard Communication standard
- If possible, obtain laminated Hazard Communication QuickCards from the local OSHA office. Twenty (20) can be ordered per request from the OSHA on-line service.

- If work in summer months is expected, obtain laminated Heat Stress QuickCards from OSHA. Twenty (20) can be ordered per request from the OSHA on-line service.
- If extra training on the 2012 Hazard Communication Standard is needed, the HCS2012 exercise may be used.
- Emergency Response Guidebooks or devices with ERG loaded
- SDS for one or more chemicals of interest

Objectives

When completed, participants will be better able to:

- Identify information available through the Hazard Communication standard
- Identify hazards using placards and labels
- Identify physical and safety hazards that may be present on a hazardous waste site
- Identify work practices and technologies to control hazards
- Find health and safety hazards and control procedures on a Safety Data Sheet

Teaching Methods

This chapter combines presentation/discussion and small group activities.

Suggested Facilitator Preparation

- Review the Participant Guide
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review the HCS2012 webpage: <https://www.osha.gov/dsg/hazcom/ghs-final-rule.html>
 - See especially the questions as you scan down the page, and the sites shown on the sidebar at the right
 - Many of the tools on this website are used in the exercises (Quick Cards, standard)
- If possible, tailor the labels and SDSs used in this chapter to the participants' needs. Refer back to the list of chemicals from the beginning of the class. As site workers, labels on landfilled or stored drums may be incomplete and old; it may be useful to construct representative 'partial' labels.

- Review the Emergency Response Guidebook
- Prepare an outline for your presentation
- Review Exercises (and tailor to background of participants; review instead of full discussion, as appropriate for these HazCom exercises. Select which are needed and adjust agenda to conduct those needed to fill gaps in participant knowledge).
 - What do these terms mean?
 - Pictograms
 - Labels
 - Placards and Labels
 - Content of SDS
 - Using an SDS to Find Safety Information

Minimum Content Requirements

- DOT system of placards and labels – Emergency Response Guidebook
- NFPA 704 system
- Hazard Communication standard labels
- Pesticide labels
- HMIS system
- Infectious materials and radiation symbols
- Shipping papers
- Hazardous waste manifests
- Waste profile sheets
- SDSs
- Physical and safety hazards

Questions you may be asked

1. Where can I find information on hazards such as dust and exhaust from equipment generated during remediation activities?

If you identify the type of dust, information can be found on the OSHA website by searching on the dust (examples: silica, asbestos).

<https://www.osha.gov/dsg/topics/silicacrystalline/>;

<https://www.osha.gov/SLTC/asbestos/construction.html>. Diesel exhaust information can be found similarly by searching osha.gov for 'diesel' (see <https://www.osha.gov/SLTC/asbestos/construction.html> and

https://www.osha.gov/dts/hazardalerts/diesel_exhaust_hazard_alert.html). Emissions from gasoline or natural gas-powered equipment may also be a concern; EPA has good resources, including <https://www.epa.gov/regulations-emissions-vehicles-and-engines>. NIOSH is a useful resource for this question as well.

2. Can a current SDS be used for a material made 20 years ago?

It depends: some manufacturing processes for chemicals have remained the same and some have changed. If the manufacturer is known, contacting the person listed on a current SDS is recommended. Even if the same process is used, contaminants may have been reduced over time.

3. I am going to be working on digging up drums that have been buried for 30 years. Labels may be pretty useless.

It is likely that labels will be difficult if not impossible to read. The hazard assessment that will be shared during the on-site training should include information obtained about location and quantity of various hazardous materials. Drum sampling may be required to confirm contents. This is an important activity when contents are not known or must be confirmed.

Presentation of the Session

This session can be presented as follows:

Material Identification

In this section, labels, placards and documents that can be used to identify hazardous materials will be covered. Ask:

- Are you familiar with the Hazard Communication standard?
- What labels and placards are you familiar with?
- Have you ever used documents such as shipping papers or SDSs?
- How are labels, placards and documents useful on a hazardous waste site?

Exercise – What do these terms mean?

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: varies depending on prior HCS2012 training (allow time for report-back, as appropriate).

Materials: Worksheet found in Exercise Manual

Procedure: Have each group complete Worksheet.

Facilitate a report back.

Pictograms

Review the pictograms associated with HCS2012.

Exercise - Pictograms

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: varies depending on prior HCS2012 training (allow time for report-back, as appropriate).

Materials: OSHA Quick Card and worksheet in Exercises

Procedure: Have each group complete Worksheet.

Facilitate a report back.

Labels

- HCS2012 does not replace the DOT placards used when shipping chemicals.
- Review how to use the DOT Emergency Response Guidebook (ERG). Provide a copy of the book to each participant.
- Display DOT placards and labels. Discuss the meaning of colors, words, symbols and numbers on the placards.
- Select a DOT placard, and lead the class through identification of one chemical. Have the page numbers ready to give to the class. Tying in the discussion to an actual incident could make the identification more exciting; read the Numbered Guide information or hit the important points.

Exercise – Labels

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 20 minutes (15 for exercise and 5 for report-back).

Materials:

- NIOSH Pocket Guide and worksheet in Exercises
- List of chemicals generated during “Introduction to Chemical Hazards”
- Additional labels besides the one found in 40 Hour Exercises may be used, especially for chemicals listed at the beginning of the class. The chemical can be customized to the participants or facility where training is held.

Procedure:

Have each group complete Worksheet: Where is health and safety information on the label? for the label(s) provided.

Facilitate a report back. You may wish to project each label used on a screen, so that everyone can see it during the report back.

Labeling Systems

Labels may be found on small containers or large stationary tanks of chemicals. Colors, symbols and numbering systems are used to identify hazards.

National Fire Protection Association (NFPA)–704 System

- Display an NFPA label. Discuss the meaning of colors, numbers and special symbols.
- The higher the number, the higher the hazard. This is the opposite of the HCS2012 system. However, HCS category numbers do not appear on labels. They will be found in Section 2 of the Safety Data Sheet (SDS) for chemicals.

Hazard Communication Standard Labels

- Hazard Communication standard labels are likely to be found on chemical containers coming from the manufacturer.

- Container labels under HCS2012 have certain required elements, including a pictogram. The use of pictograms is a quick way of communicating the hazard(s) of a substance.
- Signal words can only be “Danger” (more hazardous) or “Warning”.
- Hazard classes are found in Appendix C.4. of HCS2012.

Other types of labels are not going away. Alternative labeling systems such as the National Fire Protection Association (NFPA) 704 Hazard Rating and the Hazardous Material Information System (HMIS) (which were both discussed previously) are permitted for workplace containers. However, the information supplied on these labels must be consistent with HCS2012, e.g., no conflicting hazard warnings or pictograms. See: <https://www.osha.gov/dsg/hazcom/hazcom-faq.html#11>

The HMIS (Hazardous Material Information System)

Display an HMIS label. Discuss the meaning of colors, numbers and letters. Like the NFPA system, the higher the number, the higher the hazard.

Letter codes (A-K, X) indicate PPE required.

An asterisk in the first box next to “Health” indicates a chronic health effect. The target organ is designated by an icon. Physical hazards are also indicated by icons.

Pesticide Labels

Display a pesticide label. EPA regulates pesticides under FIFRA. Pesticides make up 7 of the top 30 chemicals on the Substance Priority List of hazardous substances found at NPL (Superfund) sites.

Infectious Materials and Radioactive Substance Symbols

Discuss radiation and infectious materials symbols, which are commonly used in this country. Tell participants to treat materials with respect if they see these symbols.

Exercise – Placards and Labels

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 20 minutes

Materials:

- Hazard Communication standard labels
- DOT Placards or Labels
- NFPA Labels
- HMIS Labels
- DOT Emergency Response Guide Book
- NIOSH Pocket Guide

Procedure:

Divide the class into small groups. Pass out examples of different labels and placards to different groups or individuals. Compare the different labeling systems. Ask all the groups the same questions from Exercises at the same time. Answers to the questions will vary, depending on what chemical and what label or placard are involved. Not all labeling systems provide the same information.

Ask:

- If you need to look up information, where do you look?
- When should you familiarize yourself with the chemical?
- Which placard or label gives the most information?
- Which placard or label gives the information quickest?
- What information is missing from your placard or label?

Participants will notice that there is a lot more information on the Hazard Communication standard labels than on an NFPA-704 label or a DOT placard, and the information is available without referring to a guidebook or SDS.

- DOT, NFPA, and HMIS placards and labels offer quick, general warnings to the hazards of a substance. The HMIS label also offers information on personal protective equipment needed.
- The number from a DOT number placard can be used to look up further information in the Emergency Response Guidebook (ERG).

- If the name or CAS number of a substance is given along with the NFPA or HMIS label, more information can be found in an SDS, the NIOSH Pocket Guide, WISER or other resources.

Documentation

Discuss other sources of information.

Review in the Participant Guide:

- Shipping papers for hazardous material-required by DOT
- Manifest forms-required by the EPA and DOT
- Waste Profile Sheets-analysis of hazardous waste
- SDSs – required by the Hazard Communication standard to be available in the workplace
- Documents are important resources for recognizing health and safety hazards
- Discuss the limitations of documentation

Refer to the OSHA Quick Card: Sample Label, found in the Participant Guide. Go over the label elements (BLUE headings on the sample label). NOTE: SDSs are required on site for chemicals used in remediation activities, not hazardous wastes being remediated.

Exercise – Contents of the SDS

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: varies depending on prior HCS2012 training (allow time for report-back, as appropriate).

Materials: Appendix D to CFR1910.1200 found in Exercise Manual

Procedure: Ask participants to use Appendix D of the HazCom 2012 standard to find the minimum information required in each of the 16 sections of the SDS. Is the SDS below (or one provided by the facilitator) adequate?

Exercise – Using an SDS to Find Safety Information

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 30 minutes

Materials:

- OSHA Quick Card, Hazard Communication Safety Data Sheets
- SDS on the following pages, or an SDS of interest to the participants

Procedure:

Ask participants to use an SDS to find the health and safety information necessary to fill out Worksheet – Information in an SDS, found in Exercises. It is recommended to use an SDS for a chemical identified by participants at the beginning of the course, or the SDS given on the following pages may be used.



GHS08 Health hazard

Repr. 1B H360 May damage fertility or the unborn child.



GHS07

Acute Tox. 4 H312 Harmful in contact with skin.

Acute Tox. 4 H332 Harmful if inhaled.

Skin Irrit. 2 H315 Causes skin irritation.

STOT SE 3 H336 May cause drowsiness or dizziness.

GHS Label elements, including precautionary statements

· *Hazard pictograms*



· *Signal word* Warning

· *Hazard statements*

H312 Harmful in contact with skin.

H332 Harmful if inhaled.

H315 Causes skin irritation.

H336 May cause drowsiness or dizziness.

· *Precautionary statements*

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P321 Specific treatment (see on this label).

P322 Specific measures (see on this label).

P405 Store locked up.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**

· **NFPA ratings (scale 0 - 4)**

Health = 2

Fire = 1

Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 2

Fire = 1

Reactivity = 0

3. COMPOSITION/INFORMATION ON INGREDIENTS

· **Chemical characterization: Substances**

· **CAS No. Description**

107-98-2 1-methoxy-2-propanol

· **Identification number(s)**

· **EC number:** 203-539-1

· **Index number:** 603-064-00-3

· **Dangerous components:**

1589-47-5 2-methoxypropanol ≤ 2.5%

4. FIRST AID MEASURES

· **Description of first aid measures**

· **General information:**

Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.

· **After inhalation:**

Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.

In case of unconsciousness place patient stably in side position for transportation.

· **After skin contact:** *Immediately wash with water and soap and rinse thoroughly.*

- **After eye contact:** Rinse opened eye for several minutes under running water.
 - **After swallowing:** If symptoms persist consult doctor.
 - **Information for doctor:**
 - **Most important symptoms and effects, both acute and delayed** No further relevant information available.
 - **Indication of any immediate medical attention and special treatment needed**
- No further relevant information available.

5. FIREFIGHTING MEASURES

- **Extinguishing media**
- **Suitable extinguishing agents:** Use fire fighting measures that suit the environment.
- **Special hazards arising from the substance or mixture** No further relevant information available.
- **Advice for firefighters**
- **Protective equipment:** Mouth respiratory protective device.

6. ACCIDENTAL RELEASE MEASURES

- **Personal precautions, protective equipment and emergency procedures** Not required.
- **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
- **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
- **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7. HANDLING AND STORAGE

- **Handling:**
- **Precautions for safe handling**
Ensure good ventilation/exhaust at the workplace.

Prevent formation of aerosols.

· **Information about protection against explosions and fires:**

Protect from heat.

Protect against electrostatic charges.

· **Conditions for safe storage, including any incompatibilities**

· **Storage:**

· **Requirements to be met by storerooms and receptacles:** *No special requirements.*

· **Information about storage in one common storage facility:** *Not required.*

· **Further information about storage conditions:**

Keep receptacle tightly sealed.

Protect from heat and direct sunlight.

· **Specific end use(s)** *No further relevant information available.*

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

· **Additional information about design of technical systems:** *No further data; see item 7.*

· **Control parameters**

· **Components with limit values that require monitoring at the workplace:**

107-98-2 1-methoxy-2-propanol

REL ST: 540 mg/m³, 150 ppm

TWA: 360 mg/m³, 100 ppm

TLV STEL: 360 mg/m³, 100 ppm

TWA: 180 mg/m³, 50 ppm

· **Additional information:** *The lists that were valid during the creation were used as basis.*

· **Exposure controls**

· **Personal protective equipment:**

· **General protective and hygienic measures:**

Keep away from foodstuffs, beverages and feed.

Immediately remove all soiled and contaminated clothing.

Wash hands before breaks and at the end of work.

Avoid contact with the skin.

Avoid contact with the eyes and skin.

· **Breathing equipment:**

In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

· **Protection of hands:**

Protective gloves:

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.

· **Material of gloves**

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:** *Goggles recommended during refilling.*

9. PHYSICAL AND CHEMICAL PROPERTIES

· **Information on basic physical and chemical properties**

· **General Information**

· **Appearance:**

Form: *Fluid*

Color: *Colorless*

· **Odor:** *Alcohol-like*

· **Odour threshold:** *Not determined.*

· **pH-value at 20 °C (68 °F):** *4-7*

· **Change in condition**

Melting point/Melting range: *-96.7 °C (-142 °F)*

Boiling point/Boiling range: *80 °C (176 °F)*

· **Flash point:** *110 °C (230 °F)*

· **Flammability (solid, gaseous):** *Not flammable.*

· **Ignition temperature:** *270 °C (518 °F)*

· **Decomposition temperature:** *Not determined.*

- **Auto igniting:** *Not determined.*
- **Danger of explosion:** *Product does not present an explosion hazard.*
- **Explosion limits:**
 - Lower:** 2.3 Vol %
 - Upper:** ~ 20 Vol %
- **Vapor pressure at 20 °C (68 °F):** 12 hPa (9 mm Hg)
- **Density at 20 °C (68 °F):** 0.962 g/cm³ (8.028 lbs/gal)
- **Relative density** *Not determined.*
- **Vapour density** *Not determined.*
- **Evaporation rate** *Not determined.*
- **Solubility in / Miscibility with Water:** *Not miscible or difficult to mix.*
- **Partition coefficient (n-octanol/water):** *Not determined.*
- **Viscosity:**
 - Dynamic:** *Not determined.*
 - Kinematic:** *Not determined.*
- Organic solvents:** 34.0 %
- VOC content:** 34.0 %
- Density:** 997.9 g/l / 8.33 lb/gl
- Solids content:** 66.0 %
- **Other information** *No further relevant information available.*

10. STABILITY AND REACTIVITY

- **Reactivity**
- **Chemical stability**
- **Thermal decomposition / conditions to be avoided:** *No decomposition if used according to specifications.*
- **Possibility of hazardous reactions** *No dangerous reactions known.*
- **Conditions to avoid** *No further relevant information available.*

- **Incompatible materials:** No further relevant information available.
- **Hazardous decomposition products:** No dangerous decomposition products known.

11. TOXICOLOGICAL INFORMATION

- **Information on toxicological effects**
- **Acute toxicity:**
- **LD/LC50 values that are relevant for classification:**
107-98-2 1-methoxy-2-propanol
 - Oral LD50 5660 mg/kg (rat)
 - Dermal LD50 13000 mg/kg (rabbit)
 - Inhalative LC50/4 h 6 mg/l (rat)
- **Primary irritant effect:**
 - **on the skin:** Irritant to skin and mucous membranes.
 - **on the eye:** No irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
- **Carcinogenic categories**
- **IARC (International Agency for Research on Cancer)**
 - Substance is not listed.
- **NTP (National Toxicology Program)**
 - Substance is not listed.

12. ECOLOGICAL INFORMATION

- **Toxicity**
- **Aquatic toxicity:** No further relevant information available.
- **Persistence and degradability** No further relevant information available.
- **Behavior in environmental systems:**
- **Bioaccumulative potential** No further relevant information available.
- **Mobility in soil** No further relevant information available.
- **Additional ecological information:**

· **General notes:**

Water hazard class 1 (Assessment by list): slightly hazardous for water

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

· **Other adverse effects** *No further relevant information available.*

13. DISPOSAL CONSIDERATIONS

· **Waste treatment methods**

· **Recommendation:**

Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**

· **Recommendation:** *Disposal must be made according to official regulations.*

14. TRANSPORT INFORMATION

· **UN-Number**

· **DOT, ADR, IMDG, IATA** *UN3092*

· **UN proper shipping name**

· **DOT, IMDG, IATA** *1-METHOXY-2-PROPANOL*

· **ADR** *3092 1-METHOXY-2-PROPANOL*

· **Transport hazard class(es)**

· **DOT**

· **Class 3 Flammable liquids.**

· **ADR, IMDG, IATA**

· **Class 3 Flammable liquids**

· **Packing group**

· **DOT, ADR, IMDG, IATA** *III*

· **Environmental hazards:**

· **Marine pollutant:** *No*

· **Special precautions for user** *Warning: Flammable liquids*

· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code** *Not applicable.*

· *UN "Model Regulation": UN3092, -METHOXY-2-PROPANOL, 3, III*

15. REGULATORY INFORMATION

· *Safety, health and environmental regulations/legislation specific for the substance or mixture*

· *SARA*

· *Section 355 (extremely hazardous substances):*

Substance is not listed.

· *Section 313 (Specific toxic chemical listings):*

Substance is not listed.

· *TSCA (Toxic Substances Control Act):*

Substance is listed.

· *Proposition 65*

· *Chemicals known to cause cancer:*

Substance is not listed.

· *Chemicals known to cause reproductive toxicity for females:*

Substance is not listed.

· *Chemicals known to cause reproductive toxicity for males:*

Substance is not listed.

· *Chemicals known to cause developmental toxicity:*

Substance is not listed.

· *Carcinogenic categories*

· *EPA (Environmental Protection Agency)*

Substance is not listed.

· *TLV (Threshold Limit Value established by ACGIH)*

Substance is not listed.

· *NIOSH-Ca (National Institute for Occupational Safety and Health)*

Substance is not listed.

· *OSHA-Ca (Occupational Safety & Health Administration)*

Substance is not listed.

· **Product related hazard information:**

The product has been classified and marked in accordance with directives on hazardous materials.

· **Chemical safety assessment:** *A Chemical Safety Assessment has not been carried out.*

16. OTHER INFORMATION

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** *Safety Data Sheet Department*

· **Contact:** *Safety Department*

· **Abbreviations and acronyms:**

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road); IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation; IATA: International Air Transport Association

ACGIH: American Conference of Governmental Industrial Hygienists

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

NFPA: National Fire Protection Association (USA)

HMIS: Hazardous Materials Identification System (USA)

VOC: Volatile Organic Compounds (USA, EU); LC50: Lethal concentration, 50 percent; LD50: Lethal dose, 50 percent

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Physical and Safety Hazards

Ask : "What are some examples of physical and safety hazards?"

List responses. If the participants don't list all of them, as you discuss each hazard, add those they missed. Display the list where the whole class can see it.

The Hazard Control chapter will cover control measures to control hazards – from most preferred to least preferred, they are: engineering controls, administrative controls, and PPE.

Ponds and Lagoons

Ask participants for their experiences working around ponds and lagoons.

Confined Spaces and Excavations

Confined spaces are covered by 29 CFR 1910.146 and are discussed in detail in the Work Practices chapter.

Excavations are covered by 29 CFR 1926.651, and require special training. Excavating is one of the most hazardous construction operations. Many violations of confined space rules involve excavations. For helpful information, see:

mailto:https://www.osha.gov/Publications/trench_excavation_fs.html

Electricity

Two electrical standards are often among the OSHA top ten most frequently cited standards for violations. Useful information may be found at:

<https://www.osha.gov/SLTC/electrical/index.html>

Slips, Trips, and Falls

Ask: What are the most likely causes of slips, trips, and falls? Discuss, following the Participant Guide content.

Ladder safety

The OSHA ladder safety construction standard, 29 CFR 1926.1053, is often one of the top ten for citations. An OSHA ladder safety pamphlet is available at:

<https://www.osha.gov/Publications/OSHA3625.pdf>

Struck-By Hazards

Most struck-by fatalities involve heavy equipment such as trucks or cranes. Chemical protective clothing and respiratory protection may cause poor field of vision, making this especially dangerous. An OSHA Construction e-Tool is available at:

<https://www.osha.gov/SLTC/etools/construction/struckby/mainpage.html>

Vehicle Safety

Two OSHA standards pertaining to vehicle safety are 29 CFR 1926.601, Motor vehicles: and 29 CFR 1926.602, Material handling equipment. An OSHA publication on Preventing Backovers is found at: <https://www.osha.gov/doc/topics/backover/index.html>

Steam

Anything that looks like a cloud of steam should be avoided. Steam piping and steam-heated equipment may be hot enough to cause serious burns. Any detection of a cloud (steam or other known hazard, or an unknown hazard) should be reported immediately to Safety personnel. Guidance in OSHA standards to protect from this hazard in manufacturing is found for pulp and paper (1910.261) and textile (1910.262) industries where there is requirement for insulation or guarding for all steam and hot water pipes within 7 feet of the floor or a working platform, or within 15 inches of stairways, ramps or fixed ladders. This may provide some guidance for work at remediation sites but is not applicable directly.

Ergonomics

The NIOSH document, Practical Demonstrations of Ergonomic Principles, <http://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/2011-191.pdf>, has good illustrations of neutral and awkward postures.

Noise

Review the figure in the Participant Guide showing dBA levels for various sounds.

An OSHA web page on Occupational Noise Exposure is found at <https://www.osha.gov/SLTC/noisehearingconservation>.

Signs of excessive noise exposure include:

- You hear ringing or humming in your ears when you leave work
- You have to shout to be heard by a coworker an arm's length away
- You experience temporary hearing loss when leaving work

Buildings (structural integrity and type of construction)

Ask: What are some potential hazards from buildings on waste sites? Review those listed in Participant Guide

Falls from Heights

The fall-protection construction standard, 29 CFR 1926.501, is a frequently cited OSHA standards for violations.

Review fall protection requirements and arrest systems as outlined in Participant Guide.

Temperature Extremes

Discuss the hazards associated with heat and cold. Below is information to supplement that found in the Participant Guide.

OSHA recommends “Water, rest and shade” to avoid heat-related illness. You may find helpful information at: <http://www.osha.gov/SLTC/heatillness/index.html> Chemical protective clothing (CPC) and respiratory protection increase heat stress. It may be necessary to reduce the duration of work activities in CPC and respiratory protection during warm or hot weather.

When working outdoors, winter cold may be a problem. Useful information may be found at: https://www.osha.gov/as/opa/cold_weather_prep.html

Equipment maintenance

Ask: What are some hazardous maintenance activities? Discuss, using the Participant Guide.

Exercise - Hazard Recognition Scenario

Number of Facilitators Required: 1 or more, consistent with ratio shown in the Minimum Criteria

Time Requirement: approximately 20 minutes

Materials:

- Participant Guide
- NIOSH Pocket Guide

Procedure:

This exercise uses the scenario found in Exercises. It may be performed in small groups, or the facilitator may lead the whole class through the exercise.

Ask "What will you be concerned with at this site?"

Answer:

1. The vapor pressures of the chemicals are high, and vapor densities greater than 1.0 indicate that all of the vapors generated will concentrate in the lowest part of the pit. You may be asphyxiated if you go into the pit without a supplied-air respirator.
2. All of the chemicals listed have adverse health effects. Chloroform and benzene are carcinogens.
3. Acetone and benzene are flammable.
4. Only the vapors have been sampled. Other, non-volatile chemicals may still be present in the drums.
5. Additionally, it should be noted that the particular characteristics of the site may be problematic. Make note of the steepness of the sides of the trench and other characteristics of concern. Heavy equipment operating near the edge of the pit may increase the chances of a collapse.
6. The use of heavy equipment also presents a struck-by hazard and a vehicle hazard.
7. Because the drums have been buried for 30-40 years, they are sure to be deteriorated.

Summary–Material Identification, Physical and Safety Hazards

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are some work practices and technologies to control hazards?

- Identify information available through the Hazard Communication standard
- Identify hazards using placards and labels
- Identify physical and safety hazards that may be present on a hazardous waste site
- Identify work practices and technologies to control hazards
- Find health and safety hazards and control procedures on a Safety Data Sheet

Ask if there are any additional questions and provide answer or place in the parking lot.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

MONITORING

| | |
|-------------------------|---|
| Time Requirement: | 1 hour |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria (assistants needed for the exercise) |

Materials

The following materials will be needed:

- Participant Materials (Participant Guide and exercises)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Examples of monitoring instruments and/or a personal sampling train

Objectives

When completed, participants will be better able to:

- Identify hazards that can be detected or measured
- Identify equipment used to monitor air, water, soil and surfaces
- Identify the procedures required when conducting monitoring
- Demonstrate the use of one or more monitoring devices

Teaching Methods

- Presentation
- Demonstration
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review this section
- Review OSHA standard 1910.1000, Air Contaminants, where PELs are listed
- Review OSHA standard 1910.1020, Access to employee exposure and medical records
- Review background reading materials
- Review facility SOPs for monitoring, confined-space entry, lockout/tagout, etc. (contract programs only)
- Prepare class notes
- Review exercises and activities
 - Monitoring Lab
 - CGI
 - Detector Tube
 - Detecting Oxygen in a Bag Sample
 - Determine need for other monitoring exercises---water, soil, surface (based on expected work activities)
- Review manufacturer information and instructions for use, maintenance, and storage of equipment used during module
- Have as many instruments as possible available for observation/demonstration

Minimum Content Requirements

- Uses of monitoring equipment
- Exposure levels
- Explosive limits
- Demonstrations of available equipment

Questions You May Be Asked

1. What do I do if told to get into a 10-foot deep trench and no one has tested the air?

You should be prepared to discuss safe confined-space entry (CSE) procedures. Be prepared to describe the actions an employee may take if directed to enter a space that has not been adequately tested. For contract programs, the CSE program should be reviewed prior to presenting this module. For open enrollment, general approaches of working through union or company health and safety officers should be discussed. You must be aware of the consequences of refusal to work.

2. How do I know if my employer does adequate monitoring on a routine or emergency basis? For contract programs, reconnaissance will provide you with information about the employer monitoring program and equipment.

3. How do I request monitoring information and what do I do with it? Discuss options such as keep it with personal medical records, provide it to private or union occupational medical doctor.

Presentation of the Session

This session can be presented as follows:

Monitoring for Workplace Hazards

Tailor this initial discussion to the experience of participants. If participants have little experience with hazardous materials in any setting, responses will be limited. Go back to the video of site work shown on Day 1 and ask: "Why would you want to monitor the air at this remediation site?" List responses where the whole class can see them. Be prepared to fill in any gaps not mentioned. Refer back to the list generated at the beginning of the class and to examples in the Participant Guide.

Ask: "When would you want to monitor?"

Ask: "How are the results of these (refer to the list) reported?"

What Can Be Monitored in the Air?

Review the following:

1. Radioactivity
2. Corrosivity
3. Fire and Explosion Hazards

Combination (LEL/explosivity, combustibility) meters are approved for use in flammable environments where oxygen does not exceed 20.9% unless specifically tested in oxygen-enriched atmospheres. An alternative is to use a sample tube to draw the air to the meter, located in a normal oxygen atmosphere. The length of the tubing will vary based on manufacturer recommendations (30-199 feet), and the tube material must be compatible with the environment (non-reactive/adsorbing). For example, Tygon may absorb gas/vapors including ammonia, chlorine, hydrogen sulfide and benzene; Teflon or EPDM would be preferred—consult the manufacturer. Condensation can also be a problem with tubing; be alert for signs of condensation and use any result with caution.

Distinguish between percent on these meters and ppm for human health. 1% is 10,000 ppm. Normal oxygen in air is present at 209,000 ppm.

LEL catalytic bead sensors respond accurately only in the presence of 8-12% oxygen. In very low oxygen atmospheres (inert tank, for example), a 0 LEL reading will not be correct with this sensor! Evacuation should be considered at 10% LEL.

4. Oxygen Deficiency/Enrichment

The question in the Participant Guide under this heading gives three different oxygen levels. Issues that may arise for each are:

- a) $O_2 = 19.5\%$ - Oxygen is deficient below this level. A positive-pressure SCBA or positive-pressure airline respirator equipped with an escape air supply must be used when the oxygen level may be below 19.5%.

Ask: Would you trust the atmosphere based on this one measurement right at the lowest acceptable concentration? (Probably should not. Could be measurement error, may differ across the space.)

What would you do? (examples: measure again in more locations; use SCBA)

- b) $O_2 = 20.5\%$ - Oxygen is within the acceptable range to use an APR, but you should investigate the reason why the oxygen level is below the normal 20.9%. Are toxic gases or asphyxiants replacing the oxygen?
- c) $O_2 = 23.5\%$ - Oxygen is enriched above this level. Special procedures to minimize the risk of explosion will be needed.

Ask: Would you trust the atmosphere based on this one measurement right at the highest acceptable concentration? (Probably should not. Could be measurement error, may differ across the space.)

What would you do? (example: assure no spark sources)

- 5. Toxic Chemicals
- 6. Biological Hazards

What Can Be Monitored in Soil, Water or on Surfaces?

Review the following:

- 1. Soil
- 2. Water
- 3. Surface

Overall Guidance

This section provides information on how to sample, the need for a sampling protocol, and preparing for sampling.

Underscore the need for following a written procedure. Call attention to:

- Personal monitoring calibration
- Need to know work schedule
- Chain of Custody
- Review the need to have a plan, and follow quality assurance procedures

Sampling Plan or Protocol

Ask: What does a sampling plan include? Facilitate a discussion to cover the information found in the Participant Guide.

Before you sample...

Review pre-sampling considerations for direct-reading instruments and personal monitoring devices as found in the Participant Guide.

After you sample...

Discuss the activities listed in the Participant Guide that should be conducted post-sampling.

Sampling instruments and Tools

Discuss the features of several instruments commonly used in hazardous waste site work, and demonstrate them and/or pass them around the class. Some examples might include:

- pH paper
- Oxygen/Combustible-gas indicator (CGI)/Combination instruments
- Colorimetric detector tubes
- Personal alarms
- Hydrocarbon detectors
 - Photoionization Detectors (PID)
 - Flame Ionization Detectors (FID)
- More Specialized instruments
- Radiation exposure monitoring
- Noise Monitor

Noise Monitoring

Point out that noise sampling can be accomplished using a sound level meter for area measurements or a noise dosimeter for personal sampling of an individual worker's noise exposure.

Note the app that is useful when a SLM is not available.

<https://play.google.com/store/apps/details?id=com.pjw.noisemeter>

Personal Monitoring for Organic Vapors and Particles

Review methods that require a pump and those that do not. Illustrate the sampling train that would be placed on a person in order to determine exposure.

Area Monitoring for Particles/Fibers/Dust

Area monitoring is generally done with high-volume sampling pumps, as shown.

Water Sampling

The following resources provide background:

http://www.epa.gov/sites/production/files/2015-06/documents/gw_sampling_guide.pdf
<http://oilandgas.ohiodnr.gov/portals/oilgas/pdf/EPA-fact-sheets/RecommendationsforDrinkingWaterWellSamplingBeforeOilandGasDrilling.pdf>

Utilize You Tube videos to demonstrate water sampling, such as:

<https://www.youtube.com/watch?v=x9fri5rmbbl>
https://www.youtube.com/watch?v=7_5RcnaFn_w&list=PLa86V_dhHTNUD4_x2OqyX-Tx711_MfLky
<http://www.youtube.com/watch?v=yfnoQhHBOHg>

Soil Sampling

The following resource provides background:

<http://www.epa.gov/sites/production/files/2015-06/documents/Soil-Sampling.pdf>

Describe the application of the various types of sampling:

- Surface
- Below surface, guide
- Below surface, mechanized

The notes shown below each type of sampling assist in determining which application can be used for a specific situation.

Surface Contamination Sampling

There are several reasons to conduct surface sampling at a hazardous waste site. Procedures shown in <https://www.youtube.com/watch?v=FLv8dUUxmfk> can be adapted to non-lead environments.

Monitoring at an Emergency

Pre-planning is essential for emergency response. The Emergency Response Plan (ERP) should contain the monitoring plan for emergency response. Emphasize that conditions can change constantly during an emergency.

Exercise—Monitoring

During this exercise, participants will have the opportunity to use a combustible-gas indicator, indicator tubes, and an oxygen meter.

Checklists for each station are in the Exercise Manual.

This section may be challenging for participants who have never used air-monitoring equipment; however, they use equipment regularly to measure characteristics of air, (i.e., pressure in tires and temperature), and they see air quality data as part of the weather report.

Materials:

- Combustible gas indicator and instruction manual
- Bottle of rubbing alcohol
- Pan
- Tape measure or ruler
- Checklist
- Clipboard and pens for each participant
- Face shield (for the facilitator)
- Funnel (to recycle alcohol)
- Ammonia
- Indicator tubes
- Brown paper bags
- Oxygen meter
- Safety glasses

Presentation:

Station 1: Use of the Combustible-Gas Indicator

- Assemble the equipment and PPE, and make sure the site has no sources of ignition.
- Don face shield and prepare pan of solvent.
- Review safety precautions.
- Answer questions.
- Team assembles necessary equipment and develops strategy.
- Team approaches “spill” and performs task at three different distances.
- Team completes Sampling Lab Data Sheet.

Station 2: Use of Indicator Tubes

- Review instructions and assemble PPE.
- Review safety precautions.
- Answer questions.
- Team approaches chemical and takes reading at three distances.
- Team completes Sampling Lab Data Sheet.

Station 3: Use of Oxygen Meter

- Calibrate instrument.
- Review safety precautions.
- Answer questions.
- Team (individual) performs experiment.
- Record results on Sampling Lab Data Sheet Station 3.

Summary—Monitoring

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are some hazards that can be detected or measured?

- Identify hazards that can be detected or measured
- Identify equipment used to monitor air, water, soil and surfaces
- Identify the procedures required when conducting monitoring
- Demonstrate the use of one or more monitoring devices

Ask if there are any additional questions and provide answer or place in the parking lot.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

Work Practices

| | |
|-------------------------|--|
| Time Requirement: | 3 hours |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria |

Materials

The following materials will be needed:

- Participant Materials (Participant Guide and exercises)
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk
- Mock Site Safety and Health Plan. Use parts of the company plan if this is a contract program; use OSHA resource to formulate mock plan (<https://www.osha.gov/dep/etools/ehasp/>) that includes the SOGs important for training this group.

Objectives

When completed, participants will be better able to:

- Identify general work practices for some waste site activities
- Identify essential elements of a model work practice
- Develop written work practice guidance for a waste site activity
- Identify the need for adequate illumination and site sanitation

Teaching Methods

- Presentation
- Demonstration
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide, Exercises and Review guide
- Review this section
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review OSHA standard 29CFR1910.146 (Permit-Required Confined Spaces)
- Review OSHA standard 29CFR1910.147 (Control of Hazardous Energy (Lockout/Tagout))
- For contract programs, relevant SOPs and the site-specific ERP should be reviewed
- Prepare class notes
- Design an SOG

Minimum Content Requirements

- Definitions of SOGs and SOPs
- Elements of an SOG
- Confined space entry
- Lockout/tagout
- Illumination and sanitation requirements at hazardous waste sites

Questions You May Be Asked

1. What if we don't have SOPs at our work site for some of our tasks."

You must be ready to facilitate discussion of how to determine if an SOP exists, how to obtain a copy within the union/management structure, and how to approach problem resolution.

2. My duties may change as the remediation progresses. Will I get training on SOP for the new task?

There should be on-site training as described in the SOP for each work practice.

Presentation of the Session

This session can be presented as follows:

Site Activities and need for procedures (SOGs/SOPs)

Refer to the long list of activities shown in the section to underscore the need for written procedures. The site-specific HASP contains all of the details (and is another reason for the follow up three-day training session).

Ask:

- What is an SOP or an SOG?
- What are some SOPs or SOGs that you have used in your work?
- What hazardous waste site activities might be covered by an SOP?

Emphasize that site-specific SOPs are part of the on-site training required by the HAZWOPER standard.

The Exercise is designed to stimulate the review of detailed information in the guide, by the members of each small group. Depending on the size of the program, some of the Work Practices may be reviewed by the facilitator, after the report back of the exercise.

Elements of an SOP

Emphasize that an SOP may be short or long. In many restrooms, handwashing instructions are posted next to sinks. This is an example of a very elementary SOG. Why is it there?

Confined-Space Entry

SOPs for confined space entry should be reviewed to determine compliance with 29 CFR1910.146. Review guidelines for a permit-required confined space.

Emphasize that one should never rush into a confined space to perform an attempted rescue. Specialized training is necessary for confined-space rescue. Over half of deaths in confined spaces are to would-be rescuers.

Lock-out/Tag-out Procedures

Ask: What are the recommended elements of a lock-out procedure? List responses provided by participants and discuss any remaining from the list found in the Participant Guide. Direct participants to the example of a Lock-Out Tag found in the Participant Guide.

Drums and Drum Handling Procedures

Safe work practices for handling drums must be included as an SOP in the safety and health program. All site activities must be organized so that drum or container moving is kept to a minimum.

Separate site-specific SOPs may be developed for various aspects of drum work, including:

- Shipment
- Inspections
- Moving Drums
- Different types of drums including Explosives or Shock-Sensitive Wastes and Lab Packs
- Staging
- Storage
- Opening Procedures
- Sampling Procedures

Spill Control

A spill containment program is required wherever drum and container rupture may result in a major spill. (OSHA does not define *major spill*.) This program may be part of an overall spill control plan, which describes actions which are to be taken if either a minor or major spill occurs.

Confinement is done from a distance. You should maintain enough distance to prevent contact with the leaking material. During containment, you approach the point of release. Potential for exposure is generally greater during containment.

Fire Prevention

Ask: What are the employer responsibilities for fire prevention? Discuss, using the list provided in the Participant Guide. Repeat for worker responsibilities.

Equipment Maintenance

Ask: What should be considered when equipment maintenance is necessary in the Hot Zone? See Participant Guide for guidelines.

Hot-work

Direct participants attention to the hot-work permit found in the Participant Guide.

Power Tool Use

Ask: What guidelines should be used for power tools? Discuss, using the list found in the Participant Guide.

Loading and Unloading

The Participant Guide provides guidance for several loading/unloading situations. Review each with participants, bringing attention to how the situations are handled differently.

Excavation

Ask: What must be considered when soil removal is needed? Facilitate a discussion, using Participant Guide guidance.

Ask: What are the steps for soil removal? Walk through the plan, as outlined in the Participant Guide.

Motorized Equipment and Vehicle Operation

Ask: What should be included in an SOP for heavy equipment operation? Use list in Participant Guide to discuss.

Ladder and Scaffolding Use

Facilitate a discussion on ladder and scaffolding safety, drawing attention to the extra caution needed when wearing PPE.

Exercise - Design an SOG

In this exercise, participants will design an SOG for a work practice that may take place at a hazardous waste site. The class can work in small groups for this exercise. Provide 30 minutes for participants to complete their worksheets and 45 minutes for each group to report answers to the class.

One of the work practices described in the Participant Guide can be used for the exercise, or any other work practice relevant to the group. Priority should be given to work practices that will be needed in the Simulation on the last day of the course. If some necessary work practices are not covered by any of the groups, you may want to present them to the whole class.

An example of the content of a site-specific SOP is given on the next 2 pages. Information on steps in other work practices can be copied from the Participant Guide or from published sources.

EMERGENCY RESPONSE TEAM—Does-It-Right Inc.
EQUIPMENT and SUPPLIES INSPECTION and MAINTENANCE
STANDARD OPERATING PROCEDURE

| | |
|----------------|-----------------|
| Authorized by: | Facility: |
| Date: | Revision Dates: |

Purpose:

The purpose of the SOP for Equipment Maintenance is to ensure equipment readiness during emergency response operations.

Scope:

The Emergency Response Team Coordinator and the Emergency Response Team (ERT) will follow this SOP prior to and after emergency response operations. The maintenance program includes inspecting, re-servicing, and testing emergency response equipment.

Inspections

- Inspections will be conducted on all emergency response equipment on a monthly basis
- Vehicle inspections will be conducted on a weekly basis
- An inspection log will be maintained for each emergency response vehicle
- All equipment will be inspected after each use, including training and emergency response operations
- The attached checklists will be used when conducting these inspections
- The ERT Coordinator is responsible for ensuring that all inspections are conducted
- The ERT Coordinator will file completed vehicle and equipment inspection checklists

Re-Servicing

- All vehicles will be re-serviced (fuel, water, oil, etc.) after each use
- All self-contained breathing apparatus will be re-serviced after each use, including an after-use inspection and the filling of all air bottles
- All equipment will be cleaned before it is put back in service
- Any battery-powered equipment will be re-charged after each use

Testing

- The ERT Coordinator is responsible for determining what equipment requires periodic testing
- Periodic testing includes calibration of air monitors, hydrostatic testing of air bottles, testing of breathing air, testing of fire hose, and testing of fire protection systems

Taking Out of Service

- When equipment is defective, it will be taken out of service and replaced with equipment that is operational
- If defective equipment is not replaced, the ERT Coordinator must receive written notification
- The defective equipment will be red tagged with an indication of the specific problem
- Defective equipment will be isolated and secured to prohibit re-use
- Defective harnesses, webbing, ropes and hoses will be destroyed

End Model SOP Outline

Summary – Work Practices

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are essential elements of a model work practice?

- Identify general work practices for some waste site activities
- Identify essential elements of a model work practice
- Develop written work practice guidance for a waste site activity

Ask if there are any additional questions and provide answer or place in the parking lot.

Written work practice plans help protect worker safety and health and limit offsite contamination. Detailed descriptions are included in the Safety and Health Plan at each site.

Elements of the written work practice may include:

- Title Page or Title Block – identification of the activity, date and approvals
- Table of Contents
- Definitions of any specialized or unfamiliar terms
- Purpose, including any applicable standards or regulations
- Scope – what is covered and, if necessary, what is not covered

Emergency conditions

- Personnel – who completes the work and who else must approve or take part in the activity
 - Qualifications
 - Required Training
- Equipment and/or materials needed
 - PPE
 - Forms/checklists
- Procedures or steps
 - Air/Water/Soil/Surface Monitoring
 - Conditions to be aware of during the work

At the site, the written document is a Standard Operating Procedure.

At each hazardous waste site, employees must be trained in the specific SOPs that are relevant to their duties.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

DECONTAMINATION

| | |
|-------------------------|--|
| Time Requirement: | 1.5 hours |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria (an assistant needed for the demo; two assistants for the exercise) |

Materials

- Participant Guide and exercise
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk

Objectives

When completed, participants will be better able to:

- Identify steps in pre-planning decontamination
- Identify methods to prevent contamination of personnel, PPE and equipment
- Identify the purpose of each work zone put in place for decontamination
- Identify basic decontamination methods
- Identify safe procedures for decontamination line operators
- Demonstrate setting up a decontamination line

Teaching Methods

- Presentation/discussion/demonstration followed by an exercise

Suggested Facilitator Preparation

- Review the Participant Guide
- Review this section
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review OSHA 1910.120(k)
- Review relevant sections of the HASP and facility SOPs for decontamination (contract programs only)

Minimum Content Requirements

- Reasons for decontamination
- Setup of work zones
- Methods of decontamination

Questions You May Be Asked

1. "If there is no written plan for decon on at our work site, what should we do?"

You should be prepared to facilitate a discussion about working through union or management representatives to facilitate review and possible changes in the facility Health and Safety Plan (HASP). Emphasize that HAZWOPER requires the development and implementation of a decon plan. Procedures will vary from remediation to remediation.

2. "Am I dragging contaminants around the site and into my car and home if I don't follow decon properly?"

Yes. Use this opportunity to reinforce the need for proper decon to protect family members and the community.

Presentation of the Session

This session can be presented as follows:

Introduction

Ask:

"Why is decon important? What should be considered?"

Make a list of the participant responses where everybody can see them. You can fill in items omitted and refer participants to the introductory material in the chapter.

- <https://video.search.yahoo.com/yhs/search?fr=yhs-sz-001&hsimp=yhs-001&hspart=sz&p=decontamination+videos+for+hazmat#id=96&vid=15deb1c936f20e5971062cef0d8d19dd&action=view>. Images are also found in the Participant Guide.
- A short (Running time: 1:18) video of a decon line in action can be found at: <http://www.youtube.com/watch?v=-s1Aukkngw8>. This video (which has no audio) could be watched critically, and criticized for deficiencies at the end of the chapter.

Pre-Planning for Decontamination

The HASP needs to be kept up to date for the hazards currently present at the site.

Preventing Contamination

PPE is not foolproof. For best protection of your health, always avoid direct contact with contaminants as far as possible.

Emphasize that sound engineering controls can significantly reduce or eliminate vapor hazards.

Work Zones

Establishing work zones helps to control contamination and protect the health of workers, their families and the community.

Primary Activities in Each Work Zone

The decontamination process takes place in the Warm Zone.

Decontamination Line

Proper removal of PPE in the decontamination line will allow the employee to leave the site without bringing contamination along. Refer to the figures in the Participant Guide.

Decontamination Procedures

Review content found in Participant Guide. Emphasize that equipment must be properly decontaminated and any liquids and disposables used for decontamination must also be decontaminated or disposed of properly.

Other Considerations

The Participant Guide covers protection of decon line workers, safety precautions during decon, and emergency decon lines.

Exercise – Suit-up and Decontamination

During this exercise participants will have the opportunity to inspect and then don and doff PPE ensembles for a decon line work.

Checklists are found in the Exercise Guide.

Materials:

Minimum PPE and devices:

- SCBAs or APRs assigned to participants
- 24 Chemical-protective suits-assorted sizes and brands (one with a tear)
- 24 Pairs of long outer gloves (include some that will need to be replaced)
- 24 Pairs of inner gloves (include some that will need to be replaced)
- 24 Pairs steel-toe, chemical-resistant boots
- Duct tape
- Hard hats (optional)
- Disposable outer boots (optional)
- Two-way communication system (optional)
- Disposable suits (optional)

- Ear protection devices-muffs and plugs (optional)
- Ice vest/cooling system (optional)
- Lab Performance Checklists (one set per participant)

Minimum Decon Line Equipment:

- (3) pools or tubs
- Plastic sheeting, 15' x 45' minimum, 4 mil thick or greater
- Assorted brushes, minimum of 3 long-handled
- (3) Garden hoses with water hook-up and backflow preventer or 3 garden sprayers
- (4) Stools or three-step ladders (If using Level A, provide enough for suiting up, doffing, and decon.)
- (3) Trash bins with liners
- Clipboard and pen (one per participant)
- Lab Performance Checklists (one set per participant)
- Clothing racks

NOTE: if you have GloGerm or Glitterbug and a UV light available, it can be used to determine the completeness of decon. See <http://www.glogerm.com/>. Use care to use the UV light only on the PPE to prevent any burns to participants or instructors.

Presentation:

Set up the area with PPE. Equipment should be displayed so participants have the opportunity to handle it.

Be sure that each participant has a buddy.

Set up three stations as follows and rotate the teams through the three stations:

1. Inspect and Don PPE (15-25 minutes)
2. Decon and Doff PPE (15-25 minutes)
3. Set up and Assist with Decon (30-50 minutes)

Two options, depending on class size:

- Option A: Divide the class into three teams
- Option B: If the class is very large, create four teams

Option A: 3 Teams

Phase 1:

- Team 1 sets up and performs decon line
- Team 2 dons PPE, goes through decon line, and doffs PPE
- Team 3 assists Team 2 donning and observes decon line

Phase 2:

- Team 1 dons PPE, goes through decon line, and doffs PPE
- Team 2 assists Team 1 donning and observes decon line
- Team 3 sets up and performs decon line

Phase 3:

- Team 1 assists Team 3 donning and observes decon line
- Team 2 sets up and performs decon line
- Team 3 dons PPE, goes through decon line, and doffs PPE

Option B: 4 Teams

Phase 1:

- Team 1 (up to 8 participants) begins donning
- Team 2 (up to 4-6 participants) assists with donning
- Teams 3 and 4 (up to 4-6 participants each) set up decon line

Phase 2:

- Team 1 passes through decon line
- Team 2 begins donning
- Team 3 assists with donning
- Team 4 performs decon line

Phase 3:

- Team 1 performs decon line
- Team 2 passes through decon line
- Team 3 begins donning

- Team 4 assists with donning

Phase 4:

- Team 1 assists with donning
- Team 2 performs decon line
- Team 3 passes through decon line
- Team 4 begins donning

Phase 5:

- Team 1 performs decon line
- Team 2 observes
- Team 3 assists with donning
- Team 4 passes through decon line

Donning PPE

- Demonstrate each piece of PPE, as needed
- Review CPC inspection procedures, as needed. Emphasize degradation and permeation concepts.
- With one person, demonstrate proper donning procedures
- Refer to manufacturer instructions for donning the SCBA
 - Example of method to check SCBA for proper operation:
 - Make sure both valves are closed
 - Open bottle valve fully. (Bell on gauge will ring.)
 - Turn the bottle valve back 1/4 or about one twist of the wrist
 - Open the main-line valve, and check to see if the regulator pressure gauge matches what was showing on the bottle pressure gauge
 - Close the cylinder valve. Make sure that the air pressure does not drop by 100 psig in 30 seconds.
 - Very slowly, purge air from the regulator outlet. The needle of the gauge will drop slowly. The low-air alarm rings when the gauge is between 600 and 500 psig.
 - Close the main-line valve by pressing in on the release pin, and turn clockwise (to the closed position)
- Hand out copies of the Checklists. Have each participant complete the checklists, give to you to sign, and turn in.

Level B

- Put on suit
- Tape sleeves and pant legs
- Put on SCBA
- Tape on hood/mask
- Proceed single-file through decon line
- Complete lab performance checklist

Level C

- Put on suit
- Tape sleeves and pant legs
- Put on APR
- Tape on hood, if necessary
- Proceed single-file through decon line
- Complete lab performance checklist
- Review inspection and maintenance of PPE

Set up Decon Line and Assist with Decon

Option A

Note: The decon line is set up and disassembled by each team.

- Participants set up decon line
- Critique the line and correct problems as necessary
- Participants run decon line. (May have them wear splash suits to keep from getting wet.)
- Participants complete performance checklists, which you will review and initial
- Decon line is disassembled

Option B

Note: The decon line is set up initially and remains intact throughout the entire exercise.

- First groups (Teams 3 and 4) set up decon line
- Critique the line and correct problems as necessary

- Participants run decon line. (May have them wear splash suits to keep from getting wet.)
- Participants complete performance checklists, which you will review and initial
- Final group (Team 1) disassembles the line

Summary—Decontamination

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are the steps in pre-planning decontamination?

- Identify steps in pre-planning decontamination
- Identify methods to prevent contamination of personnel, PPE and equipment
- Identify the purpose of each work zone put in place for decontamination
- Identify basic decontamination methods
- Identify safe procedures for decontamination line operators

Ask if there are any additional questions and provide answer or place in the parking lot.

There are three zones:

- **Hot Zone or Exclusion Zone**
- **Warm Zone or Contamination Reduction Zone (CRZ)**
- **Cold Zone or Support Zone**

Methods to decontaminate personnel, PPE, and other equipment will vary depending on the substances at the site.

The decontamination line is:

- An organized series of procedures
- Performed in a specific sequence
- Used to reduce levels of contamination on personnel, PPE, and equipment
- In operation until no contaminant is present

All personnel working the decon line must be decontaminated before leaving the CRZ.

All decon equipment must be properly decontaminated or disposed of properly.

When decontamination of materials is incomplete or not possible, the materials must be disposed of appropriately.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

HAZARD CONTROL

| | |
|-------------------------|---|
| Time Requirement: | 2 hours |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria (an assistant needed for the exercise) |

Materials

- Participant Materials (Participant Guide and exercise)
- Whiteboard, easel and easel paper, or chalkboard
- Markers or chalk
- Masking tape

Objectives

When completed, participants are better able to:

- Identify types of hazard control that can be used at a hazardous waste site
- List the elements of a HAZWOPER Safety and Health Program
- Identify topics that must be included in the site-specific Health and Safety Plan
- Implement controls for hazards identified during a simulated site activity

Teaching Methods

- Presentation/discussion
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide and exercise
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Prepare an outline to follow. Different groups will have different needs. It is better to respond to their concerns than to follow an outline rigidly. Refer back to the list generated during “Previous Experience You Bring to Training”.

Minimum Content Requirements

- Review the Hierarchy of Controls
- Elements of Health and Safety Program
- Elements of the Health and Safety Plan
- Development of New Technologies for use on waste sites

Questions you may be asked

1, “PPE is easier, so I don’t understand why it is last on the list.”

Ask: what has to happen after the PPE is purchased? Facilitate a discussion of the need to properly fit, train, inspect/maintain, replace PPE. This requires personnel, tracking, record keeping, and the ongoing costs do accumulate.

2. Will robots used on sites?

Robots are used on sites, especially when a hazard such as radiation is detected. Over time, it is expected that drones may be used to characterize large remediation sites.

Presentation of the Session

The session can be presented as follows:

Types of Hazard Control

Ask, "What is the most effective type of control?"

If no one answers, bring up the hierarchy of control discussed earlier, and illustrate with the page in the guide

Discuss why the hierarchy places PPE at the bottom

Safety and Health Program

Ask "Knowing what you now know about potential hazards on a waste site, what would you want to see in a comprehensive program to reduce the hazards?"

Facilitate the discussion, bringing out the main points of the Program as detailed in the Participant Guide.

Site Characterization and Analysis

Refer to the Participant Guide to facilitate a discussion to bring out key points.

New Technologies

Remediation is constantly evolving. Encourage participants to ask questions about how the waste is being handled and treated on site.

Working with Local Fire/Emergency Personnel

Ask: What are the key considerations regarding working with local fire and emergency personnel? Facilitate a discussion based on content found in the Participant Guide.

Exercise – Hazard Control

Use "Exercise – Hazards and Controls" in Exercises to link potential hazards and controls of any type. Facilitate a discussion with report backs from small groups.

As appropriate, point out where the selected controls fall on the hierarchy, and distinguish between engineering, administrative and PPE.

Summary – Hazard Control

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are types of hazard control that can be used at a hazardous waste site?

- Identify types of hazard control that can be used at a hazardous waste site
- List the elements of a HAZWOPER Safety and Health Program
- Identify topics that must be included in the site-specific Health and Safety Plan
- Implement controls for hazards identified during a simulated site activity

Ask if there are any additional questions and provide answer or place in the parking lot.

Administrative controls usually consist of written programs or plans which are implemented to prevent harmful situations. Engineering controls include substitution, isolation, and ventilation. Use of personal protective equipment is another method of limiting exposure.

Elements of a site **safety and health program** include: the organizational structure, comprehensive work plan, site-specific safety and health plan, standard operating procedures (SOPs), safety and health training, medical surveillance program, and any information necessary to link the overall company to the site-specific plan.

Site characterization and analysis are important and continuous parts of hazard control. They are conducted before and during site work to assess health and safety risks and determine ways to control hazards and contamination.

The **safety and health plan** is a written document which includes site-specific information designed to identify, evaluate, and control exposures to hazards.

Hazard control procedures are to be planned and implemented before personnel enter the site. The site control program must include: site map, work zones, buddy system, site communication procedures for routine and emergency situations, standard operating procedures, and identification of the nearest medical facility.

Medical surveillance is an administrative control used for evaluation of hazard control effectiveness. It can provide the baseline health status of new employees, as well as annual and post-employment health information.

Work zones are boundaries determined by physical layout and monitoring conducted during the site characterization to minimize the spread of contamination outside of the work site.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

RIGHTS AND RESPONSIBILITIES

Time Requirement: 1 hour

Number of Facilitators: 1 or more, consistent with ratio shown in the Minimum Criteria

Materials

- Participant Materials (Participant Guide and Exercise)
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk

Objectives

When completed, participants will be better able to:

- Identify major components of the Superfund Amendments and Reauthorization Act (SARA)
- Identify worker rights and responsibilities under the OSHAct
- Identify employer rights and responsibilities under the OSHAct
- Identify federal agencies that regulate the use and transportation of hazardous materials

Teaching Methods

- Presentation/discussion
- Small Group Activity

Suggested Facilitator Preparation

- Review the Participant Guide
- Review this section
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review <https://www.osha.gov/workers.html>
- Review <https://www.osha.gov/dcsp/smallbusiness/index.html>
- Review <http://www.csb.gov/investigations/detail.aspx?SID=43> for the case study
- Develop background if contract program: has there been an OSHA inspection?
- Review OSHA reporting requirements, effective 1/1/2015 in states where enforcement is federal <https://www.osha.gov/recordkeeping2014/OSHA3744.pdf> if in a state-plan jurisdiction, determine implementation date by contacting OSHA

Minimum Content Requirements

- Worker Rights and Responsibilities
- Employer Rights and Responsibilities
- Roles of OSHA, EPA, USCG, DOT

Questions You May Be Asked

1. “Can they really make me shave?” Review the hierarchy of controls and hazards from inhalation.

‘yes’ if RPE is required.

2. “Does OSHA have to cite?”

No. OSHA only cites when an apparent violation is found.

3. “Are there alternatives to OSHA?”

Yes, there is a federal or state-based consultation group that can be called to visit a facility and conduct the same quality of inspection that OSHA would perform. These groups do not issue citations and assist in remediating health and safety deficiencies.

Presentation of the Session

This session can be presented as follows:

Federal Regulations

Exercise – Rights and Responsibilities

Introduce this exercise as a ‘see what you know’ start for the session. (See Exercises.)

Answers: 1, 2 F
 3, 4 T
 5 F
 6, 7 T
 8 F
 9, 10 T

Identify through feedback/discussion where more information is needed and use that to guide the review of Employee and Employer R&R, using or with reference to <https://www.osha.gov/workers.html> Review the exercise at the end of the OSHA discussion to assure everyone’s questions are answered.

SARA

Write SARA where all can see. Ask: Who knows what SARA stands for?

Briefly review the benefits to workers of SARA.

HAZWOPER

Review that this training is a direct result of SARA.

Ask: Are there questions about HAZWOPER?

OSHA

Although SARA required HAZWOPER, development of the standard and enforcement is under OSHA. The OSHAct requires that every employer provide ‘employment and a place of employment free from recognized hazards’. This is referred to as General Duty Clause.

Format for a citation and the annual posting of Work-related Injuries and Illnesses are shown in the Guide.

Other Agencies and Legislation

Briefly note that EPA, DOT, USCG, NRC have jurisdiction over hazardous materials through a number of legislative actions (some of which are described).

Ask: who has heard of Superfund? Describe the connection to site work.

Exercise - Regulations and Agencies

A mock ERP can be found at:

<https://www.med.uc.edu/eh/academics/training/mwc/exercise-resources>

You are a member of an employer-employee safety and health committee. The committee has decided to review all employer safety and health programs to make certain that they meet or exceed all existing safety and health regulations. You have made up a list of questions or concerns, and your job is now to check them out and report back to the entire committee. (See Exercises).

1. What agency and regulations might govern respirators for routine or emergency use?

OSHA Respiratory Protection

2. Your facility is located near a Great Lake port. Who would you notify if an accidental release occurred?

USCG, EPA, local fire department

3. Where could you find regulations on how to safely handle 55-gallon drums that contain hazardous materials?

HAZWOPER (might also cite DOT if in transport)

4. List two OSHA regulations that include training of workers.

Long list: examples include HazCom, HAZWOPER, the PPE standards

5. Where will Safety Data Sheets be kept to allow employee access?

On site in hard copy or electronic format

6. Which hazardous waste site workers must receive medical examinations, and who pays for them?

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.

Employer pays

7. To what safety and health records does an employee have access upon request?

Each worker can access personal exposure and medical records

Any studies of workplace exposures

8. List three other concerns at hazardous waste sites and the agency you would contact for information.

Trucks entering without proper documentation—DOT

A very black plume exiting the treatment incinerator—EPA

Requirements for working on the pond in a boat—USCG

Uncovered waste with radiation symbols—NRC

Summary—Rights and Responsibilities

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are worker rights and responsibilities under the OSHAct?

- Identify major components of the Superfund Amendments and Reauthorization Act (SARA)
- Identify worker rights and responsibilities under the OSHAct
- Identify employer rights and responsibilities under the OSHAct
- Identify federal agencies that regulate the use and transportation of hazardous materials

Ask if there are any additional questions and provide answer or place in the parking lot.

OSHA is the federal government agency that has major responsibility for writing and enforcing safety and health rules in the workplace. The regulations are either enforced by the federal government or state employees; these state programs are known as 'state plans' and must be "at least as effective" as the federal program. HAZWOPER references many other OSHA regulations, resulting in a broad standard.

Employees and employers have rights and responsibilities established by the OSHAct. A major employer responsibility is to furnish a workplace free from recognized safety and health hazards likely to cause serious physical harm. A major employee responsibility is to follow reasonable employer safety rules and to wear personal protective equipment when required. Employers and employees have specific rights regarding OSHA enforcement, development of standards, and inspections.

The following governmental agencies may be involved in hazardous waste operations:

- **EPA** (Environmental Protection Agency) – concerned with the protection of the environment's air, land, and water.
- **DOT** (Department of Transportation) – concerned with the transport of hazardous materials through interstate commerce.
- **USCG** (United States Coast Guard) – concerned with the transportation of hazardous material across navigable waterways and the preservation of our bodies of water.
- **NRC** (Nuclear Regulatory Commission) – responsible for community and worker protection from radiation hazards.

The following regulations may have an impact on hazardous waste operations:

- **TSCA** (Toxic Substance Control Act) of 1976
- **RCRA** (Resource Conservation and Recovery Act) of 1976
- **CERCLA** (Comprehensive Environmental Response, Compensation, and Liability Act) of 1980
- **SARA** (Superfund Amendment and Re-authorization Act) of 1986

The following governmental agencies may be involved in hazardous waste operations:

- **EPA** (Environmental Protection Agency) – concerned with the protection of the environment-- air, land, and water.
- **DOT** (Department of Transportation) – concerned with the transport of hazardous materials through interstate commerce.
- **USCG** (United States Coast Guard) – concerned with the transportation of hazardous material across navigable waterways and the preservation of our bodies of water.
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The following regulations may have an impact on hazardous waste operations:

- **TSCA** (Toxic Substance Control Act) of 1976
- **RCRA** (Resource Conservation and Recovery Act) of 1976
- **CERCLA** (Comprehensive Environmental Response, Compensation, and Liability Act) of 1980
- **SARA** (Superfund Amendment and Re-authorization Act) of 1986
- **HMTUSA** (Hazardous Materials Transportation Uniform Safety Act) of 1990

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

EMERGENCY RESPONSE

| | |
|-------------------------|--|
| Time Requirement: | 1 hour |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria |

Materials

The following materials will be needed:

- Participant Materials (Participant Guide and Exercise)
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk
- Mock Emergency Response Plan - enough copies for exercise. Use parts of company plan if this is a contract program. Training-only ERP can be found here:

<http://med.uc.edu/docs/default-source/Environmental-Health/mwc/mwc-mock-erp-section-1.pdf?sfvrsn=2>

<http://med.uc.edu/docs/default-source/Environmental-Health/mwc/mwc-mock-erp-section-2.pdf?sfvrsn=2>

<mailto:http://med.uc.edu/docs/default-source/Environmental-Health/mwc/mwc-mock-erp-section-3.pdf?sfvrsn=2>

Additional training only health and safety plans can be found in Appendix D of the Site Worker Refresher Performance Measures Facilitator Guide found here:

<http://med.uc.edu/eh/academics/training/mwc/training-manuals>

Objectives

When completed, participants will be better able to:

- Identify required elements in an Emergency Response Plan
- Identify the differences between an Emergency Response Plan and Emergency Action Plan
- Identify the roles of key positions in the Incident Command System (ICS)

Teaching Methods

- Presentation/discussion
- Small Group Activity

Suggested Facilitator Preparation

- Review the Participant Guide
- Review this section
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review training mock Emergency Response Plan
- Prepare answers based on the Mock Plan to be used. A modification of the employer plan may be used if available.

Minimum Content Requirements

- Emergencies
- ERP and EAP
- Unified Command

Questions You May Be Asked

1. “I am a local fire fighter so why do I need more training for response at my new job at a remediation site?” OSHA site worker standard requires that everyone on a site know about the procedures. This training does not make you a responder, but increases your ability to detect a problem, report it and react appropriately if an emergency alert is sounded.

2. “Can we decide to evacuate and not respond to any emergency?”

The employer can make that decision, but a plan and training are still required. This plan is the Emergency Action Plan (EAP).

Presentation of the Session

This session can be presented as follows:

Emergencies

Review the OSHA definition of Emergency. Differentiate between ERP and EAP.

ICS

Refer to the Organization shown in the guide. Discuss function of each person/group.

Exercise – What should be done?

In this exercise, participants will use a mock (for training purposes only) ERP provided by the program to identify appropriate actions for the following scenarios:

1. You see one person in Level A down and the buddy with hands at her throat.
2. An excavator operator in the Cold Zone has just backed through a pipe providing natural gas to the incinerator.
3. You and three others are surveying the perimeter when Fred is bitten by a snake. Someone heard a rattle, but the snake was not seen.
4. You have been onsite for a month and are at the entrance taking a break during the first hot day of the season, and are approached by the local TV crew that just arrived to see what is going on because a neighbor called regarding the dust coming from the site.
5. A back hoe has just overturned in the Hot Zone. The operator appears injured.
6. A load of clean fill is being dumped when you notice a red plastic bag.
7. The emergency alarm sounds.

8. A dike holding drainage water from the pit has ruptured and is flowing toward the school.

Facilitate a discussion during the report back.

Summary–Emergency Response

Review the learning objectives. This can be interactive by turning each learning objective into a question. For example, ask: what are some hazardous waste site activities?

- Become familiar with some site activities
- Describe previous work experience
- Identify training requirements using the HAZWOPER standard
- Access information resources

Ask if there are any additional questions and provide answer or place in the parking lot.

Potential unintentional or unexpected spills or releases at a hazardous waste site may occur and require preparation through pre-planning and practice.

Response follows predetermined plans, developed to include specified content:

Emergency Action Plan (EAP) for evacuation

Emergency Response Plan (ERP) for on-site response using an Incident Command System (ICS)

An alerting system is used to inform everyone on site of an emergency condition.

The training required for all workers is detailed in the EAP or ERP

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?

BRINGING IT ALL TOGETHER

| | |
|-------------------------|--|
| Time Requirement: | 3.5 hours |
| Number of Facilitators: | 1 or more, consistent with ratio shown in the Minimum Criteria (Entire team for the site simulation) |

Materials

- Participant Guide
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk
- Site simulation arena set for use

Objective

When completed, participants will be better able to:

- Complete the Simulation that follows

Teaching Methods

- Interactive to allow opportunity for questions/answers
- Small-group activity

Suggested Facilitator Preparation

- Review the Site Simulation that will be conducted later
- Review the Site Simulation Health and Safety Plan
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review feedback from previous exercises
 - Were some done very well?
 - Did any exercise require remediation for ‘successful completion’?
 - Select tasks that require additional practice
- Review the list of chemicals of interest to participants
- Prepare a list of activities for this session
- Determine if you will do a table top or use the arena

Minimum Content Requirements

Practice components of the Site Simulation exercise

Questions You May Be Asked

1. We are all going to be doing different tasks at the site, and some of don't know what we will be doing. Why do we all need to do decon and Level A and?

Facilitate a discussion about being prepared for remediation work, where much of the activity will change over time and new assignments may be made to many participants.

2. I was told that I would just be controlling site access. This still seems like a lot of training for that work.

Ask: Can you think of any activity or event at the site that would result in the occupant of a guard shack being exposed to a hazard? (examples: identify leak from truck leaving site, explosion occurs and wind blows plume toward guard shack)

Presentation of the Session

This session can be presented as follows (tabletop or arena):

- Provide a drum or drums with:
 - Some label information
 - Mock Site description hazard characterization
 - Air monitoring results
 - Electronic and/or print resources including:
 - NIOSH Pocket Guide
 - ERG
 - Glove chart
- Provide the task to be accomplished
- Evaluate risk of exposure
- Develop a work plan (access SOPs participants wrote)
- Facilitate task: stimulate consideration of as many work practices as possible
 - Example: what else is going on at the site?
 - Excavation nearby?
 - Example: any hazard due to walking/working surface instability?
- Set work zones and identify teams
- Walk through the task (with as much use of PPE as time allows)
- Discuss follow up actions such as additional decon, resupply, waste disposal
- Debrief (see below)
- Review the plan for the up-coming Site Simulation (see below)

Debrief

Assure that everyone has opportunity to comment on identified work practice or other improvements. Discuss how the improvements can be accomplished during the upcoming simulation.

Review the up-coming Site Simulation

Include dress requirements.

Site Simulation

The Site Simulation is a series of exercises designed to familiarize each program participant with the good work practices used at a hazardous waste site. At a simulated site, each participant will don, doff and decontaminate respiratory and other personal protective equipment. During the simulation, a site set up with the various work zones, pairs of participants utilizing the Buddy System will participate in specific tasks such as segregating, overpacking, handling, identifying and sampling drums and decontaminating tools and equipment (or other tasks relevant to future work).

The layout of the Simulation, Trainer Qualifications and the Site ERP are described in this section.

Minimum Simulated Site Specifications

- Running water available from an outside spigot or an air driven pump to supply water for the exercise (decontamination) and potable water to prevent dehydration among participants.
- Telephone or radio to summon emergency assistance
- Access to adequate restrooms within 100 yards of site
- Physical site at least 150' x 150'
- Shelter (shield from sun/rain and for breaks and briefings) to seat 30
- Identify alternative site as a contingency plan

Site should be situated so as to minimize public reaction or preparations should be made to deal with concern among passersby. Radio communication requires advance notice to agencies monitoring stations that this is a drill, the name of the group conducting the drill (other locally required information) and notification to the agencies that the drill is terminated.

A sign should be used to indicate that training is occurring; local authorities (police and fire, etc.) and the local media should be notified if the exercise is visible to the public

If night exercises are contemplated, lighting requirements set by OSHA must be met

Close proximity to the classroom facility is preferable

Preparation-Minimum Required Equipment/Supplies

- 8-10 SCBA units with cases and airline capability; 8-14 spare tanks with recharge capability onsite
- 8 complete Level A training ensembles. Suit fitted with glove rings so the participant can retract hands into suit to operate SCBA, wipe fog from face shield, etc.
- 1 level A suit for demonstration purposes
- Airline system to run 2 airline units with egress and SCBA units
- 24 Full Face APR with cartridges
- 24 complete Level B ensembles
- 24 complete Level C ensembles
- Paper towels and spray disinfectant
- De-fogging solution
- Visqueen
- 24 Hardhats
- 4 Overpacks
- 4 Drums (55-gallon, plastic or steel—new or reconditioned)
- Drum Dolly
- Spark-proof bung wrench and wrench for overpack
- Radio system for use with Level A (optional but strongly recommended)
- Decontamination supplies
 - 3 baby pools/decon pool/methods to construct pools with boards and tarps etc.
 - 3 50' lengths of garden hose
 - 3 sprayers attachable to hoses
 - Sprayer
 - 2 long-handled brushes

- Garbage can
- 2 rinse buckets
- Air Monitoring (optional)
 - Colorimetric pump and appropriate tubes
 - Sampling pump
 - Direct reading detector—oxygen, LEL, hydrogen sulfide
- First Aid Kit
- Drinking fluids and disposable cups
- 4 stools or short step ladders for suiting up
- Barrier tape, stakes, safety cones
- Masking and Duct Tape
- Clipboards
- Binoculars (for Recon)

Participant attire

- Steel toed shoes
- Eyeglasses, if corrective lenses are used (NO contacts); may need eye glass kits
- Work clothes

Participant Tasks at Simulated Site

- Properly don/doff/decontaminate Level A, Level B and Level C
- Demonstrate ability to do at least one of the following activities
 - Overpack
 - Segregate drums
 - Handle/move drums
 - Sample/identify (labels on) drums
 - Decontaminate tools
- Spend minimum of 10 minutes in Level A
- Walk/maneuver in PPE ensembles
- Identify/read drum markings
- Optional: use monitoring equipment, implement site safety plan, respond to stimuli

Rotation

8:00-9:00 a.m. Orientation to site, work zones, emergency response plan, hand signals, exercise tasks and rotation. Demonstrate with group P suiting up before 9 a.m. and group S observing

Description of Site Simulation Exercise Tasks

Task#1 While wearing Level A PPE, participate in the following activities:

- Place a drum in an overpack drum
- Move drums to segregate after identifying labels and markings
- Handle or otherwise move drums
- Identify and collect a sample from a drum
- Decontaminate tools used so they can be taken off site

Task#2 Rest break

Task#3 Don Level A PPE

Establish and check communications by hand signals or radio

Have towel or cloth inside suit to wipe face shield, as needed

Task#4 Help another participant don Level A

- Clean face piece
- Change tank
- Hook up radio (if used)
- Hook up airline in the suit
- Zip up

Task#5 Unsuiting person accompanies each suited person in Task#1; provide assistance if needed

Task#6 Task#5 participants suit up in Level B and C

- Decontaminate Level A
- Assist in removal of Level A

For 12-24 participants, form 6 groups (P, Q, R, S, T, U). For fewer than 12 participants, the exercise will be adjusted by eliminating Tasks 2-4. Each group should be identifiable, by using color coded hard hats, a group letter on hard hats or a letter on suits.

Lay out the simulation field in a logical and clear fashion. See attached. Each task/station should be clearly marked with signs or stakes, numbers on traffic cones or drums or other easy to identify system.

Rotations can be conducted as shown:

| Group Time | P | Q | R | S | T | U |
|-----------------------|----------|----------|----------|----------|----------|----------|
| 09:00-09:25 | 1 | 6 | 3 | 4 | 5 | 2 |
| 09:25-09:50 | 2 | 5 | 1 | 3 | 4 | 6 |
| 09:50-10:15 | 6 | 4 | 2 | 1 | 3 | 5 |
| 10:15-10:40 | 5 | 3 | 6 | 2 | 1 | 4 |
| 10:40-11:05 | 4 | 1 | 5 | 6 | 2 | 3 |
| 11:05-11:30 | 3 | 2 | 4 | 5 | 6 | 1 |

Notes:

30 minutes added to allow for extra time needed at a work station.

As the groups begin to rotate, note that the group from decon (Task#6) rotates to Task#5 (to accompany the folks doing Task#1)

When groups complete the walk with the suited participant (Task#5), they rotate to helping the next group suit-up (Task#4)

The group that completed helping suit-up (Task#4) rotates to begin suiting up (Task#3)

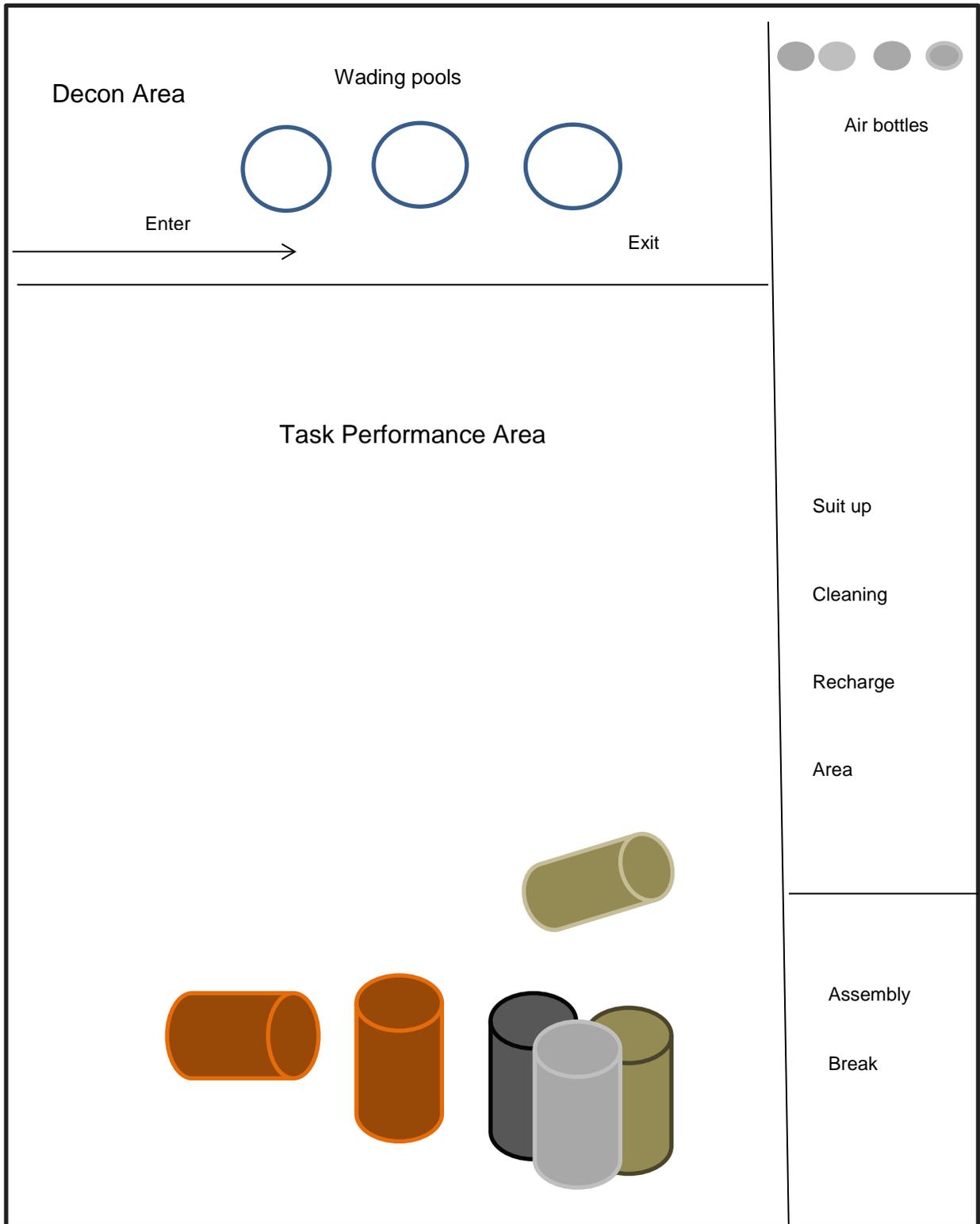
The group that completes activity in Level A and goes to decon (Task#1) rotates to break (Task#2)

After the break (Task#2), the group rotates to decon (Task#6)

Summary:

Task#6 Decon → Task#5 Accompany suited up → Task#4 Assist with suit up →
 → Task#3 Suit up in Level A → Task#2 Break → Task#1 Activity

Participants start at any one of the tasks, and proceed through the order shown.



Example of Site Simulation Layout in Field or Parking Lot

Exercise Stimuli (Optional)

Stimulus: Drum inaccessibility

Proper Response: Participant finds safe alternate route to drum. If no safe alternate, then abort mission.

Needed: Materials necessary to block safe access to target drum. Additional drums, building materials, streams, trees, etc. can be used depending on topography.

Stimulus: Incompatible Lab Pack

Proper Response: Recognize and report to facilitator

Needed: Lab Pack

Stimulus: Unlabeled or double labeled drum

Proper Response: Recognize and report findings to facilitator

Needed: Mislabeled drums or extra labels

Stimulus: Open lid with smoke reaction visible or other evacuation stimulus

Proper Response: Evacuate, alerting others

Needed: Smoke tubes, drum

Stimulus: Site security breach

Proper Response: Suspend activities and alert intruder to leave

Needed: Individual to act as intruder; boundaries clearly marked

Stimulus: Bulge in drum

Proper Response: Participants do not attempt to open and sample drum, report finding to facilitator

Needed: bulged drum

Stimulus: Wind Direction

Proper Response: Determine wind direction by observing wind or weather instrument

Needed: Wind sock, pole

Trainer Qualifications for Site Simulation

1 lead facilitator and 3 or more helpers are needed at a minimum for the mechanics of conducting the simulation. See the NIEHS Minimum Criteria for most recent guidance for specific tasks included in the simulation (download from key documents at <http://tools.niehs.nih.gov/wetp/>).

Trainer qualifications include:

- Medically cleared to use respiratory protection for training
- Experienced in use of all the PPE and procedures
- Skills in anticipation and recognition of possible hazards when using PPE
- Skills in anticipation and recognition of possible hazards during decon
- Documented training in recognizing heat and cold stress effects
- Working knowledge of the Emergency Response Plan

Emergency Response Plan for Conducting the 40H Site Simulation

Introduction

The Site Simulation Exercise is a complex multi-part exercise that integrates much of the training of the 40-hour Site Worker Program into a hands-on simulation during which participants don and perform tasks in Levels A, B and C PPE.

As with any hands-on simulation or exercise there are numerous potential safety hazards (e.g., crushed by a falling drum). In order to assure that facilitators and participants are aware of these potential hazards and how to react, the minimum safety requirements shown below must be implemented during every Site Simulation Exercise.

Safety Briefing

Before the Site Simulation Exercise is started, all program attendees will receive a safety briefing that covers the contents of this plan. (You may want to have participants sign an acknowledgement of participation in the briefing.) If in-suit radios are not used, a clear set of hand signals must be established, verified and used during the Exercise.

Emergency Communications

- Emergency communication equipment (telephone or 2-way radio) will be present at the training site

- Communication equipment will be verified to be working before the Exercise begins
- Emergency telephone numbers and directions to the health care facility will be posted at each telephone or available on the cell phone of each instructor before the exercise is initiated.
- Maps to the nearest treatment center should be posted in the event it is elected to transport a non-emergency case for treatment

Emergency Medical treatment

At least one facilitator present on the training site shall have completed at least the equivalent of the Red Cross Basic CPR course (8 hours).

At least one facilitator present shall have current certification in the Red Cross Basic CPR Course or its equivalent (8 hours).

A standard First Aid Kit shall be available for use during the Simulation Exercise.

Use of a standby EMS crew is preferable (if available) instead of the above.

Site Access

There shall be at least two entrance/exit points to the simulation site.

If the Simulation Exercise is conducted in a public area, a sign shall be posted identifying it as a training simulation.

Physical Hazards

Heavy lifting and physical exertion will be required. Extra caution is required because of the additional stresses from PPE wear. Use of proper lifting technique is essential.

The bulky, heavy PPE increases potential for falling because it restricts range of motion and changes the center of gravity. The extra weight also increases the risk of injury from a fall. These problems will be magnified if the simulation site is not on level ground. A non-suited safety person must stay close to each suited person.

Handling and moving drums is always hazardous but even more so in PPE. All facilitators and course attendees are required to wear safety shoes. Extra care and attention is required to protect the hand from pinching or crushing injuries.

Heat Stress

Heat stress due to wearing heavy equipment and chemical protective suits must be a major concern in summer months and cannot be ignored even in cold weather.

All attendees should be familiar with heat stress from classroom presentations and be able to recognize it.

Adequate drinking water and electrolyte replacements (e.g., Gatorade) must always be available. At high heat stress levels up to two liters of liquid per hour may be required by each person to maintain body fluid levels.

Air temperature and humidity should be monitored before suits are donned. This information is available from the National Weather Service or the local airport weather station.

The lead facilitator must monitor heat stress condition and adjust work/rest times and breaks to insure everyone drinks enough fluid.

All facilitators and attendees must insure they drink adequate liquids to avoid becoming a heat casualty.

Shading in the break area is recommended.

Cool weather may present opposite problems - as the suit is removed, the participant could shill from cold air hitting the body.

Wearing Level A and B

Wearing Level A and B protection presents additional hazards which need attention:

Weight—the additional weight increases stress and affects mobility and balance

Claustrophobia—some people cannot be enclosed in a suit. They must be calmed and removed from the suit.

Hyperventilation—the stress of the suit or respirator causes some people to hyperventilate. They must be calmed and removed from the suit to restore normal breathing.

Breathing Rate—under stress the breathing rate increases and the SCBA tanks will empty faster than the rated time. This means less work can be accomplished.

Low Pressure Alarm—people wearing SCBAs should be reminded that the low pressure alarm does not mean the air is gone, but there is 3 to 5 minutes remaining. This additional reminder may help to prevent panic when an alarm sounds.

While wearing level A or B, each person shall have a 'buddy' within arms length who is not suited and can react provide assistance in any emergency.

All SCBA face masks will be cleaned/disinfected between users.

All Level A training suits should be sprayed with a disinfectant and towel (paper) dried between users.

Responsibilities

Facilitators

Insure that all issues listed in this plan have been discussed in class prior to the Site Simulation Exercise.

Insure all participants are aware of the hazards, how to recognize and react to them.

Have at least three facilitators present at all times during the Exercise (four preferable). One shall be designated as lead and have overall responsibility for the exercise.

Attendees

Be aware of hazards from classroom and hands-on training

Be aware of all aspects of the site safety briefing

Watch yourself and your fellow participants to try to avoid hazards.

Weather

In the event of adverse or inclement weather, the lead facilitator must determine if the Exercise can be conducted without endangering participants substantially beyond the inherent risks of the Exercise under the best conditions. Weather conditions to be considered include but are not limited to excessive heat or cold, rain, snow, limited visibility, high winds.

Plans should exist for use of an alternate sheltered training location to avoid disruption due to weather.

Emergency Stop

An emergency stop signal (e.g., hand position, air horns) that is separate and distinct from any signal used as a training stimulus will be used to terminate the exercise in case of an emergency.

All personnel on site must know the emergency top signal.

CLOSING AND PROGRAM EVALUATION

This concludes the program and may be done after the post-test depending on training center agenda.

Time Requirement: 1 hour

Number of Facilitators: 1 or more, consistent with ratio shown in the Minimum Criteria

Materials

- Whiteboard, easel with paper, or chalkboard
- Markers or chalk
- Evaluation forms

Objectives

- Review initial list on questions to assure complete
- Review the exam
- Answer questions
- Review need for 3-day on-site, site-specific training and annual refresher
- Thank participants

Teaching Methods

- Discussion

Suggested Facilitator Preparation

- Review first day list of questions raised by participants.

Minimum Content Requirements

- Review initial questions
- Review the exam
- Answer last questions
- Thank participants

Questions You May Be Asked

1. “What happens if I do not take a refresher?”

If needed for a job, you will not be eligible. Some employers ‘stretch’ the requirement to 18 months, if the refresher is taken ASAP, but it is a gamble.

2. “What if there is no site-specific training?”

Generally we find that employers provide the site-specific training because the value of company policy and procedures is recognized. See:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=20840 Note that even on a new site, some update is needed as products and hazards may be different.

3. “How do I become a ‘trained supervisor’?”

There is an 8-hour supervisor program for this purpose.

Presentation of the Session

This is an opportunity for final questions and to assure that the list of questions generated on day has been addressed during the program.

Evaluation is important to continued program improvement. This should not be rushed. Provide 15 minutes to complete the program evaluation forms and collect them.

Thank participants for attending the program.

Facilitator Follow up

Make this program better:

Forward suggestions to your Program Director

Are there other 'Questions you may be asked' that should be included?