



Anhydrous Ammonia Emergency Responder Facilitator Guide

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Midwest Consortium for Hazardous Waste Worker Training

Acknowledgments

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Warning

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

Disclaimer—training defines what a responder is prepared to do safely

The Occupational Safety and Health Administration (OSHA) standard to help ensure health and safety during emergency response activities requires specific training for members of the response team, depending upon the duties to be performed. This program is intended to assist the employer in meeting the requirements of the Technician-Level responder to ammonia releases only at industrial sites. Employees trained at this level are permitted to approach the point of release of ammonia to stop or reduce the flow. According to the regulation 29 CFR 1910.120(q)(6)(iii):

Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance.

This program is not a full technician-level program, but rather one focused solely on anhydrous ammonia. Additional training will be required for responders who may be

responsible for controlling the release of other hazardous materials. In addition, annual refresher training is required by OSHA for all emergency responders.

All web links are active as of 2/17/2020; if you find an error, please inform Linda Alerding at alerdilr@ucmail.uc.edu so that it can be updated.

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Course Overview – Facilitator Guide

This Technician-level Emergency Responder training course was developed to assist employers in certifying the required competencies shown in 29 CFR 1910.120(q) for workers who will respond to ammonia releases in food processing only. Those completing the program successfully are not competent at the technician level to respond to any other type of release.

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

This course is designed to be taught in 24 hours. Included in the 24 hours are daily presentations, reviews, and hands-on or small groups exercises and activities; a pre- and post- test are required. Breaks and lunch are not included in the 24 hours. An example of a 24-hour agenda is below; any modifications should be consistent with the content shown and provide 24 contact hours. It is the desire of the Midwest Consortium for Hazardous Waste Worker Training to allow professional instructional freedom yet maintain consistency of training. 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 workshops. To provide an effective participant /teacher ratio and maximize learning, limit the class to no more than 24 participants.

When finished, participants will better be able to:

- Recognize hazards of ammonia
- Contain a release
- Minimize exposure to ammonia
- Prevent the spread of the contaminant
- Describe practices to reduce potential emergencies
- Implement actions in the emergency response plan
- Play a role in the Incident Command System

Recommended Agenda

Day 1	Day 2	Day 3
Course Introduction, Pretest 30 min		Review Days 1 and 2 30 min
Intro to Ammonia ER 30 min	Level B or A Dressout 90 min	Emerg Resp Tabletop 45 min 100 min
Chemical Properties 60 min	Material ID 45 min Exercise 45 min	Safety briefing and simulation set up 45 min
Toxicology 45 min		
Med Surveillance 15 min	Monitoring 30 min	
PPE 45 min		
Lunch	Lunch	Lunch
PPE Exercise 60 min	Monitoring Exercises 120 min	Level A or B Simulation 120 min
CPC & exercise 60 min	Work Practices 45 min Exercises 60 min	Cleanup and Critique 45 min
Level C or B Checkout and Dressout 90 min		Questions and Test 45 min
PPE other 15 min	Decon 60 min	
Review 30 min	Review 15 min	Evaluation and Closing 20 min
Hours 8.00	Hours 8.50	Hours 7.50

Facilitator Preparation

This 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. These varied formats are designed to meet the different types of learners who might be present in your course. A suggested agenda is shown above; depending on the knowledge and skill levels of participants, the times may be adjusted to meet the needs.

The agenda shows two dressouts sessions—C and B or B and A, depending on what will be used in the Simulation. Determine the needs of participants prior to program delivery. When no information is known, it is recommended that B and A are used, with a demo of C when time allows.

Schedule breaks as needed. The 24 hours of training is contact hours, not including breaks and lunch. When changes are made, a final agenda should be placed in the program file, documenting 24 contact hours of training.

The Facilitator Guide provides step-by-step instructions for presenting the material. Each section 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. Each facilitator should be familiar with the material in the Participant Guide, the Facilitator Guide and the Exercises to be taught; the lead instructor should be familiar with all aspects of the program. Participants recognize when one facilitator does not know what has already been covered by others; therefore, it is recommended that each facilitator be briefed on the entire program content. In addition, facilitators should be familiar with the OSHA Standard, 29 CFR 1910.120(q) and other applicable standards mentioned in the text. Review the number of participants and assure that you have sufficient staff to meet the WTP Minimum Health and Safety Training Criteria; see

<https://tools.niehs.nih.gov/wetp/index.cfm?id=142>, page 27. Also assure that the definition of 'successful completion' and any policy to remediate deficiencies are obtained from the Program Director.

Reconnaissance at the company(ies) where participants are employed will enhance the program. This will provide background on the types of ammonia releases that may be expected, areas of emphasis (ex: engine room, rescue), topics not relevant, label and marking systems and diagrams and plans.

If the process is to copy required checklists after completion so that participants have documentation of skills, assure that copy facilities are available. If the procedure is to hand out checklists and then collect them for the program file, assure that you have adequate copies for use.

Lesson plan forms may be helpful when drafting your presentation outline. Examples of lesson plan 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 this course:

- 29 CFR 1910.120, HAZWOPER
- 29 CFR 1910.119, PSM
- NIOSH Pocket Guide
- North American Emergency Response Guidebook

The following instructional resources are useful:

OSHA resources

- https://www.osha.gov/SLTC/etools/ammonia_refrigeration/ammonia/index.html
- <https://www.osha.gov/SLTC/ammoniarefrigeration/evaluation.html>
- https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARD_S&p_id=9761
- https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARD_S&p_id=9757
- https://www.osha.gov/SLTC/etools/ammonia_refrigeration/references/iiar_psm_guidelines.html#Chapter%203

interpretations of training requirements

- <https://www.osha.gov/laws-regs/standardinterpretations/1991-05-10-0>
- <https://www.osha.gov/laws-regs/standardinterpretations/2003-06-24-0>
- <https://www.osha.gov/laws-regs/standardinterpretations/1993-01-26-6>

EPA resources

- https://www.epa.gov/sites/production/files/2015-05/documents/accident_prevention_ammonia_refrigeration_5-20-15.pdf
- <http://www.toxalert.com/appNotes/docs/AnhydrousAmmonia.pdf>
- <https://www.youtube.com/watch?v=16pjAjdsiMU>

International Institute of Ammonia Refrigeration

- http://web.iiar.org/membersonly/PDF/CO/ANSI_IIAR7_2013.pdf

TRANSCAER Anhydrous Ammonia Training (see especially section III. Properties)

- <https://www.transcaer.com/aa-tour>

New Jersey Hazardous Substance Fact Sheet for Ammonia

<https://nj.gov/health/eoh/rtkweb/documents/fs/0084.pdf>

Regional resources

EPA Region 7

https://www.epa.gov/sites/production/files/2015-05/documents/accident_prevention_ammonia_refrigeration_5-20-15.pdf

State-specific resources and regulations

Illinois

https://ifca.com/media/web/1480521399_2016_new_nh3_rules_compliance_guide.pdf
https://www.cdc.gov/mmwr/volumes/69/wr/mm6904a4.htm?s_cid=mm6904a4_w
<https://wgntv.com/2017/06/06/7-hospitalized-after-ammonia-leak-in-streamwood-food-processing-complex/>

Indiana—Please share updates as identified

Kentucky—Please share updates as identified

Michigan

https://www.michigan.gov/documents/deq/deq-oea-aqd-brochure-Anhydrous_Ammonia_Fertilizer_492094_7.pdf

Minnesota

<https://www.mda.state.mn.us/fire-department-response-ammonia-releases>
<https://www.mda.state.mn.us/ammonia-incident-summaries>

North Dakota

<https://www.legis.nd.gov/information/acdata/pdf/7-12-01.pdf>

Ohio

<http://epa.ohio.gov/dapc/atu/112r>

Tennessee—Please share updates as identified

Wisconsin

<https://www.greenbaypressgazette.com/story/news/2019/10/17/residents-evacuated-possible-ammonia-leak-american-foods-green-bay/4008221002/>

Videos-general

Municipal training video (staged)

<https://www.youtube.com/watch?v=lzObhHet9QM&feature=youtu.be>

Arkansas plants

<https://www.youtube.com/watch?v=kI3aHXHlqrc>

Chemical Safety Board

<https://www.csb.gov/millard-refrigerated-services-ammonia-release/>

Presentation of Material

Review time is shown on the agenda at the end of days 1 and 2 and at the beginning of day 3. Use this time to reinforce key points and objectives.

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 trainees 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 word slides, slides with term definitions, and slides as lecture outlines. These

types of slides are not effective at keeping trainee attention. Effective slides contain questions, color graphics and short lists.

Exercises

Small-Group Activities and Exercises

Small-group activities and exercises (many with performance measures) are incorporated throughout this training course. Exercises are collected in a separate document, the Exercise Guide. In this Facilitator Guide, the instructions for the activity are shown. Scenarios for several response settings are presented in this Guide so that tabletops and hands-on work can be selected based on participant needs. As a facilitator, you will select the appropriate material and provide the exercise to the participants. The purpose of these activities and exercises is to experientially involve trainees in clarifying information, identifying options and developing skills.

Most activities or exercises are done in small groups or with a buddy. These 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 trainees will have no problems participating in group discussion, while others may have a hard time talking with group members, especially on day 1. Some participants will hesitate to be the recorder for the report backs. As with any team or group, facilitate productivity by the group, as they wish to organize themselves for a task.

Suggestions for handling group activities and discussions include the following:

- Allow trainees to freely express their values, attitudes, and opinions.
- Do not judge trainee 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 volunteer from the group present answers to the class.
- Keep the groups focused on the task at hand. Because small-group exercises can draw heavily on the trainees' 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 trainees 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.

Activities are designed to provide the opportunity for trainees to observe demonstrations and receive hands-on experience using equipment while reinforcing theoretical aspects learned in class. Some are set up as rotating stations with an assistant facilitator at each station. Performance checklists are completed by the trainee during many of these activities; the performance checklist is reviewed and signed by the facilitator when work at each station is completed. Retention of Performance Checklists in the Program File is required to document skills; knowledge test scores are also retained. The combination attendance, 100% on all Checklists and a minimum score of 70% for knowledge is the definition of Successful Completion. The training center policy on remediation for anyone who does not achieve Successful Completion must be followed.

Assure that only those who have provided Fitness for Training documentation participate in any respiratory protection/CPC exercises.

Course Introduction

Time Requirement: 30 minutes

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

Materials

- Student materials (Participant Guide)
- Agenda
- Local example of release that resulted in a response
- Pretest

Objectives

During this introduction, participants will:

- Use a local example to identify or illustrate response hazards
- Complete a pretest

Teaching Methods

Discussion

Suggested Facilitator Preparation

- Review agenda and Participant Guide
- Provide an example of a local release or one from the Midwest that resulted in a response. See options in Resources below or search in newspaper, newsletters and @MidwestHazMat
 - Include in the description:
 - Location and surrounding area features (homes, other hazards, transportation routes, water ways)
 - Time of day
 - Material(s) released—name and volume
- 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)
- Assure that all facilitators know the requirements for 'successful completion'

Minimum Content Requirements

- Welcome everyone and facilitate brief introductions
- Review the HAZWOPER acronym and the MWC
- Present a local example
- Review the agenda and goals of the program
- Each participant completes the pretest
- Review requirements for successful completion

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. We do not deal with ammonia. I have no idea why I am here.

This course will help you identify what is needed in order to do a response to an ammonia release. If the employer determines that you will not respond, but will call in outside assistance, this program will help you communicate better with that team.

3. Why does this take 3 days?

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 of a responder.

Resources

Local releases—news from the press; some include a video

South Holland IN release:

https://www.nwitimes.com/news/local/ammonia-leak-causes-evacuation/article_d5dba69d-d17b-5c88-a09d-f46c151b03e8.html

Louisville KY release:

<https://www.safetyservicescompany.com/industry-category/construction/ammonia-leak-in-louisville/>

Corbin KY release:

<https://www.thenewsjournal.net/ammonia-leak-forces-evacuations-in-corbin/>

Note: Wayne Whiting at Lakeshore Technical Center has video of interview with IC. Please contact him for access if planning to use this Kentucky example.

Mt. Sterling KY release:

<http://www.wkyt.com/home/headlines/7900922.html>

Lake County IL release:

https://www.cdc.gov/mmwr/volumes/69/wr/mm6904a4.htm?s_cid=mm6904a4_w

Seward IL release: (illustrates bounce down, due to atmospheric conditions)

<https://www.chron.com/news/nation-world/article/Northern-Illinois-town-evacuated-after-ammonia-1809721.php>

<https://www.youtube.com/watch?v=sNkdAs1e7Cw>

https://video.search.yahoo.com/yhs/search?fr=yhs-pty-pty_forms&hsimp=yhs-pty_forms&hspart=pty&p=seward+il+ammonia+release+part+2#id=1&vid=0436d84944abdca01c70c02be3519fde&action=click

http://www.illinoisattorneygeneral.gov/pressroom/2007_05/20070511.html

Chicago IL release:

<https://www.youtube.com/watch?v=QH1UNdCQd3I>

Wellston OH release:

<https://www.nytimes.com/1989/10/16/us/entire-town-in-ohio-is-evacuated-in-gas-leak.html>

Winton Hills OH release:

<https://www.wlwt.com/article/ema-ammonia-leak-prompts-shelter-in-place-in-winton-hills/21284807>

Vandalia OH release:

https://www.wdtv.com/news/chemical-leak-evacuates-vandalia-plant_20180323102438638/1073178993

Ohio release:

<https://www.daytondailynews.com/news/local/anhydrous-ammonia-incidents-southwest-ohio/06V3iBzYOBnSqtqKI8U8VN/>

Berry Hill TN release:

<https://wreg.com/2017/06/06/two-nashville-plants-evacuated-after-ammonia-leak/>

Godlettsville TN release:

<https://fox17.com/news/local/tysen-plant-in-goodlettsville-evacuated-due-to-ammonia-leak>

Darien WI release:

<https://www.firehouse.com/rescue/hazardous-materials/news/21015508/darien-wi-birds-eye-food-packaging-plant-ammonia-leak-firefighters>

Abbotsford WI release:

<https://www.firehouse.com/rescue/hazardous-materials/news/21015508/darien-wi-birds-eye-food-packaging-plant-ammonia-leak-firefighters>

<https://wsau.com/news/articles/2018/apr/24/abbyland-ammonia-spill-remains-under-investigation/>

Wauseca MN release:

<https://www.homefacts.com/environmentalhazards/Minnesota/Waseca-County/Waseca/Polluter-Birds-Eye-Foods-Llc-56093gnlnk4004t.html>

Hudsonville MI release:

https://www.mlive.com/news/grand-rapids/index.ssf/2014/03/environmental_company_called_t.html

Other resources:

Many releases are also described on the MWC twitter feed: @MidwestHazMat. The following may also be useful:

California example: <https://thebusinessjournal.com/del-monte-to-pay-190k-epa-settlement-over-sanger-plant-gas-leak/>

Boston example <https://www.youtube.com/watch?v=d2laXfaszrA&feature=youtu.be>

Presentation of the Session

This session can be presented as follows:

Introductions

Introduce yourself and ask each participant to provide an introduction.

Introduce HAZWOPER and the MWC

Turn to the Participant Guide and review HAZWOPER.

Using the Acknowledgements, introduce the Midwest Consortium, and the idea of 'model training', developed to be interactive and to facilitate development of skills that can be applied at work and in the community to reduce emissions and to respond when needed. Illustrate all the locations of training centers by pointing to the cover of the manual. Note that your organization is part of the MWC, a group funded by NIEHS to provide 'model' programs that emphasize interactive training for both knowledge gain and skill development that really 'sticks' and can be used at work.

Recent Releases (Local example)

Provide some context for training by using a local regional example to generate discussion. Questions you might ask include:

1. Is there anything that could have been done to prevent the release?
2. What actions might have limited the effects of the release?
3. Did everyone seem to know what to do?
4. What could be done to assure a different outcome in the future?

Agenda and goals for the 3 days

Distribute the agenda for the program.

Refer participants to the agenda and highlight:

- Specific topics (e.g., Chemical Properties, Toxicology, Work Practices)
- Specific exercises
- Skills
- PPE, plans

Review the overall goals of the program, found in the Participant Guide.

Review ‘successful completion’.

Underscore the participatory nature of the program and how to get the most from the sessions.

Point out web access to a glossary and list of acronyms; if you have paper copy for use during the program, alert participants to location of the resources at the training facility.

Pretest

Distribute the pretest and provide approximately 15 minutes for each participant to complete it. Retain scores for the program file.

Summary

Review the list of ‘how to get the most out of training’.

Answer any questions.

Introduction to Ammonia Emergency Response

Time Requirement: 30 minutes

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

Materials

- Student materials (Participant Guide and Exercise Manual)
- Copies of HAZWOPER or access to the electronic version

<https://www.osha.gov/laws-regulations/standardnumber/1910/1910.120>

- Copies of PSM or access to the electronic version

<https://www.osha.gov/laws-regulations/standardnumber/1910/1910.119>

- For definition of 'hazardous substance': section 103(14) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (42 U.S.C. 9601); U.S. DOT 49 CFR 172.101 and appendices; 40 CFR 261.3; 49 CFR 171.8.
- White Board, easel and easel paper, or chalkboard
- Chalk or marker

Learning Objectives

During this session, participants will:

- Review the format of the HAZWOPER regulation
- Use HAZWOPER to find and review a definition of Hazardous Material and Emergency Response
- Discuss advantages of response organization
- Describe the limited scope of this program
- Review the OSHAct and worker and employer rights and responsibilities

Teaching Methods

Discussion

Suggested Instructor Preparation

- Review agenda and Participant Guide
- Review HAZWOPER, especially the definitions and paragraph q
- Assure web access, if to be used to access HAZWOPER
- Test web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdlr@ucmail.uc.edu
- Review <https://www.osha.gov/workers/index.html>
- Review <https://www.osha.gov/dcsp/smallbusiness/index.html>.
- Develop background if contract program: has there been an OHSA inspection, a release? Is there an ERP or EAP?
- Review OSHA reporting requirements

Minimum Content Requirements

- Review HAZWOPER format
- Review definitions of hazardous material and emergency
- Discuss response organization
- Discuss the need for ammonia-specific training
- Review the OSHAct and rights and responsibilities

Questions You May Be Asked

1. “You said we have to do this every year?”

Your employer is required annually to certify competency to respond at this level; very often, an employer includes refresher training as part of that process. The refresher programs are generally 8 hours and may include (or be supplemented by) drills or other training during the year.

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.

4. What if I move to another employer where ammonia is not used. Am I still a technician?

No, this program only pertains to ammonia work. If you are responsible for approaching the point of emission of any other hazardous material more training is needed. As shown in the standard, 24 hours of training at the Operations Level is required prior to a full technician-level training program.

5. Why is this limited to just ammonia?

In refrigeration for food processing, ammonia is the primary chemical release hazard. This program was developed to respond to the most-anticipated releases. A full process hazard analysis is required to identify any other hazards, plan appropriate response actions and identify the training needs of all who will be involved.

Presentation of the Session

This session can be presented as follows:

The format of an OSHA standard

Review 29 CFR 1910.120 broadly and be prepared to discuss state-plan and federally enforced approaches. Maintain a focus on paragraph q.

Lead participants to 29 CFR 1910.120(q)(6) that shows the training for each level of responder activity. Show that in order to participate in Technician training, 24 hours of operations training should have been completed. Refer participants to the regulation to show that for the technician-level program, a prerequisite is 24 hours of training at the operations-level. Underscore that this limited-duration program does not provide the broad competencies of those who respond to releases other than ammonia. Review the actions that each level of emergency responder can do.

What is a Hazardous Material and an Emergency?

There are various definitions. The manual includes very generic definitions.

Have participants find the definition of ‘hazardous substance’ in the Definitions section of HAZWOPER.

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

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

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

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

[D] Hazardous waste as herein defined.

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

Introduce Process Safety Management, 29 CFR 1910.119 NOTE: determine if this standard applies as part of reconnaissance (contract) or during program introductions (open enrollment).

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

<https://www.osha.gov/SLTC/processsafetymanagement/standards.html>

Facilitate a discussion and answer any questions that are asked.

How is a Response Organized?

Ask: How can an organized response limit exposure? Discuss.

Ammonia-specific program

Ask: Why is ammonia-specific training needed? Facilitate a discussion on the topic.

OSHAct

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. Review each of the Rights and Responsibility for workers.

Ask: How does this impact responders?

Review each of the Rights and Responsibility for employers.

Ask: How does this impact responders?

Summary

Review the learning objectives

- Review the format of the HAZWOPER
- Review the definitions of Hazardous Material and emergency
- Discussed advantages of response organization
- Describe the limited scope of this program
- Review the OSHAct and worker and employer rights and responsibilities

Answer questions.

Chemical Properties of Ammonia

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 Manual)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- NIOSH Pocket Guide

Learning Objectives

When completed, participants will be better able to:

- Describe the importance of basic chemical terms relevant to ammonia
- Identify special characteristics of ammonia that impact responders
- Demonstrate an ability to find properties of chemicals using resources

Teaching Methods

- Small-group activity
- Presentation
- Video

Suggested Facilitator Preparation

- Review the Participant Guide and exercise
- Prepare any stories and case studies which may be used
- 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 and the following:
 - <https://www.thefreelibrary.com/Refrigeration+systems+failures+due+to+sudden+evaporation+and...-a0394346896>
 - Flammability and explosibility of ammonia (with details on flash point determination)
https://www.researchgate.net/publication/292546166_FLAMMABILITY_AND_EXPLOSIBILITY_OF_AMMONIA
- Review resources
 - SDS such as <https://www.praxair.com/-/media/corporate/praxairus/documents/sds/ammonia-nh3-safety-data-sheet-sds-p4562.pdf?la=en>
 - New Jersey Fact Sheet:
<https://nj.gov/health/eoh/rtkweb/documents/fs/0084.pdf>
 - Reaction with water: <https://www.youtube.com/watch?v=vgBe0fsPcjk>

Minimum Content Requirements

- Selected chemical properties of anhydrous ammonia
- Discuss the physical and chemical properties of ammonia
- Identify ammonia properties that require special consideration in a responder
- Use of the *NIOSH Pocket Guide to Chemical Hazards* to find chemical properties

Questions You May Be Asked

1. Why do I need to know about things like boiling point or vapor pressure?

Knowing the properties of ammonia can help predict behavior and hazard. For example, outdoors, ammonia will rise and disperse but in an enclosed space such as a warehouse, ammonia gas might collect at the top the building increasing hazard to anyone who had to access the roof through the warehouse.

2. Most of our releases occur in an isolated part of the plant. We evacuate, call the ammonia technician and then provide support functions. But we can still get exposed. Does this training help with those functions?

Yes, decon, monitoring and command support functions are covered.

Presentation of the Session

This session can be presented as follows:

Important Terms

When you begin your presentation:

Ask: What happens when ammonia is released? List responses for future reference.

Ask: What chemical properties do you think are important to know when dealing with ammonia?

- List answers where all can see. As you review the properties in this section, take more time with those the participants did not identify.
- As you introduce each chemical property, ask the participants if they can give an example of how it relates to ammonia. Keep them thinking and participating.

Boiling Point and Vapor Pressure

Ask some questions like:

How is ammonia maintained as a liquid at the plant? (under pressure)

What happens if there is a release? Vaporizes—see BP at -28. Extracts heat from environment.

Specific Gravity

Emphasize that ammonia has low sp gr and it vaporizes FAST.

Ask: What happens if ammonia is released to water?

Relative Gas Density

Ask: Based on VP, what happens when ammonia is released outside? Inside—does it rise or fall?

FI.P., ER, FP, dissociation, VER, T_{CR}

Note these commonly reported chemical properties are difficult to determine or not determined for anhydrous ammonia.

Solubility

Ask: Does anhydrous ammonia easily dissolve in water? Discuss how solubility changes based on temperature and pressure.

pH, Acids, Bases

Ask trainees to give examples of acids and bases. Have trainees look at the pH scale in the Participant Guide and identify where household ammonia (ammonium hydroxide) is on the scale.

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.

Incompatible Chemicals

Using the list in the Participant Guide, identify any incompatible materials that are in the plant. If participants do not know, ask: Do you have any tools that are brass? Contact

of brass with ammonia can cause the metal to become brittle and fail. Review elements and compounds ammonia is incompatible with.

Explosive Limits/Fire Tetrahedron

Discuss the LEL, UEL and ER or FR for ammonia.

Note that oil droplet contamination can increase fire risk.

Toxic Products of Combustion

Ask: Why is there concern about the ‘stuff’ that results during and from fire”.

Review what results from ammonia burning.

Ask: Could there be hazards from structure or surrounding materials in your plant?

Weather

Ask: How can the weather impact the behavior of ammonia?

Video of ammonia release (see options below)

Municipal training video (staged)

<https://www.youtube.com/watch?v=lzObhHet9QM&feature=youtu.be>

Arkansas plants

<https://www.youtube.com/watch?v=kI3aHXHlqrc>

Chemical Safety Board

<https://www.csb.gov/millard-refrigerated-services-ammonia-release/>

Exercise — Using the NIOSH Pocket Guide to Find Chemical Properties

Number of Facilitators Required: 1

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

Materials: NIOSH Pocket Guide and Worksheet in the Exercises Manual. Note that this activity is not a Performance Measure; the Worksheet is not graded or collected.

Procedure: Ask: Are there any terms that look unfamiliar? (example CAS). Review meaning and use of any that are identified.

Guide the trainees through the exercise as needed. Have them work in small groups or individually.

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

Review any terms that were confusing to participants.

Summary – Chemical Properties

Review learning objectives

- Describe the importance of basic chemical terms relevant to ammonia
- Identify special characteristics of ammonia that impact responders
- Demonstrate an ability to find properties of chemicals using resources

Ask the trainees to give details of the properties of anhydrous ammonia for the terms below. The NIOSH Pocket Guide is a useful reference.

- Boiling point (BP)
- Vapor Pressure (VP)
- Specific gravity (Sp. Gr.)

- Relative gas density (RGasD)
- Flash point (Fl.P.)
- Expansion ratio (VER)
- Critical temperature (T_{CR})
- Acid, base (pH)
- Solubility (Sol)
- Lower and Upper Explosive Limits (LEL, UEL)

It is very important to know these properties in order to respond safely. Special properties of ammonia to consider include

- Incompatibilities
- Toxic products of combustion
- Low boiling point
- High expansion ratio
- Solubility
- Effects of weather

Toxicology and Health Effects

Time Requirement: 45 minutes plus 15 minutes for medical surveillance

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

Materials

- Participant Guide, Exercise Manual
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Wall charts or slides of organ systems
- Medical dictionary, SDS Dictionary, MWC glossary
- NIOSH Pocket Guides

Learning Objectives

When completed, participants will be better able to:

- Identify several principles of toxicology important in ammonia exposure
- Identify human responses to ammonia exposures
- List reasons why medical surveillance is important to emergency responders
- Describe privacy of medical information
- Demonstrate an ability to find health effects of ammonia exposure using resources

Teaching Methods

- Presentation/discussion
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide
- Note that human exposure toxicology data is presented on page 38; this is very different from exposure guidance. See the source cited.
- Test all web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Copy Performance Checklist
- Prepare an outline to follow
- Review resources
 - <https://www.atsdr.cdc.gov/mmg/mmg.asp?id=7&tid=2>
 - <https://www.youtube.com/watch?v=YUd-PAy3iy4>
 - a fatality <https://www.youtube.com/watch?v=AKuwDfbHpBY>
 - New Jersey Factsheet:
<https://nj.gov/health/eoh/rtkweb/documents/fs/0084.pdf>
 - NIOSH Pocket Guide

Minimum Content Requirements

- Using NIOSH Pocket Guide to find health effect information
- Basics of toxicology related to ammonia
- Possible routes of entry of ammonia
- Effects of ammonia on the body
- Heat and Cold
- Medical Surveillance Program requirements

Questions You May Be Asked

1. One of my friends who is a refrigeration technician has lost most of his sight. Is this related to work?

Admit that you have no data based on SDS, New Jersey Fact Sheet and NPG. Suggest the friend contact an occupational physician with the concern; see the Association of Occupational and Environmental Clinics <http://www.aoec.org/>.

2. Why is freezing called burn?

Ask: What happens to the skin when it freezes? Be ready to discuss that the injury to the skin and underlying tissues is similar. Both heat and cold destroy tissue.

Presentation of the Session

The session can be presented as follows:

Introduction

Ask: Has anyone ever choked or had irritated eyes because of an exposure at work?

Exercise – Using Resources to find Health Effect Information

In this exercise participants will use the NIOSH Pocket Guide and the New Jersey Fact Sheet to find health effect information for ammonia. Use this exercise as a review of routes of entry, symptoms, target organs of ammonia exposure at the beginning of the sections, not at the end. Refer participants to the manual for definitions/explanations.

Number of Facilitators Required: 1

Time Requirement: approximately 35 minutes (20 for exercise and 15 for report-back)

Materials: NIOSH Pocket Guide and worksheet in Exercises

Procedure: Guide the trainees through the exercise as needed. Have trainees work in small groups or individually.

Have trainees select a representative from each group to report to the entire class (if time allows). The Performance Checklist should be reviewed by you and collected for the program file. If participants want to retain the information, provide a copy when time allows or ask that they record the information on the Exercise manual Performance Checklist.

Using the report back, cover the basic principles of toxicology including acute effects, chronic effects and routes of entry. Identify any errors in information obtained and review any items that were confusing to participants. Below are some questions and notes for the report back as well as a few additional questions.

Ask: What did you find about routes of entry for ammonia?

- Discuss **inhalation, skin /eye contact, ingestion, and injection**
- Distinguish between skin contact and skin absorption
- Introduce multiple routes of entry

Ask: What are the symptoms of exposure?

Ask: Which symptoms are related to local effects?

Ask: Which symptoms are related to systemic effects?

Ask: What are the target organs that may be affected?

Ask: What is an acute exposure?

- If no one answers, write the answer where all can see.
- Discuss acute exposures and health effects from examples provided by individuals in the class or your own experience. Facilitate a discussion of workplace exposures that result in an acute effect.

If they don't seem engaged:

- Ask: What toxic effect does alcohol have on humans? You will likely get the answer of a chronic effect (liver damage) rather than the acute effect (central nervous system).

Ask: What is the acute effect of ammonia exposure?

Ask: What is meant by the warning properties of the chemical? Some examples:

- Severe irritants of eyes, throat, airways, and skin
- Smell; ammonia has a pungent smell, but the sense of smell can be unreliable-don't depend on your nose

Ask: What is a chronic exposure?

Write some examples of chronic exposures where all participants can see. Emphasize that this involves exposure day after day resulting in many exposures without time to clear from body.

Ask: Do you know of any chronic effects of ammonia exposure?

Refer participants to the New Jersey fact sheet. Provide a minute for them to find that section and voice the information.

- Cancer. Not tested in animals
- Asthma, Lung disease
- Reproductive hazard—tested and not classified as such

Factors That Influence the Body's Response to Exposure

Ask the participants to imagine that everyone in the room is exposed to anhydrous ammonia (gas) at one time. (What route of entry is this?) Everyone is asked to report if throat irritation is experienced and at what time.

Does everyone experience the same concentration in the air?

This is EXPOSURE

Then assume that one person is 6 feet tall and one is 5 feet tall (not specific people, as someone may feel uncomfortable). Ask: When each of these people breathe, does one take in more air than another?

This DOSE.

The 5-foot person reports throat irritation at 10 minutes and the 6-foot person reports throat irritation at 7 minutes.

At the same exposure, it took longer for the 5-foot person to inhale the same quantity of air that resulted in the first indication of irritation.

Dose-response: The greater the amount taken into the body, the greater the effects.

Exposure or Dose? The concentration of a chemical in the air is Exposure. The concentration of the chemical or a metabolite in the body is Dose.

Ask: Why do you think people may respond differently to exposures? Some reasons may include:

- Current health status
- Age
- Race
- Allergy history
- Heredity (includes sensitivity to allergens, metabolism, biochemical mechanisms, susceptibility, etc.)
- Previous chemical exposure

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

Make sure participants can use key terms: target organ, health hazard, acute, chronic, local, systemic.

Emphasize the target organs for ammonia (respiratory tract, skin, eyes)

Heat and Cold

Ask: What are the symptoms of overexposure to heat? Refer to table in Participant Guide.

Ask: What are the symptoms of overexposure to cold? Refer responses in Participant Guide.

Medical Surveillance Program

Key points:

- HAZWOPER includes requirements for medical surveillance for responders that meet specific criteria.
- Employers are required to pay for required medical exams
- The employee should report all work-related injuries and illnesses immediately

Exposure Records

- OSHA gives employees the right to obtain relevant exposure and work-related medical records
- The employer must keep records of medical exams and exposure monitoring until 30 years after the worker's employment ends

Summary

Review learning objectives

- Identify several principles of toxicology important in ammonia exposure
- Identify human responses to ammonia exposures
- List reasons why medical surveillance is important to emergency responders
- Describe privacy of medical information
- Demonstrate an ability to find health effects of ammonia exposure using resources

Ask participants to give details about ammonia regarding the following terms:

- Acute effects, acute toxicity
- Chronic effects, chronic toxicity
- Routes of entry
- Local effects
- Systemic effects
- Warning properties
- Sensitizer
- Target organ
- Carcinogen

Contrast Dose-response and Exposure-response

Heat and cold stress

Medical surveillance requirements are shown in HAZWOPER.

Personal Protective Equipment (PPE) Introduction

Time Requirement: 15 minutes

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

Materials

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

Objective

There are no formal learning objectives for participants for this brief overview.

Teaching Methods

Presentation/Discussion

Suggested Facilitator Preparation

- Review the Participant Guide
- Prepare class notes

Minimum Content Requirements

- Overview of PPE; relate to agenda
- This is also an opportunity to gauge the level of knowledge of participants regarding PPE and the hierarchy of controls

Questions You May Be Asked

1. PPE seems easy so why are we spending so much time worrying about it?

Be prepared to facilitate a discussion of the need to properly fit, train, maintain, and replace PPE. This requires personnel, tracking, recordkeeping and the ongoing costs do accumulate. It is critical that PPE be ready when needed!

2. We all grow beards during hunting season; is this a problem?

Facilitate a discussion about how this will affect the face-to-facepiece seal. Ask one or more participants to don a full-facepiece respirator and do a user check. Then place several short straws or other materials between the facepiece and the face. Have the participants repeat the user check. This could also be done by asking someone who needs an eyeglass kit inside the facepiece to do a user check with eyeglasses on.

Presentation of the Session

The session can be presented as follows:

Introduction

Discuss PPE in terms of RPE, CPC and other; link to the agenda.

Emphasize that PPE is the last line of defense against ammonia exposure.

Ask participants about PPE use in at the work site or used during previous ammonia responses.

Summary—PPE Introduction

Summarize the points made during the brief overview discussion. Document points made in the program file.

PPE - Respiratory Protective Equipment

Time Requirement: Presentation – 30 minutes

Exercise – 60 minutes

Number of Facilitators: 1 for presentation/discussion, 2 or more for demonstration, workshop, consistent with Minimum Criteria

Materials

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

Section Objectives

When completed, participants will be better able to:

- Describe appropriate applications of respiratory protection for ammonia response
- Evaluate situations to determine if respiratory protection is required
- Identify the requirements of a respiratory protection program
- Demonstrate ability to don, use (inspect, clean), and doff respirators
- Identify the elements of respirator training that should be provided by the employer

Teaching Methods

- Presentation
- Demonstration
- Small group activity
- Workshop

You should provide various examples of the types of respirators. If possible, as the different types of respirators are introduced, pass the facepieces around the room for the participants to look at. At the end of the presentation, ask some review questions to sum up the presentation. Long question-and-answer sessions with the trainees should be avoided, because many of their questions will be answered during the workshop.

Suggested Facilitator Preparation

- Review the Participant Guide
- Review information from Program Director on expected response activities
- Prepare an outline for notes
- Review exercise (Respiratory Protection Demo and Workshop)

Demo: Don, doff full-facepiece APR

Demo: Fit testing, qualitative and quantitative

Practice: User Checks of an APR

Practice: Donning and doffing full-facepiece APR with supplied air bottle

Practice: Inspecting and cleaning respirators

Optional: Wearing an airline with escape unit

- 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 workshop stations
- Copy Performance Checklists for participants
- Review 29 CFR 1910.134, Respiratory Protection
- Some OSHA offices have internal directives (not a national interpretation letter) regarding use APRs when a personal ammonia monitor is worn. Check with your local OSHA office for any needed guidance.

Minimum Content Requirements

- Selection - when respiratory protective equipment should be used and what type
- Occupational exposure limits
- Use - respirator fit, medical fitness required
- Care and maintenance of respirators
- Exercise

Questions You May Be Asked

1. Students might remark, "We don't inspect our PPE this way at our site. So what are we supposed to do?"

Be prepared to facilitate a discussion about working through union or labor representatives to facilitate review and possible changes in the facility Emergency Response Plan (ERP). Emphasize that HAZWOPER requires the development and implementation of written procedures. Alternative procedures may be effective. Stress that inspection must be performed.

2. "What do I do when my employer tells me there is no budget to get new gear, 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 regulation requires that employers provide protective gear. Perhaps the employer is waiting to order a smaller size until the next fiscal year?

3. "What about facial hair? My employer has a 'no beard' policy, and I don't like it because I cannot do many of the response activities."

Emphasize that facial hair prevents a good fit, resulting in exposure to toxic substances. (see demos in the 'questions you may be asked section' of the introduction.

4. "What about medical clearance?"

Facilitate a discussion of the stresses of wearing PPE. Medical clearance is required for respirator use; employers may have additional requirements based on other PPE.

5. "We use SABA, not SCBA."

Supplied Air Breathing Apparatus (SABA) is the global term that includes SCBA. SABA is not used by most responders because of the mobility concerns. SABA may be used in specialized responses but the need to have adequate length of supply line and a source of clean air limits use during a response. The most frequent use of SABA at a response might be on the decon line—away from the response.

Presentation of the Session

The session can be presented as follows:

Respirator Selection

Ask: What considerations determine selection of 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

Types of Respirators

Introduce the two basic types of respirators (APR & ASR)

Note that ‘facepiece’ refers to the elastomeric part of the unit. A respirator is a device worn over the mouth and nose or entire face to prevent inhalation of toxins. Some may use ‘facepiece’ and ‘face mask’ interchangeably, but only ‘facepiece’ is used in this manual.

Air-Purifying Respirators

Ask: What is an air-purifying respirator (APR)?

Show an example of an APR to the class. 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.

Ask: Why is a half-mask APR not used for ammonia response?

Mention PAPRs. Underscore that only full face is used for ammonia.

Cartridges and filters for protection from Chemicals and Particles

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

Refer to the table in Participant Guide.

Atmosphere-Supplying Respirators (ASR)

Ask: How many of you have used a supplied-air respirator (SAR)?

Ask: Was it a self-contained breathing apparatus (SCBA)?

- Discuss key parts of a SCBA including air tank, facepiece, hose, demand regulator, main-line valve, and by-pass valve.

- Demonstrate donning and doffing a SCBA, using the following checklist:
 - Check gauges and valves for appropriate values
 - Turn on cylinder valve and listen for low-pressure alarm
 - Put on the tank and harness and adjust straps
 - Don the facepiece and check the facepiece seal (required user-check; fit-testing will be reviewed later in this chapter)
 - Check operation of the main-line and by-pass valves
- Underscore that training must be provided by the employer for the specific type of unit used.

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

Occupational Exposure Limits

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

Key points:

- Emphasize that 1 ppm and 1 mg/m³ are very dilute concentrations, but some chemicals are hazardous even at these low concentrations
- Percentage is used for more concentrated mixtures. 1% would be 10,000 ppm
As each of the guidelines/standards below are reviewed, include the value for ammonia. It may be useful to post these in the training room.

Exposure guidelines and standards

Ask: What exposure guidelines are used by your organization?

Note: some employers adopt TLVs and some have developed companywide OELs

IDLH/PEL/TLV/REL/STEL/C

Points to be emphasized:

- There are several occupational exposure levels that are important, 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 8-hour PEL may not be exceeded
- Short-term exposures should be compared to the STEL

Exposure Records

It's important for participants to know that any exposure monitoring results are part of their medical records and can be obtained by the employee under the OSHA Standard on Access to Employee Exposure and Medical Records (29 CFR 1910.1020).

Important Points to Remember About Occupational Exposure Limits

Most PELs, RELs, and TLVs are 8-hour average concentrations

- STELs are set for very few compounds
- IDLH, STELs, and C values are generally measured over short periods of time

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

Ask: How many of you have had quantitative fit testing?

Review positive- and negative-pressure user checks including:

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

Ask: How many of you do a user check before each donning? Discuss difficulties that may occur while using respirators.

Assigned Protection Factors/Fit Factor Calculation

(cover as time allows and need is documented)

Review use of APFs in respirator selection.

Discuss:

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

Cleaning, Storage, Inspection, and Maintenance of Respirators

Ask: Why is it important to maintain respiratory equipment? Refer to guidance provided in the Participant Guide to review when inspecting, cleaning, and storing respirators. This administrative control is a required part of a respirator program.

Minimum Requirements for a Respirator Program

Ask: What topics should be required for a respirator program that will protect you from ammonia exposure?

- List responses
- Refer to the list in the Participant Guide for points that must be included. Also refer to the Sample Respirator Program provided by OSHA found here:
<https://www.osha.gov/Publications/3384small-entity-for-respiratory-protection-standard-rev.pdf#page=103>
- Review training requirements

Medical Fitness to Wear a Respirator

Ask: Why should a physician or other licensed health care provider review the job description and examine you if you are assigned to wear a respirator?

List responses

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

Respiratory Protection Demo and Workshop

Number of Facilitators Required: 1 or 2

Time Requirement: approximately 60 minutes including report-back

Materials: See below for each station

Procedure: Set up stations for rotations

Introduction

The purpose of providing the workshop is to give the trainees an opportunity to practice skills relevant to use of SCBAs, APRs, air-line egress units, and cleaning and inspection procedures appropriate for ammonia response.

The stations include:

1. User checks of an APR
2. Donning and doffing APR with supplied air bottle (SCBA)
3. Inspecting and cleaning respirators
4. Wearing an airline with escape unit (optional)

At least six functioning SCBA air bottles are needed if a full class of 24 participants is present. Everyone should have a facepiece.

Each of the stations requires one facilitator who has experience with or is very familiar with the equipment to be donned in order to answer questions as needed. Each station has a checklist to guide the trainee and facilitator as to what occurs at the station. After the trainee does the required tasks and completes the checklist, it is brought to the station facilitator, who signs off, indicating that the trainee has successfully completed the activity.

The checklists are part of the Consortium documentation of Successful Completion and must be collected from the trainees and maintained by the training institutions. Make copies of the checklist from the Exercise Manual. Provide two demonstrations as an introduction.

Demonstration: Don/Doff full facepiece APR

Demonstration: Fit testing and user checks

Station 1: User checks

Equipment:

- One facepiece per trainee
- Performance checklist (see Exercise Manual) with clipboard and pen for each trainee

Organization:

- Set up an equipment pick-up area

Instructions:

- Issue facepiece
 - Demonstrate the user check procedure
- Each participant conducts checks

- Have trainees complete the Workshop Performance Checklist, which you will review and sign

Station 2: Donning and Doffing an SCBA

Equipment:

- One facepiece per trainee
- At least 4 SCBA air bottles. Minimum of 1200 lbs. of air pressure for each trainee
- Manufacturer procedures for donning and doffing SCBA
- One table for every four trainees
- Paper towels and mild cleaning solution, or moist wipes.
- Performance checklist (see Exercise Manual) with clipboard and pen for each trainee

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 trainees) for donning and doffing

Instructions:

- Issue facepiece 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 trainee.
- With your guidance, have trainees 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 workshop (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 trainees wear the SCBA
- Give trainees the opportunity to walk up and down steps

- Watch participants carefully for any sign of distress. 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 trainees 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"
- Participant retains the facepiece for use in other workshops
- Have trainees complete the Workshop Performance Checklist, which you will review and sign.

Station 3: Inspecting and Cleaning Respirators

Materials - Each station should have:

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

Organization:

- Have station set up with equipment for cleaning respirators
- Have various facepieces available, some with defects.

Instructions:

- Trainees should pair up and share wash basins, sponges, soap, and disinfectant (maximum 2 trainees per basin)
- Review and demonstrate inspecting and cleaning of respirators
- Disassemble respirator and all its parts
- Inspect respirators for worn parts and defects
- Alert facilitator if defects are found

- Wash and dry respirator
- Reassemble respirator (if there is time)

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 facepiece, 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 trainees complete Workshop Performance Checklist, which you will sign and keep.

Station 4: Wearing an Air Line with Escape Unit (optional)

Materials:

- SAR (one per trainee)
- Minimum 1200 lbs. air pressure for each trainee
- Egress units (one for each trainee)
- Clipboard and pen for each trainee
- Workshop Performance Checklist

Organization:

- Have station set up with equipment.

Instructions:

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

Summary—Respiratory Protective Equipment

Review learning objectives

- Describe appropriate applications of respiratory protection for ammonia response
- Evaluate situations to determine if respiratory protection is required
- Identify the requirements of a respiratory protection program
- Demonstrate ability to don, use (inspect, clean), and doff respirators
- Identify the elements of respirator training that should be provided by the employer

Ask participants if they have any further questions about respirators.

Ask participants to name the advantages and disadvantages of different types of respirators.

Ask if a written respirator program for ammonia response (and other exposures) is available at the worksite. Does it include the required points?

PPE - Chemical Protective Clothing

Time Requirement: Presentation & Levels of Protection Exercise – 60 minutes

 Level C-1 hour

 Level B-1.5 hours

 Level A-1.5 hours (optional)

 PPE Checkout Demo and Workshop-1 hour

Number of Facilitators: 1 (2 or more during workshops, consistent with Minimum Criteria)

Materials

- Participant Materials (Participant Guide, Exercise Manual)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Tables

- Open-space room which will allow groups mobility with protective equipment
- Chemical protective clothing (CPC) of the appropriate level
- Tape recommended by the manufacturer should be used in the field
- SCBA units (one per trainee)
- Cylinder of breathing air (1 breathing air cylinder per trainee)
- Air-purifying respirators
- Cleaning wipes
- Plastic wash basins (1 per every 2 trainees)
- Soap and disinfectant
- Sponges
- Paper towels
- Mannequin (if needed)
- Assorted PPE for checkout; some should have imperfections/damage

Section Objectives

When completed, participants will be better able to:

- Identify general types and uses of RPE and CPC for ammonia environments
- Identify selection criteria for CPC for ammonia
- Describe precautions to be taken when wearing PPE
- Demonstrate proficiency donning and doffing PPE
- Identify proper procedures for inspection and storage and who to notify that maintenance is needed

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.ucmail.uc.edu
- Review background reading materials
- Prepare class notes
- Review exercises and activities
 - Levels of Protection
 - Inspect and Maintain PPE (PPE Checkout)
 - Don and Doff Level A
 - Don and Doff Level B
 - Don and Doff Level C
- Review manufacturer information and instructions for equipment used during module
- Assemble supplies and equipment for lab stations
- Get selection chart for supplier used by company
- Prepare examples of different types of CPC, including several with damage. Have representative CPC available for pass-around during presentation
- Tailor the exercises to locally relevant scenarios
- Copy Performance Checklists for participants

NOTE: PPE checkout is shown in the Participant Guide for Level C only. You can use it for other levels, as time allows for preparation of some defective examples. The requirement to conduct an inspection is included in Levels A and B, as item 2 on the Performance Checklist; you may choose to include one defective item and identify whether participants notified the lead facilitator.

Minimum Content Requirements

- The different types of chemical protective clothing (CPC) that are available for ammonia response
- Recognize when CPC should be used and what type
- Different levels of protection of PPE
- Strengths and limitations of PPE
- Use and care of CPC
- Contact point for needed maintenance of CPC
- Donning and doffing of the levels of PPE
- Check out PPE

Questions You May Be Asked

1. Trainees 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 response 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. "How does this hazard assessment get done?"

Be prepared to help identify the responsible party and questions that might be asked and the information from responders that is used; note that responder input often changes the assessment as the response is conducted.

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 might need during an ammonia response?

Ask: What considerations should be made when selecting protective clothing?

List responses where the entire class can see them

Personal Protective Equipment Program

Ask: What would you include in a PPE program for responders? Refer to list in Participant Guide.

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

Ask: What ammonia emergency response hazards are present in your current work or in previous work?

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

Ammonia-specific concerns for CPC Selection

Ask: What are the unique concerns for CPC selection that come with response to ammonia? Discuss the 3 headings found in the Participant Guide.

Ask: What examples of improper selection or use have you seen?

Refer to the CPC Selection Guidelines page in the Participant Guide.

Levels of Protection

Direct participants to the pictures and descriptions found in the Participant Guide

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 or have mannequin

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

NOTE: In practice, MWC trainers have noted that Level C is not used often in a response, but full facepiece APR may be used in the initial hazard and risk assessment

Exercise - Levels of Protection

This exercise may be performed in small groups or as a class. It can be tailored to the needs of participants by adding to or replacing the situations shown below with locally relevant scenarios. Use a selection of scenarios that can be matched to a range of levels of protection.

Number of Facilitators Required: 1

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

Materials:

- NIOSH Pocket Guide
- Participant Guide

Procedure:

Distribute the exposure scenarios provided or that you have developed. NIOSH Pocket Guides should be available for each group. Allow time for each small group to determine an answer. Ask for report-back.

1. An alarm set to alert residents of ammonia concentrations of 5 ppm has sounded at the perimeter of a plant where peas and other vegetables are frozen. What level of protection do you wear to check the perimeter station?

Level D. Carry APR.

2. At a food processing plant, ammonia is entering the warehouse. What level of protection is used to approach the pipe that has been damaged to stop the leak?

Level A

3. More than 400 gallons of ammonia were released when a rooftop valve failed. It has been repaired by responders and the response team and back-up team are now at the decon line. What level of protection is required for the decon workers?

Level B, as it was likely a Level A response. (Depending on the temperature and other considerations, the ERP might allow Level C if it is determined that evaporation has resulted in no residual ammonia on the responder CPC.)

4. During a delivery of ammonia, a breach in the transfer line resulted in release. What level of protection is needed for responders?

Level A or B (discuss what conditions would be considered—direction of the run-off or vapor cloud relative to the tanker valve shut off, for example)

Penetration, Degradation, Permeation

Ask: What is the difference between penetration, degradation, and permeation?

Ask: What properties of ammonia could lead to degradation?

Chemical-Resistant Materials

Refer to the Participant Guide for a list of CPC materials and their advantages and disadvantages.

Ask: How many of you have used material or glove charts to match hazard to protection?

Precautions When Wearing CPC

- List 5 precautions to consider regarding CPC, as listed in Participant Guide
 - Have trainees make a list of five precautions to consider. This task should take about 3 minutes. Ask for volunteers to state what they considered.
 - List trainee responses where everyone in the class can see them. Add additional responses to complete the list.
- Refer trainees 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. Frequently, a checklist will be provided in the company's written program. Show participants some examples of CPC that should not be put into service or has degraded in storage such as holes, tears, sticky, cracked.

Ask: Who do you alert when need for repair of CPC is identified?

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 Level A and B suits

Levels B and C Exercises are required; Level A is optional, depending on reconnaissance and the hazard assessment. Assure that the emergency plan for training is in place; consult Program Director for requirements.

Exercise - Level C Dressout and Level C PPE Checkout

Exercise – Level B Dressout

Exercise – Level A Dressout – optional, depending on need

Number of Facilitators Required: See each exercise

Time Requirement: approximately 1 hour (including report-back) for Level C and 1.5 hours for Levels A and B

Materials: See below.

Procedure: Each is described below

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

Four separate sessions are conducted: PPE Checkout, Level C dressout, Level B dressout, and Level A dressout. If you want, you can use the PPE Checkout checklist for Levels B and A also; see NOTE in Preparation, above.

Each level of dressout requires one leader/facilitator who is experienced or very familiar with the clothing and respiratory equipment to be donned so that he/she can answer questions as needed. A checklist to guide the trainee and facilitator as to objectives/skills demonstrations are provided. After the trainee has donned and doffed the suit and completed the checklist, you review, sign, and collect the checklist.

These Performance Checklists are part of the Consortium documentation of training and must be collected from the trainees and maintained by the training institution.

Before running each dressout facilitator should have demonstrated the PPE and read through the checklist to know what is expected of him/her and the participants.

Level A

Materials:

- SCBAs (one for each pair of trainees)
- Extra facepieces 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 suits
- Tape recommended by the manufacturer should be used in the field
- Clipboards and pens
- Performance 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 trainees) for donning and doffing

Level B

Materials:

- SCBAs (one per pair of trainees)
- Extra facepieces 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
- Tape recommended by the manufacturer should be used in the field
- Clipboards and pens
- Performance 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 trainees) for donning and doffing

Level C

Materials:

- APRs (one per pair of trainees)
- Extra facepieces in various sizes
- Manufacturer procedures for donning and doffing APRs
- One table for every four participants
- Paper towels
- Mild cleaning solution
- Moist wipes
- Level C suits
- Tape recommended by the manufacturer should be used in the field
- Clipboards and pens
- Performance checklists
- Selected suits, gloves, boots, and hard hats
- Assemble PPE for checkout—some of which should have defects.

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 trainees) for donning and doffing

Other PPE

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

- Face protection
 - Full face shield
 - Eye protection
 - Face shield not tested for permeation
- Gloves
 - Performance charts
 - Sizes

- Damage
- Inspection
- Boots
 - Steel Toes
 - Stitching, molded seams
 - Shank
- Hard Hats
 - Approved versus not approved
 - Bump caps

Summary – Chemical Protective Clothing

Review learning objectives

- Identify general types and uses of RPE and CPC for ammonia environments
- Identify selection criteria for CPC for ammonia
- Describe precautions to be taken when wearing PPE
- Demonstrate proficiency donning and doffing PPE
- Identify proper procedures for inspection and storage and who to notify that maintenance is needed

Ask participants to explain the differences between the different levels of protection and when each should be used. Use this opportunity to make any clarifications or fill in gaps in knowledge.

Ask participants to list factors which could reduce the effectiveness of protection. Provide any answer that participants don't mention.

Ask participants for any special considerations for ammonia responses. Be sure to note:

- Must be resistant to liquid ammonia, ammonia gas/vapor, ammonium hydroxide
- Escaping ammonia may create lower temperatures in the work area. Verify resistance/integrity and flexibility of CPC at lower temperatures.

PPE —Other Protective Gear

Time Requirement: 30 minutes total

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

Materials

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

Section Objectives

When completed, participants will be better able to:

- Recognize OSHA standards or guidelines from other organizations for hearing, eye/face, hand, head and foot protection

Teaching Methods

This session incorporates standards for Personal Protective Equipment (PPE) other than Respiratory Protective Equipment (RPE) and Chemical Protective Clothing (CPC) as a participant review and feedback.

- Presentation/discussion
- Small-group activity

Suggested Instructor Preparation

- Review the Participant Guide
- 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 CPC sections of the program that these participants have completed.
- Prepare copies of the standards/guidelines (or assure enough 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

Questions You May be Asked

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

That too is PPE; if a participant needs to use it because of assigned duties or response activity, specialized training is required. Facilitate a discussion about whether the same principles apply—hazard analysis, provided and inspected, appropriately fit, training, maintained.

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).

Exposure-Specific Protective Clothing and Testing

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

Noise

Refer to figure in Participant Guide, showing exposure levels from various sources. Underscore the need to evaluate communication systems prior to purchase.

Summary - Other PPE Requirements

Review the leaning objective

- Recognize OSHA standards or guidelines from other organizations for hearing, eye/face, hand, head and foot protection

OSHA has specific standards for

- Hearing Protection
- General Requirements: Personal Protective Equipment
- Eye and Face Protection
- Head Protection
- Foot Protection
- Electrical Protective Equipment (gloves and sleeves)
- Hand Protection

The general Personal Protective Equipment standard (29 CFR 1910.132) requires that 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.

Ask: Based on this discussion, what are some of your takeaways as you go back to your employer? List them on a writing surface viewable by all.

Answer any remaining questions.

Material Identification

Time Requirement: 45 minutes (plus 45 minutes for Exercise)

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

Materials

- Participant Materials (Participant Guide, Exercise Manual)
- Whiteboard, easel with paper, or chalkboard
- Markers or chalk
- Hazard Communication standard, with appendices
- If possible, obtain laminated Hazard Communication Quick Cards from the local OSHA office. Twenty (20) can be ordered per requester from the OSHA on-line service.
- If extra training on the 2012 Hazard Communication Standard is needed, the HCS 2012 exercise may be used. It can be found here:
<http://med.uc.edu/eh/academics/training/mwc/exercise-resources>
- System labels for exercises
- SDS for Ammonia, for example Praxair Ammonia Safety Data Sheet
- Emergency Response Guidebooks or devices with ERG loaded

Learning Objectives

When completed, participants will be better able to:

- Identify anhydrous ammonia containers based on shapes and sizes
- Identify label information on piping systems including specifications of the International Institute of Ammonia Refrigeration (IIAR)
- Identify label information in the Hazard Communication standard or other systems including NFPA 704, DOT, HMIS for containers
- Identify other resources for hazmat information available with shipments
- Demonstrate an ability to identify health and safety information using resources

Teaching Methods

- Presentation
- Discussion
- small group activities

Suggested Facilitator Preparation

- Review the Participant Guide
- Test web links prior to the session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Obtain a diagram of the plant system, or a generic system for use in this training. Identification of the major components in the refrigeration cycle is critical for the hazard and risk analysis as part of pre-planning and will be used to select response options during a response.
 - NOTE: the refrigeration system and IIAR markings are likely the major focus of this section when you prepare your outline
- Review the HCS 2012 webpage: <https://www.osha.gov/dsq/hazcom/index.html>
- Be familiar with key concepts such as pictograms, labels, placards, SDS content and how to use it to find safety and health information.
 - 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 SDS exercises (Quick Cards, standard)

- Review the Emergency Response Guidebook
- Review exercises and prepare materials. This includes making sure there are locally relevant labels (system labels exercise) and scenarios (ERG exercise). The labels and scenarios and the expected responses are retained in the program file. The scenario is a Performance Measure for the learning objective: Demonstrate an ability to identify health and safety information using resources. If a different Performance Measure is used, assure that it is signed, dated and retained as part of the program file to document successful completion.
- Prepare copies of Performance Checklist.
- Prepare an outline for your presentation

Minimum Content Requirements

- Container shapes and sizes
- Ammonia Refrigeration Systems
- Systems and symbols
 - Hazard Communication standard
 - Piping System Labeling
 - OSHA Process Safety Management of Highly Hazardous Chemicals (29 CFR 1910.119)
 - NFPA 704 system
 - HMIS system
 - DOT system of placards and labels – Emergency Response Guidebook
- Exercises
 - Identifying Information on System Labels
 - Using the ERG
 - Finding Safety and Health Information, SDS--Optional
 - Finding Safety and Health Information, Electronic Resources--Optional
- Written Documents
 - Shipping papers/Bill of lading
 - SDSs

Questions You May Be Asked

1. “Why are there so many different labeling systems?”

Because they were made by different groups. DOT labels are for transportation of chemicals, while the NFPA and HMIS systems are for workplace hazards. HCS 2012 (OSHA) doesn't require replacing these workplace warnings, but any other system must

be consistent with HCS. Suppliers must provide an SDS according to HCS requirements; most companies are using HCS labels only when labels are required.

2. "Which of these labels and pictograms are we required to use?"

If you are transporting chemicals you must comply with DOT regulations. For workplace hazards, any system must be consistent with HCS 2012.

3. "Can we keep using the MSDS sheets we have that were computerized in 2010?"

No, the format and information in HCS 2012 differs; the newer ones must be uploaded to your system or made available on paper as part of your HazCom program.

4. "What changes took place with the new 2012 standard?" There are 3 major changes.

- 1) Hazard classification updates
- 2) labels include signal word, pictogram, and hazard statement
- 3) SDSs are in standardized 16-section format

Presentation of the Session

The session may be presented as follows:

Prepare a chart to help students differentiate between various systems

Container Shapes and Sizes

Review the usual contents of various types, shapes and sizes, referring to the excellent illustrations found in the Participant Guide.

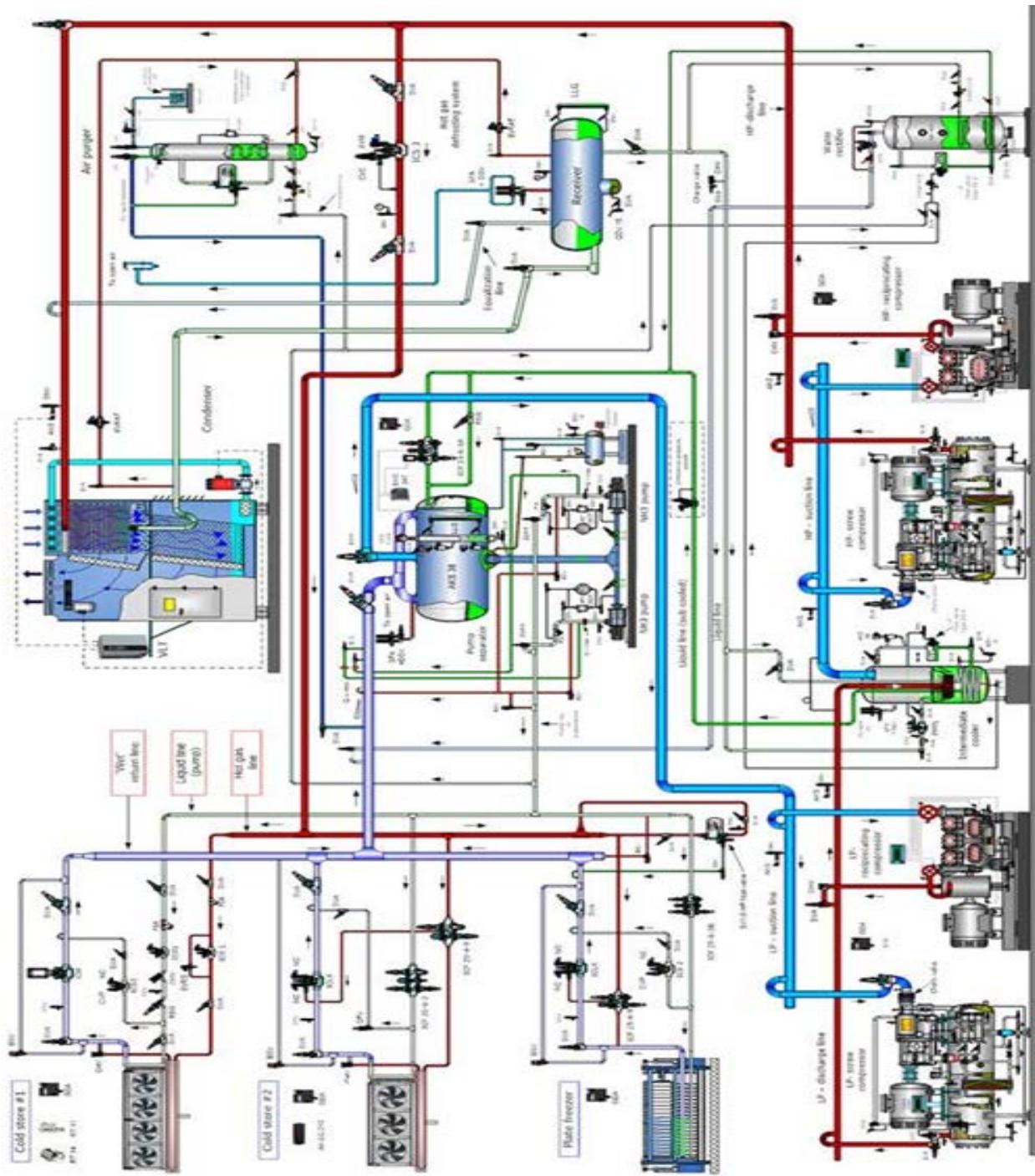
Ask: Which are at your worksite or sites where you may respond?

Ammonia Refrigeration Systems

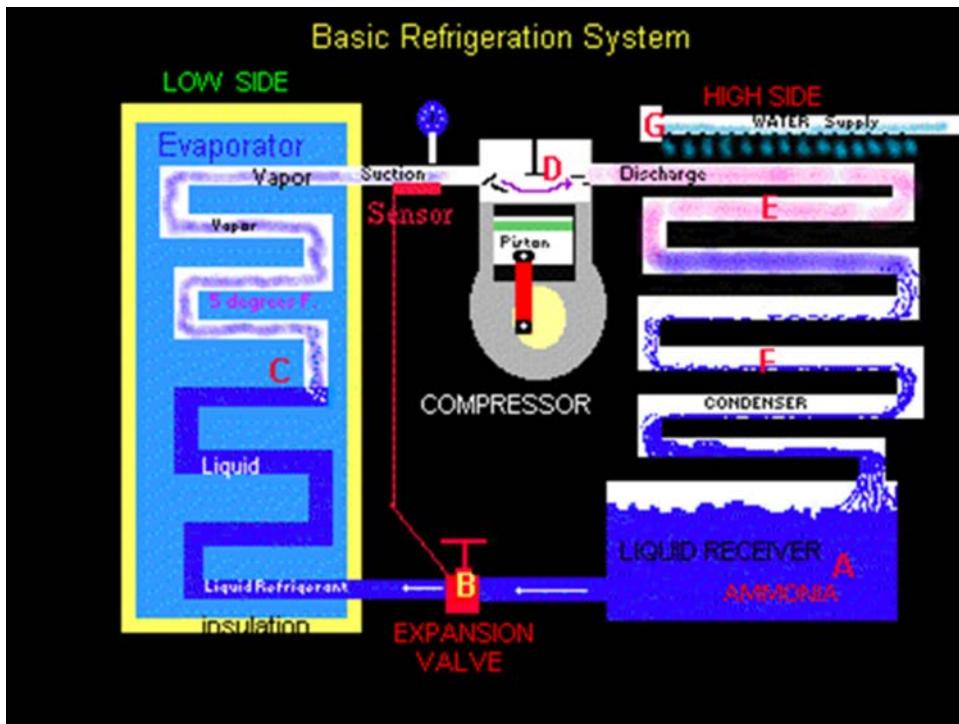
Review the basic components of a refrigeration system, including compressor, condenser, expansion device and evaporator.

Obtain diagram of the system or use one of the generic diagrams available. This one is courtesy of Discovery Designs Refrigeration, LLC (used with permission). It may need to be enlarged when copied before use.

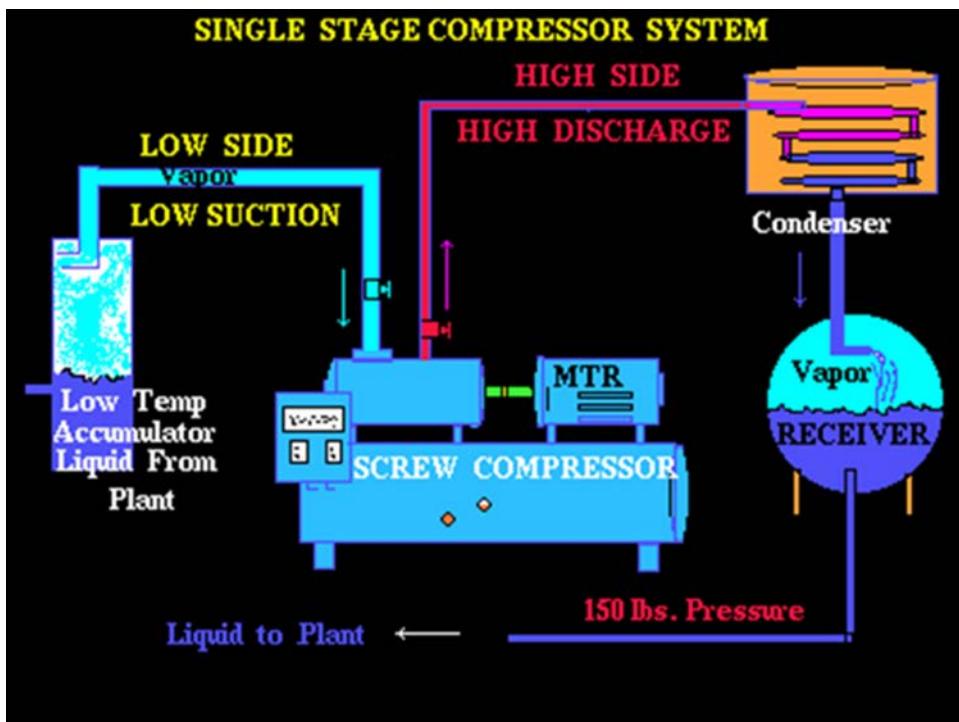
Title: Two-stage ammonia plant with pump separator and hot gas defrosting system – principle

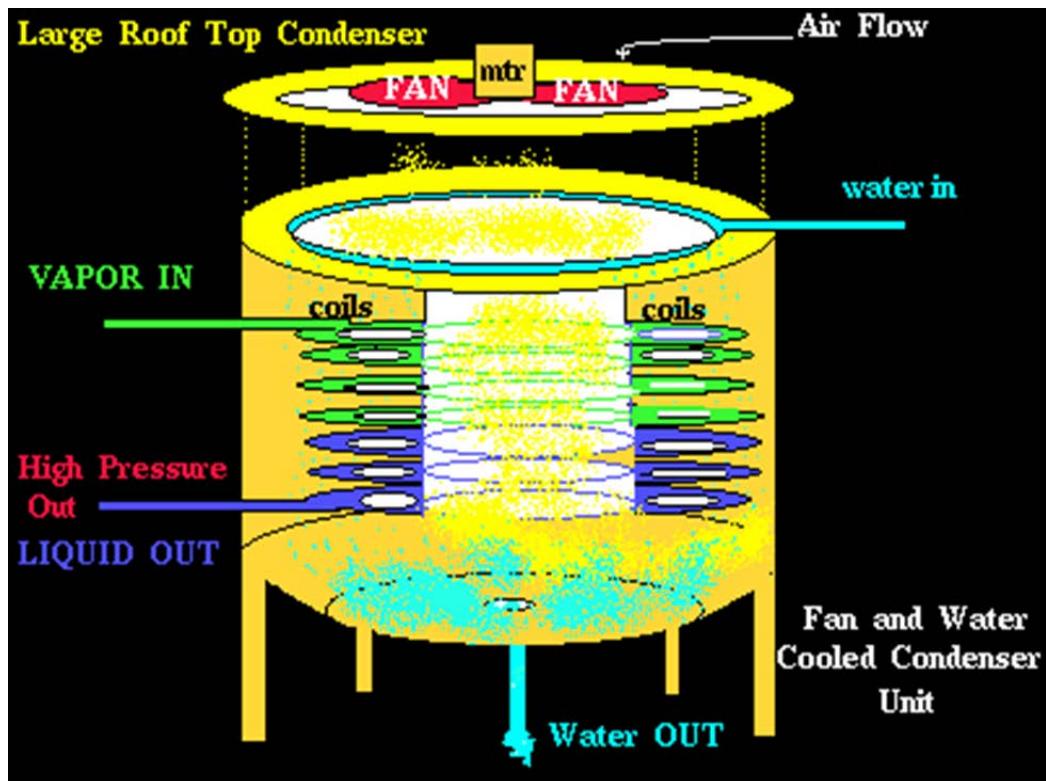


The following illustrations provided by Lakeshore Technical College may also be useful.



Component Parts





Condenser



Systems and Symbols

In this section, labels, placards and documents that can be used to identify hazardous materials will be covered. In order to gain information about whether participants have received effective Hazcom training, Ask:

- Are you familiar with pictograms?
- What other labels and placard systems are you familiar with? NOTE: trainees may not know the name of a system; be prepared to hold up examples.
- Have you ever used documents such as shipping papers or SDSs?
- How are labels, placards and documents useful to a responder?

Hazard Communication Standard

Ask: What does Hazard Communication Standard (HCS2012) require manufacturers to put on labels?

List the requirements of HCS2012: all manufacturer labels to have pictograms, a signal word, hazard and precautionary statements, the product identifier, and supplier identification. The signal word for ammonia is “Danger”. Hazard classes are found in Appendix C.4. of HCS 2012

Ask: Are manufacturers required to use HCS 2012?

Other types of labels may still be used. If another system is used, it must be consistent with HCS 2012, so the content must be there and no conflicting hazard warnings or pictograms. Alternative labeling systems include the National Fire Protection Association (NFPA) 704 Hazard Rating and the Hazardous Material Information System (HMIS) See: <https://www.osha.gov/dsg/hazcom/hazcom-faq.html#11>

Refer participants to their Guide for pictograms for ammonia.

Piping System Labeling

Discuss labeling, referring to the symbols in the labeling system in the Participant Guide. Review the IIAR system, also in the Participant Guide, noting sections and colors of the label.

OSHA Process Safety Management of Highly Hazardous Chemicals (PSM, 29 CFR 1910.119)

Ask: What is PSM? Discuss what this standard requires and its application to preparing for and responding to an ammonia release.

Exercise – Identifying Information on System Labels

Create four labels for participants covering a range of process operations. Participants will complete the worksheet using IIAR resources in the Participant Guide or employer-specific listings obtained through reconnaissance.

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 HCS 2012 system. However, HCS category numbers do not appear on labels. They will be found in Section 2 of the Safety Data Sheet (SDS).

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.

Emergency Response Guidebook–System of Placards and Labels (Enforced by the US Department of Transportation [DOT])

- Review how to use the DOT Emergency Response Guidebook (ERG). Provide a copy of the book to each trainee for use during the program.
- 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.

Performance Measure

Use one of the following three activities to document skills to use resources.

Using the ERG

Generic exposure scenario

An alert has sounded, and initial information is that an external supply tank has ruptured due to malicious activity. The location of the rupture is not known, but a large cloud can be seen approaching streetlights about $\frac{1}{4}$ mile from the tank location. The windsock is not moving.

Answer using Table 3, Green. Use nurse tank, low wind, night= 0.8 miles

Or

A tank truck that arrived about at 9 a.m. for delivery has been struck by heavy equipment being used by a contract construction crew and product is escaping. There is some wind and app for weather shows 5 mph winds, with gusts to 10 mph.

Answer using Table 3, Green. Moderate wind, day=0.3 miles

Facilitate a report back.

If you develop more relevant scenarios for the worksite of participants, include them in the program file documentation.

Written Documents: 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
- 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

Finding Safety and Health Information using an SDS

Number of Facilitators Required: 1

Time Requirement: approximately 30 minutes (25 for exercise and 5 for report-back)

Materials:

- OSHA Quick Card, Hazard Communication Safety Data Sheets
- SDS for ammonia (preferably one from supplier of the worksite)

Procedure:

Ask participants in small groups to use an SDS to find the health and safety information necessary to complete the 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. Facilitate a report back to resolve questions or problems in finding information.

Finding Health and Safety Information using Electronic Resources

Electronic resources are increasingly useful tools for emergency responders. In this Incident Command System exercise, you will use several online databases as resources to gather information needed to plan a response to an emergency scenario.

See

<https://www.med.uc.edu/docs/default-source/Environmental-Health/mwc/using-electronic-resources-hazmat-facilitator-guide-2017.pdf?sfvrsn=0>,
<https://www.med.uc.edu/docs/default-source/Environmental-Health/mwc/using-electronicresources-hazmat-participant-2017.pdf?sfvrsn=0>

Assign one part of the form to each small group. After 30 minutes, facilitate a discussion and report back.

Summary-Material Identification

Review the learning objectives

- Identify anhydrous ammonia containers based on shapes and sizes
- Identify label information on piping systems including specifications of the International Institute of Ammonia Refrigeration (IIAR)
- Identify label information in the Hazard Communication standard or other systems including NFPA 704, DOT, HMIS for containers
- Identify other resources for hazmat information available with shipments
- Demonstrate an ability to identify health and safety information using resources

Review the methods of labeling ammonia in the workplace and in transit. Refer to Participant Guide.

Review a Hazard Communication Standard label and ask for the meanings of selected terms.

Ask participants if they have any further questions about material recognition.

Answer any questions that the participants may have.

Monitoring

Time Requirement:	Presentation: Exercises:	30 minutes 2 hours
Number of Facilitators:	1 plus up to two assistants for the exercises, consistent with ratio shown in the Minimum Criteria	

Materials

The following materials will be needed:

- Participant Materials (Participant Guide and Exercise Manual)
- Whiteboard, easel with paper, or chalkboard
- Markers or Chalk
- Representative monitoring instruments relevant to responses of participants

Learning Objectives

When completed, participants will be better able to:

- Describe reasons to monitor during a response
- Identify features (including limitations) of ammonia monitors
- Describe procedures required when conducting monitoring at an ammonia response
- Demonstrate proficiency in using ammonia 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.ucmail.uc.edu
- Review this section
- Assure that any monitoring device is approved for use in corrosive, ammonia atmospheres. As part of reconnaissance, identify type/source of meters available for use and verify each is appropriate for ammonia.
- Review Exercises
 - Select exercise(s) to be done
 - Assemble instruments/supplies needed
 - PRACTICE each exercise and adjust as needed; this may require multiple tries
 - Copy Performance Checklist for participants
- Review employer SOPs for monitoring (contract programs only)
- Review manufacturer information and instructions for calibration, bump testing, use, maintenance, and storage of equipment to be used during the program. Test to assure operability.
- Have instruments available for observation/demonstration that will be used and are appropriate for the participants
- Review resources:
 - <https://www.honeywellanalytics.com/en/products/MicroDock-II>
 - <http://www.indsci.com/calibration-station-or-docking-station/>
 - <https://www.osha.gov/dts/shib/shib093013.html>
- Develop outline/notes to cover those instruments following the Participant Guide
- Document exercises conducted as part of the program file

Minimum Content Requirements

- Uses for Monitoring Data (detect, measure)
- Monitoring at an emergency

- What can be monitored in air?
- Overall Guidance
 - Emphasize need to assure any monitor to be used will not be degraded by ammonia
- Sampling Plan or Protocol
- Selected (relevant) sampling instruments and tools
- Demonstrate ability to use one or more pieces of monitoring equipment

Questions You May Be Asked

1. Our 4-gas meter seems to always give the same result when we respond. Can this be correct?

Note that the program covers the essentials of keeping a calibration log and maintenance log. Are these done and up to date? Has the person who is in charge of the logs been trained in use and troubleshooting?

2. The last time we responded to a release, there was no monitoring that I saw. We were just told to go in and take care of the mess where the tote failed, and we had to shovel the stuff up for hours.

If the material was identified and of low toxicity, and it was a solid, there may have been no need to monitor. Adequate respiratory (FF APR, fit tested) and skin protection may have been enough as detailed in the ERP.

Presentation of the Session

This session can be presented as follows:

Introduce appropriate instruments based on reconnaissance with employer or input from participants for their ammonia response situations.

The Importance of Monitoring/ Uses for Monitoring Data

Introduce this section by asking: "Why would you want to monitor?" List responses where the whole class can see them. Be prepared to fill in any gaps not mentioned.

Ask: When would you want to monitor?

Ask: How are the results of these reported?

Monitoring at an Emergency

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

What Can Be Monitored in the Air?

Review the following:

Oxygen Deficiency/Enriched

The Participant Guide under this heading shows 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 air-line respirator equipped with an escape air supply must be used when the oxygen level may be below 19.5%.
- b) $O_2 = 20.5\%$ - Oxygen is within the acceptable range (19.5%-23.5%) 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. Special procedures to minimize the risk of explosion will be needed.

Fire and Explosion Hazards /Explosive Limits

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. 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. Review LEL and UEL concepts which were covered in CHEMICAL PROPERTIES

Ammonia

Note that specific equipment for this will be used during this section.

Corrosivity

Review pH. Ammonia gas has no pH, but ammonia plus water (in air, on skin/eyes, respiratory tract) forms a corrosive compound, ammonium hydroxide (household ammonia is shown on the pH scale in the Participant Guide).

Conducting Monitoring Activities

Overall Guidance

This section provides overall guidance for monitoring and general considerations when preparing for sampling.

Highlight considerations in the Participant Guide that are relevant to ammonia.

Underscore the need for following a written procedure and follow quality assurance procedures.

Sampling Plan or Protocol

Ask: What should a sampling plan include? See Participant Guide.

Before you sample...

Review the important points to remember in the Participant Guide for direct-reading instruments and personal monitoring, as appropriate for the participants

Sampling Instruments and Tools

The notes shown below each type of sampling instrument or tool in the Participant Guide include operational characteristics, cautions for use and practical guidance. These notes do not replace the Operator Manual supplied at the time of purchase

Ask participants to verify the name of some sampling instruments and tools available to them for use.

Review the overall format of the description of each instrument.

Discuss the features of relevant instruments to be used by participants during responses and demonstrate them and/or pass them around the class. Some examples might include:

- pH paper
- Oxygen/Combustible-gas indicator (CGI)/Combination instruments
 - Includes multi-gas meters
- Colorimetric detector tubes
- Personal alarms and ammonia monitors
- Photoionization Hydrocarbon Detectors
- Metal Oxide Sensors
- In-place Ammonia Monitors
- Remote-location Ammonia Monitors
- Sulfur Stick
- Colorimetric Badges

Exercise - Monitoring

Number of Facilitators Required: 1

Time Requirement: approximately 30 minutes (25 for exercise and 5 for report-back)

Materials: See below for each exercise

Procedure: See below for each activity

Intro—how to select, etc.

Demo or participant activity

Depending on class size and available instruments, the stations may be modified. Try to keep the groups small—no more than 4 for best learning. For example, if no PID is available for participants to use, it may be best to describe only and spend program time using available instruments. These measurement activities are to be conducted as performance measures—individually or as a group. Video resource available: example <https://www.youtube.com/watch?v=sAtErWEhwdc>

If possible, find a video of the unit used by the participants.

Performance Measures (Checklists provided in Exercise Manual):

- Bump Test and Follow-up
- Detecting and Measuring
- Measuring Oxygen, LEL, pH and Relative Gas Density

Demonstration, with measurement - NH₃ Contamination on Clothing (worksheet provided in Exercise Manual)

Activity 1. Bump Test and Follow-up

Option A - multi-gas meter

Materials:

- Multi-gas meter
- Test gas(es) and regulator
- Tubing and fittings

Preparation:

If possible, use meter(s) available to participants

Review manufacturer instructions for bump test and calibration

Procedure:

1. Warm up and set up meter per manufacturer instructions
2. Connect meter to calibration gas
3. Record result(s)
4. If outside of specs (+/- 10% or range specified by manufacturer for bump test), then calibrate unit, per manufacturer specs

Option B - multi-gas meter with a docking station

Materials:

- Multi-gas meter
- Docking station for gas(es)

Preparation:

If possible, use meter and docking station available to participants

Review manufacturer instructions for meter and docking station

Procedure:

1. Follow manufacturer instructions regarding any need to warm up unit
2. Connect meter to docking station
3. If outside of specs (+/- 10% or range specified by manufacturer for bump test), then calibrate unit, per manufacturer specs

Option C - ammonia monitor

Materials:

- Ammonia monitor
- Test gas and regulator
- Tubing and fittings

Preparation:

If possible, use meter available to participants

Review manufacturer instructions for bump test and calibration

Procedure:

1. Set up meter per manufacturer instructions
2. Connect meter to test gas
3. Record result(s)
4. If outside of specs (+/- 10% or range specified by manufacturer for bump test), then calibrate unit, per manufacturer specs

Exercise 1 discussion

1. Note that the LEL and O₂ values did not change with the addition of the ammonium hydroxide.
2. How do the measurement values compare with each other?
3. How do the measurement values compare with PELs or exposure guidelines?

Activity 2a. Detecting and Measuring

Set up stations for each instrument: colorimetric tubes, PID, ammonia monitor

Station 1. Colorimetric Tubes

Materials:

- Ammonia colorimetric tubes
 - Recommend several concentration ranges
- Colorimetric tube pump
 - NOTE: might use more than one type of pump (bellows, piston) with several concentration range tubes
- Safety glasses/goggles for tube breaking
- Tube breaker
- Receptacle for used tubes and ends
- Tedlar bag or other container with a hole to use as a sampling port
- Ammonium hydroxide (commercial grade source is adequate)
- Air supply
- Multi-gas meter
- Tubing to connect instruments to bag
- Instrument manuals or quick-reference guides
- Exercise manual or copy of exercise for recording data

Preparation:

1. Prepare test atmospheres—practice before doing with participants

Put several drops of NH₄OH solution purchased at the store or 28% NH₄OH Technical Grade in a Tedlar bag or closed clear plastic tote of known volume. Assure that the bag or tote has sampling port such as tygon tube. Allow the liquid to evaporate. It is best not to use anhydrous ammonia for safety reasons.

Experiment with this prior to the program to identify the amount that should be added to create an atmosphere with a concentration less than 300 ppm. Record the amount for use in future programs. If using a Tedlar bag, record the volume of air added as well.

Add the identified quantity of ammonium hydroxide to the container. If using a bag, add air to inflate.

2. Leak test the pump

3. Prepare charcoal tube for use and connect to source of contamination.
4. Collect sample per instructions from tube supplier (volume, number of strokes...)
5. Record ppm NH₃
6. Use the multi-gas meter to sample the container.
7. Record O₂, LEL, CO, H₂S or other compounds for which the meter is equipped with sensors

Station 2. PID

Sample the bag or container with a PID

Preparation:

Review instructions for the PID

Assure that monitor is bump tested or have participants do this task

Station 3. Ammonia monitor

If the ppm is in the range of the NH₃ monitor (known from above if Option C included) and it has a pump, use it to determine the concentration in the container or bag.

Preparation:

Review instructions for the monitor

Assure that monitor is bump tested or have participants do this task

Discussion.

1. May want to review that colorimetric, detector and length-of-stain are names for the same supply. Some may also refer to the method by vendor name, such as Draeger pump and tube.
2. Which is the most accurate measure of exposure?

Ammonia monitor if properly maintained, calibrated

Why? PID needs to be corrected.

Charcoal tube values +/- 25% at PEL

Activity 2b. Compare Readings

Materials:

- Ammonia monitor
- PID
- Charcoal tubes
- Test atmosphere

Procedure:

1. Use the calibrated or bump tested monitors and collect concentration data using a multi-gas meter, PID and colorimetric tubes
2. Using the colorimetric tube as 'true' concentration, calculate the correction factor (CF) for the PID, as

$$\frac{\text{'True' concentration (use ammonia monitor or charcoal tube)}}{\text{PID reading}} = \text{CF}$$

Exercise 3 discussion

1. Since the colorimetric tube is +/- 25% at PEL, is the PID more accurate?
2. How does the corrected PID reading compare with the value obtained using the ammonia monitor?

Activity 3.

Oxygen and LEL (Conduct in a hood)

Materials:

Prepare test atmosphere to use in hood

Refer to preparation guidance in Station 1, above

- hood
- LEL meter or multi-gas detector
- Charcoal tube pump
- Charcoal tubes in desired range
- Ammonia meter

Procedure:**1. Prepare test atmospheres—practice before doing with participants**

Calculate amount of anhydrous ammonia needed for the volume of a Tedlar bag or sealed container available to create an atmosphere that is approximated 1% or 10,000 ppm.

Experiment with this prior to the program to identify the amount that should be added to create an atmosphere at the needed concentration. Record the amount for use in future programs. If using a Tedlar bag, record the volume of air added as well.

Slowly release remaining test atmosphere through the hood ventilation system.

Add the identified quantity of anhydrous ammonia to the container. If using a bag, add air to further inflate.

2. Measure LEL, O₂**3. If using multi-gas meter, measure other compounds as appropriate****4. Measure concentration using colorimetric tubes****5. Record results****Discussion for Exercise 4****1. Did the concentration of ammonia affect the results?**

Some LEL monitors will not detect ammonia due to the high Flash Point or the T₉₀ may be long (minutes, not seconds).

2. What is relation between ppm and %?

Use this as an opportunity to review that 1% is 10,000 ppm.

Option for Exercise 4**1. Modify the above set up by**

If the test atmosphere is in a container, place a petri dish of water in the container before introducing the anhydrous ammonia.

If using a bag, introduce a small pool of water (25 cc) prior to the anhydrous ammonia. Follow cleaning procedures and maintenance for the bag before reuse.

2. Commercially available ammonium hydroxide
3. water sample from source used in 1, above
4. pH paper
5. measure pH in the reserved water sample, water in container/bag, commercially available ammonium hydroxide
6. Record results

pH and Relative Gas Density (RGasD)

Station 1. pH

Materials:

Refer to setup in Exercise 4

- Petri dish containing water, if container used
- Pooled water, if bag used,
- pH paper

Station 2. RGasD

Materials:

- Concentration gradient tube
- 2 PIDs OR wide-range electrochemical ammonia monitor
- 5-foot ladder (minimum) with pail shelf or another stable surface for PID
- Tubing to connect sampling ports to measurement devices
- Anhydrous ammonia source
- Tubing to connect anhydrous ammonia to prop
- PPE for handling ammonia source

Procedure:

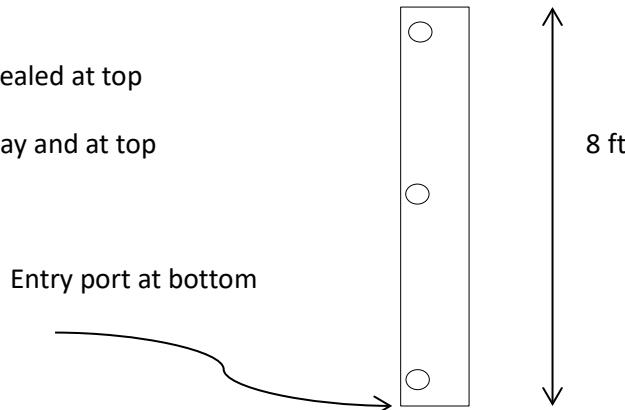
Preparation for concentration gradient:

1. Construct concentration gradient prop--a vertical tube with three ports for sampling

8-foot PVT tube, 4-6 inch in diameter. Sealed at top

Sampling ports at 4 inches, about halfway and at top

Tight fitting pan at bottom or sealed.



2. Prior to the exercise, by trial-and-error identify how much anhydrous ammonia to add from a cylinder at the bottom of the tube. Record results for use in programs.
3. Assure that sampling devices are bump tested and ready for use.
4. Position participants at sampling ports

NOTE: One will be on a ladder. Take this opportunity to discuss safety.

NOTE: If only a passive monitor is available, this can be run by blocking the middle port and leaving the top port 'open'. Preplanning is needed to alert any nearby folks that ammonia may be detected by smell. The person holding the monitor should keep it as close as possible to the port to minimize loss into the workspace. Be prepared to immediately cap the top port as soon as the contaminant is detected.

5. Release ammonia into entry port at bottom
6. Record time of initial reading in middle of tube and at top of tube

NOTE: it is important to assure that the concentration is expected to be within the range of any electrochemical monitor. An excursion to a very high concentration due to releasing too much into the prop can result in 'blowing the monitor away'. That will be a substantial loss to the users.

Exercise 5 Discussion

1. What was the concentration when first detected at the middle and top ports?
2. Did the concentration continue to rise?

Demonstration - NH₃ Contamination on Clothing

Number of Facilitators Required: 1

Time Requirement: approximately 30 minutes (25 for exercise and 5 for report-back)

Purpose: to illustrate that even at high concentrations ammonia as a gas does not adhere to and is not adsorbed by clothing.

Materials: clear container
Cloth towel or cotton shirt
Ammonia source
Monitoring device (PID, colorimetric tube, multi-gas)
Hood

Preparation: Prior to conducting this the first time, by trial-and-error, identify the amount of ammonia needed to reach 300 ppm in the container

Demonstration: Place shirt or towel in the container
Leave for 30 minutes
Monitor concentration at clothing immediately upon removal
Monitor again in 2-3 minutes
Record results where everyone can see

Discussion:

1. Does ammonia collect or adhere to clothing? Why or why not?
Does not collect or adhere to the material used in the demo.
Could it differ for other materials?
--might try over a break with a synthetic?
2. Restate that the concentration in the container was about 300 ppm. Compare with PEL and IDLH and ask:
How are these numbers useful in determining PPE if only gas exposure is expected?
Level C does have use if only ammonia gas at concentrations that can be controlled with an APR—CPC not needed

Summary—Monitoring

Review the learning objectives

- Describe reasons to monitor during a response
- Identify features (including limitations) of ammonia monitors
- Describe procedures required when conducting monitoring at an ammonia response
- Demonstrate proficiency in using ammonia monitoring devices

Review the different methods to evaluate spaces and ammonia concentration including:

- Where performed
- Information obtained
- Uses of results, including in termination reports

Work Practices

Time Requirement:	Presentation/discussion 45 minutes
	Exercise 60 minutes
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 Manual)
 - Whiteboard, easel with paper, or chalkboard
 - Markers or chalk
 - For-Training-Only ERP (see MWC website)

Learning Objectives

When completed, participants will be better able to:

- Define the terms standard operating procedure (SOP) and standard operating guide (SOG)
 - Describe work practices to reduce risk of injury and further release/contamination during response operations
 - Demonstrate ability to perform a work practice relevant to an ammonia response

Teaching Methods

- Presentation/discussion
- Demonstration
- Small-group activity

Suggested Facilitator Preparation

- Review the Participant Guide and Exercise Manual
- Review this section
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.ucmail.uc.edu
- Review OSHA standard 29 CFR 1910.146 - Permit-Required Confined Spaces
- Review OSHA standard 29 CFR 1910.147 - Control of Hazardous Energy (Lockout/Tagout)
- For contract programs, relevant SOPs in the site-specific ERP should be reviewed
- Using the material in the Participant Guide and the For Training Only ERP, prepare SOGs for the selected activity(ies) in the workshop; for LOTO refer to 29 CFR 1910.147 appendix A.
- Prepare class notes
- Copy Performance Checklists for participants
- Document exercises used in the program file.

Minimum Content Requirements

- Definitions of SOG and SOP
- Elements of an SOG
- Relevant Work Practices shown in the Participant Guide

Questions You May Be Asked

1. Trainees may state that particular SOPs are lacking at their work site.

Be ready to facilitate discussion of how to determine if an SOP exists, how to obtain a copy within the company structure, where to find 'models' for comparison and how to approach problem resolution.

Note that the topics for many SOPs are shown in OSHA standards. For example, see 29 CFR 1910.147.

The following guidance from OSHA may be useful in answering questions about confined spaces:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21788

Presentation of the Session

This session can be presented as follows:

Types of Hazards

Ask: What are some examples of physical and safety hazards that should be anticipated at an ammonia response? 'How would you organize work so that the risks of injury or illness are reduced?

List responses. Display the list where the whole class can see it.

Participants may list more than are shown in the Participant Guide. Be prepared to discuss additional work practices. If the trainees don't list all of those shown, as you discuss each hazard, add those they omitted, if relevant (not everyone will work around ponds/lagoons, for example).

Review - measures to control hazards, from most preferred to least preferred, are: elimination/substitution, engineering controls, administrative controls, and PPE. Work practices are administrative (written) procedures but may include other approaches as part of the overall plan. For example, ventilation would be included in the written confined space entry work practice.

Ask: How many of you routinely make use of the “buddy system” during responses?

- Review benefits
- Note that hand signals are covered later in the program

Standard Operating Procedures (SOPs/SOGs)

Ask:

- What is an SOP?
- What are some SOPs that you have used in responses?

Describe the need for an SOG in training. A training-only SOG is only for guidance and not site-specific.

Emphasize that an SOP may be short or long. Placement of boundary DO NOT ENTER signs at specified height on the fence line and under security lights for night visibility is an example of a very simple SOP.

Underscore the need for written procedures for the various hazards. The site-specific ERP should contain all the details.

For each work situation/task below, ask participants to list the hazards and approaches to limit the hazards:

Slips, Trips, and Falls

Ask: What actions help prevent s/t/f?

Steam

Anything that looks like a cloud of steam should be avoided. (The cloud could be a chemical.) If steam, severe burns can occur.

Confined Spaces

SOPs for confined space entry should be reviewed to determine compliance with 29 CFR 1910.146. 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 entry and rescue. Over half of the deaths in confined spaces are would-be rescuers.

Electricity

Energy sources can result in severe injury or fatalities that adds to an emergency.

Ask: When do you have to use Lock-out/Tag-out?

Facilitate a discussion of appropriate Lock-out/Tag-out procedures. Note: Checklist should document that areas for LOTO were identified.

Ergonomics

Ask: What work practices related to ergonomics can you adopt to reduce injuries to responders?

Vehicle Operation

Emphasize that:

- Special rules of vehicle operation may be in effect during an emergency.
- Only trained and qualified personnel authorized by the company should operate equipment during an emergency.
- Operators should familiarize themselves with the restriction PPE imposes before operating vehicles in critical situations.

Special ammonia note

An ammonia release may cause temperatures to drop low as -40° F.

Discuss the impact on equipment and materials and the need for preplanning.

Actions to stop or divert a release

Distinguish between offensive (stop) and defensive (divert) actions.

An SOP is needed for each approach, tailored to the results of hazard assessment in the pre-planning.

Exercise – Work Practices

Number of Facilitators Required: 1

Time Requirement: approximately 45 minutes (30 for exercise and 15 for report-back)

Materials: See below for each exercise - each group can do one or more, as time allows

Procedure: See below for each exercise

Depending on the type of emergency participants may encounter, select one of the following exercises: Spill Control, Patching and Plugging, LOTO. Each has a Performance Checklist to complete (see Exercise Manual).

The Exercise is designed to stimulate the review of detailed information in an SOG by the members of each small group.

Minimal PPE is recommended only to prevent the trainees from becoming excessively wet, as this exercise can be viewed as ‘practice’ for the simulation later in the program. Full PPE with respirators/SCBA may be used, although it will require more time.

The facilitator should describe the problem, provide additional materials, and answer questions.

- Minimize hazards--do not use hazardous substances during the simulation.
- Implement the ERP for the training center during the activities (i.e., know emergency medical numbers, have an instructor who is an EMT, etc.; consult Program Director for further details)
- Emphasize the use of non-sparking tools.

During discussion identify deficiencies in performance and provide suggestions for improvement. After the exercise, hold a short debriefing and review the common elements below. Write where all can see.

- Someone in Charge
- Proper PPE/Tools
- Inspect
- Minimize Contact
- Buddy System

Spill Control (Prevent a Release from Entering a Drain/Sewer)

Pre-Exercise:

- Prepare an SOG for Preventing a Release from Entering a Drain or use the employer SOP
- Assemble materials that may include:
 - Sorbent socks, pillows, and/or sheets
 - Sandbags
 - Blocking rugs
 - Dry granular sorbent (cat litter, vermiculite, dirt)
 - Shovel
 - Salvage drum
 - Manufacturer spec information for absorbent
- Assemble PPE
- Prepare the area for a simulated release

Procedures:

- Have the team assemble the necessary equipment from the available supply and develop a strategy, following the SOG/SOP
- Have the team review their strategy with you
- Don PPE, as needed
- The team approaches the perimeter of the spill and performs the task in a manner that minimizes contact with the material
- Team initiates clean-up, and discusses disposal/cleaning of PPE/equipment
- Reinforce concepts of decontamination
- Have team members complete performance checklists, which you should then review and sign and retain for the program file

Patching and Plugging (Stopping a Release)

Pre-Exercise:

- Prepare an SOG for Preventing a Release from Entering a Drain or use the employer SOP
- Assemble a ‘leaking’ system. If the piping is too small to label, prepare wooden tags showing IIAR or employer-specific markings that can hang on the unit.



Plug/patch simulator, courtesy of Lakeshore Technical College

- Assemble materials that may include:
 - Plugs of various sizes
 - Mallet
 - Screw drivers/wrenches
 - Adjustable bands
- Assemble PPE
- Prepare the area for a simulated release
- Always use non-sparking tools (made of plastic or Beryllium).
- Think about compatibility when selecting types of patches and plugs. Carefully evaluate the container to be patched or plugged in order to select the best device(s) for the job. Note details such as the shape of the surface of the container; the size, shape, and texture of the puncture and/or dent; and the presence of corrosion or pressure within the container.

Procedures:

- The team assembles the necessary equipment from the available supply and develop a strategy, following the SOG/SOP
- Review the strategy
- Don PPE, as needed

- Team approaches the point of release to stop release in a manner that minimizes contact with the material
- Team initiates discussion of disposal/cleaning of PPE/equipment
- Reinforce concepts of decontamination
- Team members complete performance checklists, which you should then review and sign and retain for the program file
- Debriefing-Emphasize the following points:
 - Evaluate the work practice. Make suggestions and recommendations. For example, if inappropriate actions were observed, have the class discuss worst-case results.
 - Emphasize the need for using compatible materials.
 - Finally, ask the trainees if they have additional questions concerning absorption techniques.

LOTO

Pre-Exercise:

Copy the model SOG for LOTO here: <https://www.osha.gov/laws-regulations/standardnumber/1910/1910.147AppA>

Review the exposure scenarios used in Levels of Protections (generic in this manual, or site-specific)

Procedures:

- Distribute the blank SOG or the site-specific SOP
- The team completes the SOG or reviews the SOP
- Team members complete performance checklists, which you should then review and sign and retain for the program file

Exercise Overall Debriefing - Emphasize the following points:

- Evaluate. Make suggestions and recommendations.
- Plug/Patch: Ask "What if . . .?" type questions (i.e., "What if a bolt used to plug a drum is protruding enough to prevent overpacking? Should we use a hacksaw on it? What if partial corrosion is present?")

- Spill Control: Reinforce differences between operation-level and technician-level actions
 - Emphasize the need for using compatible materials and non-sparking tools
 - Finally, ask the trainees if they have additional questions concerning basic patching techniques.
- LOTO: reinforce one key, one person

Collect Performance Checklists to document skills.

Summary – Work Practices

Review the learning objectives

- Define the terms standard operating procedure (SOP) and standard operating guide (SOG)
- Describe work practices to reduce risk of injury and further release/contamination during response operations
- Demonstrate ability to perform a work practice relevant to an ammonia response

Implementing detailed written work practice plans or Standard Operating Procedures will assist in responders maintaining health and safety. These detailed plans are included in the employer ERP; review, update and routine practice increase the effectiveness of the plan.

Decontamination

Time Requirement: 60 minutes

Number of Facilitators: 1 and an assistant for the exercise, consistent with the ratio shown in the Minimum Criteria

Materials

- Participant Guide and Exercise Manual
- Whiteboard, easel with paper, or chalkboard,
- Markers or chalk
- Decon line equipment, supplies, etc.

Learning Objectives

When completed, participants will be better able to:

- Identify the importance of pre-planning for decontamination
- Identify the activities conducted in each zone
- Recognize considerations for establishing each work zone
- Identify basic decontamination methods used at an ammonia response
- Demonstrate ability to set up a decon line

Teaching Methods

Presentation/discussion/demonstration followed by an exercise

Suggested Facilitator Preparation

- Review the Participant Guide and Exercise
- Review this section
- Test web links prior to session and if any are inoperative please notify the Midwest Consortium at alerdiir@ucmail.ucmail.uc.edu
- Review OSHA 29 CFR 1910.120(k)
- Review relevant sections of the ERP and employer SOPs for decontamination (contract programs only)
- Develop a scenario for which the decon line will be needed. Include: release, time of day, wind, surroundings/topography, weather
- Copy Performance Checklist for participants
- Place specifics of decon scenario in the program file

Minimum Content Requirements

- Pre-planning for decontamination
- Limiting contamination
- Work zones
- Decontamination procedures
- Exercise
- Discuss levels of protection, lack of collection of water, others in area with no protection. Problem or no problem?

Questions You May Be Asked

1. "We don't do decon this way at our responses. So what are we supposed to 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 ERP. Emphasize that HAZWOPER requires the development and implementation of

written procedures. Alternative procedures may be effective. Stress that inspection should (must?) be performed.

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

The answer is yes. Use this opportunity to reinforce the need for proper decon to protect yourself, your family members and the community.

Presentation of the Session

This session can be presented as follows:

Introduction

Ask: What has been your experience with decon?

What should be considered when performing decon?

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

- Useful decon videos include:
 - <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>
 - A short (run time: 1:18) video of activities in a decon line:
<http://www.youtube.com/watch?v=-s1Aukkngw8>. If time allows, this video (which has no audio) could be watched critically and evaluated for deficiencies at the end of the section.
 - Select several minutes of this video:
https://video.search.yahoo.com/yhs/search?fr=yhs-pty-forms&hsimp=yhs-pty_forms&hspart=pty&p=ammonia+decon+video#id=3&vid=0a210e99efff1d64f630ab144e7b17ff&action=click
- Point to the diagrams found in the Participant Guide.

Pre-Planning for Decontamination

Ask: What should be included in your decontamination plan? See list in Participant Guide.

Emphasize that the ERP needs to be reviewed and updated when hazards you may respond to change.

Ask: When is decon used?

Limiting Contamination

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

Ask: When donning PPE, what things can you do that will help minimize potential contact with contamination? Review list in Participant Guide.

Ask: During response, what can be done to minimize exposure to contamination? Review list in Participant Guide.

Work Zones

Ask: What work zones have you used?

Introduce and explain the three Work Zones. Review graphics in the Participant Guide. Emphasize that establishing work zones helps to control contamination and protect the health of workers, their families and the community.

Primary Activities in Each Work Zone

Ask: What activities occur in each Work Zone? Refer to diagrams found in Participant Guide. Use discussion to make sure participants understand the difference between zones. Consider making a list of what takes place in each zone

Decontamination Line

Continue to refer to the graphics in Participant Guide. Proper removal of PPE along the decontamination line will allow the responder to leave the site without bringing

contamination along. Follow procedures in ERP.

A few points to emphasize:

- Each procedure is performed at a separate station. The stations are arranged in order of decreasing contamination, preferably in a straight line.
- Tools and equipment are dropped at specified locations
- First, outer more heavily contaminated items such as boots, gloves, and suits are decontaminated and then removed
- Next, inner, less-contaminated clothing (inner boots and gloves) is decontamination and removed
- Facepieces are removed near the end of the line
- Materials that cannot be decontaminated are discarded

Ammonia Decontamination Procedures and Follow-up Steps

Ask: What are the primary methods of decontamination, like rinsing off contaminants for example?

Ask: How can you tell how effective the decontamination is?

Emphasize that equipment, tools and PPE must be properly decontaminated. Any liquids and disposables used for decontamination must also be decontaminated or disposed of properly.

Be sure to go over each procedure, drawing special attention to unique considerations with ammonia.

Evaluating the Effectiveness of Decontamination

Cover each of the methods related to an ammonia release.

NOTE for discussion: Decon might not be necessary due to high vapor pressure of ammonia. Follow criteria described in the ERP that should include visual inspection and monitoring before the final decision is made.

Other Considerations

Ask: What safety precautions can be taken to protect those on the decon line as well as those being decontaminated? Review list of General Safety Precautions in Participant Guide as well as Ammonia-specific precautions.

Decontamination and Emergency Medical Issues

Ask: How do you handle complications such as injuries or if the area is a crime scene? Which comes first, treatment or decon? Discuss possible ammonia-specific health effects and an approach to handling them.

NOTE: Decon may be needed for victims; water decon should be available as part of preparedness.

Optional Demonstration-Victim Decon

Demonstrate victim decon using a training mannequin. Facilitate discussion.

Exercise – Setting up a Decon Line

During this exercise, participants will have the opportunity to set up a decon line. PPE is not required.

Number of Facilitators Required: 1, with 1 or more assistants to help with supplies

Time Requirement: approximately 45 minutes (35 for exercise and 10 for report-back/critique)

Materials:

Checklists are found in the Exercise Guide

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
- (3) Trash bins with liners
- Clipboard and pen (one per trainee)
- Lab Performance Checklists (one set per trainee)
- Clothing racks

Procedure:

- Provide the necessary equipment and develop a response scenario for the group to address. Trainees set up decon line.
- Critique the line and correct problems as necessary.
- Sign and collect the Performance Checklists to be included in the program file.

Collect Performance Checklist to retain as part of documentation of successful completion.

Summary—Decontamination

Review the learning objectives

- Identify the importance of pre-planning for decontamination
- Identify the activities conducted in each zone
- Recognize considerations for establishing each work zone
- Identify basic decontamination methods used at an ammonia response
- Demonstrate ability to set up a decon line

There are three zones:

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

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.

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

- Physical removal
- Chemically removing contaminants
- Rinsing off contaminants
- Disinfecting and sterilizing (infectious materials)
- Combining the above methods

Stations are arranged in order of decreasing contamination, preferably in a straight line. Decontamination activities are located in the Contamination Reduction Zone (CRZ).

All personnel working the decon line must be decontaminated before leaving the CRZ. All decon supplies, solutions, and 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.

Emergency Response

Time Requirement: Presentation/discussion 45 minutes

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

Materials

- Student materials (Participant Guide)
- ERP for training or use employer/local ERP—see resources below
 - Company Plan available - Use the plan or a shortened version
 - No Company Plan Available – Use plan in the MWC 40T. View here:
https://tools.niehs.nih.gov/wetp/public/course_detail.cfm?crs_det_id=212; also
[SOG, Appendix B to this Guide](#)
 - OSHA eHASp. <https://www.osha.gov/dep/etools/ehasp/>
 - An ERP for training is shown 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>

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

NOTE: This section has been updated to be consistent with NIMS 2017.

https://www.fema.gov/media-library-data/1508151197225-ced8c60378c3936adb92c1a3ee6f6564/FINAL_NIMS_2017.pdf

Learning Objectives

When completed, participants will be better able to:

- Describe application of the ERP to an ammonia release
- Identify the functions of positions in the Incident Command System (ICS)
- Describe methods to control a release
- Identify a potential ammonia release emergency at your plant

Teaching Methods

- Discussion

Suggested Instructor Preparation

- Review Participant Guide
- Obtain/develop/update ERP to be used
- Review any listed on-line resources
- Test web links prior to the session and If any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Review level of knowledge regarding ICS (intro to HAZWOPER ER, day 1) as you plan this agenda; include more discussion, as needed.
- Through reconnaissance, obtain the alarm system and meaning of each alert signal. If more than one company is participating, collect this information during the program to assure that it is known to all at each plant.

Minimum Content Requirements

- Review Hazardous Material definition
- Review “emergency” definition
- Review Emergency Response (ERP content, planning, roles/ICS), training levels, communication, treatment/first aid, security/control, termination, plans

Questions You May Be Asked

1. I have been responding to spills, but this is my first training. How do I get more training?

Your level of training needed depends on your responsibilities. An employer can certify your competence by documenting proficiency (see listing in 29 CFR 1910.120 for each level).

(This training may have occurred. Now your employer wants you to have off site training at the Technician level. Refresher training will be required in the future.)

2. We never do sessions at the end of a response, because we have to get back to work. Is this training really needed?

Termination is an important part of a response and Technician-level responders must be able to implement this aspect of a response. Much can be learned by reviewing what went well and what did not go so well during a response. This leads to changes in the ERP, equipment/supplies and perhaps ore training or drills.

Presentation of the Session

This session can be presented as follows:

Review the objectives

When does an ammonia release become an emergency?

Ask: Is there a distinction between an 'organized response' and a 'do it yourself cleanup'?

Ask: What has triggered a response by you or your team?

Review the OSHA definition of an emergency.

Emergency Response Plan (ERP)

Ask participants to turn to the list of required elements of an ERP shown in the Participant Guide. Review the list

Ask: How often do you and your team contribute to updating the ERP you use?

Pre-emergency planning and coordination with outside parties

Ask: What is an important first step in planning?

In 29 CFR 1910.120 it is an assessment; in PSM it is a Hazard Assessment. By any name, it is critical to evaluate where and under what conditions a release could occur. Only then can pre-planning go forward.

Ask: What outside parties may be involved in ammonia release? Discuss planning and coordination with these parties, including the list of initial size-up information in the Participant Guide.

Personnel roles, lines of authority, training and communication

Personnel roles, lines of authority

Ask participants to turn to the list of important activities in the Participant Manual

Review terms that are not as familiar to participants (depending on level of knowledge demonstrated on day 1 and conversations throughout the program)

Ask: How can preplanning and practice improve the conduct of (examples: monitoring, decon, PPE selection...)?

Ask participants to turn to the chart of the Incident Command System (ICS). The Incident Command System is the overall structure for roles and lines of authority. See https://www.fema.gov/media-library-data/1508151197225-ced8c60378c3936adb92c1a3ee6f6564/FINAL_NIMS_2017.pdf.

Ask: Who is the Incident Commander in your responses?

Ask: Where is the response team shown on the ICS chart?

Review the functions of the various positions.

Training

Refer to the “Introduction to Ammonia Emergency Response” section of the Participant Guide, where the levels of training (awareness, operations, technician) are discussed under “Why an Ammonia-specific Program?”

Communication

Ask: What are some reasons that communication systems will be needed?

Ask: What are barriers to communication?

Ask: What back-up systems are used?

Practice hand signals.

Ask: List reasons for the 'buddy system'.

Emergency recognition and prevention

Ask: What is the first alert that would be sounded for a leak at your plant?

Safe Distances and Places of Refuge

Ask: Who is responsible for determining safe distances and places of refuge?

Site Security and Control

List reasons that site security and control are important at a response.

Evacuation Routes and Procedures

Ask: When are evacuation routes and procedures established? Reinforce that these should have already been laid out in the ERP.

Decontamination

Refer to Decontamination section.

Emergency Medical Treatment and First Aid

Ask: Who in your organization can provide treatment in a response?

Ask: Why does OSHA require someone trained in patient transportation be available at a response?

Emergency Alerting and Response Procedures

Emergency Alerting

Ask: What must an alarm system do? Review content in the Participant Guide.

Ask: What are the properties of ammonia and how will it behave when it escapes? Review the list in the Participant Guide and discuss.

Response Procedures

Ask: What are some important aspects of responses procedures?

Responses should include planning, written procedures, training/practice, appropriate equipment/PPE, etc.

Video – ‘Shock to the System’

Watch the video and discuss, following the content in the Participant Guide.

Large Release

Ask: How would a large release be handled differently than a small release? Discuss the differences

Releases That Do Not Involve System Shut Down

Ask: What is the most common source of an ammonia leak? What options are there for addressing this release? Use the content in the Participant Guide to review options.

Termination (critique of response and follow up)

Ask: Please review the listing of termination activities. Is there anything that should be changed?

Ask: Why would forms be useful?

Show on the agenda, that termination will be practiced in an exercise (see agenda).

The above content is repeated in ‘Clean up and Critique’.

PPE and Emergency Equipment

Refer to PPE, Monitoring and Work Practices sections

Summary

Review the learning objectives.

- Describe application of each part of an ERP to an ammonia release
- Identify the roles of key positions in the Incident Command System (ICS)
- Describe methods to control a release
- Identify a potential ammonia release emergency at your plant

Answer questions.

Tabletop

Time Requirement: 100 minutes

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

Materials

Scenario (participant version) and provided answers (facilitator version) in the Appendix of the Facilitator Guide

Learning Objectives

When completed, participants will be better able to:

- Demonstrate active participation in the ICS to implement an Emergency Response Plan through termination (tabletop)

Teaching Methods

Hands-on tabletop

Suggested Instructor Preparation

- Review the tabletop exercise (see Appendix A to the Facilitator Guide) or choose to adapt one from the 40T Facilitator Guide Appendix. If you choose to adapt an exercise, describe it fully in the Program File.
- Copy Performance Checklist for participants.

Minimum Content Requirements

Implement a response through termination (tabletop)

Questions You May Be Asked

Think about key points in the Tabletop and how to facilitate a discussion if a participant identifies areas of needed training or areas where pre-planning at the workplace appears to be deficient.

Presentation of the Session

This session can be presented as follows:

Review the objective

Complete the Tabletop Exercise

Collect Performance Checklists to document completion and file with other Program materials.

Summary

Review the learning objective:

- Demonstrate active participation in the ICS to implement an Emergency Response Plan through termination (tabletop)

Ask: What is the most important thing you learned during this tabletop?

Ask: Provide an example where more information would have altered your decision.

Answer questions.

Level A or B Simulation with Full Decon Line

Time Requirement:	45 minutes for safety briefing and setup 120 minutes for simulation
Number of Facilitators:	1 or 2 for prep Simulation staffing will conform to Minimum Criteria: Levels A or B, 1 facilitator or assistant per 5 participants
Class size:	24 maximum

Materials

- Student materials (Participant Guide, ERP for training, Appendix B of this Guide, or use employer/local ERP, scenario; Performance Checklists)
- An ERP for training is shown 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>

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

- ERP for the training arena at your center or offsite location
- Supplies for simulation

Objectives

When completed, participants will be better able to:

- Participate in sizing up a scene
- Contribute to planning a response
- Don/doff a level of protection
- Demonstrate participation in setting up and critiquing a decon line, consistent with the level of protection of the simulation
- Demonstrate an ability to conduct a task required in a technician-level response and provide critique
- Properly dispose of contaminated materials

Teaching Methods

- Discussion
- Group activity
- Hands-on

Suggested Instructor Preparation

- Review Participant Guide and specifications in this guide (and ERP for training site)
- Review diagram for Level A or Level B decon for ammonia
- Review ERP SOP or SOGs that are needed, including, Decon the tasks to be done, overall response SOG (see Appendix B)
- Select/review/revise scenario and tasks to be conducted in this technician-level response. (Modifying the conditions or materials in one of the tabletops might be considered.)
- Obtain copies of the needed checklists (see Exercise Manual)
- Assemble all needed supplies in the training area for the session
- Review any listed on-line resources
- Test web links prior to the session and If any are inoperative please notify the Midwest Consortium at alerdilr@ucmail.uc.edu
- Copy Performance Checklists for participants
- File scenario, SOGs and any supporting documents in Center program file

Minimum Content Requirements

- Participate in scenario response
- Conduct assigned task(s)

Questions You May Be Asked

1. We do not have an ERP.

Be prepared to facilitate a discussion to identify who to ask about this at the company. (It is likely there is one, but training has not been adequate.) Use 29 CFR 1910.120 to identify what must be in a plan, so that the participant is prepared to discuss this with appropriate personnel in the employer organization.

2. Our air monitoring person is at corporate, 400 miles away. How do you deal with this?

This must be covered in the ERP. Facilitate a discussion of alternatives: for releases of some materials, monitoring may not be needed (a food processing plant where the coolant is ammonia and one of the process lines containing ammonia is broken by a forklift). For unknowns, monitoring will be needed: are there emergency crews in the area that can be called? What is in the ERP?

Presentation of the Session

This session can be presented as follows:

Before the Simulation, take the opportunity to cover the Emergency Response Plan for the training site, introduce the scenario and SOGs and answer questions about the Response Simulation.

Exercise – Level A or B Simulation with full Decon

The Emergency Response Simulation is a coordinated response requiring Technician-level actions. For a simulated response, each participant will conduct one or more assigned roles.

During the simulation, a response scene will be set up with the various work zones, in order to respond using good work practices. Pairs or groups of participants will participate in specific tasks such as sampling the air, identify the hazard, control an emission with appropriate PPE, go through decon, decon others and/or equipment or other task(s) relevant to expected response activities.

The sections below include specifics for the Simulation site, Trainer Qualifications, the training center ERP and considerations in designing/conducting the Simulation.

Minimum specifications for a response simulation site

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 and emergency telephone numbers and directions to the site will be posted at each telephone on the site

Maps to the nearest treatment center should be posted in the event it is elected to transport a non-emergency case for treatment

A standard First Aid Kit shall be available

An emergency stop signal such as hand-held air horns must be available

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

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

Identify alternative site as a contingency plan

Site should be situated to minimize public reaction or preparations should be made to deal with concern among passersby. Radio communication requires advance notice to

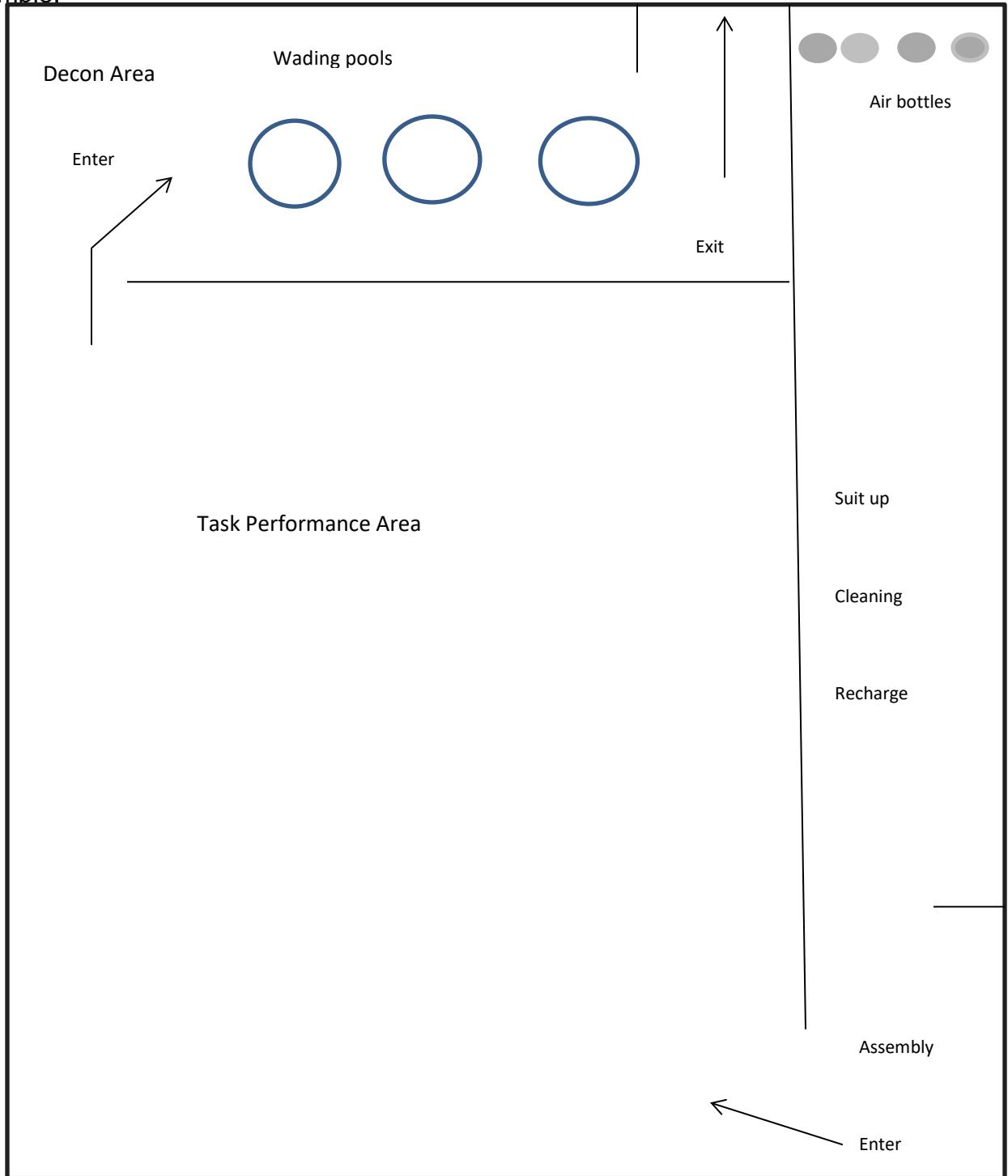
agencies monitoring stations that this is a drill, the name of the group conducting the simulation (other locally required information) and notification to the agencies that the drill is terminated.

If conducted in an area that may be observed by the public or others at the facility, 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.

Example:



Example of Response Simulation Layout in Field or Parking Lot

Trainer Qualifications for Response Simulation

- One lead instructor and 3 or more helpers are needed at a minimum for the mechanics of conducting the simulation.
- Medically cleared to use respiratory protection
- 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
- At least one certified in First Aid and CPR, unless EMS is onsite
- Documented training in recognizing heat and cold stress effects
- Working knowledge of the Emergency Response Plan

Appropriate documentation of the qualifications is retained in the Program File.

Emergency Response Plan for the Conduct of the 24H Ammonia Simulation

Introduction

The Response Simulation Exercise is a complex exercise that integrates much of the training in the 24-hour Ammonia Program into a hands-on simulation during which participants don and doff appropriate PPE to perform specific roles in the ICS according to SOPs/SOGs in the ERP.

As with any hands-on simulation or exercise there are numerous potential safety hazards (e.g., splash to the face with the simulated release hazard). In order to assure that instructors and participants are aware of these potential hazards and how to react, the minimum safety requirements shown below must be implemented during every Response Simulation Exercise.

Safety Briefing

Before the Response 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 on the site.

Communication equipment will be verified to be working before the Exercise begins.

Emergency telephone numbers and directions to the site will be posted at each telephone on site.

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 last one instructor 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 Response Simulation Exercise.

Use of a standby EMS crew may be used as an alternative to the above.

Site Access

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

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

Physical Hazards

Heavy lifting, walking on uneven surfaces and physical exertion may 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.

Approaching the point of release is always a hazardous activity. All instructors and course attendees on site are required to wear safety shoes. Extra care and attention are required to protect against spreading contamination.

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 signs/symptoms.

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 instructor on site must monitor heat stress conditions and adjust work/rest times and breaks to insure everyone drinks enough fluid.

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

A shaded break area is recommended.

Cool or cold conditions may present opposite problems, as the suit is removed a person could chill 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 someone's alarm sounds.

While wearing level A or B, each person shall have a 'buddy' within an arm's length who is not suited and can notify the IC and 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

Instructors:

- Ensure that all issues listed in this plan have been discussed in class prior to the Simulation.
- Ensure all participants are aware of the hazards, how to recognize and react to them.
- Have at least three instructors always present during the Exercise (four preferable based on Minimum Criteria). One shall be designated as lead and have overall responsibility for the exercise.

Participants:

- Be aware of hazards from classroom and hands-on training
- Be aware of all aspects of the safety briefing
- Watch yourself and your fellow participants to try to avoid hazards

Weather

In the event of adverse or inclement weather, the lead instructor 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 site 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 stop signal.

Considerations in designing/conducting the Simulation

Minimum Required Equipment/Supplies for 24 participants:

8-10 SCBA units with cases and airline capability; 8-14 spare tanks with recharge capability onsite

If Level A to be used: 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
- If response uses Level A: 16 complete Level B ensembles
- If response uses Level B: 16 complete Level C ensembles
- Paper towels and spray disinfectant
- De-fogging solution
- Visqueen
- 24 Hardhats
- Adequate supply of safety shoes/boots

Simulation set up: (modify supplies and monitoring equipment based on scenario selected)

- A release that is relevant to the participants (pipe or another container)
- Prop for valve turning, or plug/patch. See photo below



From LTC

- Spark-proof tools for any work to be done
- 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

- Colorimetric pump and appropriate tubes
- pH paper
- Direct reading detector

Other supplies

- First Aid Kit
- Drinking fluids and disposable cups
- 4 stools or short step ladders for suiting up
- Barrier tape, stakes, safety cones
- Tape compatible with the suits
- Clipboards
- Binoculars (for Recon if part of the scenario)

Participant attire

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

Participant Tasks at Simulation Site

Properly don/doff/decontaminate Levels A or B, or Levels B and C

Demonstrate ability to do at least one of the following activities

- LOTO
- Stop the release
- Prevent spread of the release
- Decontaminate responders and tools

Rotation

Depending on the number of participants and the scenario, there may be time for some to complete more than one task by rotating (example: release control, decon). If a rotation is used, a schedule should be developed to show which groups will rotate and the duration each group will have to accomplish the task.

Design the Scenario

Describe the scene

What has happened?

The setting—other buildings, inhabited areas, drains, waterways, roads, rail, etc.

The time of day and weather

Participants will find a drawing of the scene useful. This can be displayed on paper or whiteboard.

(See the various tabletop scenarios for examples of detail and drawings.)

ERP

SOGs or SOPs and risk assessment information should be presented in a ‘for training only’ ERP or by using sections of the employer ERP.

Plan Roles/Assignments

One of the facilitators will act as IC, when decisions are needed. An important IC role in the Simulation is to ask leading questions, to guide the development of the response.

Groups of participants will assume the following roles:

- Risk Assessment using the ERP
- Set up decon
- Conduct decon
- Response

Other activities shown in the ICS, depending on numbers of participants such as:

- Security
- Public Information
- Finance

All participants will contribute to observations, communication and actions

Exercise Stimuli (Optional)

Stimulus: Do not have the right tool after entry into hot zone

Proper Response: Alert the back-up team and obtain the tool

Needed: Multiple tools

Stimulus: Label/marking does not match what is expected

Proper Response: Relay observation to IC for further risk assessment/resolution

Needed: Incorrect label/marking on container (not observable until enter hot zone)

Stimulus: Site security breach

Proper Response: Suspend activities and alert intruder to leave

Needed: Individual to act as intruder; boundaries clearly marked

Stimulus: Second emission source

Proper Response: Alert IC

Needed: hidden or delayed leak

Stimulus: Wind Direction changes

Proper Response: Determine wind direction by observing wind or weather instrument; reassess position

Needed: Windsock, pole

Participants should retain signed Performance Checklists for use in Termination.

Summary

Review the learning objectives

- Participate in sizing up a scene
- Contribute to planning a response
- Don/doff a level of protection
- Demonstrate participation in setting up and critiquing a decon line, consistent with the level of protection of the simulation
- Demonstrate an ability to conduct a task required in a technician-level response and provide critique
- Properly dispose of contaminated materials

Note that review and feedback are conducted as part of Termination.

Cleanup and Critique (Termination)

Time Requirement: 45 minutes

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

Materials

- Student materials (Participant Guide and Exercise Manual)
- Performance Skill Checklist - Termination

Objectives

When completed, participants will be better able to:

- Inspect equipment used in the simulation and tag as appropriate
- Properly dispose of contaminated or damaged materials
- Demonstrate use of proper procedures in termination
- Demonstrate an ability to contribute to a critique of a response

Teaching Methods

- Hands-on activity
- Discussion

Suggested Instructor Preparation

- Review Participant Guide and exercise
- Copy Termination Performance Checklist

Minimum Content Requirements

- Clean up the area
- Inspect supplies and tag as needed
- Properly dispose of contaminated or damaged materials
- Critique Simulation

Questions You May Be Asked

1. We do not have money for any new PPE. We just have to keep using it.

Facilitate a discussion of reasons that the PPE may not be protective. When this occurs, the employer is no longer meeting the responsibility of supplying PPE that is protective.

2. Our response supplies tend to disappear. Is there a way to keep supplies ready for use?

Facilitate a discussion on what others in the group do to assure that supplies are there if a response action is needed. Some groups are also putting a diagram on storage units, showing location of various supplies for easy access. This is especially useful if outside groups may assist in a response.

Presentation of the Session

This session can be presented as follows:

Review the objectives

Termination Activities

Review the listing of termination activities in the Participant Guide. Note that others may be specified in the employer-specific SOP.

Clean up the area, inspect and tag

Ask: List the actions needed to clean this area

- Inspect
- Sort, Discard, Verify decontamination, Re-stow
- Tag each pile
- Dispose of Properly

Ask: What considerations are important in disposal of

- Contaminated PPE, tools, supplies
- Liquids that may include hazardous materials
- Damaged materials

Critique

Using the Performance Checklists from the Simulation, initiate a critique:

Ask: What went well and what could have been done better.

Make a list of ‘went well’ and ‘could be improved’

Fill in gaps that you noted, by asking leading questions. For example, ‘Did anyone notice that some of the decon water splashed out of the containment?’. This could then be added to the ‘improved’ list.

For the ‘could be improved’

Facilitate a discussion of how to improve each item/action.

Ask: How would you improve

Complete the Termination Checklists. Collect Simulation and Termination Checklists as part of program documentation.

Exercise – Clean up and Critique

Number of Facilitators Required: 1

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

Materials: Participant Guide and Performance Checklist from Exercise Manual

Procedure: See Exercise Manual

Summary

Review the learning objectives.

- Inspect equipment used in the simulation and tag as appropriate
- Properly dispose of contaminated or damaged materials
- Demonstrate use of proper procedures in termination
- Demonstrate an ability to contribute to a critique of a response

Facilitator Follow up

Make this program better:

Forward suggestions to UC

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

Assure that notes from the critique are added to the Program File, to improve the scenario preparation when offered next.

Closing and Program Evaluation

This concludes the program and may be done after the post-test depending on training center agenda.

Time Requirement: 20 minutes

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

Materials

The following materials will be needed:

- Chalkboard, marker board or easel with paper
- Markers or chalk
- Evaluation forms

Objectives

- Review anything remaining in the ‘parking lot’ to assure complete
- Answer questions
- Review the need for annual refresher
- Thank participants. Identify key rights and responsibilities workers have under the OSHAct

Teaching Methods

Discussion

Suggested Instructor Preparation

- Review the 'parking lot' for any other notes made during the program.

Minimum Content Requirements

The following are minimum content requirements for the section:

- Review 'parking lot' and any other items
- Answer last questions
- Thank participants

Questions You May Be Asked

"What happens if I do not take a refresher?"

If needed for a job, you will not be up-to-date and may be required to take this program again. Some employers 'stretch' the requirement to 18 months, if the refresher is taken ASAP, but it is a gamble.

Presentation of the Session

Thank participants for attending the program.

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.

Appendices

Appendix A includes the Participant Guide and Facilitator Guide for the Tabletop Exercise.

Appendix B includes Emergency Response Operation SOGs

Exercise Participant Guide

Emergency Response Tabletop

Working in small groups, read the information below and answer the questions. Select a record keeper in your group who will take notes and report the work of the group back to the other participants for a critique.

Following the tabletop, a full exercise will be conducted with PPE and decon.

The Incident

The temperature is 80° F on a July day. There is a slight breeze out of the west.

At approximately 9 a.m. Joe is working in the distribution center and hears a crash. When he turns to see what is going on, he sees that a forklift mast has hit a refrigeration unit. The driver, Ralph, is slumped over the controls. There is a small stream of liquid running down the unit onto the floor and the odor of ammonia is already strong. Joe is forced to retreat before he can rescue Ralph.

The temperature in the distribution center is 10° F.

There are four trucks at the dock and the white cloud is growing as Joe leaves the center. The Management offices and production facility are in a separate building, west of the Distribution Center.

Your Assignment

Answer the questions on each page, before proceeding to the next page.

1. Who does Joe call? List the information that he reports.

Call:

Information:

2. What should Joe do after making the call?

3. Another worker grabs Joe and says they have to rescue Ralph right now. What should Joe do?

4. Who is the IC, and where should the ERT members assemble?

5. After a brief size-up, the team decides there is a potential for an emergency if the leak escalates, and they implement the ER plan. List the immediate risks and objectives to reduce/ mitigate each.

Risk	Objective to reduce/mitigate
a.	
b.	
c.	
d.	

6. What internal/external phone calls must be made?

What outside resources must be alerted?

7. Does anyone need to be evacuated at this time?

Who, if any?

8. Estimate the size of your ER team now. Diagram your IC system.

9. Identify your exclusion zone on Figures A and B.
 10. Entry Team One is to rescue Ralph. List steps and considerations to do this.
 11. Do you have enough people to have another entry team to begin shutting down the system or implement isolation?
 12. How many employees will it take to secure the area (refer to 9, above).
 13. The plant manager is now on the scene. What is her role in the response? Is she qualified to be the IC?

14. Human Resources reports that one employee is unaccounted for. What are the options the IC must consider?

What does the IC do?

15. A reporter arrives at the same time that the outside emergency responders arrive with vehicles.

Who will deal with the reporter?

Who will deal with the external responders?

16. The first team is unable to find Ralph and returns. What are the options that must be considered?

Would driving the semis away from the docks help?

17. Maintenance reports to the IC that the system has been isolated. How long will ammonia continue to escape and cloud the area?

What about Ralph?

18. Someone suggests that the fire department fog ahead of the rescue team to clear the cloud. What are the pros and cons of this action?

Pros

Cons

Who is the IC if the fire department is on the scene now?

Can the fire department do this safely?

19. The switchboard operator reports that the cement company called and is noticing a strong odor of ammonia. The plant is $\frac{1}{2}$ mile to the Northeast, across the highway. Who handles this information?

What is done?

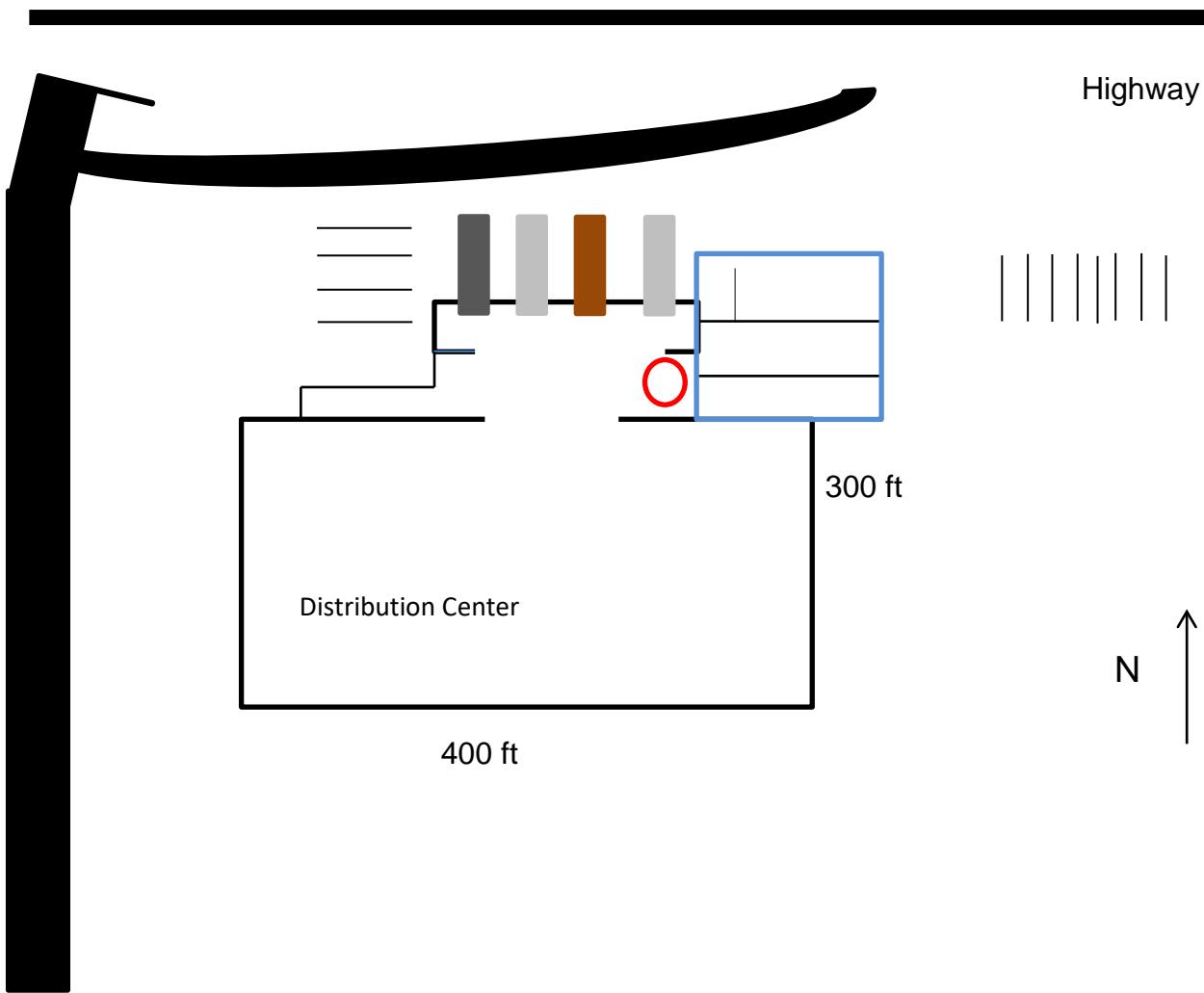
20. Who are the players at the incident now? Show as changes on the IC diagram (8, above).

21. What has been learned about the missing employee?

Have off-shift ER personnel been called in to assist?

22. The Fire Chief calls for the regional hazmat team. What is your role now?

23. If the incident continues, will Ralph be alive when he is found?



○ Ralph

□ Refrigeration

Figure A



Figure B

Exercise Facilitator Guide

Emergency Response Tabletop Exercise

Working in small groups, participants will read the information below and answer the questions. Each group should select a record keeper who will take notes and report the work of the group back to the other participants for a critique. After the tabletop, this scenario can be run as a full-scale exercise.

The Incident

The temperature is 80° F on a July day. There is a slight breeze out of the west.

At approximately 9 a.m. Joe is working in the distribution center and hears a crash. When he turns to see what is going on, he sees that a forklift mast has hit a refrigeration unit. The driver, Ralph, is slumped over the controls. There is a small stream of liquid running down the unit onto the floor and the odor of ammonia is already strong. Joe is forced to retreat before he can rescue Ralph.

The temperature in the distribution center is 10° F.

There are four trucks at the dock and the white cloud is growing as Joe leaves the center. The Management offices and production facility are in a separate building, west of the Distribution Center.

Assignment

Alert participants to follow the directions to answer all questions on each page, before proceeding to the next page. The following items in the Participant Guide should be on one page each: 1-4, 5-9, 10-13, 14-17, 18-20, 21-23. Suggested answers are shown below, keyed to the page of the Participant scenario.

Page 1 of Participant scenario

1. Who does Joe call? List the information that he reports.

Call: 911, Supervisor, ERT, FD depending on ERP and previous training

Information:

calling to report a forklift incident
chemical release

2. What should Joe do after making the call? Secure the area

3. Another worker grabs Joe and says they have to rescue Ralph right now. What should Joe do?

Prevent entry. Refrain from rescue until more information is received.

4. Who is the IC, and where should the ERT members assemble?

Have participants review the diagram

Command post is in the NW corner

Team members at the corner

Ralph is initial IC

Page 2 of Participant scenario

5. After a brief size-up, the team decides there is a potential for an emergency if the leak escalates, and they implement the ER plan. List the immediate risks and objectives to reduce/ mitigate each.

Risk	Objective to reduce/mitigate
a. death/ exposure	remove Ralph from hazard
b. loss of product	supply line, contain
c.	
d.	

6. What internal/external phone calls must be made?

ERP may require corporate notification, other

What outside resources must be alerted?

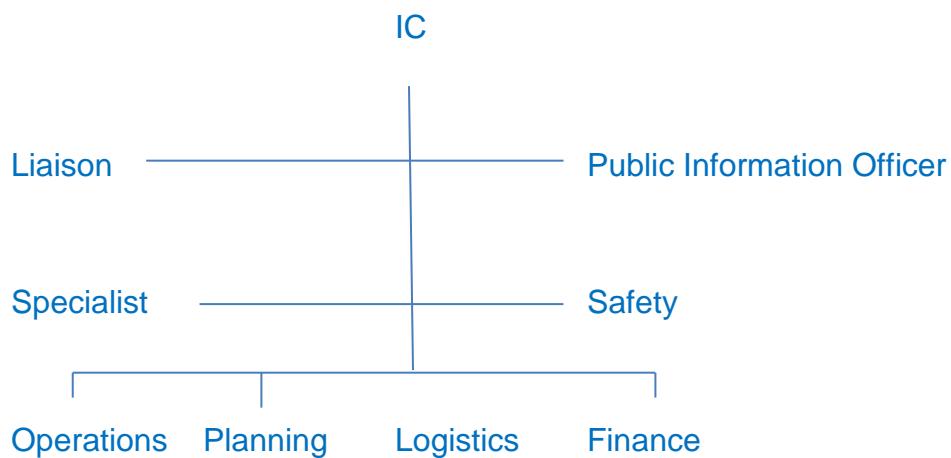
Fire Department, County Emergency Management

7. Does anyone need to be evacuated at this time? Yes

Who, if any? Employees in Distribution Center

8. Estimate the size of your ER team now. [12](#)

Diagram your IC system.



9. Identify your exclusion zone on Figures A and B.

At the plant, include the interior of the distribution center, as it is not known if there is door that can be closed, or closes automatically when there is a release. Also include the dock and area north and west toward the highway (due to wind information). Based on volume (small), this exterior should initially be 100 ft, and then be extended to 0.1 mi (ERG, green section). If large spill, might use nurse tank as the surrogate for a source (ERG, green section Table 3), and then the downwind distance would be 0.3 miles.

For the larger layout, based on a large spill, the area at the cement plant would be included. Even if a small spill, the cement plant might be included depending on observation by the IC.

Page 3 of Participant scenario

10. Entry Team One is to rescue Ralph. List steps and considerations to do this.

Identify product and hazards

Identify PPE

Isolate power on forklift

Perform removal

11. Do you have enough people to have another entry team to begin shutting down the system or implement isolation?

Ask ICS; depends on company training level

12. How many employees will it take to secure the area (refer to 9, above).

At least 4, one for each door plus potentially more depending how the response goes.

13. The plant manager is now on the scene. What is her role in the response? Is she qualified to be the IC?

Role depends on level of knowledge of plant operations

IC assignment depends on training

Page 4 of Participant scenario

14. Human Resources reports that one employee is unaccounted for. What are the options the IC must consider?

Call the person if cell phones are allowed at the facility

Where was he/she last seen? What are the usual duties of the person?

What does the IC do?

Call for outside assistance (personal accountability reporter)

15. A reporter arrives at the same time that the outside emergency responders arrive with vehicles.

Who will deal with the reporter?

Public Information Officer (see IC chart)

Who will deal with the responders?

The IC

16. The first team is unable to find Ralph and returns. What are the options that must be considered?

He left the area on his own?

Were they sure of his last location?

Where did he go?

Should the semis be moved?

17. Maintenance reports to the IC that the system has been isolated. How long will ammonia continue to escape and cloud the area?

Depends on system.

What about Ralph?

Once safe, systematic search is initiated for Ralph

Page 5 of Participant scenario

18. Someone suggests that the fire department fog ahead of the rescue team to clear the cloud. What are the pros and cons of this action?

Pros	Cons
Reduce concentration	takes time

Who is the IC if the fire department is on the scene now?

We are, until we transfer

Can the fire department do this safely?

Depends on training, wind direction and local environmental considerations.

19. The switchboard operator reports that the cement company called and is noticing a strong odor of ammonia. The plant is $\frac{1}{2}$ mile to the Northeast, across the highway. Who handles this information?

IC

What is done?

Air sampling; notify DNR or appropriate agency

20. Who are the players at the incident now? Show as changes on the IC diagram (8, above).

Show on diagram; could differ as the group makes decisions.

Page 6 of Participant scenario

21. What has been learned about the missing employee?

Nothing.

Have off-shift ER personnel been called in to assist?

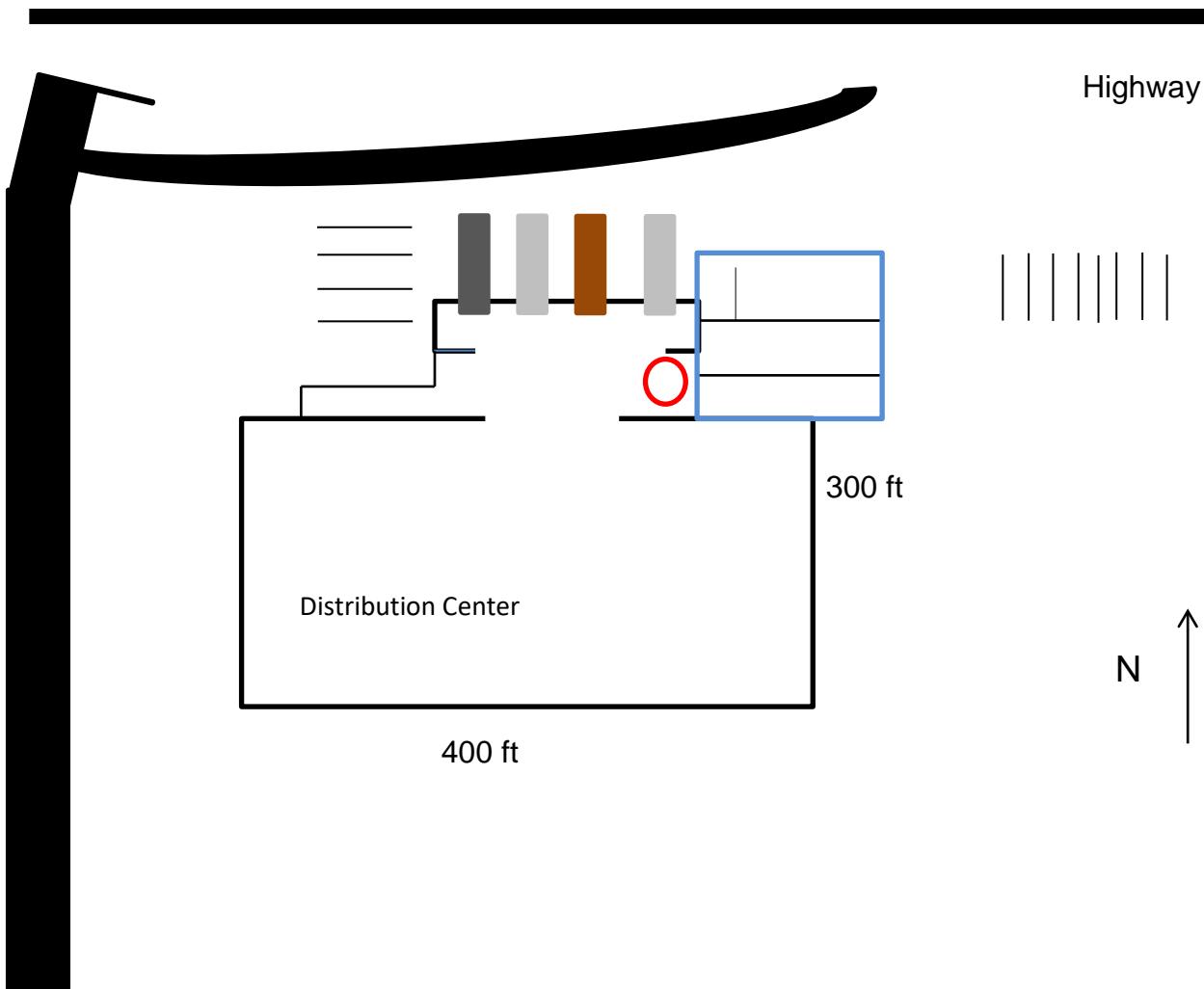
No

22. The Fire Chief calls for the regional hazmat team. What is your role now?

Transfer command

23. If the incident continues, will Ralph be alive when he is found?

He may have left the scene—not enough information



○ Ralph

□ Refrigeration unit

Figure A



Figure B

Emergency Response Operation SOGs

In this appendix we identify some generic SOGs to protect health and safety in a response.

A checklist of key activities to be conducted as part of an ammonia response action can be developed from this listing.

Response Operations

1. Secure the area and begin establishing work zones.
2. Activate the Incident Command System, filling in
 - Names
 - Times
 - Decisions
 - Data, etc.

If enough personnel are available, assign a recorder to assist with this activity.

Note: 29 CFR 1910.120(q) requires the IC to develop a specific Plan for the response. For a fixed facility, filling out a model ICS chart and a checklist (developed in advance for this facility and part of the ERP), listing response goals, objectives and methods (referencing SOPs in the ERP) fulfills this requirement.

3. Establish a command post
4. Determine wind direction, if applicable
5. Deploy a reconnaissance mission. This usually follows the format in PSM, utilizing the SOPs and the area monitoring system. Typically, a Refrigeration Tech with a radio and a backup with a radio will go to investigate the scene and attempt to determine the nature of the emission, doing an initial Hazard and Risk analysis.

Example: A monitor that is set to alarm at 25 ppm in the engine room with no additional readout could result from a minor leak creating 35 ppm concentration at the alarm sensor. Alternatively, a major leak could have occurred with a concentration at 350 ppm or 3,500 ppm. All these concentrations would have set the alarm to alert. Reconnaissance is required to provide the additional information on the scope of the release, done according to an SOP.

Example: An area monitor at an air intake indicates a leak on the roof. Knowing the wind direction, the reconnaissance team approaches the leak from an upwind position, locates the leak and closes an upstream valve per the PSM SOP. Control of the emission is done quickly and safely and the primary objective for the responders is

to control ventilation to remove the ammonia vapors in a manner that does not exposure workers or responders.

6. Hazard and Risk Analysis is conducted based on information collected or provided
7. Determine level of PPE for responders
8. Bump test air monitors if not done already in preparation for use
9. Set response priorities, per SOPs

Strategic goals

Tactical objectives

Tactical methods

Example: IC decides to find leak in engine room following SOP
Entry and Backup teams dress in Level A, with radio communication
Decon team dresses in Level C
Safety Officer
 Performs checkout of air monitors
 Records air times for entry/backup teams
Entry performs Hazard and Risk analysis
 IC and Refrigeration Engineer are in communication
Option: medical check is recommended

10. Set up decon, including transfer of back-up supplies to the area. If the back-up team is also the decon team, this can slow down the response considerably, but this may be necessary when there are few team members. An option is to encourage the addition of response team members who do not dress in PPE or do any activity with risk of exposure. They are support members who assist with dressout, set up, recording information and other duties.

11. Medical help is on standby and/or has been notified per the SOP. OSHA requires medical help be available when first responders are involved in a hazardous materials event. If It is not clear if medical is needed; they should be alerted that the response is in progress and they will be called if needed The severity of the release and the Hazard and Risk Analysis should be considered and the SOP consulted for guidance; an SOP with definite criteria will help the IC.

12. An on-site IC must lead the response. While this may seem obvious, a well-trained team may accomplish all the pre-entry SOPs without an IC, but once at the scene, the IC takes control, reviews actions taken prior to arrival, gives approval for progress, orders additional actions and directs all future actions.

In practice, refrigeration technicians, refrigeration engineers and/or maintenance personnel conduct the Hazard and Risk Analysis. Based on the results, the IC implements the needed SOPs in the ERP or outlines a needed SOP for an unexpected activity.

13. Reaffirm communications are working and in place for all response team members who need them, as well as management.

14. Conduct a pre-entry briefing for entry, back-up, decon including reminders to:

- Follow SOPs and all other instructions
- Use and report monitoring data
- Communicate with command as directed and respond promptly
- Record information as required, or report verbally
- Notify command of changes that may affect the Hazard and Risk Analysis
- NEVER go rogue in making decisions; communicate with command

Example: A refrigeration technician on the entry team determines that closing valve A is a better option to stopping the emission than the tactical objective of closing valve B. as the IC is not a refrigeration specialist request to close valve B may be authorized.

15. Remind Entry and Back-up/Rescue of the ‘buddy system’ and that best practice is to keep you buddy in line-of-sight.

16. Assign one entry responder as the communicator (if voice-activated communication is not used). This is usually the person doing the air monitoring and reduces response time if removing an arm in Level A is needed to key a microphone.

Also designate the lead responder, often the refrigeration technician who may get closer to the emission, having a higher risk of exposure but having high skill in the system operation and able to identify malfunctions.

Example: A written data form on a clip board may aid the entry team and provides the tools to record information.

Monitor NH₃ @ entry to roof: _____ ppm

ID leak in system (check off fill in)

Booster Discharge	
Condensation Drain	
Defrost Condensate	
Economizer Suction	
Hot Gas Defrost	
High Pressure Liquid	
High Stage Discharge	
High Temperature Recirculated Liquid	
High Temperature Recirculated Suction	
Low Temperature Recirculated Liquid	
Low Temperature Recirculated Suction	
Liquid Injection Cooling	
Low State Suction	
Relief Valve	
Thermosyphon Return	
Thermosyphon Supply	
Other _____	

LOTO complete by _____

Valves closed ID# _____

ID# _____

Measured NH₃ @ Entry Team isolation location: _____ ppm

This record becomes part of the response documentation and provides verification of information communicated to command.

17. Identify back-up communication methods
18. Address emergency procedures
19. Do not take risks. Stay clear and safe.

This check list for information and SOPs/Best Practices could become a book in itself, based on the potential situations that may be encountered.

The ERP is not a static document ever changing with updates and amendments based on experience and facility

Example: An SOP written for a roof response may not work well if the response is at night. This was identified when a practice drill was conducted at night. The SOP was revised to improve safety and increase lighting.

Termination Activities

The IC directs Termination, but various aspects may be assigned to others in the command structure. For example, plant personnel may oversee updates to the ERP based on feedback at the incident critique meeting.